INDIVIDUAL TARIFFS FOR MOBILE SERVICE BUNDLES
A Negotiation Calculation Tool

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Abstract: This paper aims to develop a bargaining model for calculation of individual tariffs for mobile service. In almost all publmic communication services today , tariffs are set unilateraly by the suppliers for some generic services ; the present and future emphasis on both unique content needs,and on service personalization, restrict the old tariffing principle to those users who only need basic universal services . Realizing this evolution , the ultimate goal is to provide a tool for computing individual tariffs. The paper first looks at the intrinsic drivers of individual tariffs both from sociological and economic perspectives. The paper proceeds further with a bargaining model for individual tariffs which is centered on user and supplier behaviours. The user, instead of being fully rational, has “bounded rationality” and his behaviours are not only subject to economic constraints but also influenced by social needs. The supplier can be either a firm (typically a communications service operator) or community ; each supplier has his own goals which lead to different behaviors. In the proposed solution, individual tariffs are decided through interactions between the user and the supplier. Game theory is employed to provide structured analyses of the interactions and tariff design. We developed a computational model based on the bargaining model. It can be used to determine the individual tariff between a firm and an individual user. Preliminary results, which are based on a music training service treated as a bundle of communications, content, and assistance , show that individual tariffs can be beneficial to both the user and the supplier.

1 INTRODUCTION

Individual tariffs existed at the dawn of the telecom history. Due to the limited supply and demand, tariffs were negotiated between the individuals and the telephone companies. Individual tariffs faded out when telecom industry began to thrive in the early 20th century under economies of scale. Users started to pay same prices for standard services.

Today, individual tariffs exist in industries such as airline, travel and hotel, where prices are associated with booking time, booking history, restrictions the individual users willing to accept, etc. In telecom industry, customer-specific tariffs widely exist at enterprise/group level. The tariffs mainly depend on aggregated amount that the customers intend to buy. Looking back, most tariff models in use today in telecom (fixed and mobile) were derived from those of physical goods, assuming limited capacity in either bandwidth or transmission capacity. This worked well when there were limited types of standardized services. The rapid developments in technologies and social environment have changed the scope of telecom services (Chen & Pau,2004).

This paper aims to develop a bargaining model for the development of computational models of individual tariffs. The ultimate goal is to provide a tool so that the determination processes of individual tariffs are automated or semi automated and the prohibitive service provisioning overhead is avoided.

2 BASIC CONCEPTS

In order to define individual tariffs, the opposite is defined first. ***Public tariffs*** in telecommunication refer to the regulatory protected ability for an identified user to obtain from a service provider, by a bilateral contract, a set of standard prices for a set of standardized services

Individual tariffs in telecommunications refer to the regulatory protected ability for an identified user

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to obtain from a service provider, by a bilateral specific contract, a set of service specific prices corresponding to a request or a proposal from the user specified with a service demand profile and some duration.

The ***users*** of individual tariffs are the recipients of services. The ***service provider/supplier*** is defined in a broad sense as the entity that provides access, content and applications, or a combination of them to users. We identify four types of service providers: firms; closed communities where membership is required; open communities which do not require a formal membership and ultimately, individuals.

In e-Commerce, some concepts exist akin individual tariffs , e.g. in sales automation for e-procurement .The main difference with the present research is that those experiments do not include content but only business process management or information distribution aspects . The present research also incorporates the case where the supplier is an e-community driven by other preferences then just profit or market share .

In this research, we focus on mobile services first because the huge demands on the quantity and diversity of mobile bundles. Second, mobile gadgets are widely deemed integral and intimate in a person's daily life. The highly personal nature of them allows mobile services to be personalized, which is a prerequisite of individual tariffs.

3 DRIVERS AND BARGAINING MODEL OF INDIVIDUAL TARIFFS

3.1 Intrinsic Drivers of Individual Tariffs

From a sociological perspective, a post-modern society is characterized by its lack of dominant ideology, culture or fashions. This is also reflected in the diversity of personal values which give meanings and directions to an individual's behaviours. Not all individual users are willing to consider personalized services and tariffs. Some prefer a pre-determined bundle with little transparency and limited choices. But there are values held by a growing population inviting personalized services and individual tariffs. Here is a non-exhausted list of drivers that we consider to be fundamental.

Individualism. This paper follows the definition of individualism defended by (Hayek , 1980). Under this individualism, there are universally accepted principles under which man makes his own choices and take full responsibility; he is free to follow his own will, to make full use of his knowledge and skill, and he is guided by his concerns for the particular things of which he knows and he cares. Personalized mobile services and tariffs are reflections of Hayek's individualism; where a person in a free society has the freedom of choices of services, at anytime and anywhere. It is also reflected in the freedom of service creation and provision, either to a family, a community, or to the whole society.

3.2 Economic Incentives of Individual Tariffs

Price discrimination. The concept was coined by (Pigou , 1920), who distinguished three types of price discrimination. Different types of price discrimination have different welfare effects in terms of maximizing consumer plus supplier surplus. Theoretically, first-degree price discrimination leads to a Pareto efficient outcome. Early analyses of price discrimination were done under monopolistic settings and about physical goods; the supplier's technologies involve no economies of scope, and usually possess constant or decreasing return to scale. Other dimensions of price discrimination have been studied by (Eden ,1990), (Levine, 2001), (Varian, 1996) .

Current technologies already permit suppliers to track and trace user behaviours and infer their preferences so as to provide services accordingly. ***Willingness-to-pay.*** WTP is the maximum amount of money the user is prepared to pay for a service/bundle , which is a measurement of value that the user put to the service. WTP is higher when attributes of a service meet precisely the user demands, which is also one of the economic reasons that call for personalized services and tariffs.

By involving the consumers in a service design through interactions, users' specific demands are identified and integrated to the service. User's WTP is higher than the comparable standard services, *ceteris paribus* (Franke, 2004).

Risks. The four possible ways to provide individual tariffs for mobile services lead to different risks, not only to service providers but sometime to the end-users.

Individual tariffs introduce more risks to end-users who bear little risks under public tariffs. Specifically, the risks can be over-committing or over-consumption which may lead to a service disruption. As a consequence, the individual may be denied access from others or access to the information society. Suppliers, i.e. firms, communities or even individuals, share a common goal when providing individual tariffs: to minimize risks. The thinking of sure/certain profit from users is currently dominant in mobile as well as other telecom industry. Individual tariffs are calling for a change to allow uncertainty in revenue from each individual user. The guiding principle, which has already been recognized in insurance industry for hundreds of years, is to have a positive profit *on average*. Insurance alleviates financial losses by transferring risk of loss from one entity to another by method such as pooling. There is no research applying the “pooling” thinking to *differentiated* telecom services and tariffs, where the focus will be on pooling the user demands and willingness-to-pay for a service. At individual level, each user’s demands for a service may seem unique and serving them may be costly. But for a supplier who serves many users, the pooling of the demands offer market potential. Furthermore, by pooling, the negative profits from individual users are allowed as long as the aggregate profit remains positive, which generates an overall robust business.

3.3 User Behaviours

A user can be characterized as fully rational and self-interested. The model is used broadly in economic and other social sciences. However, many researchers have found limits in this model.

3.3.1 Full and Bounded Rationality

The strict definition of full rationality states that, an individual’s preference relation is rational if it possesses the properties of completeness and transitivity. It means the individual is able to compare all the alternatives and the comparisons are consistent. Furthermore, rationality implies that the individual has complete information of all alternatives and knows about the consequences of his choices; he also has unlimited time and unlimited computational power to pick his most preferred option. In reality, such perfectly-rational person never exists.

Herbert Simon has pointed out that the individual’s preferences do not possess the rational prosperities when comparing heterogeneous alternatives. Simon characterized this as “bounded rationality”. Model construction under bounded rationality assumption can take two approaches. First is to retain optimization, but to simplify sufficiently so the optimum is computable. Second is to construct satisficing model which provides decisions good enough, with reasonable computational cost (Simon, 1979). Neither approach dominates the other. Related work is found in (Tversky, 1974), (Kahneman, 2002) .

3.3.2 A Social Dimension

The self-interested property implies that economic man is amoral and has no sense of right or wrong. He ignores all social values unless adhering to them gives him benefits; his preferences are exogenous and not affected by societal environment at all. However, it is never true. In choosing to act, individuals commonly consider the consequences of actions not only for themselves but others as well; they have social preferences (Bowles, 2004). We contend that the social preferences of mobile services are decided by benefits that an individual elicits from the interactions under different social environments and with different people. Major factors affecting social preferences are social context, and content ,especially as content occurs to confirm a relationship (Licoppe, 2003).

3.3.3 Modified Behaviour Model

The art of decision making is to obtain a complete ranking of the alternatives that reflect the preferences. Very often, this is done by assigning a numerical value to each alternative. The number is usually called utility. Specifically, we consider two types of utilities of mobile communication services, namely economic utility and social utility. Many preferences, especially social preferences, are partially rational or irrational. Therefore many situations can not be described by utilities but only by preferences. Here we assume that there are partial preferences, which can be mapped out by types and contexts. If a selection of a subset of preferences leads to a locally monotonic function, then there exists a utility function that can be used for computational purposes.

A mobile service normally has multiple attributes; the utility function is then constructed by following the method from multiple attribute utility theory. First, a utility function for each service attribute is assessed. Then a multiple attribute utility function determines how the level of one attribute affects overall utility vis-à-vis a set of assessed weights of relative importance. The individual tries to optimize his utility. Due to his bounded rationality, his optimizations are carried out in a simple way. When making a decision, the individual uses satisficing rules and tries to achieve an acceptable level of utility before he stops.

3.4 Supplier Behaviour

We also take a utilitarian approach when modelling a supplier's behaviour. When the supplier is a single firm, economic utility is elicited from economic benefits such as profit or market share, which is generated by service offering. If we expand the analysis further, a supplier also has social preferences for his decisions (e.g. environmental preferences). There may be conflicting goals over a supplier's economic utility and social preferences; he will try to achieve equilibrium/equilibria between them. However in this research, we assume that the supplier derives only economic utility from service offerings. A firm seeks to achieve maximum economic benefit and at the same time minimum risks.

The goals of a community, when offering mobile services, are to achieve financial breakeven and minimize service provisioning risks.

4 ANALYTICAL DESIGN CALCULATION USING COMPUTATIONAL GAME THEORY

The main advantage of game theory is that it provides structured analysis of decisions, which are made as reactions to another player's decisions. Over years, game theory has evolved to incorporate "bounded rationality" in its analyses (Aumann, 1997) . Further, the cooperation between disciplines such as computer sciences, artificial intelligence and economics gave birth to computational game theory which enables richer ways of modelling complex problems of interactions in an efficient way by computers. One such example is the ability to incorporate some aspects of the sales psychology inherent to bargaining ,e.g. COSIM .

Individual tariffs are decided by the interactions between the user and the supplier. The bilateral contracting procedure between them can be modelled by an imperfect information game, where the payoffs are the utilities that both parties receive from the service. In general, the negotiation process is modelled by a recursive Stackelberg game, where the first player has a dominant influence over the followers. We empower the user by letting him move first. Different decision rules and constraints can be applied to investigate the equilibrium, if it exits, when the individual sets his service and price requirement to the supplier.

5 A COMPUTATIONAL MODEL AND AN EXAMPLE

5.1 Service Design Space & Perceptual Space

As mobile and computing technologies evolve, technical specifications of a mobile service become much more complex. From a supplier's perspective, it is common to define tens or even hundreds service attributes in a single service. We characterize a space that is constructed by these *technical attributes* as a ***service design space*** (or an explicit space). Each dimension in this space corresponds to a technical attribute of the service, including tariff.

When reaching an agreement with a supplier, the user wants the details to be specified in text or a specification form. Service level agreements (SLAs), which use to be a way to ensure quality of service (QoS), are becoming increasingly common to set commercial and business terms of service provisioning (Pau, 2005). SLAs generally take the form of a structured template, with specific QoS metrics that are evaluated over a specific time interval or to a set of defined objectives. Thus SLAs are often written in technical language.

However, an ordinary user usually does not understand most of the technical details of the service specifications. Even given a complete literal translation and additional explanations of the attributes, it is unlikely that the user has the patience to go through all the details. More importantly, user needs to balance among the value of each attribute and the constraints so as to optimize his payoffs. Such perfectly-rational user never exists. Instead, user demands are often expressed in plain (natural) language which involves little technical details. His perception of the service is usually much simpler. We define a ***perceptual space*** as a space constructed by the *perceived attributes* of a service (e.g. 'a fast connection'). The perceived attributes are actually the results of a reduced mapping or an "attribute substitution plus simplification". The reduced mapping is based on certain heuristics or as a result of learning of the technical attributes into features that the user in general can relate to. To reach a concrete SLA, a translation or a mapping between the explicit space and the perceptual space is necessary.

5.2 The User

Suppose users can be divided into groups which share similar preferences for a specific class of services. We employ a statistical method called principle component analysis (PCA) to find out the mapping between an explicit space and a perceptual space for a specific group interested in the same class of services. We assume the mapping is valid for a new user, who can be placed in a same group.

Denote the explicit space as x space. PCA generates new vectors which are linear combinations of the x coordinates . Denote the PCA space as z space, and the principle component coefficient matrix as *p* (each column containing coefficients for one principal component)*,* we have z=x *p*. The PCA method has two advantages: a). The first PCA components often explain more variance than the rest of the components, which can be left out without losing much information. b). The generated PCA components are orthogonal to each other (Latin , 2003) .

Interpretation of the PCA components is service specific. In reality z space has much smaller dimensionality than x space due to user's perceptual capabilities. For a given service, we analyze the first components which cover +/-80 % of variance.

The next step is the elicitation of a utility function. User's revealed preferences may not possess the properties which are the necessary conditions to find a utility function. On the other hand, by working only in a perceptual space, it is easy for the user to set where he would like to be, and that is called a target point (actually a vector of values), which mixes economic and social aspects of the service. In this model, we assume the user's utility function is the inverse of the Euclidean distance from a user's best reachable points (because of constraints) to his target point. A user maximizes his utility by approaching as close as possible to his target point. This is also a simplified decision process.

5.3 The Supplier

The supplier, as a profit-oriented company, is assumed to make decisions based only on his economic utility. We define this utility, in the context of the negotiation of an individual tariff, as the expected marginal profit that the supplier receives from serving a specific individual user. The utility function is defined in terms of attributes in the explicit space including price and service provisioning costs. The supplier maximizes his utility, under certain constraints. In the case the supplier is a community with social prefeences as well, a different utility is chosen similar to Section 5.2.

5.4 The Negotiation Process

During service personalization, a user and a supplier negotiate on a set of service attributes and their values, including tariffs/price in view of a SLA. The negotiation process has a non-cooperative and recursive nature. It is modelled as an n-stage user-lead Stackelberg game. The individual user is the leader as he sets forth first his wishes in the context of individual tariffs, and not the supplier as it in supplier driven public tariffs. During each stage, each player tries sequentially to optimize his own utility taking into account what the other has proposed under his own constraints. Players update their constraints based on what others proposed as variable tolerance bounds as a learning process.

Payoffs & constraints*:* the players' payoffs are expressed in their utility functions. User's utility function is expressed in a perceptual (z) space while the supplier's in a technical (x) space. Optimization of the user utility is carried out in z space and optimization of the supplier utility in x space. Players set their constraints separately in x space. The final SLA is expressed in x space in view of provisioning by the supplier. Since the user's utility function, constraints, optimization and SLA are expressed in two different spaces, transformations from one space to another is carried out when necessary.

Equilibrium: A one-stage Stackelberg game can be solved to find a Nash equilibrium, which is a profile of actions with the property that no player can deviate to achieve a better payoff, given the actions of the other player. In the recursive Stackelberg game used in our model, we define an equilibrium point as a point where no player can elicit a higher utility by deviation or entering a new stage of the game; furthermore, the point should also provide the supplier a non-negative payoff. As in any constrained computational game , if user of supplier is unwilling to admit tolerances represented by constraints, the corresponding Lagrange multiplier values go up increasing risk to the other party,or the negotiation concludes by early withdrawal and to a switch / churn to another more flexible supplier .

Negotiation process: It has several steps.

Step 0: In the beginning, the supplier advertises the offering of a class of mobile services. The service attributes (including price) and their values are expressed in x space (denoted as x_offer^0). The service attributes are translated into perceptual attributes, thanks to a pre-existing survey amongst potential users of the service, serving as a learning function. The individual user sets his target values for the perceptual attributes based on his preferences. The values of the attributes of the public offer from the supplier are also mapped into the user's perceptual space: it serves as an initial reference point for the user (denoted as z_offer^0).

Step 1: User optimizes his utility in z space, under his own constraints and taking into consideration the supplier's offer. The result of user's optimization at stage *i* is denoted as $z\_user\_result^i$; it is then transformed into x space as $x\_user\_result^i$.

Step 2: User decides whether to stop or not, based on his own decision rules. In case of the former, he may opt out to take the public offer or to negotiate with another supplier. If the user decides to continue the present negotiation, he communicates with the operator about his request, which is $x\_user\_result^i$. The user may at the same time signal to the supplier a possible tolerance region in x space.

Step 3: The supplier updates his constraints regarding the proposed value $x\_user\_result^i$ and the possible tolerance region signalled by the user. He then calculates his own optimum under the updated constraints. Denote the supplier's choice in x space as x_operator, which is a vector. The result is denoted as $x\_operator\_result^i$. The supplier then decides whether to accept the proposal, or to propose back his last optimized values. He may stop the game based on his own decision rules.

***Recursion and Stopping rules*:** the procedure repeats from Steps (1)--(3) until it satisfies one of the following conditions: $z\_user\_result^{(m+1)} = z\_user\_result^m$ or $x\_operator\_result^{(m+1)} = x\_operator\_result^m$. Either player can stop the game when the results show a non-convergence trend, which either appears as an oscillation (e.g. $\|z\_user\_result^{(m+1)} - z\_user\_result^m\| = d, d \neq 0$) or an amplification (e.g. $\|z\_user\_result^m - z\_user\_result^{(m-1)}\| < \|z\_user\_result^{(m+1)} - z\_user\_result^m\|$). Furthermore, the supplier will stop the game when the result of his optimization leads him to negative profit.

5.5 Implementation and Preliminary Results

We have developed a tool to automate the numerical calculation of utilities and the negotiation process of tariff and service personalization. One off-line part calculates the PCA mapping between the explicit space and the perceptual space from a group-survey of potential users with latent interest in the service. The other on-line part decides if equilibrium exists based on the utility functions, constraints and decision rules set by both players, and computes the equilibrium if it exists.

We have created a mobile service bundle with limited service attributes to illustrate the computational model and to test the tool. The service is inspired by the real practices by the operators in mobile music area (e.g. the "Radio DJ" service promoted by Vodafone: www.vodafone.de/music or see (Manes, 2005) for other cases) and it is called "mobile singing classroom" where the users can improve their singing performance by following the courses and getting instructions and content. Users are supposed to be students from a music college; the supplier is an operator assisted by teachers. Table I shows the revealed preferences from three users (A, B, C) and the negotiation results. Gains and losses (when compared to the public offer) are analysed for each player; the results can be a win-win or win-loss situation. Users, as leaders of the games, achieve gains. The differences in gains across users stem from their different preferences and constraints. The operator achieves better results in two cases but a worse result in one case (utilities not reported here) . Detailed descriptions of the software implementation and full results of the mobile singing classroom case are available in (Chen & Pau , 2006).

Table I: User revealed preferences, operator's public offer and negotiation equilibrium results.

Name	Initial points			Public offer	Final EQ Point		
	A	B	C		A	B	C
Database size Thousand song)	6	1	3	2	5.6	1.9	2.6
Instructions per lesson	2	8	4	4	2.1	6.2	3.2
Coding rate of songs (kbps)	128	144	144	114	130	119	122
SMS searches per lesson	7	1	3	2	6.2	1.9	3.0
Distribution method (1-10 from fixed to mobile)	3	9	7	5	5.8	7.3	5.6
Nb of question student asks (full contract period)	2	60	30	10	1	58.3	1.3
Contract length (month)	2	4	3	2	1.6	5.2	2.5
Nb of lesson per month	20	8	10	5	19	6.1	8.4
User's bid for the service (full contract period €)	100	100	70	30	63.	98	53.6

6 CONCLUSIONS

This paper tries to carve out a small piece of land out of the uncharted area of individual tariffs for bundles in mobile communication services ,paving the way to tariffing of boadband bundles as well (such as IP TV , alarm sevices , financial applications) . Based on user and supplier behaviours, our bargaining model aims to provide guidance to build computational models for implementation, where the determination of individual tariffs can be automated or semi automated so that the provisioning overhead is not prohibitive. The preliminary results from the computational model show that individual tariffs can be beneficial in some cases to both the users and the supplier. Our next steps of work involve comparing different types of equilibria when the user and the supplier use different strategies and decision rules. Risk will also be incorporated in the model by linking individual's utility with random distributed parameters so that the supplier can get a quantified portofolio income with known risks .

It should be noted that the use of the perceptual space has the added advantage to the supplier of reducing the surveying costs amongst users and allowing him still to offer catalog bundle tariffs close to user groups expectations . More precisely , in marketing terms, the two main deployment options are :

-supplier surveys a rather large population of potential customers witgh personalized needs (roughly 1000 users is enough for PCA stability) ,and determines by the tool set bundles with different service charactristics fo users just to choose from

-or a sophisticated user engages in a real time negotiation with the supplier, using the tool,in which case provisioning costs are reduced because they are automated ,including opt-out decision

REFERENCES

Aumann,R.J. ,1997, "Rationality and Bounded Rationality" , Games and Economic Behavior, vol. 21, pp. 2-14

Bowles,S. , 2004, " Microeconomics: behavior, institutions, and evolution", New York: Russell Sage Foundation

Chen, H. and Pau, L-F, 2004 , "Individual Telecommunications Tariffs in Chinese Communities: History as a Mirror of the Future, and Relevance for Mobile Service Development in China", Fourth International Conference on Electronic Business, Beijing ; Available from : https://ep.eur.nl/handle/1765/1582

Chen,H. and Pau,L-F, 2006, "Individual Tariffs for Mobile Communication Services: a Computational Model", Beijing: 16th Biennial Conference of the International Telecommunications Society ITS

Eden,B.,1990, "Marginal Cost Pricing When Spot Markets are Complete," Journal of Political Economy, vol. 98, pp. 1293-1306

Franke, N. and Pille,F. ,2004, "Value Creation by Toolkits for User Innovation and Design: The Case of the Watch Market", Journal of Product Innovation Management, vol. 21, pp. 401-415

Gergen,K.J., 2002, "The challenge of absent presence" in J. E. Katz and M. A. Aakhus, Eds. , "Perpetual Contact : Mobile Communication, Private Talk, Public Performance", Cambridge, New York: Cambridge University Press, pp. 227-241

Giddens,A. , 1991, " Modernity and self-identity: self and society in the late modern age", Cambridge: Polity Press

Hayek, F.A., 1980 ," Individualism and economic order" Chicago : University of Chicago Press

Kahneman,D. and Frederick,S. , 2002, "Representativeness revisited: Attribute substitution in intuitive judgment", in T. Gilovich, D. Griffin, and D. Kahneman, Eds.,"Heuristics & Biases: The Psychology of Intuitive Judgment", New York: Cambridge University Press, pp. 49-81

Lattin,J.M.;Carroll,J.D.; and Green,P.E., 2003, "Analyzing multivariate data". Pacific Grove, CA: Thomson /Brooks /Cole

Levine,M.E. ,2001, "Price Discrimination Without Market Power," Law-Econ Discussion Paper No. 276, Harvard, Mass.: Harvard Law School

Licoppe,C. , 2003 , "The Social Context of the Mobile Phone Use of Norwegian Teens", in J. E. Katz, Ed :"Machines That Become Us : The Social Context of Personal Communication Technology", New Brunswick, N.J: Transaction Publishing

Manes,S., 2005, "Music in the Air," Forbes, vol. 176, pp. 74

Pau,L-F, 2005, "Privacy management contracts and economics, using Service Level Agreements (SLA)" , Rotterdam : Erasmus Research Institute of Management ,ERIM report series research in management ERS-2005-014-LIS ;. Available from : https://ep.eur.nl/handle/1765/1938

Pigou,A.C. ,1920 , "Discrimination Monopoly (Part II, Chapter XVII)," in "The Economics of welfare". London: Macmillan and Co

Simon,H.A., 1979, "Rational Decision Making in Business Organizations", American Economic Review, vol. 69, pp. 493-513

Tversky,A. and Kahneman,D., 1974 , "Judgment under Uncertainty: Heuristics and Biases", in: D. Kahneman, P. Slovic, and A. Tversky, Eds. New York: Cambridge University Press., pp. 1124-31

Varian,H.R. ,1996 , "Differential Pricing and Efficiency", New York: First Monday