Innovative Pricing

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Innovative Pricing

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[1] During the 2.5 years that Gunnar has been my supervisor he has fully read and commented each of the six chapters 15 times on average (a total of 90!).

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ABSTRACT

The rapid advance in technology, notably computing and communications technology (C&C), has meant that products of an increasingly intangible nature are being developed. Digital products are often being substituted for hardware products and are growing in dimensionality and complexity. This creates a problem for firms having to decide how to charge for such complex products, parts of which being easily accessible for free. Firms are, therefore, reaching for new methods of pricing to capture the value of their products, thus introducing bundling and pricing combinations not thought of previously to be able to capture a satisfactory value for the total product. Pricing then becomes an act of innovation. This thesis addresses this aspect of strategy under the name *Innovative Pricing (IP).*

JEL classification: O31; D81; L96; M21

Keywords: Innovative Pricing; Experimentally Organized Economy; Pricing; Telecommunications; Mobile Internet; Strategy; Electronic Commerce.

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CHAPTER I – SUMMARY ESSAY

1 WHAT IS INNOVATIVE PRICING?

Information and communications technologies are important economic activities, accounting for a dominant part of resources used in production. Information and communications technology, furthermore, represents an increasingly important part of product development. The technology itself, however, is often given away for free, or is sometimes even subsidized to customers. In addition, and this introduces my research problem; information and communications technologies are frustratingly difficult to define, to price and, hence, to trade in. We have a typical property rights problem. Innovative Pricing (IP) addresses these problems.

When products are poorly defined, complex and changing over time, the firm will have to identify a parameter as a pricing base of the product to assure that the cost of the whole product is recovered and a targeted revenue reached. Multidimensional products such as telecommunications products and services distinguish themselves from other products by a considerable amount of additional collective characteristics. These characteristics materialize as a cloud of new technology (spillovers) more or less available to external users free of charge. These spillovers operate as an externality (of the product) but they cannot be charged for directly because of weak property rights. The IP method is one of searching for, and protecting property rights such that the pricing scheme captures a targeted revenue. When the level of uncertainty and the rate of product innovation in the market are high, this choice of pricing base (this pricing decision) becomes critical for achieving acceptable profitability. To identify an effective base for pricing then becomes an act of innovation i.e. pricing becomes an act of innovation.

My thesis develops a theory for this Innovative Pricing (IP) method and studies its implementation in practice. It is essential to note that the chosen pricing base is to be considered an exceptional, preferably proprietary, but non-unique (to the product) feature. The actors introduce pricing experiments in the market that, if successful, can be compared to acts of innovation compatible with Schumpeter's (1911/1934) definition of an innovation.

The phenomenon as such (IP) can be observed in business practice (see examples in chapters II, V and VI). To address it theoretically, however, stirs up deep and abstract problems lodged at the assumptional roots of the mainstream economic model of perfectly

informed equilibrium markets on which standard pricing theory rests. IP is a real phenomenon because the full and perfect information situation does not exist. My problem is that the product (to be priced) cannot be defined until after the act of innovation (IP). Hence, an economic model that allows for IP in that sense is needed to address the problem theoretically.

The analytical approach will be to create an abstract theoretical frame – probably much more abstract than the standard general equilibrium model – to address a very down to earth practical business pricing problem. This need to travel between the two extremes of highly abstract theory and a practical, hands on business problem is typical of the computing and communications industry (Eliasson & Johansson, 1999). This is how I proceed.

1.1 Organization of Thesis

This doctoral dissertation at the Royal Institute of Technology (KTH) consists of five studies that are all integrated into a consistent whole by this summary chapter/cover essay. Each chapter can be read independently, but all the chapters and the cover essay together place the problem of Innovative Pricing (IP) in a complete and consistent theoretical context.

The remainder of this cover essay relates IP to existing economic theory and identifies the character of the IP problem as addressed in this study and applies IP theory to telecommunications. Then follows a section where I describe the general research objectives and the boundaries of the thesis. In the following section I discuss the materials and methods of each of the following five chapters that include a theoretical description of IP (chapters II, III, and VI) and case studies illustrating its application (chapters II, IV, V and VI).

In the concluding section, I present and interpret the implications of the results (in the five special studies) both for economic theory and practical pricing problems. Finally, I present a summary.

1.2 The Theoretical Frame of the Experimentally Organized Economy

The theory of the Experimentally Organized Economy (EOE; Eliasson, 1987, 1991, 1992) is used in this thesis as an analytical frame and as intellectual support. The theory of the EOE is evolutionary in the sense that it deals explicitly and endogenously with knowledge based

information processes, learning and communication and has no stable exogenous equilibrium. It therefore lies outside the mainstream static equilibrium model. The EOE is obtained by slightly modifying the assumptions of the mainstream economic model (Eliasson, 1996, p. 54). The properties of the theory of the EOE, however, stand in stark contrast to those of the equilibrium theory, and are more in line with the Austrian and the Schumpeterian (1911/1934) and to some extent the Neo-Austrian (e.g. Hayek, 1945; Kirzner, 1973) traditions.

The primary assumption which sets the theory of the EOE apart from mainstream equilibrium economic theory and other schools of evolutionary theory, such as Nelson & Winter (1982), the Sussex school (e.g. Freeman, 1974) and the Neo-Austrian tradition (e.g. Kirzner, 1973) is the concept of an, for all practical purposes, open set of opportunities. This opportunity set referred to as the state space, expands as a result of innovative recombinations of technology and learning. Under the assumptions of the EOE the invisible hand of Adam Smith has to be represented differently than in the models with an exogenously determined equilibrium. The basic assumption is that the opportunity space is enormous but not infinite in a strict mathematical sense. It is always restricted from above by a not well defined boundary that constantly expands because of innovation and learning (Eliasson, 1990a). The 'open' state space of the EOE introduces a dominant element of uncertainty defined as situations in which intentionally rational actors cannot deduce strategies from their preference rankings because of the complexity of the situation. The informational constraints, furthermore, do not allow them to reliably assign probabilities to the possible consequences of choices (Knight, 1921). This fits well with the intellectual frame I need to formulate the theory of Innovative Pricing (IP), and is one of the primary reasons for my choice of the EOE as a theoretical framework.

The difference between the Neo-Austrian viewpoint, on the one hand, and Schumpeterian (*and in addition the EOE*[2]) viewpoint on the other, is that the Neo-Austrians have not integrated the innovating entrepreneur as an individual actor in their theory. They have restricted the role of entrepreneurship to a movement of the economy towards equilibrium (Lundvall, 1992). In contrast Schumpeter (1911, 1947) made the interaction between entrepreneurial activities and technology the vehicle for economic development. But in the EOE the same interaction of agents in the market also explains the expansion of the state space itself. This expansion of the state space of available opportunities is referred to as the

[2] My comment in Italics.

Särimner[3] effect by Eliasson (1987, p. 29; 1996, p. 27) and has some similarities with Gustafsson (1994). A consequence of the unpredictable dynamics of the environment in the EOE may even be that new opportunities are created faster than the actors can learn of their existence (Eliasson, 1990b; Gustafsson, 1994). This is sometimes also referred to as the Information Paradox I of the EOE (Eliasson, 1990b, p.46) and it is related to the Särimner effect. This implies a state of non-stationarity that has to do with the impossibility of fully learning or exploring state space. The heterogeneity of state space and the growing importance of intangible dimensions such as quality or competence leads naturally to Information Paradox II (Eliasson, 1990b, p.16), namely that we are becoming less and less informed about what is becoming more and more important.

One could say, to use a biological analogy, that new potential opportunities are created through exploitation and tacit learning while old die (Eliasson, 1996). Here the theory of the EOE[4] distinguishes itself from Schumpeter's version of Austrian economics. Even though Schumpeter is often associated with evolutionary theorizing he explicitly rejected the use of a biological analogy in economics (Schumpeter, 1954, p. 789)[5]. This does not prevent us from using the biological analogy in this thesis, however. Entrepreneurs are both the result of and the mediators of evolution, both in its narrow biological sense and in its broader cultural sense. Their activity does not switch on and off according to well anticipated needs (Day, 1987), but is rather subjective attempts to bring something new to the market.

A dominant theme of the EOE, therefore, is the experimental nature of all economic decisions. Incomplete information and bounded rationality introduce a realistic state of deep ignorance among actors about matters that are critically important for their long run survival. Being grossly ignorant does not necessarily mean being professionally incompetent. The actors may be extremely knowledgeable in a narrow, specific field but still incompetent to deal with the same product market when it is subjected to, for instance, rapid technical change. The actors cannot be knowledgeable about everything that may be relevant to them.[6]

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[3] The name refers to the pig Särimner of Nordic Viking mythology. The Viking gods had a pig they ate for dinner, only to see it come back the next day to be consumed again. The analogy of Särimner is used in the EOE to explain how state space grows through its exploitation.

[4] e.g. Eliasson, 1996, p. 96

[5] Schumpeter's rejection of the biological analogy in economics should be seen in a contextual light, where the major biological influences in economics were Lemarck and Spencer rather than the Darwinian theory at the time (Hodgson, 1999).

[6] This happened when computer technology changed from being based on the transistor to being based on the integrated circuit. A large number of previously very competent computer makers vanished. They were ignorant in the sense of the EOE.

The arbitrarily large and expanding set of business opportunities carries the implication that no actor can survey the entire set from at any one point in time. When the environment suddenly changes previously competent actors have no more knowledge than anybody else. The state space is non-transparent, and actors are grossly ignorant and misinformed about its properties. Business mistakes will be made by actors all the time as they try new business ideas in the market (Eliasson, 1992). Furthermore, it is highly unlikely that the best (optimal) solution will be discovered. Each actor can be certain of one thing, however good their innovative solution, namely that there are better solutions that may hit the market at any time upon discovery (Eliasson, 1996).

This makes all economic activities uncertain and principally unpredictable as distinct from risky and calculable. Incomplete knowledge in combination with the expansion of the state space makes the products themselves not well defined and constantly changing because of an unpredictable market.

1.3 The Innovative Pricing Problem in Economic Theory

Already Hayek (1945) noted the problem of defining a complex good given contradictory and fragmented information. The consequences of incomplete and contradictory knowledge are, he argues, that goods will not be well defined, and that actors will have to discover which goods are goods, the way to distribute the goods, efficient methods of producing them etc. (Hayek, 1978).

One dimension of product quality is variation (product variation). New dimensions to the product specification are added to suit the taste of demanding customers (Eliasson & Eliasson, 1996). The question then arises which variants, or which dimensions to charge for. In the EOE heterogeneity of products is represented by Information Paradox II. Goods and services are not well defined if they are multidimensional and to a large part characterized by intangible qualities. Hence, information/knowledge is incomplete. Multidimensional goods and services are defined by their technical properties and use (Saviotti & Metcalfe, 1984) but also by the ways they are priced in the market. The more heterogeneous the goods and services the larger the number of potential uses and the more complete their definition as a good or a service. This multidimensionality is perhaps most typical of competence capital and makes it (almost) impossible to give a general definition of competence and knowledge (Eliasson, 2000a, p.49). Hence, competence capital cannot be defined before it has been

allocated on a job. The value and quantity of competence or knowledge capital depends on how it is allocated, i.e. how the carriers of competence choose to allocate their services to obtain ‘the right price’. We have a case of IP.

The optimal allocations are also unstable and move around as firms search for them, since their location simply depends upon how the multidimensional products are defined (priced). This definition process depends on the method of search, its transactions and communications costs, the competition and the rate of change in the economy. Firms are ignorant about demand curves which can rarely be defined, unless prices are given or the same (Kaldor, 1985). Complex products are constantly redefined and reinvented in the market, and this creates a critical connection to theories of innovation and entrepreneurship.

1.4 Pricing as an act of Innovation

Schumpeter’s (1947) definition of the entrepreneurial function focuses on the process of creating new things or the doing of things already being done in a new way.

Schumpeter underscores that entrepreneurial activity does not necessarily have to be spectacular or of historic importance. This creativity, the ability to come up with something new, is an important feature of competence capital, since the product experiments of the actors will have to be carried out without anyone having complete or calculable knowledge of all combinatorial possibilities and their consequences. Thus, the actors have to coordinate (i.e. price) something they only partially understand.

In the Experimentally Organized Economy (EOE) the competence of the actors determines firm performance. The more competent the actors the more innovatively and the more efficiently they carry out their plans and activities. By assumption the firm can be described as an experimental machine conducting and adjusting to business experiments (Eliasson, 1990a). The experimental analogy of the EOE is also a central concept of Innovative Pricing (IP), where the pricing scheme (the business idea) can be seen as an experiment that is tested in, and evaluated by, the market.

Economic performance is conditioned on an efficient process of creating, identifying, selecting, expanding and exploiting business opportunities. When efficiently organized in the EOE the pricing process minimizes the economic consequences of two types of errors: keeping losers for two long and losing the winners.

Table 1. The dominant selection problem (*in Innovative Pricing*)[7]

Error Type I: Losers are kept for too long

Error Type II: Winners are rejected

In terms of pricing, a type I error could entail maintaining a pricing scheme that, as a result of technical development or competition, has become outdated[8]. This minimization exercise, however, immediately meets with the indeterminacy problem of the EOE, i.e. the impossibility of identifying all the winners that have been lost. Since, however good the pricing schemes you have identified there will always be better unknown solutions/projects. The balancing of these two types of errors cannot be done theoretically, since actors, through their ignorance, are unaware of the existence of a possible optimum and, hence, whether they are placed optimally or not (Eliasson, 2000b). In practice this balance is constantly guided by intuition. Thus pricing decisions will often be mistaken and erroneous and never the best possible ones ex-post as a result of the non-transparent character of the state space. The main point is that pricing decisions in the EOE will be based on ignorance, not lack of marginal information, and that these decisions will not be correct in expectation. The latter is due to the non-stationarity of state space. Actors may be almost correct in their expectations, for some time, however. This stable state can be overthrown suddenly and unexpectedly by a radical change in the environment. Firms' decisions will then become completely wrong, because of their ignorance of the radical change.

Information Paradox I or the Särimner effect is needed to solve the mathematical problem of bounding the system without making it fully learnable or transparent with time. Initially, the state space is assumed to be mostly unknown. It is assumed to be subjected to steeply decreasing returns to search in the short run. Hence, the state space (the opportunity set) of the EOE will be populated by grossly ignorant actors. With time, however, they should be able to learn and the economy will converge towards a full information exogenous equilibrium. This is not an empirically viable proposition, however. Information Paradox I and the Särimner effect help us to stay relevant. By actively searching state space, actors are assumed to keep generating new opportunities, hence, expanding state space (for our purpose the set of possible pricing combinations). Thus state space is likely never to be fully discovered,

[7] Eliasson & Eliasson (1996);My addition in italics
[8] The pricing of music on the Internet is an example used later.

because it keeps expanding as a consequence of search itself, and most likely faster than actors can learn. Actors then may become relatively more ignorant with time (Information paradox I or the Särimner effect). This is a nice way of capturing the empirical fact that state space is always non-transparent and impossible to learn (for each actor) more than marginally. Hence, we do not have to introduce the mathematically awkward assumption of an infinite state space. Since 'everything is possible' and entry into the market is free no actor can ever feel safe and protected from the competition. This means that new unexpected pricing innovations constantly appear, forcing actors to redefine their products and pricing schemes and to develop new products to remain at an acceptable profitability level.

The entrepreneur (innovative pricer) thrives in this uncertain and dynamic environment contributing 'the fundamental function of creating the mechanism that allows the economy to work' (Day, 1984). Consequently, instead of regarding entrepreneurship (IP) as an exogenous push upon the economy 'it should be seen as a market parcel of the market process' (Böhm, 1990). The entrepreneur, using Schumpeter's definition endogenously brings in a new way of charging for a product by redefining its pricing base. The intangible multidimensional nature of the products and the uncertainty residing in the state space of each actor makes the introduction of IP a market experiment in the EOE

How do actors decide upon an Innovative Pricing strategy? Instead of attempting to fully inform themselves of all the possible consequences of their pricing decisions *actors will place their choice of pricing base on a single (or bundled) parameter that relates to the rest of the product in a subjectively predictable way*. The IP scheme is continuously changed as the result of a selective trial and error search in state space, attempting to avoid the errors in table 1, using bounded rationality (Simon, 1955). If an actor tries, through IP, to find a suitable base for charging he is assumed to be negatively informed by past failures (errors), and to be positively informed by successful attempts with similar pricing problems. According to Simon, the adoption refers to the process of: 'gradually and on the basis of experience responding more frequently with the choice that, in the past, has been most frequently rewarded' (Simon, 1959, pp. 271). This search process is costly, however. Large transactions and information costs will limit the amount of search that can be done by the actors. These search costs have the effect that we can describe the IP search in state space mathematically without neither bounding the system nor describing it as infinitely large (see Chapter III). The search for a pricing base in IP is, hence, maintained until the satisfactory firm specific criteria have been attained that subjectively place the pricing scheme at an acceptable level between

the errors of table 1. These Innovative Pricing schemes should not be described as optimal. They simply represent practices which so far have been found to work better than the alternatives (Metcalfe, 1995). Note, however, that in the EOE such practices will not be correct even in expectation.

Through evolutionary reinforcement, adoption (imitation) of best practices will contribute to introduce successful strategies as benchmarks for pricing. The pricing scheme (the way to charge for a product) eventually becomes a taken for granted practice. The firms execute a repeated sequence of actions that requires little conscious thought, called 'habere' in their pricing (See Day, 1987). Hence, the quicker the rate of diffusion the faster it reinforces the evolutionary mechanism[9] primarily in the sense that it creates expectations of how a particular product will be charged for and defined, but in addition, enable entrepreneurs to always question popularized bases for charging[10]. The pattern of economic evolution is, however, always contingent on the prevailing selection environment (Alchain, 1951). Even the most successful actors have to continue their search because others will and additional search will change (expand) the selection environment and make new ways of charging possible. Old winners, hence, run the risk of being overtaken i.e. committing a type I error by doing nothing.

The practical pricing problem in the EOE is that a large number of additional bases always exists, on which to base the price of a product, that are likely to be better fitted for this purpose. They have, however, been left unexploited because of the fundamental ignorance that characterizes actors in the EOE.

This further complicates the pricing problem beyond Arrow´s (1959) observation that standard pricing theory assumes that all actors are price takers, but that 'nobody' sets the price, except the 'Walrasian auctioneer'. To solve that price determination problem actors have to be modeled as small monopolies that all compete, not facing infinitely elastic demand

[9] This follows Parij's (1981) view of an evolutionary mechanism as one that works through actual adoption of past consequences (See also Vromen, 1995). This is somewhat different to Simon (1955) who places more emphasis on learning.

[10] This takes us back to competence capital as an example of a multidimensional product where IP is needed. Take IBM, for instance, that was once in supreme command of centralized mainframe computing but was incapable of dealing competitively with the surge in decentralized computing except by cutting its staff by half (Eliasson, 1996, pp. 175). Similarly, Sweden's pulp manufacturers are in supreme command of traditional chemical technology, but may be caught unprepared, and then utterly ignorant, if a new bio technology to produce pulp suddenly emerges in the market (Laestadius, 2000). Taken for granted ways of defining a product (pricing) can create a type I error (keeping an outdated solution for too long).

curves. Nobody has yet solved that problem of monopolistic competition. In such a model any estimate of the demand curve to a single entrepreneur has to involve a guess as to both the supply conditions and the prices of other sellers. In the EOE, actors also have to have an idea of the demand curve of the industry as a whole, since an undefined product adds a third uncertain quality variable to the traditional price and quantity dimensions. Consequently this new element adds further dimensions of difficulty. We are confronted with an economic version of Poincaré's (1889) three body problem[11]. In the IP world firm search is conducted in three dimensions: quality, quantity and price. My IP analysis then emphasizes quality in the sense of innovatively integrating (bundling) a characteristic of the product that can be charged for (associated with a property right, see below) with other characteristics such that the producer can capture a higher value for his product. Poincaré shows that if the initial values and the derivatives (velocities) are known (exactly) then the subsequent positions and derivatives are also fixed. The problem is then deterministic. However, Poincaré also demonstrates how such a system often becomes chaotic. A small perturbation in the initial state, for instance in the form of a misinterpretation of the quality of the product (its definition), can generate radically different states (trajectories) compared to what would happen in the unperturbed system. Many pricing decisions are thus sub-optimal. This has two consequences: First, whenever a dynamic system has more than one stable critical point, the particular equilibrium towards which the system gravitates will depend upon the path taken, the initial conditions and the external shocks. Second, in chaotic models the dynamic path is extremely sensitive to initial conditions in such a way that the outcome can change dramatically with only a small change in the latter Further, as the current state constantly changes, the initial pricing conditions will always change.

The implication for IP is that we are likely to be placed in a chaotic system, unless we are able to exactly determine the price, quantity and quality dimensions (fully define the vector of characteristics) of the product[12].

[11] Poincare is often referred to as the founder of the modern theory of dynamical systems. He created a topology, the study of shapes and their continuity, and used this new mathematical tool to attempt to answer the question "Is the solar system stable?", a question posed by King Oscar II of Sweden with a cash prize promised to (s)he who answered it definitively. In fact, however, Poincare limited his inquiry to an attempt to understand only three bodies moving under their mutual gravitational attraction (interaction). Poincare still won the prize with his 1889 thesis. In his attempt to solve this problem Poincare was the first to discover Chaos, although the term was of course unknown to him.

[12] An alternative way to create a three body problem would be to build on Savitotti & Metcalfe´s (1984) model of products represented by two sets of characteristics (likely related to the genotype/phenotype distinction in biology): Internal structure (technical characteristics) and external structure (the service it performs to its customers). A three body problem would be encountered if the third dimension of quality (pricing base) is added.

Innovative activity, as modeled by Cantner & Pyka (1998), can therefore, be seen as a myopic path dependent search at the micro level (Day, Morley & Smith, 1974). This means that new situations can constantly emerge at any moment. The economy may encounter a bifurcation point, at which it can branch off into an entirely different state. In the EOE, actors do not even have to be misinformed initially because the dramatic change will only be based on a minor estimation error (in price, quality or quantity). Practically this prevents determinism at any one point in the state space of the EOE. One practical consequence is that IP decisions will have to be constantly remade as a reaction to the unpredictable environment. Innovative Pricing can thus be illustrated by means of a natural selection and adaptive feedback mechanism guiding an endogenous myopic expansion of the product vector to enable subjective chargeability[13].

The chargeability of the product is not determined by the value it creates for its customers, however, but how that value is captured and then returned as revenue. We a have a property rights problem.

1.5 Weak Property Rights

The value of a property right to its owner depends on the right of the owner to manage the property (the asset), access the profits generated by this management and the ability to trade in the property (tradability). Restrictions on those rights reduce the value of the asset to the owner (Eliasson, 1998). It is more difficult to claim property to some assets than to others. If property rights become (partly) freely floating by their nature, or by not being protected by patents or copyrights we have an externality or a spillover. The classics of the property rights literature[14] are not very specific on their definitions of weakly defined property rights. Their work shows how well defined property rights foster economic growth, but does not tell us how to create property rights (Shleifer, 1994). Arrow´s (1962) proposal was simply to create a positive externality by making research results freely available. This is a common view of the policy maker. It means creating a short-term benefit to society and a long-term loss if the new organization of the creation of the externalities does not work.

[13] In Jonason (2001) the Innovative Pricing behavior of firms are simulated with the use of genetic algorithms over an endogenous product vector.
[14] See for instance, Demsetz (1967), Alchian & Demsetz (1972), North (1981) Jensen & Meckling (1976) and North & Thomas (1973)

For the private creator of a positive externality the situation is the opposite. He wants to be able to manage, earn profits from and trade in the values he has created i.e. to claim property rights to them. Appropriability is, however, rarely absolute We, therefore, need a graded scale between absolute and no property rights since IP means creating more or less value to the producer. It is not possible to say that there are no better contractual arrangements available (Wihlborg, 1988). Creating weak property rights is a useful term. If the property right cannot be naturally asserted, for instance by holding the asset in your hand, there are two ways: (1) legal protection and/or (2) Innovative Pricing (IP). IP is used where legal protection cannot be offered that is in a situation in which innovative activity can restore some management rights, improve access to profits and create some tradability to the creator of the asset.

For a spillover to be a positive externality the competence to commercialize spillovers must exist among outsiders. The less of that competence the less value to the originator of the spillover, ceteris paribus and the less value to claim property to. The creator of the spillovers will want to internalize them to capture their value. Property rights have even been defined as an internalized externality[15]. IP is also a method to internalize an externality. Building a new business on your own spillovers is one way to access the rents from your own spillovers. For IP to be effective, obviously, external receiver competence (Eliasson, 1990a) has to exist to create value on the basis of the spillover. It may even be in the interest of the creator of the spillover to support the building of external receiver competence to commercialize the spillovers. In many cases a win–win situation for both parties exists or can be created. This is particularly important in a situation of so called joint customership which is often the case in advanced public procurement (See: Eliasson 2001, chapter VI)

The selection process *in IP*[16] entails the survival of the fitter, not the survival of the fittest (Williamson 1987, p. 623). New IP schemes may well lead to improved efficiency in charging for a product, but again, since the market constantly changes (constant definition and redefinition of products), so does the nature of how the product is defined as property (priced). Mainstream theorists such as Demsetz (1967) and Jensen & Meckling (1976) contrary to Williamson, seem to rule out the possibility (by assumption) that hitherto unperceived opportunities remain unperceived and hence untried (Vromen, 1995). In the EOE the existence of unperceived opportunities is the normal state. The constant search in IP

[15] This is the definition used by for instance Furubotn & Pejovich, (1972) and Alchian & Demsetz, (1972;1973).
[16] My comment in italics

entails the internalization of spillovers where actors with the right receiver competence commercialize weak or non-existent property rights.

The IP solution does not only entail the capture of externalities created by the actors' own products, however. An actor can also observe spillovers in the market and design his product and property rights accordingly to capture value created by others that remaining actors in the economy, through their ignorance and inability, cannot exploit. *The redefinition and endogenous expansion of the product will be a result of the firm's attempts to make it chargeable rather than to increase its value to the customer (technical innovation).* This is the essence of IP. An extreme case is when actors appropriate profits where a value adding element of the product is no longer needed. Instead this free rider pricing is based upon the access to spillovers created by other products in the market.

1.6 Innovative Pricing and Mainstream Price Theory

Innovative Pricing as introduced here is a new concept. When Mitchell & Vogelsang (1991), Tolley (1992) and Varley (1992) use the term 'pricing innovation' they mean something very different. They use the term to describe agents' choice over a set of predefined (read 'known') product and pricing choices within a state space being either fully transparent or searchable at negligible transactions costs[17]. Mainstream Pricing (e.g. Vives, 1999, Wilson, 1993) and Industrial Organization textbooks (e.g. Tirole, 1989) generally ignore the existence of both entrepreneurs and innovations. The subject of entrepreneurship is rarely even given a line of text in these celebrated equilibrium textbooks[18].

Instead, mainstream research in microeconomic pricing is often based on Baumol and Bradford's (1970) seminal work on public utility tariffs and the optimal departures from marginal cost pricing. The study of these types of problems fanned out during the 1970s and 1980s into a large body of economic literature to cover different issues of tariff designs (e.g. Wilson, 1991), price discrimination (e.g. Varian, 1985,1989), price customization in

[17] See also Simon & Butscher, 2001; Nagle & Holden, 1995. The authors offer different pricing techniques to customize prices (price discriminate) depending on individual preferences. Simon & Butscher, 2001, refer to such techniques as innovative. Their exogenous (predefined) nature makes them incompatible with the Schumpeter (1911) definition of innovation, however.

[18] This conclusion is based on a test I call the 'Dan Johansson' test, which entails looking up the words 'innovation' and 'entrepreneur' in the indexes of mainstream economic graduate textbooks. The reader is urged to run a 'Dan Johansson' test for himself/herself.

management literature (e.g. Dolan & Simon, 1996) and variants of monopoly pricing, sometimes referred to as Ramsey pricing (Ramsey, 1927; Henderson & Burns, 1989).

A related topic of product differentiation and imperfect substitution was formulated as early as Edgeworth (1897/1925)[19]. Upon this, Hotelling (1929) based a product differentiation model in terms of the location of the products in the space of the characteristics that define them. This model still makes up the foundation of most product differentiation models of today (Vives, 1999). The standard Industrial Organization approach is to derive a pricing policy from a duopoly case, an exercise which has close links with non-cooperative game theory (Tirole, 1989). The assumptions of these models conveniently imply that these characteristics are known or at least calculable at any moment in time and that the product does not change. Hence, no unexploited complementarities exist in the form of undefined spillovers, upon which an Innovative Pricer can motivate an endogenous expansion of his product, since such a strategy would already have been anticipated by the competition. The static nature of the product in these studies and the tendency to completely ignore innovation in how the product is priced prevent us from establishing a common theoretical ground with the theory of IP. The same type of incompatibility problem is often present in mainstream marketing.

1.7 Innovative Pricing and Marketing

Price bundling is related to Innovative Pricing (IP). It is used in marketing to illustrate how to collectively charge for a portfolio of products using only one price. One example of this is Burnstein (1960)'s introduction of the concept of a tie-in-sale. A durable product (tying good) is combined with different complementary products (tied goods) to 'maximize' overall sales. The theory has been expanded to include a range of pricing strategies. One common term in this context is Block booking or Commodity bundling in which unpopular elements of products are bundled into a joint sale to increase overall profitability (Stigler, 1968). Still another type of price bundling is Add-on bundling (e.g. Guitinan, 1987) where the sale of an add-on depends on the sale of the lead service. The value of the lead service would in this case increase with the value of the add-on and could, hence, motivate a below marginal cost price, or a generous two part tariff below the going rate of the market in order to lock a customer to a particular lead product (Kotler, 2001). The problem of selecting a viable price

[19] First published already in 1897 (Vives, 1999)

level then has to take the (in economics) frequently addressed cross fertilizing demand effects and the networking effects (Katz & Shapiro, 1994; Church & Gandal, 1992) and externalities (Bousquet & Ivaldi, 1996) into account such that lead and add-on products are properly cross-subsidized (Faulhaber, 1975) in a similar (the same) manner as those addressed in product differentiation (e.g. Vives, 1999, Spence, 1976). The concepts of bundling and product differentiation are both relevant in this context, but they all share the static properties of mainstream equilibrium models (more of this in chapter VI).

Contrary to IP, price bundling (in mainstream economics) concerns a well defined product, and, in addition, often concerns deciding between an exogenous set of well defined static pricing schemes. An externality for which there exists no property right (spillovers) may have existed for a long time as an unnoticed and undefined byproduct[20], however. Suddenly, an innovative pricer can find a non-spectacular way to convert this spilled value into revenue by inventing a, by customers accepted, base on which a positive price can be set. If this option is ruled out by assumption, then there is no room for IP.

1.8 Noise and Innovative Pricing

Several mainstream studies recognize, and try to deal with the problem of increasing complexity. This has been done either by increasing the complexity of the pricing situation by introducing nonlinear properties (e.g. Wilson, 1993) or by approximating the pricing problem as one of pricing under calculable risk (e.g. Mitchell & Vogelsang, 1991; Panzar & Sibley, 1978). In the second case each actor misses the optimal price by a stochastic error. The relevance of both methods, however, is restricted by the assumption of an exogenous and finite (very small) product vector, often consisting of one single element. This can be useful in some contexts such as peak-load pricing (Panzar & Sibley, 1978; Brownlee, 1998). It, however, excludes the multidimensionality addressed in IP by definition. In does not recognize the actors' ability to redefine the product by innovatively reorganizing its pricing base or, more importantly, expand the product definition endogenously, through innovation, to fit a subjective market demand. The latter is again, what defines the theory of IP (see chapter III).

[20] See for instance Kraft's (1994) and Eliasson's (2001) illustrations of how many firms do not realize the presence of valuable by-products.

Mainstream pricing and marketing models, some of which have been mentioned above, hence, have a problem in handling products the characteristics of which change endogenously. The implication is that an endogenous search process cannot be performed if the 'product' being searched for changes because of search itself. By redefining the product innovatively a new pricing base has been introduced that yields higher value to the producer for the entire product. The product vector is an analogy to the state space in the theory of the EOE. It is arbitrarily large and constantly expands and contracts as a result of the actors' IP activities. New uses, previously undiscovered spillovers and new bases for charging are continuously discovered and abandoned. IP is needed when the assumptions of exogenous and stochastic pricing schemes no longer hold. This occurs mathematically when the mechanism that generates the stochastic noise changes endogenously. Then the process is no longer stationary. A stationary process, on the other hand, will keep generating data such that a 'statistically defined entrepreneur' eventually will know the parameters of the process for sure with any precision desired. It has been demonstrated that such statistical learning, however, requires an extremely narrow specification of state space (Lindh, 1993). Hence, the distribution that temporarily generates the white noise changes endogenously (e.g. Eliasson, 1992; p. 256). The noise is then no longer white. Innovative Pricing schemes are then needed.

These complications, however, do not necessarily exclude the applicability of standard price theory as a complement to IP (or vice versa). As a crude approximation one could say that the theory of IP handles problems at a level below that of traditional price theory. Whereas the old theory only analyses the pricing of an exogenously given product, IP studies pricing behavior in a broader setting where endogenous product change is part of pricing. The role of IP, hence, is to lay the product defining groundwork such that a pricing method can be properly applied.

2 EXAMPLES OF INNOVATIVE PRICING

Innovative Pricing (IP) can be illustrated by examples. The classic example of IP, that I will return to in more detail in Chapter II and in the Discussion, is the lighthouse. Additional examples of IP are found in the various chapters (e.g. in Chapter II).

2.1 Lighthouses

The lighthouse service itself is quite uncomplicated. Standing at the edge of a shore the lighthouse signals approaching ships how to safely enter a port. The pricing problem associated with the service, however, is for the owner of the lighthouse to charge for the usage of the service. Being a close to zero marginal cost service means that an additional ship incurs little (no) additional cost for the lighthouse owner. This is the reason Mill (1848) made the lighthouse the standard example of a collective good. The market would not support such a service and the government had to step in.

The question and the Innovative Pricing (IP) problem for the owner of the lighthouse is how to make the service chargeable. This was for long considered impossible, and the lighthouse became the standard textbook case for a public good that should optimally be supplied free of charge by the state. There was, however, an IP solution as shown by Coase (1974) to endogenously change the product by introducing a new parameter, in this case a harbor master who was authorized to collect lighthouse fees and prevent ships from leaving the harbor before the fee had been paid. The lighthouse could now be organized as a self sustained operation. The change in the product was made, not to improve its performance but to make it chargeable. In this case an authority was encouraged to step in to authorize the innovative scheme. But even that would not have been necessary. Private collective action was also possible. The harbors need the lighthouse service as well as the ships. The harbors along the coast could have joined up to prevent the ships (by force) from leaving if they had not paid the harbor fee or alternatively keep them from returning.

2.2 Music

The music industry is another example of how existing pricing practices can be put to the test and become useless unless the actors can find a way to make the products chargeable. The previous pricing practice of music relates to the costly production and distribution of vinyl records. A ‘music record‘ has become a generic term generally describing the amount of music that can be stored on such a vinyl record. The pricing transition was made to compact discs where the physical hardware of the old vinyl records still set the ‘tone’ of the pricing practices although the physical storage capacity of CD no longer was a problem.

The pricing problem facing the old distributors of music is that the physical limitations, the bases for charging, to which the pricing was leveraged have become subject to pressure, since it is technically possible, at a modest cost for the consumer, to bypass these bases of charging by sharing music as files over the Internet. There are, however, several ways of addressing this free rider problem. One solution, using the popular analogy of an amusement park, is to accept the fact that some will ride for free on the carrousels and try to recover the loss of revenue on the swings. The issue of free music on the Internet can be compared to a similar problem with the introduction of libraries. Pessimists then called for such institutions to be prohibited since they would drive book sellers out of business. The effect was the opposite. The availability of free books, created spillovers, i.e. increased the incentives for a larger part of the population to learn how to read, which boosted sales. The uncertainty here is of course whether the presence of free online music will have a positive impact on CD sales.

Another solution could be to enforce, i.e. restructure the property rights protecting the music, making its distribution and possession illegal. This is an issue addressed in paper IV of this thesis.

A third possibility could be to endogenously redefine the music product to include new bases for charging. Music already has several externalities in the form of concerts and merchandise sales, perhaps, through Innovative Pricing (IP), the music product can be made chargeable by inventing such a base to which property can be claimed. The Mobile Internet distribution channel could be one option. Finally a more drastic approach for the distributors to lessen the incentive to download illicit copies of music could be to reduce the quality of illicit copies on the Internet by changing the products endogenously[21] and start to distribute these low quality copies themselves.

2.3 Telecommunications

If one were asked to pick out the most significant innovations of the last decade, the Internet and mobile telephony would certainly be among the top alternatives. They are both pervasive technologies with wide social and economic implications. Their impact is

[21] One possible approach could be for a distribution company to start to distribute illicit copies (endogenously changed products) of their own music containing viruses beside their regular CD channel. The end user illicitly downloading the music would then probably be more hesitant, even if only a small portion of the files contained viruses.

fundamental for the development of telecommunications and they are expected to play an even more crucial role when brought together through Mobile Internet access.

Communication from mobile devices constitutes a truly dynamic market but the acceptance of mobile telephony was for long repeatedly questioned for its potential for profits. Prior to the mid to late 1980s, there were few who thought that mobile telephony would become a universal communications technology. Large parts of the telecommunications industry itself were incapable of foreseeing the potential demand from people to have mobile telephones in their cars or in their pockets, facilitating ubiquitous communication (Mölleryd, 1999).

Once mobile telephony had proven its potential as a winner, it quickly led to a rapid worldwide expansion in the use of the technology. Wireless network operators have, in general, been very successful in maintaining price levels for airtime and have at the same time continued to grow their subscriber base (number of customers). The bulk of their revenues, however, has come, and is still primarily based on regular wireless voice services. The pricing of these services has traditionally been related to a price per volume (of voice) built on the assumption of a capacity bottleneck in the network[22].

Market deregulation and saturation in combination with increasing competition and technical improvements are forcing price erosion on voice based services and is therefore posing a fundamental threat to the future profitability of operators (see chapters V and VI).

Operators, are therefore not only on the lookout for new services to diversify their product portfolio against the competition but also for new ways of charging to diversify their revenues, and thereby lessen their dependency on voice (and airtime) as a base for pricing[23].

At the same time, as consumers increasingly rely on the web to send and receive information, the demand to conduct these activities from multiple access points also increases. Bringing the Internet to mobile devices as a new value adding service, hence, appears to be a logical next step in assuring the future profitability of the wireless industry. It also introduces a pricing problem, however. Like energy and transportation networks, off-peak telecommunications services have nearly zero marginal cost. Wireless operators are obviously

[22] This description of the wireless pricing is obviously quite crude, and far from optimal but will suffice for introducing our problem, without losing track of the essentials.
[23] Several operators have anticipated this convergence. The operator Vodafone (Voice-Data-Phone) innovatively made it part of their brand name.

aware of the pricing problem in charging for capacity in the more mature fixed side market where traffic charging prices are considerably lower. The decision of how to charge for the large sunk costs of a low marginal cost service, is hence, a critical issue. IP schemes are needed.

Network externalities create both problems and opportunities. If the available capacity becomes less of a problem (through for instance mobile broadband or alternative access methods) operators are likely to have to diversify their pricing or redefine their pricing to capture the spillovers created by new technical innovations and the competition. This question is addressed in chapters V and VI.

The two way nature of telecommunications demand gives rise to an important positive network externality. The value of a network to a given user increases with the number of nodes, such is the argument of the rule of thumb often referred to as Metcalf's law. A problem arises, however, when the marginal user of a telecommunications services causes congestion and then imposes a negative externality on the network. Upgrades in capacity, in order to solve congestion, can sometimes be costly. If the utilization of airtime grows beyond the available capacity, it could cause a considerable backlash for firms following Metcalf's law[24]. The pricing problem is, hence, considerably more complex.

Another complicating issue, is the fact that telecommunications services are typically produced in a network that embodies considerably more than a single technology, often offered by several firms that have to agree upon a pricing contract. For example, transporting calls between two wireless devices requires both radio and fixed line technology, meaning that an increase in demand among users of wireless technology also imposes an externality on the fixed networks, where perhaps capacity, and hence, congestion is less of a problem[25]. On the other hand the externality swings both ways. A new user may therefore cause positive externalities on the fixed side whereas he can cause a negative externality on the radio side (or some other bottleneck). Adapting the technology to the expected demand and pricing scenario in the market becomes a typical Innovative Pricing (IP) problem of charging for multidimensional and not easily defined products. If two separate firms own the fixed technology and the radio technology then they will have to agree upon a pricing scheme

[24] See chapter V for a more elaborate discussion.
[25] The technology for transporting mobile telephony is obviously considerably more complex.

towards the end user. This can be difficult since their bottlenecks (cost drivers) and bases for charging (revenue) are likely to be different (this is the problem addressed in chapter VI).

The question, hence, is how these services should be priced in relation to the existing, and in the case of wireless telephony often still growing, revenues coming from airtime. There exists considerable opportunities for operators to redefine their existing product portfolio exposing them to the IP problem of which services should be introduced and how they should be priced to make their whole product portfolio chargeable.

3 RESEARCH OBJECTIVES

3.1 Problem Definition

By introducing the Schumpeterian innovation and intangible telecommunications products, several interesting questions relating to the concept of a product in economic theory, of establishing property rights and of pricing strategy are raised. I derive some theoretical and practical guidelines for finding a solution.

Besides the ambition to formulate a comprehensive approach to the problem of telecommunications pricing the study also has a more general theoretical ambition. Innovative Pricing (IP) involves the strategy that decides whether a business idea will become a commercial failure or a success.

IP is a common phenomenon in business. But it has been systematically kept out of economic theory because of the standard assumptions used in these theoretical fields. This is not a satisfactory situation, especially if practical men use the rules of thumb of standard pricing theory for IP problems where it does not apply. I have found Schumpeterian theory and the theory of the Experimentally Organized Economy to be useful frameworks that offer an extensive and relevant theoretical environment for such an empirical IP analysis. They serve as a point of departure to formulate theoretically valid propositions of how the entrepreneurial process of experimenting with different combinations of products and pricing becomes an act of innovation. The next step is to illustrate this theory empirically.

3.2 Aim of Thesis

The study on Innovative Pricing was inspired by my analysis (Jonason, 1998) of the pricing problem facing operators of fixed line voice telephony. I discuss several aspects of Innovative Pricing in the six chapters, each addressing one of the following issues: the IP problem of identifying a suitable base for charging; the use of pricing as an act of innovation; IP as a competitive advantage; how a pricing solution to the IP problem in one end of the market can stir up a new pricing problem in other areas and the institutional aspects of IP.

My main focus is on the issue of 'what to charge for' (pricing) rather than the issue of 'how much' to charge (price). The background to the focus on pricing is that pricing constitutes the intersection between technology (product definition/quality) and economics (price). Price, product and quality are all critical elements in any firm. The interaction between the three is thus an essential element of firm success, given the profit-seeking objective of the firm.

The central theme of the thesis is thus to lay an endogenous product defining groundwork before the appropriate price theory can be applied. Therefore, IP does not necessarily come in conflict with standard price theory but should instead be seen as its complement.

3.3 Limitations

I have chosen to use the theory of the Experimentally Organized Economy (EOE, Eliasson, 1987, 1988, 1991) as a frame for Innovative Pricing. There are several reasons for this particular choice of theoretical framework. The primary reason is the fact that while Innovative Pricing is an observable practice among firms it is not incorporated in standard pricing theory. The EOE's on the other hand recognizes uncertainty as distinct from calculable risk and market experiments and therefore constitutes a market environment in which Innovative Pricing (IP) exists and is needed.

It is beyond the scope of this thesis, however, to compare the theory of the EOE with other schools of economic thought. Schumpeterian economics and the theory of the EOE serve my purpose by allowing room for Innovative Pricing (IP). A modified theory of IP could perhaps be made compatible with other schools of economic such as the Austrian or even the Neo-Austrian model. The EOE offers a natural theoretical frame that, in addition, fits very well

with the empirical findings of the study. Elements of IP might be useful within other theoretical frameworks, however.

An interesting idea, for example, would be to model the endogenous growth of the product vector by means of a Brownian function, expanding its size through stochastic noise, the mean of which could also be of a Brownian nature. This would be a special case of the EOE and of Schumpeterian theory, which does not rely on stochastic assumptions, since the innovative process, to my mind, should not be treated as white noise. Such comparisons could, however, be interesting areas for further research (my own?) but they are beyond the scope of this study. There are obviously many more reasons for my choice of the EOE as a framework but a more extensive discussion would detract attention from our main theme.

The rapid rate of technical change in computing and communications technology proves a particular problem for thesis authors that have to with the long publishing period of a thesis. In some chapters, technology has already changed to the extent that some technologies mentioned in the chapters have become technically outdated (chapter IV in particular). This is, however, completely uninteresting from the point of view of my analysis. The purpose of the empirical chapters is to illustrate the problem, its implications and the solutions connected to IP, rather than to present an updated account of current technologies. The chapters are, hence, presented as ready and published at the time of their presentation.

4 MATERIALS, METHODS AND RESULTS

This thesis consists of two theoretical (III and IV) and three empirical (II, V and VI) studies/chapters. The three empirical studies primarily focus on the pricing problems facing telecom operators. Interviews, billing data and literature studies were the main sources of information.

The strategically sensitive nature of pricing and confidentiality has forced me to leave out, or delay the publishing of, some particularly sensitive information (such as the publication of Jonason & Wade, 2001). The excluded confidential information does not have any practical consequences for the analysis and conclusions of this study, however.

The literature survey covers books, scientific articles, analyst reports and trade magazines. A broad search was set up over a variety of relevant academic and practical databases to remain up to date on relevant literature. A key science problem, however, is that this

technology has few up to date books and academic articles. The academic publishing process is simply too slow.

4.1 Overall Validity and Reliability

The validity of this thesis depends on a) the quality of the literature survey, b) how the empirical data was collected, and c) on how applicable the conclusions and recommendations are for existing pricing problems in the market. If the literature survey presented covers theories relevant to the purpose of the research, and if the empirical data and the conclusions cover what is intended, validity should be considered satisfactory.

Problems can occur during an interview even though it has been structured and people have first hand knowledge of the present state of affairs. The interviewer may influence the interviewee by unwittingly making him understand what answer he is expected to give. The interviewer may note only those answers that, to him, make sense, thus interpreting the answers along the lines of his own bias (Silverman, 1999). I have tried to control for this problem by asking for the same information in different ways during the first hand interviews.

Another issue is the fact that some of the interviews were performed by a third party and not by the author(s) of the chapters. While this takes care of the Silverman problem, such second hand information can cause an interpretation error. The structured questions used from the study in question were of a direct nature, however, and are therefore unlikely to be misinterpreted[26].

The research was initially concerned with fixed line operators but was then carried out on wireless operators in Europe, North America, Latin America and Japan and at the wireless equipment supplier Ericsson Radio Systems. It was considered important that the pricing issue concentrated on the problem of product price definition rather than on the actual price level. The reasons for this was threefold: first, the absence of an awareness of pricing as an act of innovation in the literature, second, the generic applicability of the observations and conclusions (Emroy, 1985), third, the availability of data. Empirical data on price levels quickly become redundant and are often protected either by confidentiality or by NDAs (Non Disclosure Agreement).

[26] The questions used from the consumer lab study in paper V were of the type: “What is your monthly phone bill? ”.

First the methods of each chapter will be discussed and then the results from each chapter will be presented before finally the general findings of the thesis are summarized in a discussion and a summary.

4.2 Chapter II

The pricing problem for fixed line voice services in the Swedish telecommunications market was selected as a starting point to define and outline the opportunities for new operators to compete with the old PTT Telia. The research started with an analysis of the traditional copper-wire fixed voice service and its potential technical substitutes. Several providers of these substitutes, both at the manufacturing level and at the operator level where then interviewed by means of a scenario discussion. The hypothesis was that the increase in available capacity and competition in fixed networks would make voice a near zero revenue service. Given the assumption of free voice would consequently force operators to find alternative ways of charging. Nine fixed line providers that depended on voice for revenue participated in the project: WorldCom, RSLCom, Telitel, Netsource, Telenordia, Glocal Net, Sonera, Tele2 and Telia. The findings were then compared with those given by the suppliers of services to which the fixed voice service could be bundled. Such companies were Europolitan (wireless), Kazen & Partner (consulting), Motorola (satellite), Stockholm Energi (Electricity) and Stjärn TV (cable TV). In total, 19 interviews were made. The interviews were structured but not standardized. The questions were quite general in character to enable the interviewed person to take the discussion in any chosen direction. The questions were based on a mind map structure where the follow up questions would depend on the general direction of the interview. Using this technique, the discussion could cross several topics without losing track or distinctness. The interviews were documented in hand writing and later categorized under relevant pricing topics.

The study was conducted between March 1998 and December 1998. The initial findings were presented as part of my master thesis (Jonason, 1998) where the questions and documentation from the interviews are published along with a more elaborate discussion regarding the materials and methods. It soon became clear that the pricing problem facing fixed line voice was not a unique one, and the information was therefore expanded to include a comparison with problems from other industries such as the browser market and public goods.

The findings were presented at two internal workshops at the Royal Institute of Technology, at the KFB (The Swedish Transport and Communications Research Board) conference in October 1999 and at an international conference at the Gothenburg School of Economics in January 1999.

4.2.1 Results Chapter II

It became clear that telecom operators that relied on fixed line voice for revenue faced a pricing problem, as the role of voice became more and more subordinate to the more capacity demanding data traffic. The additional analysis of other areas of information technology confirmed expectations that this type of dynamic pricing problem was far from unique. Several examples existed where the pricing of zero revenue products had been solved. One example mentioned in the chapter was Microsoft's decision to give away the browser Internet Explorer without charge with the motivation that the free browser software motivated a higher price for its Windows operating system. In addition, it also enabled Microsoft to drive their competitor, Netscape, out of the market. A parallel was drawn to Mill's (1848) lighthouse pricing problem later addressed by Coase (1974). The IP problem of identifying a pricing base for a multidimensional product is thus not restricted to information technology. Around the time of publication of the chapter, consultants and lecturers around the world typically made their own services (lectures) chargeable by stating that this pricing problem was the characteristical part of a 'new economy', which obviously is false.

4.3 Chapter III

This chapter constitutes the theoretical core of the thesis. The argument is that pricing, as an act of innovation, has been a neglected aspect of economic theory. This is due to the fact that previous pricing theory relates to a given exogenous product and a (more or less) known demand function. The price and the quantity cannot be kept apart. It is not uncommon in business, however, that the product is adopted to fit a particular pricing scenario, because of the spillover effects the new product definition creates. It is argued that the range and dynamics of the different pricing combinations quickly puts us outside regular rational expectations theory. The problem lies in the inability of the rational expectations model to deal with structural uncertainty, preventing the agent to form a rational pricing decision even in expectation. Once such dynamic assumptions are introduced in the model we are outside

standard equilibrium and, hence, standard pricing theory. Schumpeterian theory becomes a more appropriate theoretical base.

Schumpeter's view of innovation is, however, fairly linear and is conceived as the identification of commercially viable inventions by the entrepreneur who develops new products for the market. An invention in itself is only interesting in its ability to transform the outside world, and that this change has to be commercially successful. This instantly brings up the issue of pricing.

The use of pricing as an innovation has (un)fortunately not been mentioned previously. The five aspects of innovation described by Schumpeter (1911) encompass the following[27]: (1) the creation of a new good, (2) the creation of a new method of production, (3) the opening of a new market, (4) the capture of a new supply and (5) a new organization of industry. These characteristics are all related to more efficient methods of production and are less useful in describing the pricing entrepreneur.´ This chapter thus adds to Schumpeter's theory of innovation. One reservation to this optimistic claim is to describe IP as (3) the opening of a new market. Technically the expansion of the product vector is a new market. Its purpose is not an efficiency gain in production, however, but an efficiency gain in charging.

The study was presented at three internal workshops at the Royal Institute of Technology (KTH), at an internal workshop at Ericsson Radio Systems, at the 8th annual Schumpeter Conference at the University of Manchester in June 2000 and at the METU conference at the University of Ankara in September 2000.

4.3.1 Results Chapter III

I illustrate theoretically how existing Schumpeterian theory can be applied to solve the pricing problems addressed in chapter II. An appropriate theoretical framework is the Experimentally Organized Economy (EOE, Eliasson, 1988, 1991) where the product/price mix can be interpreted as an experiment in the market. The complexity and range of the different pricing combinations available in the market prevent agents from making decisions based on rational expectations. Agents will instead set up and enact subjectively controlled pricing/product experiments based on a hypothesis about market opportunities. The complexity and uncertainty prevailing in the market creates a problem in setting prices for

[27] Hultén and Mattsson's (1994): have added (6) a new type of marketing and (7) a new distribution channel.
´

firms, however. The solution is therefore to locate a parameter that relates to the uncertainty in the market in a predictable way. This can be a unique parameter of the product, proprietary to the entrepreneur, but it can also be an accepted base for charging, held in place by transactions costs.

Schumpeter's definition of innovation relates to the entrepreneur's ability to carry out a new combination not conceived by other agents in the market. *The definition of Innovative Pricing is thus the ability to invent new unexpected price/product constellations not perceived by other agents in the market*. This pricing scheme, if commercially successful, can be compared to a regular product innovation. The IP scheme will be firm specific depending on the choice of base for charging. IP will, hence, depend not only on the pricing competence of the agent but also on its individual product opportunity set. The effect is that it causes the boundary between product and price to become diffuse.

4.4 Chapter IV

This chapter explores the property rights problem on the World Wide Web. It addresses the easy reproduction and distribution of digital products and consequent infringement problem. A considerable amount of academic literature argues that existing legislation is unable to meet the requirements introduced by the digitalization of information and the growth of the web, subsequently calling for a radical revision or abolishment.

The approach to this problem was threefold. First, the foundations of the critique were reviewed by means of a literature survey. Second, some technical solutions for protecting content were reviewed and finally the pricing effect of consumer privacy, as a result of these solutions, was reviewed.

The study was presented at two internal workshops at the Royal Institute of Technology (KTH) and at a seminar at the Swedish Transport and Communications Research Board (KFB) in December 1999.

4.4.1 Results Chapter IV

One conclusion from the study was that existing legislation can be applied to the property rights problem of digital content on the World Wide Web. The argument is based on the fact

that, no matter how swift, digital content must always be bundled with some hardware. As long as the hardware platform can be tracked existing legislation will be sufficient.

These tracking solutions can be so effective, however, that the pricing problem of the seller of content in fact becomes a pricing problem for the buyer. Full tracability eliminates anonymity. Effective property rights legislation through user tracking by way of hardware will conflict with the integrity of personal information. The chapter shows how pricing solutions in one end, hence, can create a new pricing problem in another end of the market. The competence needed for Innovative Pricing is, hence, not only concerned with foretelling the actions of the competition and technical development but also the product/pricing dynamics at other levels in the product chain. This issue is also addressed in chapter VI.

4.5 Chapter V

The origin of revenues and the pricing issues of Mobile Internet services are analyzed in chapter V. The intention of the study was to empirically verify the theoretical core as specified in chapter III. We studied the Japanese I-mode portal using two sources of data. The first data set came from the billing department of the operator NTT DoCoMo, from November 1999. The billing data described the ARPU (Average Revenue Per User) before and after an average user started subscribing to the service.

The second source of data, collected by the Consumer Lab of Ericsson Radio Systems, came from 650 interviews with 400 users and 250 potential users of the service using CATI (Computer Assisted Telephone Interview) technology. The interviews were conducted with respondents, living in Osaka or within a 30 km radius of central Tokyo.

One could argue that the first source of data (from the billing department of NTT DoCoMo) is incomplete since it lacks a control group of average NTT DoCoMo users outside the service. The increase in voice ARPU could be partly explained by the fact that the service was brand new at the time (9 months old). The subsequent increase from the introduction of content services was so large (25-30%), however, that the assumption of ‘heat of the moment’ spending is unlikely to have been the only explaining factor. Instead the increased voice usage, and the increase in overall ARPU are likely to be an effect of a change in usage of the mobile phone, which was encouraging information for operators.

This argument is also supported by the second source of data, pointing to a difference of as much as 49% between a potential and actual user of the service. The fact that the interviews were conducted five months after the billing data was collected also supports the assumption of ARPU sustainability.

Another argument that can be raised against the findings from the survey, however, is that the respondents could have been influenced in their answers because direct questions of their spending were asked. An I-mode user can perhaps be influenced to state a higher figure, while a regular user could be influenced to state a lower figure. Bearing in mind the magnitude of the stated increase (49%) and the results from the billing data (an increase in ARPU as significant as of 25-30%), however, makes this problem appear quite small. The conclusion is that the introduction of I-mode in Japan has resulted in a relatively large and sustainable increase in ARPU.

We then disaggregated the revenue data from the operator down into their respective sources of revenue to locate which parameters were to dominate in terms of size. This was only possible with the billing data.

The study was presented at an internal seminar at the Royal Institute of Technology (KTH) and to numerous internal Ericsson groups and a considerable number of operators [28]. The study has also been presented at the 2nd McMaster World Congress for Electronic Commerce in Hamilton, Canada and at the National Business and Economic Society, in Puerto Rico, organized by the University of Cleveland, USA. It had also been published as part of the course 'E-strategy' at California State University, Hayward, USA, spring 2001.

4.5.1 Results Chapter V

Both sources of empirical data support the hypothesis of Innovative Pricing. The operator NTT DoCoMo has been able to leverage its stable and unique parameters of billing and access, in such a manner that a positive price could be set on the externalities of extra voice and data traffic. The value of the service can be derived from the availability of content, but this value is only partly compensated in terms of revenue within I-mode. It is likely that the presence within I-mode has considerable externalities outside the service, such as branding,

[28] In total, the findings from the I-mode study had been presented 32 times by April 2001.

however. Such spillovers, made chargeable by IP, may be sufficient compensation for the providers of content to continue to offer their -near free- services.

The pricing scenario will not remain in a constant state, however. The large profits from the service obviously create incentives for competitors to launch competing services. An example of such a potential competitor could be 7eleven in Japan, which supplies many of the same content services, such as banking, horoscopes and comic books. The unique parameters to leverage charges could in their case be increased sales of merchandize. Another issue that will keep NTT DoCoMo on its toes is advances in technology. Broadband Mobile Internet services for instance, which could undermine airtime (data traffic and extra voice) as a reliable source of revenue.

Another conclusion that can be made from studying the revenues of I-mode, is the potential for content providers to become operators themselves, and hence, bypass the role of the operator NTT DoCoMo. It is important that the popular service providers are rewarded for the value that they create for the operator or it may result in a redefinition of their own product/pricing mix. This brings up the importance of receiver competence, information and incentive sharing as an essential part of success. This issue is addressed in chapter VI.

4.6 Chapter VI

This study was carried out at Ericsson Radio Systems, the world's largest supplier of wireless infrastructure, between June 1999 and December 2000. Three types of actors in the Mobile Internet industry were studied: Service providers, End-users and Operators. The service providers included providers of content and applications. End-users were Mobile Internet subscribers, i.e. customers of the operators. The structure of the analysis was focused on the role of the third type of agents, operators. Three of Ericsson's customers (operators) were selected, with a special focus on two of them.

The intention was to illustrate both theoretically and empirically, an issue of pricing rarely addressed in strategic literature; The effect pricing has on defining the market structure of a transaction i.e. the distinction between customer and supplier through the net direction of revenue (positive net flow for suppliers).

Open-ended interviews with executives at the operators and at Ericsson internally were conducted to gain an overall understanding of how the pricing schemes were set up in relation

to the different actors. Another important source of information was actual billing data published by the operators themselves. This data was then verified against the findings of Ericsson's own Consumer Lab research, consisting of several rounds of structured interviews with end-users from relevant domestic markets. The operators' pricing schemes differed on several levels: terminal subsidies, technical definition (bundling), price levels, end-user charging and billing. In addition, the pricing and the strategies were subject to constant change, which further complicated comparisons- but supports the dynamic assumptions of Innovative Pricing. For instance, one of the operators (operator 2) changed its pricing strategy towards its providers at the very end of the study. The study was, however, concluded before the impact of this new strategy could be observed.

The findings were presented and discussed with nine different wireless operators: Telecom Italia Mobile (TIM), Teledenmark (TDC), Telcell, Pegaso, Telia, Aliant, SBC, Orange and Mannesmann, several service providers and a considerable number of internal Ericsson groups for verification and feedback. The study has also been presented at an internal seminar at the Royal Institute of Technology (KTH) and at the Nelson & Winter conference (DRUID) in Aalborg June 2001. Some segments of the empirical data and conclusions will (?) also be published in Wireless Weekly (Jonason & Wade, 2001). It will also be published in the proceedings of the 3rd World Congress for Electronic Commerce, January 2002.

4.6.1 Results Chapter VI

One conclusion is how the operators' pricing towards providers has a defining impact on the transaction itself. Some of the providers are in fact customers (paying a positive price for placement on the portal menu). Many of the same providers are at the same time paid by other operators (or more correctly the end-users of the operators through price base sharing) to deliver basically the same content and services. This makes the operator the customer. The operators can, hence, be either customer or supplier depending upon how they set up the pricing contract with their providers.

The problem in models where providers pay for access is that it eliminates their revenue incentive to offer services that are in demand by end-users. The Mobile Internet service of the operators may, in such cases, actually work as a substitute to the providers' fixed Internet presence. The pricing decision of the operators has, hence, helped to structure the roles of the different agents in the market (supplier or customer). A more long-term solution for these

providers can be to either discontinue supply of the services (exit the market) or to become operators themselves, by for instance buying airtime (VMNO- Virtual Mobile Network Operator) or even bidding for a 3G license (redefinition). The latter option would surely make the providers into competitors rather than partners, where the competitive advantage could be reached by leveraging their unique content or applications through Innovative Pricing.

This opens up an interesting principal-agent problem, in which not only the priorities but also the firm's role in the market is subject to uncertainty (which agent will be the principal and which will be the agent). It has been observed on several occasions during the course of the study, how two firms headed into a pricing negotiation both expecting to be the agent (i.e. paid a positive price). A controversial solution to this problem, also addressed in chapter IV, is to share incentives and pricing information (not price levels) with other parties within a transaction for the creation of a 'win-win' situation.

5 DISCUSSION

Good theory anticipates empirical phenomena not yet observed. If repeated empirical phenomena cannot be identified within received theory the theory has to be expanded to incorporate the same phenomena. Innovation and entrepreneurship are such empirical phenomena that received economic theory has had difficulties with (Eliasson, 1996). Innovative Pricing (IP) is an observable phenomenon, as I will show, that adds further dimensions of difficulty. The theory of the Experimentally Organized Economy (EOE) accommodates the empirical phenomena IP, but it is very new and not yet a familiar theme of economics. To place the empirical object of inquiry of my thesis in a theoretical context I have to use the theory of the EOE on a form that relates to the IP phenomenon. This, notably, has involved deriving (in this cover essay) the three dimensional quantity, quality and price model, from the theory of the EOE. Endogenizing the quality dimension first of all (to some extent) responds to Arrow's (1959) wish to see the observed lack of theory that simultaneously determines prices and quantities attended to. It also makes it possible to derive the chaotic properties of the three dimensional quality, quantity, price determination for even a minimal perturbation in the determination of one dimension.

All these theoretical features are necessary for the analysis of IP. They derive from the nature of the enormous, complex and expanding state space of the EOE rather than the minimal and transparent state space of general equilibrium theory. I have thus included

Eliasson's (1987, 1992, 1996) Särimner effect phenomenon are Information Paradoxes I and II in my analysis. Without these the empirical phenomenon of IP cannot be recognized theoretically.

The firm so to speak creates a temporary monopoly by redefining its product. Although Schumpterian and Neoclassical economics have modeled this as shifts in a production function IP introduces a much more complicated case of innovative behavior based on a technology to appropriate (or access) the rents of an innovation (by redefining the product) that was not considered possible before. This is done by strengthening property rights.

Within the theory of the EOE, IP will, therefore, be seen as a management method to claim property rights to spillovers. It was found convenient to introduce the concept of weak property rights as an intermediate endogenous phenomenon between the two extremes no property right and the absolute access to the rents based on the receiver competence needed to create economic value from (rents on) the spillovers.

In this theoretical setting traditional price and product differentiation, price bundling, block booking, pricing innovation etc. become a different breed of analysis. I have surveyed these traditional concepts briefly to establish the difference between them and IP.

In business oriented literature there is often a lot of excitement about the creation of value for the customer. A product without a perceived benefit to the customer is obviously impossible to sell. However, as argued in chapters V and VI, given the profit seeking firm of the theory of the EOE, the creation of value to the consumer in itself is no objective of the firm. Regardless of how valuable a product is, it will inevitably become a failure unless it can be made chargeable and this chargeability needs to be protected and enforced by a working property rights system. In fact, most (even all?) of the value being charged for by the firm can originate in spillovers (weak property rights) created by other actors in the economy.

The three stages of introducing an IP scheme are:

Table 2. An Innovative Pricing scheme

1. Existence of perceived customer value

2. Creating (strengthening) property rights

3. Establishing (enforcing) chargeability

The mutual dependency between the components in table 2 is central for the theory of IP. If one of the elements is weak or missing a pricing problem arises. Chapter II addresses this issue, through the example of the lighthouse. The lighthouse service created customer value (item 1 in table 2) but the value could not be appropriately charged for since the producer could not control usage, that is, access to benefits. Property rights to the service were weak and could, therefore, not be enforced (item 2 in table 2). The solution was to establish property rights to the service by making the benefits of the lighthouse strongly related to the use of the harbor. Hence, a new base for pricing and chargeability was established by the lighthouse owners' ability to collect a harbor fee to which property rights could be tied and enforced (item 3). The fee coupled with the authority of the harbor master to prevent ships from leaving solves the problem of chargeability and property rights (i.e. the harbor charge and the physical property of the boat)[29].

As mentioned, the creation of value (the lighthouse service) is important but it is still completely dependent on the other two elements. For example, let us assume that an entrepreneur builds a better lighthouse close to the existing one. This new lighthouse owner must find a way to either bypass the existing pricing solution, i.e. come up with a new way for the ships to pay him for the value of his light, or by offering a better revenue sharing deal with the harbor master, for instance, by driving the old lighthouse out of the market (See chapter VI, telecommunications pricing). If a sufficiently large number of competing lighthouses are built the harbor master will realize his importance, and may decide to keep more and more of the harbor fee for himself, since he is, by assumption, the only one who can make the lighthouse service chargeable. By this he leverages his uniqueness (monopoly elements) to receive a large share of the revenue from the service even though he still creates only a fraction of the value. As the greedy harbor master raises his fees the incentive for the lighthouse owner to look for alternative pricing schemes to charge for their valuable (to the end user –the ships) service will increase. A new Innovative Pricing process is triggered.

This example is similar to the pricing solution that was illustrated in chapter V where the operator NTT DoCoMo leveraged its unique ability to charge the end users of the service. The result was that the operator received the bulk of the revenues while the creators of value, the

[29] Note that boats just passing by and not entering the harbor could still use the lighthouse service for free.

providers of content, received considerably less, but still considerably more than they could receive elsewhere; for instance on the fixed Internet where property rights were even weaker.

Such an ability to charge is based on a temporary monopoly, however. If the ship owners (the end users) or the owners of the lighthouses (the providers) come up with a way to either bypass the property rights, here the ability to prove the use of the harbor on which the harbor fee is based (the operator's ability to charge end users). It will then be the harbor master (the operator) who is faced with a pricing problem. A possibility is to circumvent the chargeability by changing the product in a manner that bypasses the existing product definition (reduces the strength of the property rights to the product). A far fetched solution would be for the owner of the lighthouse, or another entrepreneur, to build a new harbor or in the NTT case build a new network. Both are acts of innovation according to the theory of IP. The product is redefined, not necessarily to improve its value to the end users but to make it chargeable, i.e. adapting it to the pricing situation and to internalize the externalities in the market (use of the harbor).

In chapter II, the role of the fixed line operators would become comparable to that of the owner of the lighthouse, if voice became free. The pricing problem was, hence, to redefine the voice service to make it chargeable and find a parameter of the product that the competitors, through their ignorance, did not perceive or could not imitate (innovation). This is shown empirically in chapter VI. The business solution is to find a unique element of the product. However, if a firm leverages a unique parameter on which to charge for the entire product, it becomes dependent on the reliability of the property rights system in protecting the uniqueness of the parameters. An IP decision is intangible and subject to instant diffusion as soon as other actors in the market perceive it. The IP scheme will therefore need to be protected by the tangible definition of the product as illustrated in chapter IV, underpinning the importance of a working property rights system (to ensure chargeability).

As argued in this summary chapter (see also chapters III and V) the search for new ways of establishing chargeability will need to be done constantly since the environment (state space) constantly changes (grows). Thus it can never be predetermined at any one point in time, as is normally assumed in mainstream economics.

The more a firm decides to not only to leverage but also to charge for its unique parameters the larger the possible negative effect on overall efficiency, however. This is so in the sense

that a winner can be terminated (see table 1) because the incentives for the partners to create value are reduced because they do not feel properly compensated. The endogenous multidimensionality of the product is, hence, not sufficient. Advanced products also distinguish themselves by making the spillovers they create more or less available to external users free of charge. If the provider of such, not easily defined products and services, educate their customers of this additional value – i.e. help to build their receiver competence it will be easy to define the spillovers (externalities) as a chargeable parameter of the product. The producers of the spillovers would be happy to charge for this extra value, but cannot, because of the inability to introduce an IP solution for charging. Advanced public procurement may benefit from industrial participation programs because they raise receiver competence. This is a viable situation in the case of simultaneous joint production (the product and the spillovers) and joint customership (the same customer to both the product and the spillovers) (See Eliasson, 2001; chapter VI).

What can be perceived as a pricing solution locally can in fact create a pricing problem in another part of the market (chapters IV and VI). This creates an incentive for the suppliers and the customers to work their way around the unique element by, through IP, changing their own products to fit the pricing strategies in the market. This thesis suggests a number of solutions where this strategy could be applied. For instance, as illustrated in chapter VI, where some of the operators charged both end-users and providers of content for access, i.e. charging the content providers for the value that they create. The incentive for the content side to come up with an alternative IP scheme, by for instance vertical integration (by becoming an operator) could be a potential threat. The marketing strategy, to be efficient, *such as the intangible products of the content providers in chapter V and VI*[30], may have to include active support to the customers in capturing the spillovers locally (Eliasson, 2001; chapter VI). The critical path of the business is, hence, to create a mutual understanding of the nature of that (intangible) value of the product such that the right incentive contract can be drawn. In other words, make the direction of revenue creation congruent with the direction of value creation and, hence, make actors on both sides of the transaction into innovative pricers.

[30] My comment in italics

6 SUMMARY

I have shown that for multidimensional products:

- pricing can be seen as an act of innovation and that this innovation causes the boundary between product and price to become diffuse.
- the central aspect of pricing in an uncertain environment is to locate a parameter of the product that relates to the environment in a predictable way.
- Innovative Pricing is a way to internalize an externality and thereby make it chargeable.
- the dynamics of the market forces actors to constantly switch bases (parameters) for charging, to remain profitable.
- the dynamic search leads to an endogenous expansion in the definition of the product.
- a pricing solution in one end of the market can create a pricing problem in another.
- the creation of value is not synonymous to the creation of revenues (or profits). This reduces incentives to create value and, hence, can reduce overall efficiency.

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Chapter II

Trading in, and Pricing of not Easily Defined Products and Services

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ABSTRACT

Information and communication products are important resource using activities accounting for a dominant part of production resources (Eliasson, 1990). Information and communication technology, furthermore, represents an increasingly important part of product development. The technology is, however, often given away for free (Jonason 1998). In addition, and this is my problem; both information and communication services per se, and the corresponding technology services are frustratingly difficult to define, to price and, hence, to trade in.

The problem of defining a foundation for efficient pricing has been exhaustively discussed in literature. We have the problem of

Collective services, the marginal cost of which is zero

High transactions cost in comparison with the value of the services.

Difficult to deliver goods and services

This paper addresses these problems. Rather than classifying everything that cannot easily be priced as a collective good or service to be provided by government I look at the task of identifying and defining a pricing base as a business competence that I call *Innovative Pricing (IP).*

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1 PRICING COLLECTIVE SERVICES

A commodity is referred to as a public good if its consumption by an economic agent does not reduce its product availability for others in the community (Hirschleifer, 1976).

The classic example is the lighthouse used extensively by Mill (1848) to illustrate the nature of a collective service. If a ship receives a signal from a lighthouse tower, it does not limit other ships from receiving the same service simultaneously. Nor does an additional ship impose any additional costs in running the lighthouse. Another classic example is a bridge. It causes no additional cost for the bridge builder to let one additional car pass over the bridge, if the cost associated with the wearing down of the bridge the car causes is ignored. If the bridge is filled to capacity during rush hours, however, the additional cost for the bridge builder is substantial because the capacity of the bridge then needs to be increased.

Another example of a virtually zero marginal cost service is radio and TV broadcasting where an additional listener or viewer does not affect the capacity of the broadcasting station. The same signal is sent to all actors and the cost of allowing one more viewer, within the reach of the signal, is zero. A more recent example is the software in the IT-market. Provided that the customer has a suitable receiver, he or she imposes no additional charge for the owner of the software. One extra download of a software package, provided that it does not occur during peak hours, draws zero direct or indirect resources.

Models for the pricing goods and services have been developed through successive refinement over a long period of time and there exist many different suggested approaches for assuring chargeability.

In his note on Privatization, Contract Technology and Economic Growth, Eliasson (1993) brings up the importance of establishing explicit and implicit ownership contracts of a commodity to assure tradability. A necessary condition for determining the ownership of a product lies in clearly defining the product. Inability to define the product may prevent the enforcement of ownership to future profits, and hence tradability. In a no tradability situation, the value of the product will suffer compared to a situation where the highest bidder determines the price. In other words, a common platform must be set between the parties involved in a business transaction in order to make it effective. One example of this type of rules is the mathematical model for calculating the value of stock options developed by Black

& Scholes (1973). The mathematical model enabled traders to set an arbitrage free price on stock options, thereby making the commodity tradable.

Samuelsson (1964) suggests that in a situation where the incremental cost of a product is zero, and a loss of sales represents a social economic loss, the product should be offered without charge. This presumably calls for government action. Samuelsson here, like many authors before him, uses the lighthouse as an example of a service unable to be run by private enterprise. Coase (1974) points out (in his 'Lighthouse in Economics') that lighthouses have indeed been run by private enterprises and with even more success than the public authority. Coase highlights how a not well-defined service still can be charged for, but gives little guidance on how to organize and finance such an enterprise. Sidgwick (1901) declares that there may be circumstances where it would be beneficial to impose a charge for a collective service although there exists possibilities to bypass the charge, presumably where imperfect information still prevents some agents from avoiding the charge.

Others, like Hirschleifer (1976), argue from the point of the consumer. To the individual agent the 'publicness' of the commodity is irrelevant because he will continue to purchase additional units until the perceived value, by the customer, of the commodity falls below its price.

This calls for innovative pricing designs. As described by Coase (1974) the lighthouse 'industry' solved its collective chargeability problem with the assistance of private agents that were authorized to collect the fee or prevent the ship from leaving the harbor. In reality this meant that a proxy for the lighthouse service (availability of service) was defined as the base for pricing, a base on which charges could be enforced. Radio broadcasts, being collective, zero marginal cost services are provided free of charge. The listeners are paying something, by devoting their time and attention to commercials, or (in Sweden) being forced to pay a quarterly fee for possessing a radio or TV set. Law can enforce the charge for possession. The method of establishing chargeability is, thus, identical to the public system Coase (1974) found used in England only that the operator is not private but public.

The IT-market also has a clear chargeability problem. As soon as a corporation starts to charge for its previously free on-web services, new companies offer new and improved services for free, putting the old corporation out of business, with the intention of being able, some day, to charge for its services and applications. This problem can pose a substantial

threat to Internet commerce, since, investors are presumably only willing to invest into new software projects if the benefits received are greater than the cost. If there is little chance to assure this chargeability investors will start to look for new and less risky investment alternatives.

There are exceptions, however. Corporations such as McAfee have found a solution that fits its particular product. McAfee specializes in virus software. The initial part of the marketing and customer building phase was to offer the virus locating software for free. Once the market had absorbed 5-10 million copies, McAfee started to charge a 'symbolic' sum for software upgrades. The software upgrades were needed since new types of viruses continuously turn up. McAfee's function was to locate and find a way to deal with new types of viruses and then to include this new solution in the next release. Virus software is a good example of a product with a value that is hard to define. What is the value of a virus program? If it is needed it can be a matter of life and death for some customers. McAfee indicates that there is a way around the chargeability problem. The dynamic IT-market, however, has introduced new types of chargeability problems.

2 THE CHARGEABILITY PROBLEM IN IT

In his classic Economics textbook Samuelsson writes about markets as mechanisms where buyers and sellers meet to determine, and eventually establish equilibrium prices and quantities. This equilibrium will be reached with the guidance of Adam Smith's (1776) invisible hand being guided by the individual’s urge to pursue his or her self-interest. In general the point of optimal output of a firm was determined through comparison of marginal revenue and marginal cost, encouraging decision-makers to continue to expand output until marginal cost was equal to marginal revenue. The Data Processing (DP) market is no exception here although it produces, and trades in intangible assets of information.

New information technology, however, appears to be rewriting the rules of the business. Producers are happily offering free IT-services and applications. But in the business world, to quote Milton Friedman, there is no such thing as a free lunch, so somewhere there must be an income to finance the activity. Traditional microeconomic theory predicts that firms will not offer free services despite its zero marginal cost, if the equilibrium of MC=MR (Marginal Cost = Marginal Revenue) has already been reached. Therefore, we should ask who pays for these free products, why the firms are offering the products for free and what the provider

charges for instead. If a company offers a zero revenue service it will want to regain these revenues elsewhere. This type of offers have been common in the newspaper market where the publishers often offer the paper for free, relying entirely on revenues gained from other items such as advertisements. The gain from such a free product is of course the increased number of readers willing to read the paper if it is for free, thereby increasing the number of readers exposed to the advertisements, and hence to empower it to charge a higher price for its advertisements. The objective of this type of enterprise, of course, is to increase profits through a larger market share and more advertising income. In the end the business strategy boils down to the ability to charge for a specific part of a product. Pricing is, still, closely integrated with the product but you have to define the Innovative Pricing Environment (IPE), or the complete product, to explain the use of this new pricing scheme, which deviates from what is considered common practice in a most markets.

Entrepreneurship, to use the Schumpeterian (1911) definition means creating something not thought of previously. New innovations, in this case pricing schemes, do not have to be complex. High tech comes in at the other end (Eliasson, 1997). In a converging industry it could mean simply bringing in a new type of pricing from another part of the industry. This point is perhaps best illustrated by means of an example from the media market:

The Swedish morning newspaper Metro, Sweden's third biggest morning daily, with a circulation of 252,000 copies started operations in February 1995. The pricing base was built on the assumption that revenues received from advertisements would exceed costs incurred in editing, printing and distribution. Hence, the paper itself is given away for free. The distribution problem was solved by only offering Metro in metropolitan areas where the paper could be distributed by local public transport. Morning travelers were thereby offered a 'free' newspaper on the subway every morning. The readers of Metro are, of course, paying something by allowing themselves to become exposed to the advertisements in the paper. However, the pricing scheme is obviously not new. The owners of Metro, Modern Times Group (MTG), only took a working pricing scheme, that previously has been used for years by agents in the broadcasting market, and introduced it in another market within the media industry. In short the term Innovative Pricing, is used to describe the introduction of a pricing scheme that has a pricing base not thought of before in that particular market.

3 THE CATHEDRAL VS. THE BAZAAR

Traditionally one of the largest cost items in software companies has been the development cost associated with creating new commercial software. Many software companies have organized their releases in a systematic manner according to a set plan, described by Raymond (1998) as a Cathedral, carefully crafted and engineered by a single individual or a small group of individuals. The reason for this type of small-scale organization has been illustrated in "The Mythical Man Month" where Brooks (1995) argues that the complexity and communications cost of a project rises with the square of the number of developers while work done only rises marginally. This claim has been used as a rule of thumb and is often referred to as Brook's law. Brook's law reinforces the Cathedral development style of having programmers working in small groups often isolated from the users, with no beta releases being unleashed until the service has gone through a series of tests. The reason for software companies to have a low number of releases before 1.0 is often based on experience from previous projects. End-users lost interest in the final release either because of the adequacy of pre-releases or the inevitable bugs in the pre-releases caused too much of a hassle.

Generic code is one of the few tangible assets of a software company. It is normally kept as a well protected secret since it is nearly impossible to protect with patents. The growing polarization of the commercial software market, however, often described as "Microsoft against the rest", has brought about a shift. Currently (1999) a major share of the commercial software market is concentrated around Microsoft products. This concentration and the consequent ‘monopoly’ profits have created incentives for competitors to seek alternatives. Companies such as Oracle, Sun, IBM and Apple often base their software selection on the dogma: "Anything but Microsoft", and have sponsored attempts to undermine Microsoft's dominance. Microsoft has successfully dodged most attacks, however, either by tying suppliers to its platform or by cutting upstart competitors' financing capital through price cuts. An example of such an occurrence was Microsoft's decision to offer its browser for free and thereby cut its competitor Netscape's financing capacity.

However, new developments in the Internet community have proven to be a worthy challenger to Microsoft's dominance. A torrent of innovation is currently fueling the web development of software. Developers are making, until recently sacred, code freely available on the web, for the purpose of receiving free feedback on bugs and suggestions on how to

improve general algorithms. What used to be a very high cost and top-secret part of software development has become a free and open forum for software improvements.

Called Bazaar development it has brought about a new approach to software programming. Bazaar organization is almost the complete opposite to the traditional Cathedral approach. Instead of a small number of highly paid full-time programming wizards, working quickly and secretively on the same project, the Bazaar can consist of thousands of part-time developers scattered all over the globe, only physically connected by the Internet. The latest version of the software is published on a web-site, called the bazaar, enabling the scattered programmers to download it to their PCs. Each individual programmer then works on a problem, and when solved he passes the new bits of code back. The bazaar web-site and the development process is coordinated and supervised by an individual called a gatekeeper. The function of the gatekeeper is to assemble and implement the improvements and publish new updated versions of the software for yet another round of downloads and improvements. Ordinary users are allowed to freely download particularly successful snapshots of the software, while the Bazaar programmers continue to add improvements to the system.

3.1 Linux - A Successful Example

One successful example of this type of development is the work of Linus Torvalds. Acting as a gatekeeper Torvalds coordinated the development of the operating system platform Freax, later, and more commonly known as Linux. Linux is a freeware Unix operating system designed to operate on PCs. With an estimated customer base of 10 million computer systems and an annual growth of 40 percent, Linux was in 1998 the sole non-Microsoft operating system that expanded its market share, and was considered to be one of the largest potential challenges to OS Windows. The success of the Linux platform has inspired many corporations. Netscape, for instance, decided, in 1998, to apply the Bazaar method to its browser hoping that this new radical approach will grant Netscape a winning edge against Microsoft.

Thorvald's style of development was to release early and often with complete openness to all parties. Starting from a failed project as a scaffolding Thorvalds' Bazaar organization worked quickly, sometimes publishing new releases several times a week. Despite the fact that all developers worked for free, the enthusiasm of the Bazaar coworkers enabled the operating system platform to grow at an amazing rate. Not only did work progress quickly,

the platform also became robust because of the many individual problem solving approaches of the participants. The Linux example clearly illustrates the overthrow of old truisms such as Brook's Law. Instead of decreasing, the efficiency of the project clearly increased with the number of developers. Because the source code was open to all, the same problem seldom needed to be solved twice. Traditional development processes, by contrast, are often forced to reinvent the wheel, as other developers' solutions to the same problem are kept proprietary.

The Linux operating system has been launched commercially by the software company Red Hat. The company sells products and provides services related to Linux. Backed by familiar names such as Intel, Corel and Netscape, the company offers a commercial version of Linux. Red Hat is partly financed by selling back-office services and Linux consulting. The major contribution to Red Hat's expansion, however, comes from its investors. Why are these IT-companies willing to invest into a zero revenue service, when its only real tangible asset, the source code, is available for all? Why are professional software programmers willing to work for free on a bazaar project? To find the answer to these questions we will need to look at what drives the incentives of both developers and investors.

3.2 How Linux Solves the Chargeability Problem

In order for a project to become a success, all participants involved in its creation must gain some sort of payback. This compensation, however, is not always expressed in money.

So what benefits do the Linux platform give to its founder and its current supporters? Authors such as Allen (1998) argue that the developer’s incentive to work for free in a Bazaar organization is rooted in an underlying desire to contribute to the community and its larger interests, instead of working for individual gains from (positive) prices. Some doubts must, however, be raised about the proposition that the authors of an egocentric group, such as software developers, working on the Internet, are willing to put in great effort to promote the general wellbeing of the community. If you cannot explain it as a classical economic problem, however, the incentives of the bazaar developers may be explained from assumptions about the intangible ego satisfaction and reputation within the group (of developers). There are parallels in other areas, for instance the academic world. Why, otherwise, would academics struggle with their papers at such a low salary, when they could earn many times as much working for a business corporation.

McClelland (1961) was the first to put the study of achievement motivation into economic theory. True entrepreneurs, McClelland concluded, tend to choose tasks with a low or a moderate probability of success. The reason for this high ambition is to gain respect, and to be proud of his/her achievements, which they cannot if the success is too easily won. The overthrow of Microsoft is therefore the perfect carrot for the bazaar programmers. This argument can find additional support from the work of Ronen (1983) who makes the quest for novelty the most typical characteristic of the entrepreneur. The individual programmer's or hacker's gain from developing the Linux platform can, therefore, be compared to the recognition a scientist gets from a successful project, group recognition.

This type of effort to achieve group respect and reputation are common outside the IT-world. One typical example is the hay buck in Gävle, Sweden. Gävle raises a 5-meter hay buck every Christmas. Every year the youngsters of Gävle attempt to set the buck on fire, not so much for the pleasure of seeing it burn but rather for the recognition a successful attempt will grant the perpetrator in the local community. The buck has become the center of attention as Gävle tries different approaches to stop the buck from catching fire, through protecting the buck with 'inflammable' material, or by police-guard. Media follows the event closely, as methods both for protecting the buck as well as setting the buck on fire have become increasingly refined. Corporations, motivated by the attention, sponsor the building of new and improved bucks. The whole spectacle brings attention to Gävle and benefits the community as a whole. However, as in the case of the Bazaar developers the intention of the Gävle youngsters is to gain acceptance within their own small group rather than to benefit the community as a whole, whatever the ultimate outcome. Creative destruction if you will. The same applies to the development of Linux.

The benefit for investors in Linux companies like Red Hat, is an opportunity to establish a new competing standard to Microsoft's Windows and become providers of software to this standard and at the same time undermine Microsoft's dominance in the commercial software market. Red Hat investors, such as Corel and Intel, can gain from the development of Linux even if the new platform is only a moderate success, because it will then divert Microsoft's attention from other potential markets of the IT-industry. This market opportunity provides enough incentive for Microsoft's competitors to mobilize their resources to support a free platform. In combination with the admiration received from wounding Microsoft.

4 THE CHARGEABILITY PROBLEM IN TELECOMMUNICATIONS

Defining and charging for services are particularly difficult in the information industry. The telecommunications industry, and in particular the fixed line voice market has a unique combination of characteristics which makes it stand out from other markets in the same industry where similar problems exists.

A large number of firms (competitors); the Swedish market, for instance, had more than 20 fixed line operators in January 1999, up from 1, the government owned Telia or Televerket up until 1993, before the market was deregulated. Operators in the Swedish market are only able to raise the price temporarily because the profitable customers will then select more highly priced solutions.

Easy entry and exit; barriers to entry have been considerably lowered. It is possible to buy or rent capacity in networks by setting up virtual phone routers, and it is therefore equally easy to enter and exit the market.

Little product differentiation; the underlying product, voice, (although made more complex by the introduction of different add-ons) is still quite homogenous.

Competition by price alone; although not any longer true, homogeneity of the service is still historically the single most important characteristic of competition. The imperfect information of the market caused by operators' marketing departments is, however, increasingly influencing the individual customer.

The profitable customers are relatively few compared to the customer base. A dominant subscriber share, such as those of the old public telephone operators (PTOs), is, therefore, no guarantee for profitability.

Instead, in order to grasp the success factors of an operator's solution a thorough understanding of the subscriber characteristics is needed. We can therefore divide the customers into three segments.

Profitable shifters; the customers that produce high volumes and revenues. This type of customer is likely to leave the operator if unsatisfied. Hence, success for an operator, once critical volume has been achieved, lies in keeping these subscribers happy. Ericsson research

indicates that this type of subscriber, in the wireless market, represents around 20 % of the revenues.

Volume customers; this type of customer produces low revenues per subscriber. Because of its large size, however, this segment still contributes to a major share of revenues. These customers are important in building critical volume for the operator.

Loss of revenue customers; a customer segment which creates higher costs than revenues for the operator, either directly by causing administrative costs or indirectly by not generating enough revenue to justify the marketing effort.

Once critical volumes have been reached, competition is generally concerned with the hunt for the golden calves of high volume, light-footed subscribers.

Authors such as Barreto (1989) describe the pricing mechanism, given the above situation, as concerned with marginalism, a balancing of marginal cost and marginal revenue. The traditional voice market, however, has been driven into a dynamic environment of innovation and convergence described by Hoh (1996) as Computer Telephony Integration (CTI). Once the two schools of technology merge, the role of voice traffic is likely to become subordinated the more capacity demanding data traffic. The question, which arises from this assumption, is: 'How will the operators charge for voice in the future?'

5 TECHNOLOGY CHOICE IN TELECOMMUNICATIONS

Technical development in telecommunications, according to Hoh (1996), is moved forward along many different frontiers. The set of available technologies currently offers an enormous set of opportunities for all operators. This type of scenario very much illustrates the assumptions about the space of opportunities needed for what Eliasson (1987,1991,1996) calls the *Experimentally Organized Economy* (EOE). This model features the impossibility in attempting to fully access all information needed for a completely informed (economic) decision. Decisions must therefore be taken prematurely on the basis of incomplete knowledge, business intuition and a risk assumption that subjectively reduces the level of uncertainty as seen by the decision maker (Knight, 1921). The number of opportunities is so large that it will be practically impossible to predict the outcome of all the technical choices made, but there will be plenty of opportunities for actors in the market to make disastrous business mistakes. Successful technological choices will therefore play the critical role in

determining success or failures for firms in the IT market. Given the great uncertainty surrounding choice of technology, actors will have to act aggressively in order not to be overrun by competitors.

The telecom market was, until recently, a club of protected, big, rich and fat bureaucracies that historically have had few incentives to innovate and improve services. The reason for this lack of interest is rooted in the regulated monopolies that make up the state owned telephone companies. These giants have had profits guaranteed by regulators resulting in incentives to raise revenues by offering services that would not have met profitability requirements in a competitive environment. As the deregulation of domestic telephone markets progressed, old players realized that it no longer paid to launch unprofitable services, and although often still dominant in their domestic markets, they have seen significant parts of their customer base slip away to new entrants.

The loss of churn customers is a significant threat to the PTOs' business, since historically, according to Ericsson Radio Systems research, the most profitable customers are likely to be the first to leave. This is all common sense. A customer that puts efforts into evaluating different alternative operators, is likely to do so because he or she is spending large sums of money on telephony, and is also, in the end, likely to choose the operator that gives the best total package. The old PTOs have an obligation to offer nationwide coverage, while the new operators do not. New operators are therefore able to concentrate and tailor offers to fit profitable customers only.

If this trend continues, old government owned telecom corporations will be left with an obligation to serve a large but unprofitable customer base, while the new and more efficient players are allowed to milk the cream of the market. New operators have grown stronger in the deregulated areas of the industry and are posing a considerable competitive threat to incumbents. In a struggle to stay on top incumbent operators have found themselves caught up in an innovation race. At the same time the telecom market is rapidly converging; new technologies are constantly added and eliminated by competition. The adoption of new technologies is an experimental process in which potential winners compete their way to success. Past winners in the information technology and the data processing market have been characterized by long payoff periods, and long periods of heavy technical investments before the success of the product could be determined. There are several examples in the market today, however, that could turn these old rules of thumb upside down.

6 THE PRICING OF VOICE SERVICES

Telecommunications is a good example of an industry where the marginal cost of the service, for instance a phone call in an off-peak period, is zero (if the billing cost of the call is ignored). The industry, nevertheless, has to finance the expansion of its capacity, which requires a positive cash flow. The situation is very similar to that of Coase's (1974) lighthouse market. In the telecommunications industry, as with the Internet, almost all costs are fixed; once the lines and switching equipment have been provided, it costs very little to use it up to capacity. When maximum capacity has been reached, you will have to invest further in new capacity in order to increase usage. Traditionally the price of a telephone call has been closely related to the distance between sender and receiver. This was mainly due to the capacity limitations of the long distance networks. If capacity were to be unlimited the distance would have a much smaller impact.

During the second half of the 1990's we have seen a large increase in data transmission capacity. The reason for this growth is mainly due to a growing demand for high capacity linkage for the transmission of pictures and documents as well as an increasing use of online and interactive applications. The telephone wire has become a water tap in comparison to the waterfall of information capacity of data networks. If these two technologies were to integrate, the information sent over the networks would be almost completely dominated by data traffic. This would make telephony close to cost free, not only in off peak hours but also during peak traffic because it occupies so little of the total capacity available. The price paid by customers for voice traffic is likely to be influenced by the price of transmitting data. Economists such as Coase (1974) and Arrow (1969) both agree on the issue of bargaining. If the costs involved in setting the rate between buyer and seller are high it may be most efficient to offer the service for free. This type of reasoning can be applied for charging voice. The cost of setting the rate between buyer and seller in the telecommunications case is the billing of a call. Offering free voice would eliminate this cost and voice would thereby become a free service. However, the provider of voice would want to capture these revenues elsewhere. The broadcasting industry has solved this problem by allowing the revenues gained from commercials to cover the costs of running the station. *Gratistel*, a small voice company in Sweden, has applied the strategy on the Swedish voice market, where callers are interrupted every 3 minutes by a 10-second commercial. The application of this type of pricing outside the low quality segment of the private market is, however, a questionable proposition. Rather a new approach needs to be introduced. The most radical one would be to

offer voice as a free customer loyalty add-on to data traffic. The add-on could create increased customer loyalty and therefore allow the provider to charge more for the total package.

As an illustrative example we can use the coffee shop. When the customer buys a cup of coffee he is rarely charged for milk or sugar. The reasons for this, as with voice in data networks, is that the milk and sugar have a low marginal cost and are, hence, offered for free. The value-added, for the customer, can be substantial and the cost for charging for these items is relatively high. The cost of milk and sugar is covered by the charge for the coffee. The milk and sugar can therefore be regarded as customer loyalty adding items. Not infrequently, even the coffee is offered free to make you enter the shop and view the goods displayed. The same is likely to apply in the voice market. The most profitable customers in the voice market are also the most disloyal. The same type of conclusion can be drawn in the data communications market. Corporations that have substantial data communications costs are presumably more likely to look for cheaper alternative providers, as opposed to those that do not.

One successful strategy, for an operator, therefore, is to try to alter the price sensitivity of these high capacity users, and thereby increase their customer loyalty. If the customer loyalty benefits received in the data communications market outweigh the cost of giving away voice for free, it will be a rational decision. However, before being able to put the cost of voice in relation to these potential data communications benefits we will have to find a way to quantify customer loyalty.

7 CUSTOMER LOYALTY

If an operator in the telecommunications market decides on a new type of pricing, its' pricing method will have to create enough volume, and capacity usage, to support the high fixed cost of the infrastructure. Customer loyalty becomes an important aspect to take into consideration before deciding on how to go about when introducing a new combination of service and technology. Loyalty according to Aaker (1996) is a core dimension of brand recognition and a way to gauge the strength of a brand. It represents a barrier to entry. It is therefore essential to differentiate a company brand name if the product itself is very homogenous. In other words it is essential for the potential success of a corporation to stand out from all other competitors. According to recent (1999) Ericsson Radio research the loyalty of customers depend on three characteristics of the firm and its products:

Quality; the operator perceived to supply the highest level availability and integrity. This category is often represented by old PTTs (government owned operators)

Price Leader; the telecom operator regarded as having the lowest price level.

Innovation Leader; the operator perceived to offer the top of the line products

It must be noted, however, that these characteristics are specified as perceived by the market. In reality the technical quality, pricing and innovation of telecom services can be completely different. An example of such an occurrence is how Comviq, one of the three wireless operators in the Swedish market, has had its president participate in a number of commercials introducing different add-on services and price reductions. Private consumers, consequently, perceive Comviq as the innovation leader, although insiders often regard Comviq as a laggard.

Considerable parts of the brand name and customer loyalty literature are concerned with extrapolating the future from the past and present. The rapid change in the information technology industry makes it very hard to foretell, with the aid of past results, what impact a change in pricing would have on customer relations. Experience from a number of operator projects has resulted in the conclusion that a close relationship exists between pricing and the quality of a customer relationship. Investments in time and money into improving customer relations have paid off well by allowing the retailer to charge a higher price.

8 CONCLUSIONS

I have addressed three main problems:

Pricing of, and trading in poorly defined goods and services; a property rights and contract problem. How can tradability and chargeability be established?

Technology Choice; how to choose a winner and avoid losers and being locked into inferior technologies and legacies, and how to correct mistakes.

Brand recognition; and the building of customer loyalty when the goods and services are poorly defined.

As stated previously these are three deeply theoretical problems with very practical implications in the modern digital age when a growing part of goods and services are becoming digital. Most importantly, practical decision making will benefit if firms base their understanding of the decision on good i.e. relevant theory.

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Chapter III

Innovative Pricing: Pricing as an Instrument of Innovation

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ABSTRACT

The theory of Innovative Pricing (IP) explains the entrepreneurial process of defining a product such that it can be properly priced in an experimentally organized economy characterized by network externalities. The complexity and range of different pricing combinations make the pricing itself an act of innovation. I demonstrate how the firm selects an Innovative Pricing combination and how that selection, in turn, redefines the underlying product portfolio of the firm.

JEL-classification: O31, D81

Key words: Innovative Pricing; Experimentally Organized Economy; Pricing; Innovation

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1 INTRODUCTION

Orthodox pricing theory and practice relate to a given and well defined exogenous product and a (more or less) well known demand function. The pricing agent cannot manipulate the functionality, looks or marginal cost of this given product. Production (or product definition) comes first and pricing follows. However, examples abound (of cases) where products have had to be redefined, not because of technical insufficiency, but because of their inability to raise revenue in the market.

The restricted relevance of received theory has made pricing a neglected aspect of the economics of innovation. When innovation economists speak of pricing they do this in the context of introducing new and superior products, and not as a part of the innovation itself. In Schumpeterian theory, the entrepreneur is the person who innovates. The person who comes up with new combinations not seen previously in the market. These improvements are limited to new and improved (innovative) properties of product and efficiency gains in production and do not include pricing as part of the innovation process[31]. It is my ambition to demonstrate that pricing in itself in fact has to be a necessary part of the commercialization and realization of an invention and hence, will be an act of innovation.

The rapid growth of information technology has brought increased attention to the old problem of pricing products the marginal cost of which is close to zero. Recently firms' willingness to price their products even below marginal costs, often in the form of free software, has been increasingly observed. What pricing mechanism lies behind such economically peculiar practices? Part of the answer can be found in the network and spillover economics literature. Demand spills from one product to the next in the form of extra value that is difficult or impossible to define. The endogenous entrepreneurial process of identifying and internalizing such demand spillovers and turn them into revenue is part of what characterizes the Innovative Pricing (IP) problem.

Schumpeter's view of innovation is fairly linear and is conceived as the identification of commercially viable inventions by the entrepreneurs who develop innovative products for the

[31] Schumpeter describes the kinds of new combinations that underlie economic development. They encompass the following (1)creation of a new good or a new quality of good, (2) creation of a new method of production, (3)the opening of a new market, (4)the capture of a new source of supply and (5)a new organization of industry. These characteristics are all related to more efficient methods of production and are less useful in describing the entrepreneur experimenting with price.

market. Schumpeter states that changes in science and technology are only interesting in so far as they are capable of transforming the outside world, and this transformation, furthermore, has to be successful in the marketplace. If not commercially successful the innovation will not diffuse and, hence, will cause no positive change (Roberts, 1998). Economists have often misinterpreted this fundamental premise in their attempts to integrate innovation into the theory of the firm. New technologies are crucial, but need complementary innovations before they can be commercialized (Dahmén, 1950; Hahn, 1993; Eriksson & Lindh, 2000). Thus, the transformation from a technical invention to an innovation requires the support of a bundle of complementary products in order to be successfully introduced in the market. In addition, before a winner (a successful innovation) has reached industrial scale production and distribution a number of tests will have to be passed and significant resources invested. This is a selection process that breaks the hierarchy and forces us to address the problem of distinguishing between winners, on the one hand, and business mistakes and losers on the other. A critical task to of management will, therefore, be to structure the innovation such that it can be priced appropriately i.e. be successfully brought to the market.

To illustrate the notion of IP I begin with a standard pricing model. The complexity of the model will force us to use an alternative framework to the closed and bounded opportunity set of mainstream 'rational expectations' models and instead seek intellectual support in the theory of the Experimentally Organized Economy (EOE; Eliasson 1988, 1991). In the EOE, firms are able to incorporate only a fraction of all information residing in their state space to help them in their decisions and will, therefore, make as rational decisions as they can based on to them available information. The decisions based on this information will often be quite mistaken and rarely the best ones ex post. Pricing decisions in the experimental model will, hence, be more or less biased, often leading to business mistakes. Above all, under the uncertainty prevailing in the EOE, agents will normally be unable to comprehend the pricing decisions of other firms in the market. A complex situation emerges that is often characterized by the absence of an external equilibrium and significant uncertainty as distinct from calculable risks in Knight's (1921) sense.

Optimization mathematics applied to such (types of) systems will be of little use. The adaptive equilibrium stochastic dynamic programming solution that would be required for the existence of a rational expectations equilibrium can only be calculated for models that are quite simple, biased and grossly inefficient in solving the problem itself (Day, 1993). Lindh (1993) draws attention to this point. He observes that a firm will never be able to locate

optimum points within the rational expectations model if it does not know the distribution function beforehand and (in addition) that the distribution function then has to belong to a class of easy or uncomplicated functions. This is how I proceed.

2 BACKGROUND TO THE MODEL

In this section I describe the basic model. The introduction of two important assumptions of the theory of the Experimentally Organized Economy (EOE) will increase the complexity of the model and the disequilibrium situation in which IP is necessary will be defined.

Consider the product vector of a firm represented by the following vector of chargeable characteristics at time *t* [32]:

$$Q_t = [q_1, q_2, ..., q_n]$$

n is the number of product characteristics. The vector *Q* belongs to the product/pricing opportunity set (state space) *Ω(Q)* of the firm. State space in this context is the range of all known (to the firm) possible pricing characteristics (quality dimensions), which by the assumptions of the EOE expands ahead of the product vector *Q*. This is the essence of the Särimner effect and Information Paradox I (Eliasson, 1990). The point is that each actor will constantly keep exploring the immense state space, which abounds with business opportunities of which it is largely ignorant. This state space keeps expanding through the creation of new opportunities created by the exploration of all actors. Information Paradox I states that if state space can be assumed to expand faster than it is being searched and exploited (becomes known) by actors a situation of full information will be a for ever lost opportunity. Information Paradox I is a nice way of avoiding the mathematically awkward assumption of an infinite and open state space. Eliasson (2000) argues that this is the only reasonable empirical assumption to make because of the, for all practical purposes, unlimited dimension of quality improvement of the product[33]. By adding the dimension of quality to the

[32] The product portfolio should be interpreted as a vector of defined product characteristics representing the base of billing. This type of product description has been used previously in a stable equilibrium setting by for instance Bromwich (1990).

[33] An example of the three dimensions could be competence capital where Ω is the competence of an individual. Quality is the competence required to perform a job, such as driving a bus. The quantity is how much time the person spends driving the bus and the price is the salary he/she gets paid.

well known dimensions of quantity and price the economic system acquires radically new properties.

The added quality dimension makes the Särimner effect intuitively acceptable. One may still ask why the search for opportunities should create new opportunities. Received neoclassical economic theory excludes this possibility by assuming that the economy and all its actors constantly operate on their respective production possibility curves. In the Schumpeter (1911) system the new solutions (innovations) appear unexplained as a 'deus ex machina' of the Greek theater. This is an alternative and much more realistic assumption than the opposite assumption used in neoclassical theory. Non-linear theory lends further credibility to the existence of such unpredictable phenomena as the Schumpeterian entrepreneur[34]. One might also (see Eliasson, 1996) refer to the frequently demonstrated empirical fact that innovation and entrepreneurship are almost always based on 'cross disciplinary', insight and discovery, that can be explained ex post but never ex ante. To make the Särimner effect a credible phenomenon is also all we need to proceed, i.e. to assume that the opportunity set Ω is considerably larger than, and expands with, the product vector *Q*. The problem will be to illustrate how actors choose which of the available characteristics in *Q* should be given a positive price and which should be given away for free (priced below marginal cost).

Consider a demand domain matrix represented by a map $\theta : X \rightarrow R$. The state of the demand matrix at a given discrete time *t* is given by a value $X_t \in X$. The succeeding state is generated by the difference equation:

$$X_t = \theta(X_t, \Phi) \equiv \theta(X_t) \quad t \in N^+$$

where Φ is a vector of parameters that is defined to be a set of the real numbers $\Re$ that describes the nature of state space. An important assumption here concerns the nature of this variable, which determines the nature of our pricing problem in the EOE. Φ can take on a variety of forms. Trajectories of dynamic models are often very sensitive to initial conditions and the distribution, hence, moves away from any periodic cycle that can be represented. Such behavior has been termed chaotic (Day, 1982, 1994). It can also be unstable and capable of accommodating IP although it may posses an equilibrium. By this both structural change,

[34] See a discussion of Chaos in for instance Day(1994) and Solari et. al. (1996)

economic growth and 'unpredictable' (by any forecasting method) events can be generated. Stability not equilibrium becomes the key economic concept to be concerned about (Eliasson, 1983).

Decision-makers, in this case firms, now have limited knowledge of demand and the structure of the market. Unless firms are familiar with the distribution of the underlying structural variable, or can reconstruct the distribution by studying large numbers of output variables, before the structure of the market changes, they will be unable to comprehend all the variables needed to conceive an optimal rational expectations decision. In addition, the method and technology of search will affect the distribution function. The θ 'function' thus embodies the information and communications cost structure that determines the properties of the economic system. Because of uncertainty as distinct from calculable risks (Knight, 1921) an agent will be unaware of whether the pricing mix it has chosen is an optimum.

Firms' subjective interpretation of future market demand can be illustrated by the following function:

$$h : (t, X) \rightarrow h(t, X) := \theta^t(X_t) \quad t \in N^+$$

that sometimes is referred to as the semiflow. For any initial condition of the demand vector X_t and any non-negative integer t it gives the subsequent (subjective) state t periods later.

3 EXTERNALITIES AND INTERNALIZED SPILLOVERS

The demand for products within a portfolio of alternatives is rarely independent of the demand for other products. An increase in sales of one product is therefore likely to affect the demand of related products.

Some products have little value in isolation. If offered to a large number of consumers, or if bundled with other products, however, they generate more value than the sum of each. Hence, they could fetch a higher aggregate price. Such spillovers or demand externalities have attracted considerable attention in economic theory and have subsequently been termed network externalities (Katz and Shapiro 1985,1994).

The demand of each element of the underlying portfolio Q_t, of pricing characteristics at time t will, hence, be affected by the quantity of the other elements within Q_t

The demand matrix X at time t for our firm can now be represented by[35]:

$$X_t = \begin{bmatrix} x_1^1 & \cdots & x_1^n \\ \vdots & \ddots & \vdots \\ x_n^1 & \cdots & x_n^n \end{bmatrix}$$

Each product in Q_t, as described in the $n \times n$ matrix X_t, whose elements x_k^jdescribe the effects of characteristic j on characteristic k.

Hence:

$x_k^j = 0$ *if no effect*
$x_k^j < 0$ *if an increase in demand of j has a negative effect on demand of k*
$x_k^j > 0$ *if an increase in demand of j has a positive effect on demand of k*

The characteristics are subjected to 3 types of networking effects:

First, the effects the element has on itself. A practical example could be faxes where the value of each element increases with the total number of elements. Second, the level of complementarity/substitution between the elements. An example here could be paper to the faxes. Demand is likely to be affected by an increase in the number of available elements. Finally, the second order externalities when the level of demand carries back to fax machines from the increased demand of paper (resulting from the increased demand of fax machines).

Identifying the ex post price vector $p(X_t)$ from data presented in the non-linear EOE constitute the fundamental difficulty of Innovative Pricing (IP) when formulated in the abstract form. The complex procedure of searching for the optimal combination of output and price is affected directly by the complexity of the (unknown) distribution function and the local receiver competence of the agent (Eliasson, 1990). The endogenous expansion of our

[35] The sum of each column X_t will give us a regular $(1 \times n)$ demand vector.

product vector *Q* will allow growing complexity and multidimensional products. *The opportunity to perform this endogenous growth is the definition of Innovative Pricing (IP)* and a critical element within the theory of the Experimentally Organized Economy (EOE).

This raises the problem of identifying which characteristics of a product (*Q*) to measure and charge for. The solution is to identify unique features of the product, or more correctly characteristics of the state space $\Omega(Q)$, that relates to other intangible characteristics in a subjectively predictable way and then internalize this element (if not present already) within *Q*. Such a pricing base could be a point where the market price is (subjectively interpreted as) stable and accepted. In this sense the firm is setting up, and enacting subjectively controlled pricing and product experiments, based on hypotheses about market opportunities. These hypotheses will, at every point in time, depend on the path dependent vector *Q* and the state space $\Omega(Q)$ of the firm. This is the essence of Innovative Pricing, and once its assumptions are accepted, we have an explanation why organizations behave differently and why their behavior changes in different ways and at different rates over time, even when the circumstances and the purpose are the same. Hence again, this identification of a stable pricing base becomes an act of innovation.

This pricing base of the product then functions as a temporary monopoly and allows the firm to set a higher price for the whole than would otherwise be possible. By measuring the consumption of just one product within a bundle the transaction cost of measuring and setting up all the others is reduced. The competence needed to identify such relatively stable ex post distributions is similar to the problem Antonov and Trofimov (1993) discuss[36], and the practical problem of predicting share prices in a volatile stock market, using historic data on share prices.

In IP, the endogenous pricing innovation will be entered as an addition to the product/pricing vector Q_t. This addition is picked from the product opportunity space $\Omega(Q_t)$. This is the first step in the Innovative Pricing selection and search process. It is important for the reader to note that this addition is somewhat different from a regular product innovation in the sense that the intention is to make the product chargeable rather than to add more value (to customers).

[36] Antonov and Trofinov (1993) find in simulation experiments that long-term macro economic performance increases when actors are allowed to take individual decisions, not being constrained by centrally imposed guidelines or policies, in their case based on Keynesian or Neoclassical predictions.

The firm will now have a new product portfolio that can be represented as[37]:

$$Q_{tnew} = [q_1, q_2, ..., q_n, q_{n+1}] = Q_t + q_{n+1} \quad (1)$$

where $q_{n+1} \in \Omega(Q_t)$.

The new innovative product dimension is proprietary to the inventor i.e. its rents can by assumption be appropriately protected for instance by a patent system or when the competition does not possess the competence needed to commercialize it or when competitors are not sufficiently competent to innovate in their turn.

The new demand matrix X_{tnew} (with the new range *n+1*) and its associated networking effects can now be illustrated by:

$$X_{tnew} = \begin{bmatrix} X_t^t & x_t^{n+1} \\ X_{n+1}^t & x_{n+1}^{n+1} \end{bmatrix}$$

The new demand matrix X_{tnew} illustrates the externalities between the previous portfolio Q_t and the innovation q_{n+1}.

A firm's exclusive access to the product innovation enables it to use its pricing competence to under-price the other products of its product portfolio. It can be done in two ways:

First, in the short term, the firm can price non proprietary products within *Q* below marginal cost in order to charge a higher price for its unique elements (q_{n+1}). This strategy will be preferable if the positive indirect networking effects that stem from a low priced *Q* motivate a higher price for the innovation. Since the innovation is proprietary to the firm it can leverage this unique feature to capture monopoly profits from the whole package.

Second, a more aggressive strategy for the firm would be to leverage its innovation to threaten the profitability of other firms in the industry by under pricing those elements that are close substitutes to other products in the industry.

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[37] It is equally possible to eliminate an element from Q_t (reduce the number of pricing bases) rather than to expand it.

Starting from the traditional definition of profits

$$\Pi = pQ - C$$

where p is the price vector, Q is our product vector and C is cost, we can now express the profit function over time as:

$$\Pi = \sum_{t=0}^{\infty} \varphi p(h(t, X))Q(h(t, X)) - C_t$$

where φ is the discount factor and C_t is the cost at time t. The cost vector C is dependent on the production cost of Q_t but also on search itself, i.e. search in state space is costly.

This can be expressed on continuos form[38] as:

$$\Pi = \int_T \varphi p(h(t, X))Q(h(t, X)) - C_t$$

Similarly the profit function for the alternative product portfolio Q_{new} is:

$$\Pi_{new} = \int_T \varphi p(h(t, X_{new}))Q_{new}(h(t, X_{new})) - C_{tnew}$$

Mainstream economic theory models the rational firm and individual as profit and utility maximizers respectively. The optimum where this maximum is achieved is used as a reference point that can be expressed as an equilibrium where each agent wants to remain. There are no incentives to leave the equilibrium and the decisions of actors will, hence, be static. But if such an equilibrium is unlikely to be found, and the search process itself is costly, we are faced with a different type of problem. Firms will rather worry about how fast they can get the profitability of a product back into an acceptable operating domain. Simon (1955) calls this range satisfactory. I will call it *S*. Furthermore, the firm is primarily interested in earning as high a return to its assets as possible above the going market rate, for now and in the future. This return on investment over the interest rate, we call ε[39].

[38] See for instance Duffie (1996) or Hull (1997)
[39] This economic fundamental of the firm is presented in Eliasson (1996, p 71).

In a model with profit seeking firms search termination criteria based on reaching a satisfactory level will have to be defined. In standard search theory (e.g. Diamond, 1984) search is terminated when the expected profit gain is lower than the expected (known) search cost. This exercise, however, becomes meaningless if search (or information) costs are dominant and larger than the production cost itself. Instead, a region *S* where profits are satisfactory by some criteria can be defined. Search will be terminated, for instance, when it has taken the firm into a region *S* where profits are higher than in the past by a small margin. Repeated failure to reach *S* means that ambitions (*S*) are lowered[40]. Simon (1955) introduced the notion of satisfying behavior controlled by a payoff function in his critique of the Neoclassical optimization postulate. Thus Simon's (1955) termination criteria *V* for our search within state space could be:

$$V(\Pi, S) = 1 \,|\, \Pi \in S \text{ and } \Pi_{new} - \Pi \geq \varepsilon$$

The firm will then accept the new product portfolio:

$$Q_t \coloneqq Q_{new}$$

Search continues until the subjective profit is placed within a satisfactory range. If not reached the actor can return to equation (1) and invent a new base for charging from $\Omega(Q_t)$, but then at an increased cost C_t.

Thus the needed pricing competence, the opportunity space and cost function depend on previous IP decisions it is therefore unique for each agent in the market. This will enable firms to invent new and unexpected price/product constellations not perceived by other agents in the market and can, if proven commercially successful, be comparable to regular product innovations. These IP schemes will be firm specific depending on the firms' ability to leverage their uniqueness. This has several implications for the firm.

4 IMPLICATIONS

Positive indirect networking effects, once identified by agents in an economy, can motivate not only a change in price but also an innovative switch in the direction of the revenue stream, thus changing previous price bases of the product into costs (negative prices). Firms can be motivated to redefine a product such that its cost falls beneath an expected price, subsidize a

[40] See for instance the 'Maintain Improve Profit Performance' (MIP) targeting criteria in Eliasson (1977).

product, pricing it far below its value to the consumer, give away the product for free or even pay the customer for using the product. The motivation is that the firm will be able to internalize, by Innovative Pricing (IP), the networking effects, resulting from the increased demand for such a low price product, and, hence, generate more profit.

Products with a high value to the consumer but with a low marginal cost, such as public goods, are well suited for IP, since their reproduction cost is low on the margin. Another category are those that have a high level of information and competence asymmetry between buyer and seller, enabling one of the parties of the transaction to use the ignorance of its counterpart. If the asymmetry was restricted to access to information then the model would boil down to a standard equilibrium case, however[41]. The ignorance of actors in terms of multidimensional quality (dimensions of the product to charge for) is thus a fundamental assumption needed for IP to be relevant.

A product is likely to have a whole array of characteristics that can be charged for. Incomplete information, high transactions costs and irrational and unpredictable behavior in general makes it almost impossible practically to find the optimal charging scheme of a product bundle. Instead firms are forced to leverage on those features that they regard as stable. Firms will need to locate parameters that are unique or nearly unique i.e. those that have few or distant substitutes and give away all other products (i.e. setting a price below marginal cost). With a unique production set and the competence to innovate combined with organizational competence the firm faces an evolutionary problem of selection similar in nature to that of genetic learning algorithms, in this case finding a fit characteristic to use as a base for pricing[42].

As shown in the model, IP has the implication that both product and price are endogenous. The constant expansion and contraction of the unique price product characteristics vector causes the boundary between price and product to become diffuse. The innovative competence lies in coordinating quality, quantity and price resources to be able to define and gain access to a bundle, such that it can be appropriately priced.

Firms' inability to separate price and product is perhaps most notable in the IT-industry. Innovations in IT are often based on efficiency improvements in the handling and processing

[41] Akerlof (1970) provides an example.
[42] See Ballot and Taymaz (1998) for a micro to macro simulation or Birchenhall et al. (1997) and Holland (1975) for a description of the use of Genetic Algorithms in evolutionary modeling.

of information and not always on the introduction of new physical products, even though the exploitation of such innovations are realized at a physical level (Jonason, 1999b). There is, in fact, little difference between an innovation in the information industry that, for instance, improves the efficiency in handling flows of information, and an innovative design of pricing combinations that directs a flow of revenues within a product bundle to enable the firm to charge a higher aggregate price. By giving part of a product bundle away for free the firm might manage to increase the net flow of revenue because of the reduction in transactions costs and the indirect networking effects resulting from the increased demand of the complementary bundled product. These examples only differ in the resources they coordinate. Whether the innovation materializes as an efficient way of directing information or revenue does not affect the fact that both are new ways of coordinating resources not seen previously in the market. Both are thus acts of innovation.

Commercial success in IP is based on the firm's ability to direct the flow of revenues through the product bundle, and tap these revenue flows to meet its own profit-seeking objective. The structures of a dynamic economy do not remain stable for long, however. Instead, the market constantly changes and, hence, so do the networking effects between products as a result of decisions taken by other agents in the economy, the introduction of new innovations, as old technical innovations become public and with the diffusion of previous IP decisions[43]. An unfortunate situation can arise: A product can experience strong demand but still be unprofitable[44] unless the firm that offers the product has the ability to define a base such that it can be efficiently priced.

5 CONCLUSION

Innovative Pricing (IP) is the entrepreneurial process of defining a product such that it can be appropriately priced. IP is comparable to any type of innovation, since it enables agents to raise the aggregate price of the product through redefinition of the underlying product. This makes it possible for the firm to bypass the billing base of similar products in the market. An Innovative Pricing scheme can, however, only be compared to a technical innovation if it has not been thought of previously by other agents in the market. Under rational expectations all agents will have approximate knowledge of the effects of every pricing decision taken by

[43] An IP strategy will instantly diffuse once made public and can not be protected by other means than receiver competence asymmetry.
[44] Such as fixed line telephony, see Jonason(1999a).

every agent being assumed to be correct in expectation and would, hence, be able to anticipate any experimental or creative combination since increasing efficiency would then imply increased rationality. This makes business mistakes insurable, a notion that already Knight (1921) explicitly rejected. Conditions are uncertain as opposed to calculable and are changing constantly by actors' attempts to make the products chargeable. Innovative Pricing (IP) becomes necessary and a critical management activity the firm.

A firm, by offering a product at a price set below its marginal cost, will come to depend on a second bundle of products to cover its loss of revenues. This means that it subjects itself to uncertainty since it now has to rely more heavily on only one set of products for revenue, instead of two. It will therefore be important for the firm to protect the proprietary access (uniqueness) of this billing base for future profits by preventing other agents from bypassing it.

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Chapter IV

Protecting Content on the WWW

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ABSTRACT

The ability to locate the hardware platform of a digital property makes it possible to determine ownership within the existing legislative framework. Claiming property is a means to receive compensation for the creation of content, rather than its complete protection. Hence, the value of content depends on the extent to which claims to the income stream it generates can be technically and legally enforced. Each content provider faces a pricing problem of how to charge for the value of property, given the technical and legislative framework.

Some claim that creators of information will encounter impossible problems when claiming property to the information. Soft content in the form of digital bits, such is the argument, is more or less platform independent and can easily be transferred from one hardware to the next. The debate has also shown how many authors contest the suitability of existing legal systems to regulate property rights on the Internet and hence call for their abolition or radical revision.

Digital information is, however, always bundled with some kind of hardware. New technical tracking and identification devices enable creators to locate the hardware platforms containing their work. Such new technical solutions, although not thought of when the laws were written, will enable the application of existing law to the problems of claiming property to digital content. This leaves us with a new problem, however, since, tracability eliminates anonymity. The ability to trace content thus turns the problem of copyright protection into a privacy and integrity problem.

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1 WHO CAN CLAIM PROPERTY TO DIGITAL PRODUCTS?

The success of the digital economy has led to mushrooming growth of the Internet and e-commerce applications (Hughes, 1999; Eliasson, 1999). The digital economy has changed the nature of the products themselves and how they are created. As the nature of products change so does the form in which they can be distributed.

Eliasson (1998) defines a property right as the rights to manage an asset, access its profits, and trade in the property. The tradability of commodities requires determination of ownership. The importance of properly working property rights system is fundamental for the functioning of a market based economy (Eliasson, 1998; Commons, 1893; Commons, 1934; North & Thomas, 1970; North & Thomas, 1973; North, 1990).

North and Thomas demonstrate how property rights institutions, necessary for market based economies in North America and Europe, were not formed by overnight legislative action, but developed through the gradual evolution of institutions over a long time. Such institutional systems are more than just formal rules because formal rules can not cover all contingencies. What matters, according to Eliasson, are the interpretations of these guidelines and the ability to enforce voluntary contracts. In general, the “enabling” characteristics of legal rules appears to be critical for the evolution of an appropriate, welfare maximizing and efficient legal system (Wihlborg, 1998).

Protection against infringement is provided by legal systems around the world as copyright laws and patent laws (Neylon, 1998). Local domestic legislation vary on what characterizes property rights infringements. However, the common platform for western property rights legislation is related, not to the content but to the actual physical hardware to which it is bundled (Prime, 1999; Varian & Shapiro, 1999; Barlow, 1993; Yee, 1997). Property rights are claimed to the bottle rather than the wine (Barlow, 1993), or to the package rather than the content.

2 THE PROPERTY RIGHTS PROBLEM ON THE WORLD WIDE WEB

World Wide Web property can exist as digital bits of information, easily copied and reproduced. A content pirate is only keystrokes away from copying a photograph, mass

reproducing an academic article or stealing a life's work. Some have even argued that it would be optimal to allow unlimited use of each idea by not granting any intellectual property rights at all (Yee, 1997)[45].

Several authors argue that digital property is close to impossible to protect due to its easy reproduction and distribution (Barlow, 1993; Thurow, 1998; Gigante, 1997). These authors argue that existing property rights legislation is unable to meet the new requirements introduced by the digitalization of information and the growth of the World Wide Web. Several authors have, hence, called for a revision of existing legislation. Barlow for instance, argues that patents are not sufficient to enforce intellectual property since they are designed to protect the ability to put ideas into reality rather than the ideas themselves. Digital information on the Internet enables third parties to sell the wine without the bottles and, hence, bypass the creator's ability to claim ownership. The success of the free software movement, and the commercial use of free software such as the operative System Linux and web server software Apache have further fueled some of these fears. The spread of the Linux kernel will, according to Moglen (1999), be the first step in nullifying the intellectual property rights system. Efficient management of content ownership has, therefore, become one of the most critical aspects for agents to consider before venturing into the new environment (Krishnan, 1998).

I have previously argued (Jonason, 1999) that Innovative Pricing (IP) can be used to solve the pricing problem associated with the commercial introduction of the Linux kernel. IP is concerned with determining a suitable billing base for a particular product. It exploits one exclusive aspect or parameter of a product. This particular billing base may vary depending on market, product and legacy. If the particular billing base is bypassed, it will make it difficult to claim ownership to the product and hence to trade. How can content ownership be determined if the soft content can switch hardware platform so swiftly?

The arguments regarding the inability to claim ownership, therefore, often miss one important technical aspect of the swiftness of information. Regardless of how swift the soft content may be, it still must be bundled with some kind of hardware, if only for a short period before it is moved on. Let me explain with an example:

[45] Based on arguments first introduced by Arrow (1962)

"Caching" is a generic term referring to the process of making copies for easy retrieval. When copying a file from the Internet, caching occurs both at the user's computer (RAM) and at server level (proxy; CLI, 1995). These caches hold copies in order to minimize their access time (Athanasekou, 1998). In fact caching at proxy level reduces the computable load on the remote content server and makes it possible for that machine to supply data to more clients exponentially. The data is, hence, stored at multiple hardware locations as the packets are routed to their final destination (Sanger, 1996; Burk, 1998). In turn, according to Burk (1998), digital transmission of those copies over the Internet would presumably constitute a distribution of copies. According to the author existing legislative practice both in the United Kingdom and the United States is broad enough to cover distribution of information from a web page. The problem is, thus, to locate the specific hardware to which the illicit copy is bundled. In the next section I demonstrate that tracking technology exists today (1999) (Paskin, 1999; Augot, 1998; Varian & Shapiro, 1999) which enables the application of the existing legislative framework to make pricing of content possible (Charlesworth, 1998). If the existing legislative framework can be applied we will have no need for a dramatic change in legislation.

3 EXISTING FRAMEWORK CAN BE APPLIED

Claiming property lies in the owner's ability to recognize a copyrighted product after infringement (e.g. Varian & Shapiro, 1999). A product of easy reproduction, hence, needs to be bundled with a variable that can be uniquely identified despite repeated duplication. Since digital content can be easily unbundled from most hardware the unique feature must lie within the digital content itself. Since digital copies are perfect copies of the original all content stored on the original will be transferred to its replica (Varian & Shapiro, 1999; Garofalakis et al., 1997; Lakshmana & Moorthy, 1998).

One solution therefore is to store digital watermarks within products. Such watermarks can then be traced with a search engine. The Marc Spider, from Digimarc Corp, of Portland is one example. Digimarc embeds copyright and ownership information throughout a digital product, with details about its creator. MarcSpider then searches the Web, and reports back about the use and location of the digital information (Varian & Shapiro, 1999).

Another possibility, for protecting sound content, is to record a high or low note in a short unique sequence, untraceable for the human ear, alongside the music. Such protection could obviously be erased by means of filters, but it would make infringements considerably harder technically and in addition decrease the credibility of illicit copies for sale, since buyers would be unable to control whether such a sonic watermark has been removed or not. Storing watermarks within digital content, thereafter, opens the possibility to trace and finally pinpoint the new hardware of the replica. The technique provides legislators with a framework for applying existing laws regarding illicit copying and will thus increase content creators' ability to protect their economic interest.

However, ways exist to block these types of tracking and tracing devices. Tracking applications can only access content in the public domain of the World Wide Web. If an illicit copy is stored behind a firewall the tracking device will be unable to locate it. To solve the problem of tracking piracy behind firewalls thus calls for another type of property protection. User identification offers a solution.

If users could be identified individually and be forced to leave a trail of where they have been and what they have done on the Internet the tracing of infringements back to the hardware and, hence, the individual user would be easy.

Today, when accessing a web page, an Internet user leaves a footprint, a hit, which can be registered. The user is then able to copy, illicitly or not, any information displayed on the page. The owner of the content is unable to identify the 'bitlegger' as an individual, and if the culprit stores the content outside the public domain of the World Wide Web, its owner will be unable to trace the terminal where the replica is stored.

This problem has resulted in commercial attempts to separate individual web users. One possibility, introduced by Xerox, is to have an exclusive connection between hardware platforms. This would allow content to be channeled over so called challenge response protocols, where first a secure connection between two terminals is established before any information can be transmitted (Stefik, 1997)

Another solution introduced by Intel, the worlds largest computer chip manufacturer, includes an always-on identification number, within its Pentium III processor. In a fashion similar to the car registration numbers the Intel chip would uniquely identify an Internet

terminal. The reason was to increase the security of electronic commerce by assuring sellers that they are dealing with legitimate buyers. These numeric identifiers can be compared to a Vehicle Identification Number (VIN) that is stamped into new cars. The VIN is helpful in recovering stolen cars as well as tracking vehicle history. This along with the ability to leave digital watermarks within content would enable content creators to trace piracy across the World Wide Web, since the chip would leave a trail of footprints behind, and to finally pinpoint the hardware that stores illicit copies.

These technical solutions are examples of how Internet property can be traced and found at its hardware location. Once the hardware that holds the piracy is found, the infringement can be compared to similar cases of piracy. Thus the piracy can be identified and content owners will be able to apply existing legislation to settle ownership disputes. This would satisfy the content owners' pricing problem.

4 HARDWARE TRACKING CONFLICTS WITH PRIVACY

Once introduced, however, the Pentium III chip brought protests from consumers and the Internet community in particular, fearing that Intel would use the information sent from its new processor to conduct big brotherism. Users would, by buying the processor sign away their previous benefit of anonymity on the World Wide Web. Intel reacted to the critique by agreeing to make 'off' the default status for the Pentium III id numbers.

The efficient tracking and tracing solutions are, however, becoming a reality on the World Wide Web. As the use and transfer of content between different locations will become increasingly traceable and recordable, owners of content are able to identify ownership to their work. The other side of efficient tracking and tracing is that privacy emerges as a problem.

Several authors (e.g. Ting, 1999; Moor, 1997) have recognized the importance of individual privacy as one of the foundations for security and democracy. Unless a suitable framework for the protection of individual privacy is established, the argument is that growth in the promising market for electronic commerce may be jeopardized. If an individual on the World Wide Web cannot feel secure he is unlikely to surrender parts of his privacy, and increased transactions costs associated with trust will be the consequence.

The problem of protecting privacy in transactions is not new. Credit card companies and airliners have received critique for deficient protection of privacy in their customer databases. However, these user profile databases have been based on a proprietary solution with a single owner, or at least an isolated group of owners. Previously, a privacy infringement could be traced back to the source quite easily or in the worse case be contained by the previously limited size of the proprietary information platform. The open environment of the World Wide Web, however, has brought networking effects to the system. Private information spills between database agents, meaning that private content can be more easily accessed, distributed and used in a completely different context than what was originally intended.

The storage of user information, such as purchasing patterns and web behavior is, in fact, the creation of a different kind of Internet content, placing power in the hands of traditional content publishers. This user specific content can, depending on its nature, be extremely valuable (Hagel & Armstrong, 1997; Wilson, 1998). This observation leaves us with a new pricing problem. How should consumers price, and control the distribution of such information about themselves?

In the right hands, access to such user profiles, could bring value to the consumer since it would enable tailored one to one marketing. However, in the wrong hands the result could be very differently used in not, by the consumer, intended ways.

Let me illustrate this problem with an example. Suppose a portal has a database that enables the tracing of all consumers that have bought recipes for kosher food. Giving away this information would be of value to a store selling the ingredients to these recipes since it would enable the store to perform one to one marketing. However, if this information ends up in the hands of extremists it could be grossly misused (OECD, 1999).

Hence, efficient tracking and tracing, for the sake of pricing published Internet content, will leave us with a new problem, that of protecting and pricing user integrity.

5 CONCLUSION

I have illustrated how the existing legislative framework for claiming ownership to content can safely be used in the digital world since ownership is legally based on the hardware where the content is stored. The information itself is not property. Some authors therefore argue for

a change in the legislative framework, to establish property rights to the information itself. However, with the innovative use of pricing (i.e. Innovative Pricing) we can determine a base, which will enable creators of content to apply existing legislation to claim ownership, and thus eliminate the need for government interaction. This argument is based on the fact that, no matter how swift, digital content must always be bundled with some hardware. In conclusion, the ability to claim ownership depends on whether the creator can identify the hardware location of an illicit copy. New tracing and tracking devices enable legislators to connect soft content to hardware and, hence, provide legislators with a framework to apply existing legal practice to solve content ownership disputes. The economic and practical consequence of that possibility, of course, is another problem.

However, the technical ability to trace users and user content leaves us with a new problem. Full tracability eliminates anonymity. Effective property rights protection through user tracking by way of hardware will conflict with the integrity of personal information. The property rights problem so to speak has been demonstrated to really be a privacy problem. The problem of pricing content on the World Wide Web, hence, creates a problem of pricing privacy.

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Chapter V

Mobile Internet Revenues: An empirical study of the I-mode Portal

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ABSTRACT

Third generation mobile networks will be characterized by the convergence of the wireless, the fixed Internet and the media industries. Expectations on agents' ability to generate revenues (and profits) within this technological intersection are high and will be further geared by the future availability of broadband capacity. Some firms will prosper while others will find it difficult to defend their high stock valuations. In effect, we should expect the fundamental shift to be of a partly destructive nature. The revaluation of these companies may occur rapidly and dramatically. Investors are therefore observant of indications of how the structure of this new market will emerge and how revenues will be distributed among agents. This paper presents such an indication in the form of the Japanese Mobile Internet portal I-mode.

We use the theory of the Experimentally Organized Economy (EOE) and Innovative Pricing (IP) to assist us in our analysis. The conclusions are supported by 650 interviews, 450 of which are I-mode users and 200 potential users of the service. Another important source of material has been subscriber data from NTT DoCoMo's billing department.

JEL-classification: L11, L96, O31

Key words: Innovative Pricing; Experimentally Organized Economy; Mobile Internet, Electronic Commerce Introduction

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1 INTRODUCTION

As consumers increasingly rely on the web to send and receive information, the demand to conduct these activities from multiple access points also increases. One natural first step in this evolution of information access technology will be to bring the Internet to wireless devices. To accommodate this need, online content providers are striking deals with operators and infrastructure manufacturers to push and receive content over wireless.

Wireless carriers have generally been successful in gaining considerable revenue from customers, and have, hence, often been very profitable. The bulk of these revenues, however, has come from regular voice traffic based on airtime. It is apparent that the dependency of voice has become a considerable Achilles heel for wireless operators although, as of late, some operators, such as Finnish Sonera, have gained considerable revenue additions from SMS (Short Message Services).

Market deregulation in combination with increasing competition is forcing price erosion on voiced-based services and is therefore posing a fundamental threat to operator profitability.

Experience from fixed voice suggests that firms having their whole product portfolio under price pressure will be under threat of being priced out of the market unless they find alternative sources of revenue. This can be done by product innovation or by redefining the product portfolio offered to the market. The motivation is the search for a marginal, unique characteristic of the product that can be used as a base for pricing . The ability to locate and leverage this parameter is what characterizes the theory of Innovative Pricing (IP; Jonason, 1999). More of this later. Considering the technical convergence going on between the Internet, the Wireless and the Media industries, content and e-commerce services appear to be additions that could raise revenue and thereby safeguard the future profitability of wireless operators and lessen the dependence on voice as a source of revenue.

The additional features of mobility and personalization over mobile devices enable new types of e-commerce applications. These new attributes distinguish mobile e-commerce from the services offered over the mainstream fixed Internet, and have, hence, been coined m-commerce. Whilst there is much talk, but little evidence, of the commercial potential of m-commerce the upward trend of wireless data traffic and the development of Mobile Internet applications suggest that firms are keen to exploit this new medium.

Such new types of services, however, require new types of technical enablers and, hence, call for investments in both software and hardware. It will be possible to upgrade the traffic capacity of the network with the help of standards called GPRS (115 kbit/s), EDGE (384 kbit/s) and eventually WCDMA (Up to 2 Mbit/s)[46]. These infrastructure improvements will not only increase the transmission capacity several times but also transform the manner by which data is transmitted going from the traditionally circuit-switched connection to the Internet related, packet-based connection. One major improvement of packet-based technology over circuit-switched technology is that users can pay for transported volume rather than time of transport. They can, hence, remain online without having to pay for the time they are idle on the network. Instead, the network provider can charge the end-user per volume of data transmitted or received, greatly reducing the cost of real time applications. The two major technical innovations (of packet and broadband) will redefine the wireless services to be offered in the near future. In addition, however, it also creates a pricing problem for the operators. The added capacity of the network will have to be filled with content that is in demand by the final user. This will become even more of a problem, but also an opportunity with the next technology upgrade to broadband.

A natural prediction is that the most popular applications from the fixed Internet, mainly those of entertainment, will also be the most successful ones on Mobile Internet devices. Media and entertainment companies are, therefore, expected by many to be dominant players in this new industry. Since packet-based broadband content delivery is a new business for wireless operators most have decided to let third party providers offer these applications within the framework of a portal.

This means that, to use the analogy of Evans & Muster (2000) of richness and reach, the content providers bring the richness while the operators will bring the reach. A problem, however, is that there will constantly exist an incentive for one of the sides to bypass the function of the other for profits. In the market for Mobile Internet this could be an attempt by the operator to provide its own content, or for the content providers to bypass the operator by offering access to the end users in order to profit on content. The relationship between the two types of firms is thus of the dual nature of both cooperation and competition.

[46] The technical standards are, in reality, more complex and differ somewhat between continents (This is the European evolution).

While the pick-up rate for wireless data has been quite modest, the market for fixed Internet applications has been a virtual gold rush in terms of user growth. Some content sites and portals, such as Yahoo, average over 700 million page views per day. However, providers of content at the consumer end have had considerable problems charging for their products. One common explanation for this pricing problem lies in the nature of these intangible products, being easily copied and reproduced at cost close to zero. The bulk of the revenues from this gold rush have thus, so far, gone to those that sell the shovels, i.e. infrastructure manufacturers such as Cisco Systems.

Whether the operators will remain dominant in the wireless Internet market or whether the fixed Internet model of weak operators (access providers), strong growth but low revenues will prevail is still uncertain. Considering the former high stock valuations of the companies, one thing is certain. Any indication of how the future distribution of revenue i.e. the firms' ability to charge for their products, will have profound implications for corporate valuations. Investors and analysts are therefore observant of indications of which category of firms that will be the winners when the Internet goes mobile.

One of the first operators to integrate Mobile Internet applications with voice terminals is Japan's NTT DoCoMo with its packet-based portal solution I-mode. This paper will examine how the revenues flow between the agents within this portal. By using the theory of the Experimentally Organized Economy (EOE, Eliasson, 1996) and Innovative Pricing (IP, Jonason 1999, 2000) we will arrive at an answer, or at least an indication, of who will be the winner in the market for wireless Internet.

The Schumpeterian creative destruction process is one side of the EOE. The entry of new technology, new products or new firms (see Table I) places incumbent operators (firms) under competitive pressure and forces them to respond through reorganizing, rationalizing or exiting the market as losers.

Table I. The four mechanisms of Schumpeterian creative destruction and economic growth[47]

Innovative entry enforces (through competition)

Reorganization

Rationalization

or

Exit (shut down)

This creative destruction process can be slow, as in the old industry based, like engineering, on many integrated technologies, or fast, as in computing and communications (C&C) industry where a new technology generation kills the previous technology generation, including its producers.[48] The more unimodal the technology the faster the destruction process. This raises the question what will happen after a sequence of generations of information access technology, from fixed to wireless and then on to wireless broadband, if there is a strong demand pull for higher quality content at the customer end.

The paper is, hence, organized as follows. First the background and functionality of the I-mode portal are described in general terms and the relevant pricing literature is discussed. Next the data and the results are presented before finally the conclusions are drawn.

2 BACKGROUND

First introduced in February 1999 by the operator NTT DoCoMo, I-mode soon became one of the world's most popular wireless Internet services offering web browsing and e-mail from mobile phones. The service was actually first launched as a single VPN (Virtual Private Network) application intended for business users. This initial strategy can be explained by the fact that, historically, mobile telephony in Japan has been a private phenomenon causing peaks in traffic during non-working hours. NTT DoCoMo's initial intent was therefore to fill out low marginal cost off-peak airtime during business hours and to increase mobile usage in the less price sensitive corporate segment. This initiative created little interest in the market,

[47] Source: Eliasson, G. (1996, p. 45).
[48] See Eliasson's (1998) story of the five generations of computing.

however. The service was, therefore, innovatively repackaged (or redefined) as a private application and given the non-technical name I-mode.

Unlike WAP (Wireless Access Protocol), which uses WML (Wireless Markup Language) as its markup language, I-mode services are built using C-HTML which is similar in structure to the regular Internet mark-up language HTML.[49]Since C-HTML is closely related to regular HTML it is relatively easy to offer an I-mode version of a standard HTML web page. This also saves programmers' time from having to learn a new programming language

I-mode phones transmit data at a speed of 9,6 kbps. Although this may seem slow compared to ordinary 56 kbps computer modems, it is actually quite satisfactory for I-mode, since e-mails are limited to 500 bytes and most of I-mode's sites are relatively small averaging about 1.2 kbyte in size. Downloading e-mails and I-mode pages usually takes only a few seconds.

Web pages that can be accessed via I-mode phones are either official sites registered on the I-menu, or unofficial sites (also know as "voluntary sites") without that official sanction. One advantage of being an official site is that these usually get more page views because users can access them from their phone's menu without entering the URL. The primary advantage for the content owners of these pages, however, is the possibility to charge end-users for content through the billing agency of NTT DoCoMo. On the other hand, being listed within the portal has a number of disadvantages. Services such as search engines, links to unofficial sites, and community-based content (such as chat, bulletin boards and advertisements) are not allowed on official I-mode sites.

The subscriber's bill depends on usage of the I-mode function on the phone, and the number of fee-based I-mode content services he subscribes to. There is a basic fee of 300 yen per month to access the I-mode service, which is paid via the subscriber's phone bill to NTT DoCoMo. Since I-mode is based on packet-data transmission, users do not pay for the time they are connected to a service. Instead they are charged according to the volume of data transmitted. Using I-mode to surf web pages and send or receive e-mail generates a charge of 0.3 yen per packet of 128 bytes of transferred data (sent as well as received). All the content within the I-mode portal is offered by third parties. The billing of these services are

[49] With the exception of a few meta tags. In general, the additional tags in C-HTML enable text and pictures of I-mode to fit the mobile screens.

exclusively handled by NTT DoCoMo costing the content provider 9% of the revenue from the end-user while the remaining 91% of the content charge goes to the content provider[50].

At first glance, the business case for the content providers might appear to finally have solved the problem from the fixed side, that of generating revenue from valuable but replicable content. A closer look reveals a different picture, however.

3 MODELS FOR PRICING THE MOBILE INTERNET

Traditional economic price theory gives little hope for firms competing in non-monopoly markets where marginal costs are low. According to this theory, firms will continue to under-price one another until a below average cost equilibrium price at marginal cost is reached making no foundation for a long term business.

Pricing in an Internet environment has been analyzed by for instance MacKie-Mason & Varian (1992), Brownlee (1995), Odlyzko (1997) and Clark (1995). They show how the free pricing policy of Internet traffic has caused a problem in providing quality of service availability. The positive externalities expected from adding more users to the network may actually be negative if the marginal user causes congestion.

The optimistic law of Metcalfe stating that the benefit of users grows with the square of the number of other users in the network is therefore only true as long as the marginal user does not cause congestion (or some other negative externality)[51]. Congestion can only be avoided and networking externalities exploited as long as capacity expands ahead of utilization. Suggestions of new models for pricing Internet traffic have therefore been put forward to solve this problem (ibid.). The difficulty with the congestion pricing approach, however, according to Dolan (2000) is that marginal cost varies from one extreme to another depending on whether the network is congested or not. The high level of uncertainty prevents agents from forming an efficient pricing scheme based on rational expectations. Another common practical restriction is the technical limitations of billing systems. Even small changes in a billing system can be costly and may thus, prevent a new pricing scheme from being implemented at all.

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[50] Thus, if a content provider chooses to charge 100 JPY per month for its service it will receive 91 JPY while DoCoMo receives 9 JPY

[51] Which actually has been the case of I-mode in September 2000 when the portal experienced considerable congestion problems.

Standard pricing theory is therefore useful only for some standard, and not very common situations, where products are exogenous and well defined, demand of the market protected from uncertainty and transaction costs low. Both the providers of content and the operators then sell products, the marginal cost of which is close to zero. Standard equilibrium theorists will not only be puzzled by some of these agents ability in reality to make profits in the converging markets of media and telecommunications but also by their willingness to price considerable parts of their product portfolio even below marginal cost.

The traditional theoretical framework neither recognizes innovative redefinition of products to increase aggregate revenue, nor firms' ability to invent new bases for charging when conditions in a market change as a result of decisions taken by other agents. This, however, is typical in reality and recognized by the theory of the EOE. In the EOE firms continuously experiment with their products, changing not only the bases for charging but also the products such that they can be efficiently priced. The expected direction of revenue flow is highly uncertain in such an environment. Firms are often unaware of what type of agents in the market they will have as customers (paying a positive price) and who will be the suppliers. The enabler of such changes in the pricing base is innovative technology or product reorganization. Product development, hence, becomes integrated with pricing, since it is crucial to structure a product such that its aggregate contribution to the bottom line becomes positive. It might very well be that the pricing situation in the market is well defined while the product is not.

Thus, treating our pricing problem as homogenous goods and an exogenous price method quickly runs into difficulties. In fact, one can question whether the standard pricing theory is at all relevant since the option of redefining the product, or more correctly rearranging its attributes as a reaction to market dynamics always exists. Imposing such restrictions upon the product will ignore the dynamic options available and, hence, the uncertainty in the marginal cost of supplying the product. One controversial conclusion, therefore, is that the theoretical situation of pricing homogenous and exogenously well defined goods will never appear in real life, since the demand of products, both existing and potential, cross-fertilize across markets in a manner that is hard or even impossible to define.

The products and services mentioned in this paper are, therefore, considerably more complex than those studied in the theory of bundling, first introduced by Stigler (1965). Examples of such studies, for pricing information goods, are Bakos & Brynjolfsson (1998)

and Chuang & Sirbu (1997) who consider selling a complete bundle, which consists of all the goods available. Their experiments under designed and controlled conditions show that when consumers have similar average valuations for the information goods, profits are highest from selling only a single, complete bundle. When consumers have different average values users will prefer to purchase individual items. A slightly more complex analysis is that of Mackie-Mason et. al. (2000) allowing consumers to buy both producer defined sub-bundles of products, user defined sub-bundles or individual products (in their case electronic articles). They show that while there is a steep initial learning curve, decisions makers quickly develop an understanding of new pricing schemes.

Such studies, although interesting, again, focus the analysis on the interrelationship between exogenous attributes of a product portfolio and thus ignore the positive (or negative) demand effects a bundle has on other portfolios of attributes in the market. Such externalities are subject to uncertainty and opens up a situation where firms are able to incorporate only a fraction of all the possible demand externalities that contribute, or reduce the demand of their products and will, hence, prevent agents from making rational expectations decisions.

3.1 Innovative Pricing in an Experimental Decision Model

I-mode is a brand name, not a technology, or rather an Innovative Pricing method. I-mode uses a rather primitive technology, compared to for instance WAP but has still been more successful. NTT earns plenty of money on its new brand and can afford to buy into new technology. We, therefore, have an interesting competitive situation with many technological competitors facing one another and a cash rich innovative pricer (NTT, I-mode) that can buy into the best of them if it decides to. Will this start a Schumpeterian creative destruction process?

Kalakota & Whinston (1997) claim that in essence, e-commerce emphasizes the generation and exploitation of new business opportunities and, to use a common phrase, ‘generate business value’. This might be true but still leave firms with the problem of how to charge for this value. Inability to charge for products and services will inevitably lead to bankruptcy, no matter how much business value is created.

The pricing problem for these agents is, hence, not only the traditional theoretical problem of setting an optimal price on an exogenous product but also that of identifying the market for

spillovers that the low marginal cost producers create and then charge for this extra value somehow.

The pricing competence of the firms is, hence, to locate a base of its product portfolio, such that a base for pricing can be established. Either by rearranging the base for pricing or by adding new earlier not recognized or imagined characteristics by redefining the product. In other words, the IP problems amounts to capturing the economic value of the spillovers, or get somebody else to pay for part, or all costs to continue to offer the product. This problem and its solution has been observed on several occasions and has subsequently been termed Innovative Pricing (IP) (Jonason, 1999a, 2000). The set of pricing combinations are often unique to each agent in the market, but are still numerous as well as subject to considerable uncertainty. This means that the agent can incorporate only a fraction of all the possible pricing combinations in the market. A firm can thereby invent a completely new way of charging for its products. The competence to identify market pricing imperfections coupled with the ability to exploit these are closely linked to the role of the entrepreneur. Pricing decisions taken by agents, can therefore, if successful, be compared to acts of innovation.

By continuously redefining its business the firm is setting up and enacting subjectively controlled experiments, based on hypotheses about opportunities in the market according to the theory of the Experimentally Organized Economy (Eliasson, 1988, 1991). The firm's IP competence leads an analogy of the firm as an experimental machine in a biological theory of the firm. If the IP decisions fail in the EOE firms will reorganize or exit from the market (bankruptcy) or if the failure is identified and attended to in time, redefine the product. Success from IP means that the firm will be able to identify a temporary monopoly, given that the pricing scheme is based on a unique attribute. This advantage will prevail until the competition discovers and acts on opportunities in the market by controlling the externalities with their own IP competence to drive the flow of revenue in the market through their own bases for pricing.

The dynamics of the market, hence, prevents one particular creative pricing scheme from remaining a winning formula forever. Firms are constantly challenged in their ability to charge for their products by new IP schemes driven by changes in technology, competence and decisions taken by competition in the market. The threat causes the firm to be constantly on its toes, rearranging and redefining the attributes of its product that are used as bases for pricing.

4 FINDINGS FROM THE SURVEY

The study was carried out by the Consumer Lab of Ericsson Radio Systems during mid February to early March 2000. The material was gathered through a telephone survey with residents living in Osaka or within a 30 km radius of central Tokyo, using CATI (Computer Assisted Telephone Interview) technology. The two types of respondents were Japanese I-mode users and potential users of the service. The results were then compared to actual billing data published by the billing department of NTT DoCoMo in October 1999 shown in table IV. The accumulated results were then classified by different pricing parameters, i.e. those items that carried a positive price to the end-users. In tables II and III we report the demographics of the respondents of the survey.

Table II, Gender and age of the respondents of the survey

	Gender		**Age**		
	M	**F**	**15-24**	**25-34**	**35-49**
I-mode	47%	53%	46%	36%	18%
Potential	49%	51%	49%	27%	24%

The use of Internet services in Japan has historically been low in comparison to Europe and North America. Part of the explanation for this low penetration could be the fact that a large part of the information published on the web is in English. Another explanation could be that computer penetration is quite low, partly because of the lack of space for a computer in Japanese homes. The computer and application penetration of the respondents were therefore surprisingly high (See table III).

Table III, General device and application penetration of respondents

	Desktop	**Laptop**	**PDA**	**Game**	**Email**
I-mode	66%	49%	11%	50%	77%
Potential	69%	42%	6%	58%	67%

Data from the users' phone bill, in table IV, support the hypothesis that additional revenue can be received from the introduction of Internet content and m-commerce applications on wireless devices. I-mode users clearly spend more money than regular users of wireless telephony. The revenue increase is around 25 % or JPY 2000 per user. One viable argument is that of the early adopter. Price insensitive users are often more likely to use new services, the increase in ARPU (Average Revenue Per User) from the survey could therefore be explained by this argument. The data published by NTT DoCoMo's billing department allows us to

check this argument since it describes the same user before and after he joined I-mode. The revenue increase is therefore likely to be generic for all types of users, which obviously is not the case in the survey. This along with the price diffusion between the time of collection can also be a possible explanation for the difference in aggregate revenue between the two data sets.

Table IV Illustration of the phone bills of potential and actual users of I-mode, compared to official data provided by NTT DoCoMo (in JPY)

	<5	5-10	10-15	15-20	20-30	>30	Average	NTT Billing
I-mode	16%	47%	21%	11%	3%	2%	11,295	10,833
Potential	39%	46%	10%	5%	0%	0%	7,544	8,250

The providers of content create the end-user value of the I-mode portal. The operator does not offer any content services within the portal and although the billing of the services, provided by the operator, is clearly valuable for the content providers it brings little real value to the end user. The increase in revenue can therefore be derived from the value created by the content providers. As discussed previously, however, the creation of value does not necessarily mean chargeability. Table V, illustrates the distribution of revenue between the different pricing parameters. This leads to the conclusion that although valuable, the content represents a relatively small share of the total ARPU.

Table V Revenues broken down to individual pricing parameters (in JPY)

	Regular voice	Additional voice	Data Traffic	Service Charge	Billing	Content
I-mode	8250	1320	891	300	11	111
Regular	8250	0	0	0	0	0

The table above gives empirical support for the theory of IP. Content, such as entertainment, drives end-user demand for the I-mode service. The ability to charge for this content creates an incentive for the providers to offer these services to the end-user via the operator, since the alternative, to offer the services on a regular web page or on a unofficial I-mode page takes away this opportunity to charge.

The services of billing and access, both high value, are given away nearly for free by the operator. Instead, the bulk of the revenues comes from the indirect externalities of the service, those of extra voice and data traffic where the operator is a monopolist. The pricing problem of the operator has therefore been solved, for now. The providers of content have found a way to charge for their content but are still clearly far from directly charging the end-user for the value that their content creates. In fact, based on the billing data, the operator is rewarded

almost 25 times as much revenue as all the content providers put together. This gives empirical support to Baldwin & Currie's (2000) statement that the introduction of electronic commerce, contrary to popular belief, enhances and strengthens existing buyer-seller relationships, in this case the operator's relationship with the end-user, rather than allowing for entry to break them apart. The operator's initial failure with wireless data was solved by redefinition and repackaging. Once redefined, from a business application to a private service the operator experienced, success, measured in additional revenue.

These conclusions are encouraging for operators that have decided to venture into wireless Internet services. The dynamics of the market may turn this pricing problem around, however. NTT DoCoMo has to continue to redefine its service. The dependency on voice as a revenue source is still substantial. Revenues are based on the fact that available airtime is a bottleneck in the distribution chain. The introduction of broadband services can bring about a complete change, however. Since, this could open up the market for alternative providers of airtime.

At the same time, it could be possible for the content providers to redefine their service in a manner such that they, by Innovative Pricing, can bypass the unique parameter of access to the end-user and, hence, be granted the temporary monopoly revenues currently controlled by NTT DoCoMo. One example of such an opportunity could be that of offering local broadband access (such as Bluetooth) at local hotspots. Since the marginal cost of airtime is close to zero in such a setting, the content providers could bypass the operators base for billing (by giving away airtime for free) while instead charging more for content, which apparently still would be valuable. One argument speaking for such a bold alternative access initiative could be to offer free voice traffic in a convenience store. The motivation is that the users' presence in the store would increase the probability of them buying alternative products to the entertainment services offered in I-mode. One example of such a product could be comic books, thus forcing the operator to be constantly on its toes to protect its ability to charge.

5 CONCLUSIONS

The empirical evidence presented in this report is encouraging for wireless operators that are hesitant about their ability to generate revenue in the markets for Mobile Internet and m-commerce. By using Innovative Pricing NTT DoCoMo has been able to leverage its unique parameters of access and end user billing, in a manner such that a positive price could be set on the externalities of data traffic and additional voice. Although valuable, the content and

services in the I-mode portal has failed to generate the corresponding revenue for the content providers. The creation of value in the I-mode portal is clearly separated from that of revenue. This pricing situation will not remain, however. The operator is already aware that it will have to make new Innovative Pricing decisions in the future as a result of new technology, price diffusion of its pricing base and decisions taken by agents in the market. These factors will force the operator to constantly remain on its toes in order to remain a winner in the Mobile Internet game. Competitors are all assessing the business potential of the next technology step into mobile broadband Internet.

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Chapter VI

Innovative Pricing Effects: Theory and Practice in Mobile Internet Networks

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ABSTRACT

Multidimensional products, such as telecommunications, often distinguish themselves by a considerable amount of spillovers. The creator of the spillovers wants to commercialize the spillovers but cannot if the parameters on which the ability to charge is proprietary to another firm in the economy. These actors then need to agree upon an efficient pricing contract to be able to charge. As an effect, the direction of revenue in the transaction may not be self evident, turning previous customers into suppliers and vice versa. I use data from the Mobile Internet market to validate this claim empirically and make suggestions of possible solutions to the pricing problem facing these actors with the introduction of mobile multimedia.

JEL-classification: D40, O31, O33

Key words: Innovative Pricing, Competence Blocs, Price Theory, Mobile Internet, Strategy, Management Control

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1 INTRODUCTION

A central element within microeconomic and management theory, notably principal agent theory (e.g. Hart & Holmstrom, 1987; Holmstrom & Milgrom, 1991) and value chain theory (e.g. Porter, 1985) is the concept of the exogenous relationship between actors. The principal always knows he is a principal, the agent always knows he is an agent. Pricing in these models is restricted to maximize revenue minus cost (microeconomics), the maximization of value for a given customer (e.g. Porter, 1980; 1985) or the utilization of monopoly elements for market advantages (e.g. Goodman & Lawless, 1994). Regardless of its value, however, a product will not be a success (in terms of profit) unless its producer (owner) can make it chargeable in the market.

The problem of making products chargeable becomes acute if decision models become subject to uncertainty (as def. by Knight, 1921) and continuously change as a result of market dynamics. This situation arises when products are multidimensional and the producer has difficulties determining which dimensions are in demand and which dimensions that can be charged for. In such a situation the product or output (Hayek, 1945) is not well defined and, hence, neither is price. Given such a situation, firms often tend to search within their product, or adopt their products endogenously, to find a stable element to make the whole chargeable, as opposed to making it more valuable (through product innovation). I call this search process Innovative Pricing (IP, Jonason 1999a, 2000). I will show how the effect of this search can reconfigure existing pricing institutions and turn around the customer/supplier relationship. Hence the so often taken-for-granted roles in the market come up for question. How should then actors, dealing in multidimensional products go about to reach an efficient pricing contract? This question introduces our problem:

2 THE PROBLEM

Consider the following simple example: private builders and owners of infrastructure, notably bridges, are often faced with a pricing problem: According to theory users should be charged their marginal external cost (Pigou, 1920; Knight, 1924). One problem, however, is that the valuable element of the product (the bridge) does not contain a chargeable element (pricing base). Instead, the solution to the pricing problem is to endogenously expand the

product (the bridge) to include a pricing base (for instance a toll booth), that does not make the product more valuable from an end-user perspective, but makes it chargeable.

The problem treated in this paper, concerns, given multidimensional and dynamic products, the situation when the owner of the valuable entity (the bridge[52]) and the owner of the chargeable entity (the tollbooth) are two separate firms and, therefore, need to agree upon a pricing contract.

Technically more complex products faced with this type of pricing problem is the delivery of content and applications to mobile devices, typically news, banking and entertainment services[53]. The providers of the content and applications contribute value to the service, but rely on the network operators to charge the end user. I show how the operators tend to be myopic in their pricing contracts towards the providers and thus reduce their incentives to continue to contribute value. The spillovers in the market coupled with the pricing base make the roles in the market endogenous and subject to dynamics. The problem is illustrated theoretically both in terms of evolutionary economics and management control theory creating a bridge between the two.

The remainder of this paper is structured as follows. To begin with I present the theory of Innovative Pricing (IP) and its place in strategic literature. Section 4 argues how the institutionalized pricing scheme between agents can influence the definition of the roles of buyer and seller. I then draw on empirical data to demonstrate these points. Three different Mobile Internet revenue models are reviewed, each from a different operator. The data was gathered in cooperation with Ericsson Radio Systems, the world's largest supplier of wireless infrastructure and the three operators in question. Finally the paper concludes in section 7 that summarizes the key features of the paper, and makes some recommendations for corporate pricing decisions. For the purpose of this paper the operators will remain anonymous.

3 AN INNOVATIVE PRICING STRATEGY

Strategists, such as Porter (1980, 1985), have developed a highly regarded paradigm of strategy centralized around the creation of value. Another common focus of strategy (e.g.

[52] Those readers that question the multidimensionality of the bridge example can have a look at the impact the Oresund bridge has had on real estate prices in the Malmoe-Copenhagen region. Should the builders of the bridge be compensated for the property value they created?
[53] Examples of providers are Yahoo, Amazon, Bandai and Disney

Goodman and Lawless, 1994) suggests that firms should seek a position in which they can exhibit a measure of monopolistic power. The creation of value and the benefits of monopolistic power are obviously of central strategic importance to any business but, as argued here, need to be accompanied by the issue of chargeability. Market power or amounts of value created are irrelevant unless the firm can find a way to transform created value into revenue. Hence, 1. value, 2. monopolistic control (property rights) and 3. chargeability are interdependent.

By experimenting with different pricing combinations in the market, a firm might strike gold and find a pricing solution that allows it to charge not only for the value it creates but in addition take advantage of value created by other actors in the economy i.e. for the spillovers. This will be possible when the actor has the needed competence, and when competitors either through ignorance or inability cannot internalize their own spillovers. The firm may in fact decide to modify its pricing base of a product in an attempt to capture spillovers created by other actors in the economy, rather than by its own products. Through this the firm uses its innovative competence in pricing to endogenously adapt the product definition to a pricing situation rather than, the more common academic problem, the opposite.

Conventional price theory often deals with homogenous goods or bundles thereof (e.g. Tirole, 1988; Wilson, 1993; Ramsey, 1927; Mitchell & Vogelsang, 1991). Product definitions and pricing structures are often considered exogenous, however, and not as part of a path dependent, subjective and innovative decision process of the firm. In such models the externalities between products are known or at least calculable under some rational expectations function. The problem, however, is that when the number of combinations available to the firm are numerous, and change quickly over time, it prevents a pricing decision based on rational expectations, since the optimization upon which the mainstream pricing theory rests cannot incorporate an open state space[54]. Schumpeterian economics with its focus on the role of the entrepreneur is therefore more helpful.

[54]A segment of the CDMA division of Ericsson Radio Systems, for instance, which is only a part of the infrastructure side of Ericsson Radio Systems, has over 14,000 different products in its portfolio.
The number of bundling combinations for pricing is, hence, $3^{14,000}$ (exceeding the expected number of particles in the universe). The rapid technical development in telecommunications contributes to making the demand externalities between these bundles dynamic over time (the turn over rate is approximately two years). A mainstream Neoclassicist would, hence, need to explore a state space considerably larger than the universe that changes in definition over a period of two years, before he could even start his maximization process of revenue minus cost. Needless to say, this is very far from what goes on when Ericsson Radio Systems is pricing its products.

The entrepreneur is a person who develops new products not seen previously in the market. Thus Schumpeter (1911) views innovation as the identification of commercially viable inventions. The change in science is only interesting in so far as it is capable of transforming the outside world, and that this change has to be commercially successful. An innovation, hence, does not only involve the introduction of something new but also involves the ability to act commercially on the opportunities that this advance in science and technology offers. This returns us to the issue of pricing as an essential tool of innovation and commercial success. It may well be the case that the pricing scenario is given while the product definition, in terms of function, cost or quality is not. The pricing problem will often go hand in hand with the product definition. This integrates pricing and product innovation and will, hence, open up an evolutionary price/product setting that I call Innovative Pricing (IP; Jonason 1999a, 2000).

Management control literature sometimes brings up the related concept of the institutional entrepreneur as a breaker of institutional frameworks, such as pricing. First introduced by DiMaggio (1988) and later applied to institutional theory by for instance Fligstein (1997) and Kondra & Hinings (1998) the institutional entrepreneur is portrayed as an important contributor to cost reductions within the firm. Such studies often address the duality of institutional rules and practices pointing to the inability of static rules to give a unanimous answer to how agents should act. Gupta & Govindarajan (1984) state that firms, facing a high level of uncertainty, experience higher performance by placing greater reliance on subjective evaluation rather than on calculated mechanical (i.e. optimized) and institutionalized responses. There are, hence, gains to be made in constantly questioning, subjectively expanding and reorganizing the charging of products. Such IP business experiments thus continuously test existing institutional practices.

An institutional entrepreneur in a strategic typology is comparable to the theory developed by Miles & Snow (1978) and Miller & Freisen (1982). It distinguishes between conservative defenders and entrepreneurial prospectors. The defining variable is the rate at which the firm alters its products and markets relative to its competitors. Defenders are organizations that have a narrow and stable product line. Such agents tend to adopt institutionally stable routines. Like Schumpeter's (1911) and DiMaggio's (1988) institutional entrepreneur, the prospector, in conflict with the defender, constantly examines the environment for product and market opportunities. Prospectors rely on the product and market development to bring

change to the environment around them to generate profits, and therefore face a more uncertain environment (Miles & Snow, 1978).

What are these subjective pricing experiments based upon? Beckert (1999) addresses this issue by defining institutions as reducers of uncertainty by creating expectations in the behavior of others. The precondition to deducing strategies is for each agent to know how other relevant actors in the field will act. In accordance with Schumpeter (1911), Beckert distinguishes the role of the manager as a follower of existing institutional rules from that of the entrepreneur as a breaker of such taken-for-granted rules while searching for strategic opportunities to enhance self interest.

In a similar manner, one solution to the problem of how to act in the face of uncertainty is to create institutional practices around certain subjectively stable product elements. In regards to the IP problem this entails identifying a proprietary chargeable characteristic of the product that subjectively relates to the rest of the product portfolio in a predictable way. Such elements could, for instance, be parameters that are of a monopolistic nature. This stable characteristic can then be leveraged to charge for additional elements (spillovers) within the product portfolio that create value but less revenue than their marginal cost. Such biased parameters have to exist, or be discovered (invented), however, before the product can be made chargeable.

The effect could include a redefinition of the (invention of a new) pricing institution in line with Beckert's argument that the firm, through the identification and redefinition of stable parameters, and thereby creates expectations among other actors of how, and at which price level, similar products will be priced in the future.

To align the theory of IP with mainstream strategic literature, we can conclude that the Innovative Pricing Environment (IPE, Jonason, 1999b), a market situation favorable for IP, is characterized by a high level of institutional uncertainty. The innovative pricer thrives in such an environment creating and redefining the pricing institutions in the market contributing to reduced uncertainty 'creating the mechanism that allows the economy to work' (Day, 1984). The entrepreneurial prospector is an innovative pricer, a breaker and a creator of institutional pricing practices by being dynamic in leveraging stable characteristics of its changing product portfolio, transforming the creation of value and the monopolistic elements into revenues through endogenous expansion and redefinition of its pricing base.

4 RIPPLES BY INNOVATIVE PRICING

As argued above, the theory of Innovative Pricing (IP) entails finding a stable characteristic to make the valuable elements of the product chargeable. An innovation does not have to be spectacular, however (Schumpeter, 1911). An IP scheme can be something that is brought in from another market as long as it entails something new that other actors through inability or ignorance cannot exploit. For instance in the previous example a solution to the bridge-pricing problem could simply be to set up a tollbooth[55].

An interesting problem arises, however, when the owner of the stable chargeable characteristic and the owner of the valuable entity are two separate actors in the economy. In other words when the owner of the bridge and the toll booth are two separate firms. An instant questions arises:

Who should pay whom?

The answer, even for physical goods, may not be that self-evident given the presence of externalities. Take mobile phones, for instance, that are given away for free, charged and sometimes even charged below marginal cost depending on the chargeable externalities they create in network traffic (airtime), branding, etc.

This type of problem has been addressed for non-price innovations. For instance, in their popular microeconomic work, Nelson & Winter (1982) bring attention to the point that an innovation is often produced by a firm for sale to customers who will use it. There are thus two acts of innovation involved in this context (buyer and seller). With pricing being an innovation both agents in the transaction need to have a properly working feedback mechanism on how different pricing schemes affect overall demand to make the spillovers created chargeable. DiMaggio's (1988) institutional entrepreneur will need to be placed on both sides of the transaction. A vital ingredient in the commercial success of the Innovative Pricing experiment is, therefore, *the receiver competence* of the customer, understanding and contributing not only to the development and improvement of the product (Eliasson & Eliasson, 1996) but also to its pricing.

[55] This solution may not be very spectacular. In Schumpetrian theory it is the novelty of the innovation that counts. The first person to think of a tollbooth to charge for the usage of a bridge was hence clearly an entrepreneur (Innovative Pricer).

Suppliers are often restricted in their ability to affect the pricing of their customers and the effects can, hence, be out of their control. This can create an incentive to redefine their product, to reduce uncertainty, either to exit the provider market or entry in the operators market through vertical integration or by partnering with substitutes. Both outcomes are obviously non-beneficial, and this naturally raises the interesting question of how to avoid this scenario.

The customer's role is fulfilled partly as an informant of specifications that are needed for the products to remain competitive, for instance on how the product should be defined in terms of price. This can be arranged to create a positive sum game, where both parties can come out as entrepreneurs and winners. Failure to work together will blunt the innovation or at least subject one of the parties to uncertainty that can be used by the competition to gain an advantage. Both parties taking part in a transaction can thus be innovative pricers. This fits well with Williamson's (1988) *fundamental transformation*, which states how the bidding condition is transformed into bilateral supply. Because of this transformation opportunism can create high transaction costs if dealt in the usual market mode. It may then be in the interest of all parties, both owning the specialized asset (the ability to charge, the operator) and those renting or buying the asset (the provider) to join each other in vertical integration (Klein et. al, 1978). The marketing strategy to be efficient, hence, may have to include active support to the customer on how to structure the pricing scheme to capture spillovers, or to include an element of joint ownership of the pricing base (revenue sharing).

If suppliers benefit from a particular pricing scheme they may be willing to stimulate and even subsidize a particular product definition to their customers, or even to their customers' customers deliberately losing money on it if it stimulates the demand of a chargeable, and perhaps unique, externality. The important element of such an IP scheme is a feedback mechanism that the customer understands and can charge for these externalities (intangible cloud of spilled value), such that the supplier is properly rewarded, by revenues, for the value it creates.

An important source of information in this discovery will be those firms benefited (potentially and actively) by the spillovers acting as informants and giving rewards for the spillovers created (Eliasson, 2001). This redefinition of customer supplier relationships is continuous and depends on the general pricing dynamics and on how firms decide to improve their receiver competence.

The customer/supplier definition is based on a subjective interpretation of the externalities in the market. The firm will need to discover which customers are actually customers and which should be paid (turned into suppliers) an above marginal cost price for the externalities they create.

The theoretical hypothesis to bring with us into the empirical section of this paper is thus first to show the endogenous roles in the market as a result of how the actor decide to charge. Second to use the different pricing models as benchmarks of efficiency to give suggestions of how the pricing contract and the feedback mechanism could be set up in order to avoid the pricing problem some of the operators are facing.

5 MOBILE INTERNET DEFINITION THROUGH PRICING

One industry that has experienced an abrupt change in its pricing institution is wireless telecommunications. From being a regular voice service device with its pricing based a on per minute of use base (airtime), mobile phones now offer a wide range of contributions from several industries with multiple voice, content and application plans. This has created uncertainty not only about how these services are charged for but also how the pricing of the existing services (primarily voice), still dominant in revenue, relates to the new.

Many operators have initiated Mobile Internet portals that offer comparably simple push and email services to their subscribers. Since content services and applications are new to most operators, many have decided to outsource this role to third party providers that already hold a fixed Internet presence. The most common arrangement is that the operators handle the billing towards the end users, while the providers add value to the end-users in the form of branded services and applications. It is debated, however, how end-users' revenues are to be divided between these third party providers and the operators. The providers would like to see themselves as suppliers of services, and therefore expect to receive payment. The operators do not always agree, however. Providers are often completely dependent on the operators' billing system to make their products chargeable, a monopolistic element that the operators often take advantage of.

A positive externality created from the services is a form of branding for the providers (or general market growth[56]) which could increase the demand for products sold, and made chargeable, elsewhere (the demand for Disney films for instance). The operators, on the other hand, receive the positive externality of airtime for transporting the services in their networks.

To return to the previous example of the bridge and the tollbooth. The providers add the value (bridge) but depend on the operators (tollbooth) to make this value chargeable. As illustrated below, however, the decision on how to define customers and suppliers (direction of revenue in the transaction) will differ between markets depending on the operators' subjective perception of the spillovers created. The role of the providers as either customer (paying a positive price) or supplier (paying a negative price) is endogenous and as shown, below vary between markets.

The first indications from the Mobile Internet market point to a considerable advantage for the wireless operators being able to leverage their monopoly on end-user access and charging to gain the lion share of revenues (Jonason & Eliasson, 2001). At the same time, providers are clearly an important element in the creation of end-user value, airtime usage, and a potential diversifier for the operators against the competition.

Technically there are still considerable improvements on the horizon (such as mobile broadband). Given the institutional effects of IP, however, it is likely that the pricing institutions of today will set a standard of how Mobile Internet pricing contracts are to be arranged in the future.

6 OBSERVATIONS

The empirical part of this study was carried out at Ericsson Radio Systems, the world's largest supplier of wireless infrastructure, between June 1999 and December 2000. Three types of actors in the Mobile Internet industry were studied: Service providers, End-users and Operators. The service providers included providers of content and applications. End-users were Mobile Internet subscribers, i.e. traditional customers of the operators. The structure of the analysis has been focused around the role of the third type of agents, operators. Three operators were selected, with a special focus on two of these (number 1 and 2).

[56] For instance, one of Japan's major gas companies offers free recipes as a mobile content service. The motivation for the zero price is that free recipes stimulates the usage of gas for heating food (rather than eating raw fish).

Open-ended interviews with executives at the operators and Ericsson internally were initially conducted to gain an overall understanding of how the pricing schemes were set up in relation to the different actors. Another important source of information was actual billing data published by the operators themselves. This data was then verified against the findings of Ericsson's own consumer lab research, consisting of several rounds of structured interviews with end-users from relevant domestic markets.

The findings were presented and discussed with nine different operators, several service providers and a considerable number of internal Ericsson groups for verification and feedback.

7 RESULTS

The operators' pricing strategies were classified in the figure below. It is important for the reader to note, however, that these pricing models are simplified for the purpose of illustrating the points of this paper. An example of this is the exclusion of terminal subsidies, which can have a considerable effect on airtime usage. An additional exception is that both operator 1 and 2 have a combined flat-fee with their incremental end-user charge. Finally, operators 2 and 3 also have exceptions to their general rule of charging their providers (some actually do get paid). The models are also dynamic in the sense that the pricing contracts between the actors constantly changed during the course of the study. These simplifications do not change the general snapshot picture illustrated by figure 1, however.

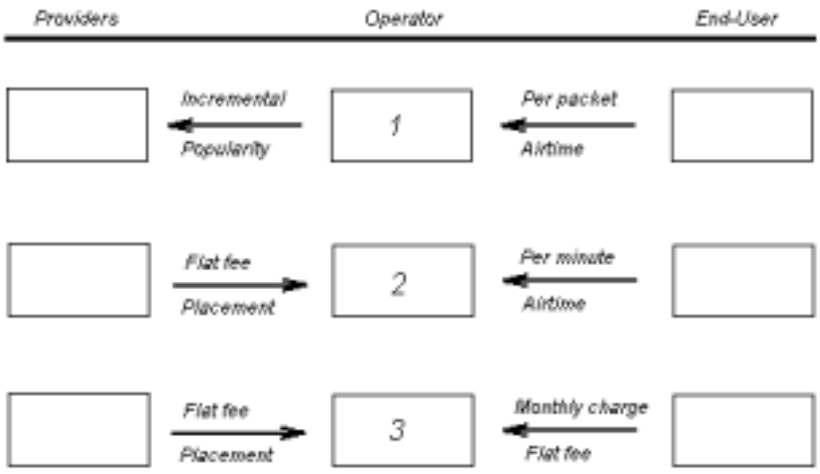

Figure 1: Three different Mobile Internet pricing models (simplified). The directions of the arrows indicate the flow of revenue, the text above each arrow describes how the product is charged and below what triggers the charge.

The three operators in the figure all have different ways of charging end-users. Operator 1 charges for the information (data traffic) sent and received by counting the number of data packets. Operator 2 uses a similar strategy but, because of technical limitations, charges its end-users on a circuit-switched basis, in minute increments. These two operators, have a considerable dependency on airtime as a base for charging. If competition forces lower prices on airtime (by the introduction of 3G?) it may force these operators to exit the market or redefine their bases for charging to make money elsewhere. Finally, operator 3 uses a flat fee for charging end-users. This pricing scheme has advantages in end-user simplicity and a cost efficient billing process. However, there is also considerable risk associated with network utilization in terms of managing capacity. Under this pricing scheme, operator 3 may be forced to upgrade capacity to cover the demand of existing customers and thus drive up network costs without a corresponding revenue increase.

Under the regime imposed by operator 2 and 3, the providers are in fact customers (paying a positive price for placement on the portal menu). Many of the same providers are at the same time paid by operator 1 (or more correctly the end-users of operator 1 through revenue sharing) to deliver similar content and services. This makes the operator the customer.

The problem in models 2 and 3 is that there is little revenue incentive for the providers. The Mobile Internet service of these operators may actually work as a substitute to the providers' fixed Internet presence. The pricing decision of the operators has, hence, helped to structure the roles of the different agents in the market (supplier or customer). A more long-term solution for these providers can be to either stop offering the services (exit the market) or to become operators themselves, by for instance buying airtime or even bidding for a 3G license[57] (redefinition through vertical integration). The latter option would surely turn the providers into competitors rather than partners, where the competitive advantage could be reached by leveraging their unique content or applications.

The three pricing scenarios presented, although snapshots, illustrate the constant market experiments in the Mobile Internet market. Operators and providers constantly change their product and pricing definitions in their evolutionary search for profits.

[57] Or in the case of Sweden, appearing beautiful enough to receive a free UMTS license from the government.

A popularized pricing scheme can quickly become a standard. For this purpose, pricing is conceived as a routine and potentially institutionalized transaction practice. By institutionalized I mean that pricing, over time, can come to underpin the 'taken for granted' ways of thinking in a particular product/market setting. Pricing solutions can remain static until an entrepreneur (Innovative Pricer) finds a way to turn the market upside down, again, creating a new pricing institution. Since the technical changes and the unpredictability of the decisions of other actors in the economy, feeds a dynamic process of continuously changing bases for pricing. The pricing institution as defined by the innovative pricer will, hence, need to be adaptive (Metcalfe, 1988) to changes in the environment.

Just as with any technical standard the continuos problem for a firm is when to abandon a particular pricing scheme. Firms are always at risk of using an outdated method of charging[58].

The decision of how to charge does not only affect the competition, the suppliers and the customers of the product. It is also a major defining element of the actors' roles in the transaction (customer or supplier). As illustrated, providers can be both customers and suppliers to the operators. Operators 2 and 3 have defined the providers as customers (i.e. paying a positive price) while operator 1 defines its providers as suppliers (i.e. paying a negative price). The set standard pricing scheme is maintained by the transaction costs and institutions of the economy and hinders deviation from what is considered normal, until an entrepreneurial prospector comes up with a new Innovative Pricing (IP) scheme that turns the whole market upside down again.

Another conclusion is that firms, previously partners, either deliberately or unwittingly can become competitors if the charging scheme is covered in secrecy or if it blocks them from profits in the market. The operators' decision of how to price their Mobile Internet presence will therefore not only be a tool of competition but also a major determinant of which companies they will be able to regard as partners and which will become competitors.

As illustrated, the problem with this type of externality pricing towards providers is that it reduces the incremental incentives to provide a compelling and at the same time low cost (little airtime usage) content service for the end users of the service. Unless providers are committed to offering a compelling service it will reduce the externality of airtime that makes

[58] See for instance Jonason (1999a) for examples from the Telecommunications market, where the old PTT Telia was rightfully described as outdated in its pricing of fixed line telephony.

the service chargeable for the operator, the receiver competence may consequently have to be built.

Inability of suppliers and providers to charge for products can have two effects. They can either exit the market or redefine their products, which potentially could make them competitors. None of these are beneficial for operators, since this either would lessen the overall value of the end product or subject the operators to increased competition. The ability for suppliers and partners to efficiently charge for their products, hence, becomes a joint problem for all parties. The critical path of the Mobile Internet business is, hence, to create a mutual understanding of the value of the product such that the right incentive contract can be drawn.

The providers in the Mobile Internet model will have to depend on revenues from elsewhere. These revenues can come from building a stronger fixed Internet brand through its mobile presence or by bypassing the operators access to the end-customers by becoming an operator themselves, changing their product and pricing base to enable chargebility (IP).

Therefore, a perhaps more beneficial pricing scheme for the operators may be to share bases for pricing with their providers, on airtime for instance, to align the revenue incentives of all participants.

The pricing scheme of the firm has to allow partners to be profitable and informed of upcoming pricing schemes if the firm wants them to remain as partners. This means that firms should share pricing information or pricing base (revenue sharing), often regarded secret and sacred, to reduce uncertainty in the market (i.e. improve the receiver competence of customers) and align the incentives of all parties. In a Beckert (1999) setting this would enable a beneficial institutional framework for charging the Mobile Internet services of the future.

8 CONCLUSIONS

This paper has drawn on theoretical and empirical material to bring elements of management control, strategy and microeconomic pricing together. Pricing decisions affect not only the institutional rules of the firm but also the rules (i.e. the range of possible pricing strategies) available to other agents in the value chain. They are endogenous in the market.

Not only partners can be turned into a competitors. Suppliers can also be redefined to become customers.

The conclusion emphasizes the rationale of sharing information and incentives on pricing strategies with both suppliers and customers. By sharing information on its pricing strategy the firm increases the receiver competence of its customers and thus reduces uncertainty of how to price. Furthermore, a shared pricing base with suppliers, (i.e. revenue sharing) is likely to reduce the incentive for the supply side to bypass the role of the firm through IP (inventing an alternative base for charging) and may thereby lower the business risk for both parties.

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