Law of nature or invisible hand: when the satisficing purchase becomes optimal

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Law of Nature or Invisible Hand: when the satisficing purchase becomes optimal.

"...the view that competitive equilibria have some special optimality properties is at least as old as Adam Smith's invisible hand..."
K.Arrow, 'The Potentials and Limits to the Market in Resource Allocation', p.110 in 'Issues in Contemporary Economics', Springer 1985.

Abstract

The transformation of the classical labor-leisure choice into the labor-search-leisure choice enables the analysis of the individual behavior under price dispersion. The consumer maximizes his consumption-leisure utility with respect to the equality of marginal loss on the search with its marginal benefit. The satisficing approach challenges this equality but the analysis of the moment of the intention to buy, when real balances and supplies as well as the knowledge about the price distribution are close to zero, discovers the unit elasticity of total consumer's efforts on purchase with respect to any level of consumption for the given time horizon. If at the beginning the consumer evaluates correctly his purchasing power with respect to the market trade-off of leisure for consumption and if he is realistic about what he can buy with his efforts, he avoids the computational complexity of marginal values because the unit elasticity rule mechanically reproduces his optimal psychic consumption-leisure trade-off. The reproduction of the optimal choice by the unit elasticity rule looks like the law of nature but the optimal allocation of time between the labor and the search at any level of consumption, which. maximizes the consumption-leisure utility, appears like the work of the invisible hand.

The satisficing decision with the inequality of the marginal values of search comes to the corner solution, when the consumer doesn't make efforts on labor and search because the quantity demanded is not worth these efforts. If the consumer challenges the corner solution and start to work and to search, the unit elasticity rule reproduces high prior expectations and the outcome results in the disappointment on purchase.

The unit elasticity rule provides the exit for the satisficing decision-making from the corner. If the consumer gradually changes his aspiration level and his optimistic prior expectations during the search, once he finds the satisficing price for the quantity demanded and the disappointment is gone. But the first satisficing offer, which doesn't generate the disappointment, is the optimal one.

The satisficing suboptimal purchase of the item of the immediate consumption occurs, when real balances, supplies, and knowledge are positive. These positive values produce the noise, which weakens the unit elasticity rule and make it useless. Under the unworkable unit elasticity rule the optimal choice really needs cumbersome calculations, and the consumer prefers to choose the first satisficing offer.

The satisficing purchase of the durable item becomes necessary because the consumer substitutes the uncertainty of the search by the certainty of the use of the item and optimizes his consumption-leisure choice during its lifecycle with the help of his willingness to take care of the big-ticket purchase. The consumer stops to care for the durable item, when the efforts on its following use are expected greater than on average. This simple commonsense rule produces the equality of the marginal costs with the average after-purchase costs and becomes the sufficient condition to optimize the prior purchase. While the following negative willingness to take care exponentially raises the maintenance costs, the equality of the marginal and average after-purchase costs results in the optimal consumption-leisure choice of the purchase and exhibits the right moment to replace or to sell the item.

Key words: satisficing, optimal consumption-leisure choice, search, equilibrium price dispersion, invisible hand, willingness to take care

JEL classification: D11, D83.

Introduction

The search-satisficing concept was born in 1957 when Herbert Simon revived the Scottish word *satisficing* to denote the decision-making when the selection of the satisfactory alternative under the search occurred with respect to some aspiration level criterion (Simon 1957). That concept was immediately confronted by the neoclassical economics, primarily with regard to the theory of consumer choice. The discussion between two fundamental theories got its emotional peak in 1978, when Simon presented his Richard T. Ely Lecture. Once the dust had been settled but the discussion continued (Slote 1989, Schwartz et al. 2002, Fellner et al. 2006). As a result, the theory of consumer choice accepted the strict distinction between maximizing and satisficing behavior (Lewer et al. 2009).

However, the idea that a satisficing decision procedure could be turned into a procedure of optimizing (Simon 1972) left the space for some methodological synthesis, which was used by the labor-search-leisure model (Malakhov 2011). But from the very beginning the labor-search-leisure model tried to refute the Simon's argument that the optimizing procedure was followed by the computational complexity. The purpose of the new approach was to discover some internal market mechanisms that could release consumers from cumbersome calculations (Malakhov 2014a, 2014b).

The analysis of the equilibrium price dispersion (Malakhov 2016) and of consumer's after-purchase efforts under the competitive equilibrium (Malakhov 2020) proved the existence of such mechanisms, which have been able to renew the idea of the satisficing-optimizing synthesis and to correct the prior conclusions. This paper represents an attempt to describe the basic market attributes, which could predetermine both satisficing and optimizing consumer behavior under the equilibrium price dispersion.

The general presentation of the labor-search-leisure model

If we presuppose that the search S displaces the labor L and the leisure H from ***the time horizon until the next purchase*** like an ice squeezes out whiskey and soda from the glass, we get the general rule of the allocation of time and the value of the propensity to search $\partial L/\partial S<0$:

$$L+S+H=T; \quad (1.1)$$

$$(-\partial L/\partial S)+(-\partial H/\partial S)=1; \quad (1.2)$$

$$dH(S)=dS\frac{\partial H}{\partial S}=-dS\frac{H}{T};\rightarrow \frac{\partial H}{\partial S}=-\frac{H}{T}; \quad (1.3)$$

$$\frac{\partial L}{\partial S}=\frac{H-T}{T}=-\frac{L+S}{T} \quad (1.4)$$

$$\frac{L+S}{T}+\frac{H}{T}=1 \quad (1.5)$$

If we multiply the propensity to search $\partial L/\partial S$ by the wage rate w, we get the value of the marginal loss of monetary labor income during the search $w\partial L/\partial S$. According to the famous George Stigler's rule, we can equalize it with the marginal benefit of the search $Q\partial P/\partial S$, where quantity demanded Q is given and the price of purchase depends on search $P(S)$. This behavioral explicit rule can be used as the constraint to some utility function $U(Q,H)$, where the quantity to be purchased Q becomes the variable value and the value of the marginal benefit per unit of purchase $\partial P/\partial S<0$ is given by the place of purchase. Indeed, at the optimum level this implicit solution should match the explicit behavioral constraint:

$$\max U(Q,H)\ subject\ to\ w\frac{\partial L}{\partial S}=Q\frac{\partial P}{\partial S} \quad (2.1)$$

$$\Lambda = U(Q,H)+\lambda(w-\partial P/\partial S\frac{Q}{\partial L/\partial S}) \quad (2.2)$$

$$\frac{\partial U}{\partial Q}=\lambda\frac{\partial P/\partial S}{\partial L/\partial S} \quad (2.3)$$

$$\frac{\partial U}{\partial H}=-Q\frac{\partial P/\partial S}{(\partial L/\partial S)^2}\partial^2 L/\partial S\partial H=-\frac{w}{\partial L/\partial S}\partial^2 L/\partial S\partial H \quad (2.4)$$

$$MRS(H\ for Q)=-\frac{w}{\partial P/\partial S}\partial^2 L/\partial S\partial H \quad (2.5)$$

$$\partial^2 L/\partial S\partial H=\frac{\partial(H-T/T)}{\partial H}=1/T \quad (2.6)$$

$$MRS(H\ for Q)=-\frac{w}{T\partial P/\partial S}=-\frac{Q}{T\partial L/\partial S}=\frac{QT}{T(L+S)}=\frac{Q}{L+S} \quad (2.7)$$

$$MRS(H\ for Q)=\frac{Q}{L+S}\frac{H/T}{H/T}=\frac{Q}{H}\frac{(-\partial H/\partial S)}{(-\partial L/\partial S)} \quad (2.8)$$

$$U(Q,H)=Q^{-\partial L/\partial S}H^{-\partial H/\partial S} \quad (2.9)$$

We can suppose that the consumption-leisure relationship is described by the utility function $U(Q,H)=Q^{-\partial L/\partial S}H^{-\partial H/\partial S}=Q^{(L+S)/T}H^{H/T}|_{(L+S)T+H/T=1}$ and its curve is tangent at the point of the optimal choice ($Q^*;H^*$) to the budget constraint line (Equations 2.5-2.9 and Figure 1):

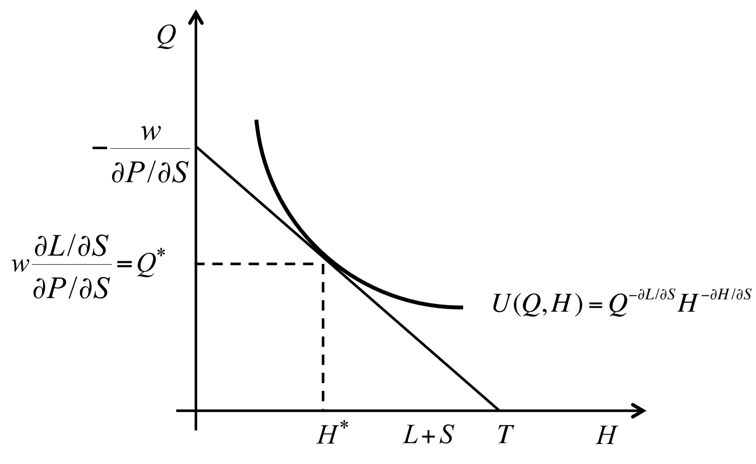

Fig.1. Implicit consumption-leisure choice under the search

Now we can simplify step by step the unusual values, do not forget that $\partial P/\partial S<0;\partial L/\partial S<0$, in order to confirm their correspondence to the classical labor-leisure choice. First, we present the behavioral choice of the fixed quantity demanded Q and the variable price of purchase $P_P(S)$ (Figure 2):

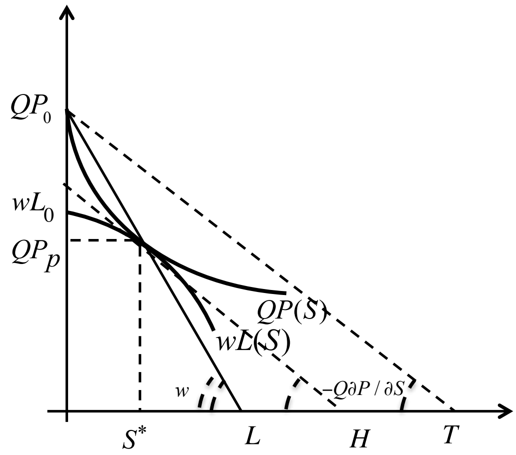

Fig.2.Explicit choice of the pre-determined quantity to be purchased

The consumer starts with his $WTP=wL_0$ and buys at QP_P level. Here we take the $Q\partial^2P/\partial S^2>0$ - shape of the $QP(S)$ curve with regard to the assumption of the diminishing marginal efficiency of the search and the $w\partial^2L/\partial S^2<0$ – shape of the $wL(S)$ curve can be easily derived from the Equation 2.1 for the values of the propensity to search under the Archimedes' "whiskey-soda-use" rule as $-1<\partial L/\partial S<0$ or $|dL/dS|<1$.[1] We see that $QP(S)$ and $wL(S)$ curves becomes tangent at the moment of purchase QP_P with the $Q\partial P/\partial S$ slope according to the behavioral constraint (2.1). It gives us the price per unit of consumption P_0=$-T\partial P/\partial S$ and the price of the trade unit QP_0 at the zero search level.

$$w\frac{\partial L}{\partial S}=Q\frac{\partial P}{\partial S}=-w\frac{L+S}{P} \quad (3.1)$$

$$w(L+S)=-QT\partial P/\partial S=QP_0 \quad (3.2)$$

$$MRS(H\;for Q)=-\frac{w}{\partial P/\partial S}\partial^2L/\partial S\partial H=-\frac{w}{T\partial P/\partial S}=\frac{w}{P_0} \quad (3.3)$$

This is the price paid by *shoppers*, consumers with zero search costs, while the purchase price P_P of *searchers*, consumers with positive search costs (Stahl 1989), is less, or $P_P<P_0$. However, if the searcher wants to resell the bought item to the shopper, he will do it at the QP_0 level that collects all his costs and is equal to his willingness to sell or to accept *WTA*. Indeed, this level represents the equilibrium price because when it matches the lowest *WTP* of shoppers with *WTA* of searchers, it also equalizes the marginal costs on purchase with its average costs and becomes the equilibrium price P_e:

[1] The value $\partial^2L/\partial S^2$=$-\partial(L+S)/T/\partial S$=$-(\partial L/\partial S+1)/T>-1$. The value $\partial L/\partial S<-1$ goes beyond the time horizon and produces «the leisure model» of behavior $(\partial Q/\partial H>0)$, that has been presented by the analysis of the service augmenting technical progress in Malakhov (2020).

$$MRS(H\ for Q) = \frac{Q}{L+S} = \frac{w}{P_0} \Rightarrow P_0 = \frac{w(L+S)}{Q} = AC \quad (4.1)$$

$$MC = \frac{\partial w(L+S)}{\partial Q} = \frac{\partial QP_0}{\partial Q} = P_0 \quad (4.2)$$

$$P_0 = AC = MC = P_e \quad (4.3)$$

While under the behavioral constraint *Q≠Q(S),* the inverse function *S(Q)* exists because the amount of search efforts depend on the quantity demanded when it takes the form of non-monetary costs *wS(Q)*. The function *wS(Q)* affects the consumer behavior not only before the purchase but also after the purchase because the allocation of time between labor, search, and leisure takes as ***the search any activity, including home production and care of purchased items that reduce monetary costs wL(Q).***

Both the implicit and explicit choices are based on the equality of the marginal values of search. The most outstanding challenge to the marginal approach is presented by the satisficing concept. In 1978 Herbert Simon wrote:

"*In an optimizing model, the correct point of termination is found by equating the marginal cost of search with the (expected) marginal improvement in the set of alternatives. In a satisficing model, search terminates when the best offer exceeds an aspiration level that itself adjusts gradually to the value of the offers received so far*." (Simon 1978, p.10).

If we try to describe this statement by means of the labor-search-leisure model, we get the following conclusion:

$$w\frac{L+S}{T} < -Q\frac{\partial P}{\partial S}; -w\frac{L+S}{T} > Q\frac{\partial P}{\partial S}; \left|-w\frac{L+S}{T}\right| < \left|Q\frac{\partial P}{\partial S}\right| \quad (5)$$

or the marginal loss of the satisficing decision is less that its marginal benefit because the consumer cuts search efforts.

In order to understand the mechanism of the satisficing decision under the labor-search-leisure choice we need to compare its basic attributes with the classical labor leisure choice.

Marginal utilities and corner solutions

The analysis of the decision-making under the search needs the specification of some logical attributes of the model.

First, we need to prove the identity of marginal utility of both consumption and leisure under the classical labor-leisure choice and the choice on imperfect market under the search that can be done with the help of the methodology for the analysis of the Lagrangian multiplier, proposed once by American mathematicians J.V.Baxley and J.C.Moorhouse (Baxley and Moorhouse 1984, Malakhov 2015):

$$labor-leisure\ choice:$$

$$\lambda = \frac{MU_w}{T-H} \quad (6.1);$$

$$MU_Q = \lambda P = MU_w \frac{P}{T-H} \quad (6.2);$$

$$MU_H = \lambda w = MU_w \frac{w}{T-H} \quad (6.3);$$

$$labor-search-leisure\ choice:$$

$$\lambda = MU_w \quad (6.4);$$

$$MU_Q = \lambda \frac{\partial P/\partial S}{\partial L/\partial S} = -MU_w \frac{T\partial P/\partial S}{L+S} = MU_w \frac{P_e}{T-H} \quad (6.5);$$

$$MU_H = \lambda w = -MU_w \frac{w}{\partial L/\partial S}\partial^2 L/\partial S \partial H = MU_w \frac{wT}{L+S}\frac{1}{T} = MU_w \frac{w}{T-H} \quad (6.6).$$

After the identity of marginal utilities is confirmed, here the question arises about the logical limits of the labor-search-leisure model, i.e., about the corner solutions. While we analyze the decision making with regard to the satisficing approach, we leave the corner solution $MU_H/MU_Q<w/P$, i.e., the consideration " I will buy that no matter the cost" beyond the scope of the analysis and pay attention to the opposite corner where the reasoning "I wouldn't buy that at any price", or the relationship $MU_H/MU_Q> w/P$ dominates:

$$labor-leisure\ choice: \lambda = \frac{MU_w}{T-H}; MU_Q = \lambda P; MU_H = \lambda w \ (7.1)$$

$$corner\, solution: P > \frac{MU_Q}{\lambda}; \frac{P}{\lambda w} > \frac{MU_Q}{\lambda MU_H}; \frac{MU_H}{MU_Q} > \frac{w}{P} (7.2);$$

$$labor-search-leisure\ choice: \lambda = w; MU_Q = \lambda \frac{P_e}{T-H}; MU_H = \lambda \frac{w}{T-H} (7.3);$$

$$corner\ solution: \frac{MU_Q}{\lambda} < \frac{P_e}{T-H} (7.4);$$

$$\frac{MU_Q}{\lambda} < \frac{P_e}{T-H}; \frac{MU_Q}{MU_H} < \frac{\lambda}{MU_H}\frac{P_e}{T-H} = \frac{\lambda(T-H)}{\lambda w}\frac{P_e}{T-H} = \frac{P_e}{w} (7.5);$$

$$\frac{MU_Q}{MU_H} < \frac{P_e}{w} \Rightarrow \frac{MU_H}{MU_Q} = \frac{Q}{L+S} > \frac{w}{P_e} (7.6)$$

We see that like in the labor-leisure model, the corner solution under the search occurs when the rate w/P_e, at which leisure H can be traded for consumption Q in the market is lower than the consumer's psychic trade-off *MRS (H for Q)=Q/(L+S)*.

The corner solution reduces the options of both labor and search. It is clear that the consumer will not purchase an item that he believes is not worth the efforts on labor and search and the level of consumption stays equal to zero.

While the corner solution works as the attribute of the utility theory, it represents the psychological phenomenon, because the equation (7.6) is easily transformed into the consideration that the expected consumption level is greater than the actual one or $Q_{expected}>Q_{actual}$. If a consumer is unaware of the implicit corner solution or he challenges it and decides to search an item, he simply forms a prior optimistic expectation on the purchase but the outcome is worse than expected. And the consumer experiences an emotion, which is called the disappointment. Coming back to the utility theory, we can say that the corner solution $Q/(L+S)>w/P_e$ means that the disappointment appears because the consumer has simply overestimated the efficiency of his efforts or his ***purchasing power***.

The last consideration directs us to the more profound analysis of the prior expectations at the moment when the intention to buy is formed.

The moment of the intention to buy

At the moment of the intention to buy, when the consumer's cash is almost gone and his supplies have also run desperately low $(L\to 0;Q\to 0)$, as well as he has no actual information about the price dispersion $(S\to 0)$, he needs to work and to search again the quantity demanded if he doesn't want to stay in the following time period with plenty of leisure time ($H\to T$) and empty fridge. At this moment this psychic trade-off of leisure for consumption *MRS (H for Q)=Q/(L+S)* takes the indeterminate form of *0/0*. However, this is not the corner solution because the consumer doesn't prefer to get *T* hours of leisure and zero consumption. He really wants to reduce leisure in favor of labor and search in order to buy. Both the consumption *Q* and the total efforts *(L+S)* represent the functions of leisure time, or *Q(H)* and *(L+S)(H),* that justifies the use of the l'Hôpital's rule for the given time horizon $T=L+S+H$ where $H\to T$:

$$\lim_{H\to T} Q(H) = \lim_{H\to T}(L+S)(H) = 0; \partial(L+S)|_{Tconst} / \partial H = -1 \quad (8.1);$$

$$\lim_{H\to T}\frac{\partial Q/\partial H}{\partial(L+S)/\partial H} = -\frac{\partial Q}{\partial H} = \lim_{H\to T}\frac{Q}{L+S} \quad (8.2)$$

We see that the prior psychic trade-off of leisure for consumption or *MRS (H for Q)=Q/(L+S)=(-∂Q/∂H)* really exists before the consumer start to work and to search the quantity demanded. It is interesting to analyze whether his preferences really stay constant and the consumer keeps this initial trade-off until the purchase.

If we take the set of equations (4), we get the simple result that the total costs *w(L+S)* or total efforts *(L+S)* on the optimal purchase have a unit consumption elasticity, or $e_{(L+S),Q}=1$ with respect to some constant price at the zero search level $P_0=AC=MC$. The inverse consideration also is true: if the total efforts on purchase are unit elastic with respect to consumption, the price at the zero search level is the constant value, or again $P_0=MC=AC$:

$$MC = \frac{\partial w(L+S)}{\partial Q} = AC = \frac{w(L+S)}{Q} \Rightarrow e_{(L+S),Q} = \frac{\partial w(L+S)}{\partial Q}\frac{Q}{w(L+S)} = \frac{MC}{AC} = 1 \quad (9.1);$$

$$e_{w(L+S),Q} = 1; w(L+S) = QP_0 \to e_{w(L+S),Q} = e_{QP_0,Q} = 1 + e_{P_0,Q} \Rightarrow e_{P_0,Q} = 0 \quad (9.2)$$

These considerations give an idea that the proof of the unit elasticity of total costs on purchase with respect to consumption or $e_{(L+S),Q}=1$ confirms the equality of the marginal values of search (the set of equation 3) and the optimality of the purchase (the set of equations 4).

Let's assume that the time horizon unit next purchase doesn't depend on the quantity demanded for this current time period, or $T \neq T(Q)$. This assumption looks rather strong but it can be accepted for some relevant range of consumption, for example, when we buy one or three bears for today and don't leave the stock in the fridge for tomorrow.

If we come back to the moment of the intention to buy, or $L;S;Q=0$, we can use the sets of equations (8) and (9) to derive the initial consumption elasticity of efforts:

$$e_{(L+S),Q} = \frac{\partial(L+S)}{\partial Q}\frac{Q}{L+S}\bigg|_{Q_0;L_0;S_0=0;T_{const}} = \frac{\partial(T-H)}{\partial Q}\frac{0}{0} = \left(-\frac{\partial H}{\partial Q}\right)\left(-\frac{\partial Q}{\partial H}\right) = 1 \quad (10)$$

The simple $e_{(L+S),Q}=1$ or the ***unit elasticity rule*** has the great methodological power. It reproduces any initial $MRS(H \text{ for } Q)=-\partial Q/\partial H=Q/L+S$ for any purchase at the given time horizon.

If the initial psychic trade-off of leisure for consumption MRS (H for Q)=-∂Q/∂H is equal to their market trade-off w/P_e, the purchase of any quantity for the given time horizon will be optimal.

If we stay within the utility theory, we omit both corner solutions. As we assumed, the corner solution $Q/(L+S)<w/P_e$ doesn't exist here, because $H>0;H\to T$ and the opposite $Q/(L+S)>w/P_e$ solution frustrates the consumer because he thinks that any quantity demanded is not worth his efforts; he doesn't start to work and to search and the quantity demanded stays at the zero level.

If the consumer submits to the market power and correctly evaluates his purchasing power, then the equation $Q/(L+S)=MRS\ (H \text{ for } Q)=w/P_e$ holds from the moment of the intention to buy till the purchase itself.

The $P_0=P_e$ equation (4.3) gets here another confirmation. The unit elasticity rule definitely states the fact, that the price, which optimizes the purchase, is constant. And what price could be more constant than the equilibrium price?

This value stays constant whatever quantity the consumer chooses for the given time horizon. The $e_{(L+S),Q}=1$ unit elasticity rule confirms the stable consumer preferences. Once the psychic trade-off of leisure for consumption $MRS\ (H \text{ for } Q)=-\partial Q/\partial H=Q/L+S$ emerges at the moment of the intention to buy, it stays constant for any consumption level within the given time horizon.

And according with the sets of equations (2), (3) and (4) ***the unit elasticity rule results in the equality of the marginal values of search for any consumption level within the given time horizon that maximizes the utility U(Q;H) of his consumption-leisure choice***.

Graphically with regard to Figure 2, the sequence of steps looks as follows:

- the consumer determines for the given time horizon T the quantity demanded Q and his willingness to pay wL_0 for it;
- he starts to search and chooses the first offer QP_P below the reservation level wL_0;
- the straight line, which passes by the point of purchase QP_P with the slope equal to the wage rate w, intersects the H-axis at the $(L+S)$ value and the Q-axis at the QP_e value;
- the straight line, which passes by ($QP_e;T$) points, has the ($-Q\partial P/\partial S$) slope, where the $\partial P/\partial S$ value illustrates the fall of the purchase price P_P under the search;
- the curve $Q\partial P/\partial S$ becomes tangent to the curve $w\partial L/\partial S$ at the moment of purchase.

As we can see, the consumer doesn't make cumbersome calculations of these marginal values. His optimal choice doesn't depend on the computational complexity H.Simon told about in his famous paper. The only thing the consumer needs is the adequate evaluation of his purchasing power and of the efficiency of his labor and search efforts.

If a man doesn't loose control of his appetites, if he recognizes well his own capacities, and if he is realistic about what he can buy with his efforts, his prior expectations or the initial trade-off of leisure for consumption will be equal to the real wage rate w/P_e. Once it is determined, the unit elasticity rule moves the consumer to the optimal choice for any level of consumption.

On the other hand, the equation (10) tells us that the efforts' spending doesn't depend on the consumption-leisure trade-off itself. If the consumer is unaware of the corner solution or he challenges it, the $e_{(L+S),Q}=1$ unit elasticity doesn't mind. The consumer simply evaluates his real wage rate or his purchasing power and gives himself up to the unit elasticity rule, which mechanically reproduces his feelings about his purchasing power for any level of consumption. His efforts are increasing ***with regard*** to the unit elasticity and ***regardless*** the individual feelings how consumption and leisure would be traded. It looks like in a way the consumer becomes hostage to his prior expectations. If he makes a mistake, this is a sad thing, but it is his choice.

The unit elasticity rule holds itself regardless the problem of the optimization of utility. It seems that this rule works like a law of nature. However, the unit elasticity rule tells nothing about the allocation of time between the labor L and the search S. But while it equalizes marginal loss on the search with its marginal benefit at any level of consumption, it means that consumer's efforts are divided between labor and search optimally for any level of consumption. It looks like the consumer makes intuitive decisions or he is led by some invisible clues how much to spend and to search.

When Adam Smith described the economic behavior of a man, he used the metaphor of the invisible hand, which led self-interested producers to meet the wishes of consumers for their common social benefit (Smith, The Wealth of Nations, Book IV, Chapter II, p.456, para.9). Here we have the same effect but in the opposite direction, when optimizing consumers are led to meet the wishes of producers.

The satisficing decision under the unit elasticity rule

While the unit elasticity rule is proved, we should understand in what way the satisficing decision coexists with it.

If we come back to the corner solution, we can see that satisficing decisions falls in the corner even on the level of prior expectations:

$$\frac{MU_H}{MU_Q} = -\frac{dQ}{dH} = \frac{Q}{L+S} > \frac{w}{P_e} \quad (12.1);$$

$$w(L+S) < QP_e = -TQ\frac{\partial P}{\partial S} \quad (12.2);$$

$$w\frac{L+S}{T} < -Q\frac{\partial P}{\partial S}; -w\frac{L+S}{T} > Q\frac{\partial P}{\partial S}; \left|-w\frac{L+S}{T}\right| < \left|Q\frac{\partial P}{\partial S}\right| \quad (12.3)$$

If the marginal loss on purchase is less then its marginal benefit, it means with regard to the unit elasticity rule that this inequality has been already formed at the level of the purchasing intentions. It looks like the satisficing approach falls in the trap at the very beginning and the consumer doesn't start to work and to search because the quantity demanded is not worth his efforts. Under the utility theory the consumer should quit the market before he starts to make efforts on the purchase because any purchase will definitely result in the emotion of disappointment, which is hardly compatible with the satisficing.

We can find the exit from this corner with the idea of the gradual adjustment of the aspiration level H.Simon told about. When the consumer cannot evaluate correctly his purchasing power at the moment of the intention to buy, it doesn't mean that he understands his mistake. He may think that his prior expectations are adequate. But the market sobers him up and he starts to search to get rid of the disappointment. It means that he is changing his individual trade-off of leisure for consumption during the search. And finally he chooses the first offer that satisfices him. But the first offer, which doesn't produce the disappointment, is the optimal one.

It means that the price P_0 at the zero search level can change its value during the search. The equation (12.3) results in the $P_0<P_e$ value, which gradually rises with the change in the *MRS (H for Q)* during the search until it comes to the equilibrium level, or $P_0=P_e$.

Really, if the consumer overestimates the efficiency of his efforts from the very beginning and the market corrects his prior expectations, the total costs elasticity with respect to consumption will be greater than 1. But according to the equation (9.2) it means, that the value $e_{Po,Q}>0$.

However, the P_0 can stay constant. But to stay constant, like it happens with the equilibrium price, this value should become ***independent on consumer's individual preferences***. It means that the constant P_0 value can appear when some niche of new *shoppers*, consumers with zero search costs, appears on the demand side. It happens when either producers make unfair offers to *shoppers* or, here we should not forget that the constant price at the zero search level equalizes both marginal and average costs on purchase, both marginal and average costs of *shoppers* fall, for example, under the labor augmenting technical progress (Malakhov 2020). But it means that the process of arbitrage starts (Malakhov 2016). The equilibrium price falls to the level of the value P_0. The former corner solution disappears and the satisficing choice again becomes optimal, now at the lower P_0 level:

$$\left|-w\frac{L+S}{T}\right| < \left|Q\frac{\partial P}{\partial S}\right| \Rightarrow MRS\,(H\ \ for\ Q) = \frac{Q}{L+S} > \frac{w}{P_e} \quad (13.1)$$

$$P_o < P_e;$$

$$MRS\,(H\ \ for\ Q) = \frac{Q}{L+S} = \frac{w}{P_0} \Rightarrow w(L+S) = QP_0 \Rightarrow \left|-w\frac{L+S}{T}\right| = \left|Q\frac{\partial P}{\partial S}\right| \quad (13.2)$$

This is the answer to the question whether the consumer really finds a price. The answer is positive. In this way the sequence of events changes and the straight line, passing by the moment of purchase with the *w* slope, comes to the *Q*-axis at the QP_0 point.

There is another question - does the QP_0 offer exist on the supply side? The answer again is definitely positive. We don't know the structure of the supply side, but if the $QP_P=wL$ level exists, the $QP_0=w(L+S)>QP_P$ level should also exist. If it weren't so, the milk would still be sold not on the doorsteps but at the gate of the farm.

But the most common case of the satisficing decisions, followed by the inequality of the marginal values of search, takes place when the unit elasticity rule doesn't work correctly. It happens, when the values $L_0;S_0,Q_0$ are definitely positive. While positive real balances, supplies, and knowledge seem to facilitate the decision-making, from the point of view of the equation (10) they work like a ***noise***, which weakens the unit elasticity rule and make it useless. Indeed, these positive values represent some parts of both tangible and human capital that cannot stay neutral to consumer's prior expectations. And when the unit elasticity rule stops to work, consumers really face the computational complexity, which they try to avoid and to make simple satisficing decisions.

The difference between the infinitely small and positive values of labor, search, and consumption, which produce the noise, can be illustrated by the common situation when the consumer is not sure that he will start his old car in the morning. Here the residual expected mileage works like a noise, which negatively impacts the decision to buy a new car and in a pinch the consumer is ready get a taxi for his two-mile trip to the office.

The same thing can happen with the old washing machine, when the pick-up and delivery services of the laundry nearby can be used as the last resort for the urgent cleaning of white shirts for the next working week.

These considerations direct us to the waste domain of satisficing purchases of durables, which needs a particular attention.

The satisficing purchases of durables

In 1979 Kapteyn et al. published the results if the field study, which had analyzed welfare functions of 1054 individuals with regard to the purchases of the set of durables (Kapteyn et al. 1979). The authors made the definite conclusion that "in making purchase decisions concerning durables, individuals "satisfice" rather than "maximize"" (ibid., p.559). It was just the study that launched the so-called "paradox of little pre-purchase search for big-ticket items", which challenged the optimizing search behavior in favor of the satisficing approach and the prospect theory (see Grewal and Marmorstein 1994, Thaler 1980, 1987).

The labor-search-leisure model provides a simple explanation to this fact. It agrees with the conclusion that the purchases of durables are satisficing. Moreover, the labor-search-leisure model takes the satisficing purchase as the ***necessary condition*** for the optimal choice. But the satisficing choice is not the ***sufficient condition***.

It was shown that the analysis of the optimal choice for durables should be put down from the level of trade units - cars and washing machines - to the level of consumption units - miles and pounds of clothes (Malakhov 2019, 2020). According to the methodology of the model, the equilibrium price for the consumption unit is net of any efforts that decrease labor costs. In this way the search costs are divided between the pre-purchase search itself, or $wS_{ex\ ante}$ and after-purchase home production and care, or $wS_{ex\ post}$.[2] However the distinction between $wS_{ex\ ante}$ and $wS_{ex\ post}$ appears only with regard to the moment of purchase, because the $wS_{ex\ post}$ costs

[2] The analysis of the trade unit's lifecycle is simplified by the assumption that all after-purchase costs are non-monetary because this assumption preserves the illustrative power of static model (S.M.).

also represent some preliminary activity, the cleaning of the purchased item for example, now with regard to its subsequent use, which "produces" following miles and pounds of clothes. It means that all goods are divided between items of immediate consumption, when only search efforts matter, and items of durable consumption, where home production and after-purchase care also take place.

As a result, the equilibrium price of a mile net of search, care, and driving itself, is produced by a taxi, while the equilibrium price of one pound of clean clothes is produced by the laundry, which provides pick-up and delivery services. And the equilibrium price of a trade unit, a car or a washing machine, is equal to QP_e value, or to the number of miles and pounds times the equilibrium price of a consumption unit. For example, this consideration underlies the choice between an old low-mileage car and a new high-mileage good car (Malakhov 2019). And the unit elasticity rule also confirms this consideration because the moment of the intention to buy corresponds to the decision in a pinch, when the consumer is ready to call a taxi or to phone the laundry nearby.

While the equilibrium price per consumption unit P_e is given by the market and stays constant, the purchase price of the consumption unit P_p is not. When the expected quantity demanded Q is low, the purchase price for a mile is great and it becomes reasonable to rent a car or even to get a taxi. But the imperfect market diminishes the purchase price with the increase in quantity demanded or expected. As a result, the purchase price for a trade unit QP_P rises but its growth is slow, or $\partial QP_P/\partial Q>0; \partial^2 QP_P/\partial Q^2<0$. The labor costs $wL(Q)$ follow the purchase price, or $\partial wL/\partial Q>0; \partial^2 wL/\partial Q^2<0$. But when the equilibrium price for the trade unit, a car or a washing machine, QP_e stays constant, it means that the dynamics of the search&care costs $wS(Q)$ is dissimilar, or $\partial wS/\partial Q>0$ but $\partial^2 wS/\partial Q^2>0$. As a result, the expected average search&care costs $wS(Q)/Q$ rise with the demanded or expected quantity Q. While the ***average*** maintenance or technological costs for the old low-mileage car are greater due to its obsolescence that the ***average*** maintenance technological costs for the new high-mileage car, but the expected average search&care costs $wS(Q)/Q$ rise with the demanded or expected quantity Q, it means that at the moment of purchase there are some other expected ownership costs above the necessary technological costs. These costs exhibit consumers' ***willingness to take care*** of good cars (Malakhov 2019).

As a result, the total after-purchase costs wS are divided between necessary technological costs OC, produced by the obsolescence of an item and voluntary costs WTC of care for it, or $wS(Q)=OC(Q)+WTC(Q)$. At the beginning of the use of the item OC are equal to zero. But WTC costs are not. For example, consumers are cleaning unnecessarily new purchased items because they enjoy them. The care slows the obsolescence and the OC curve becomes flatter as the OC'

curve at the beginning of the use of an item (Figure 3). But the willingness to take care is not the infinite phenomenon. Usually, it falls with the age of the car. And once consumers stop to take care of cars – they don't clean shoes before they get into the car, they start to put all sort of things on the back seat, and they do not brake before the speed bumps. As a result, the negligent use of the car or the negative willingness to take care raises exponentially its obsolescence costs:

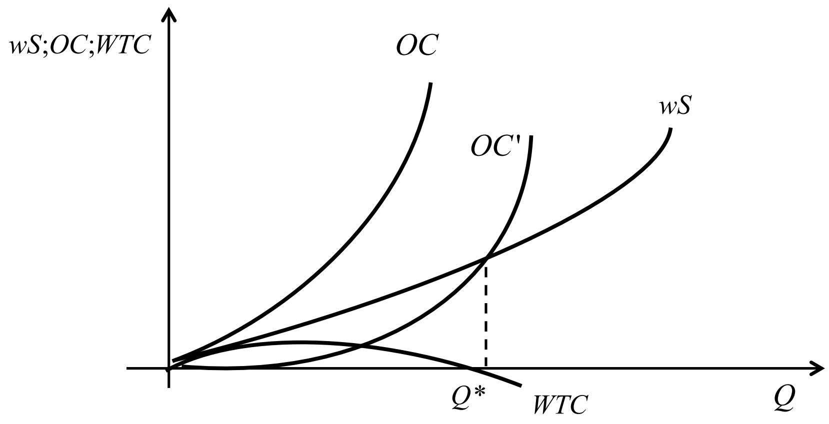

Figure 3.After-purchase costs and the optimal quantity to be consumed

It was argued that the optimal quantity of consumption units, the mileage in the case of cars, occurs, when the willingness to take care comes to zero, or *WTC=0*. This is the moment for the replacement of any big-ticket item. However, this moment doesn't necessarily exhibit the end of the item's lifecycle because the *WTC* represents a subjective value. It means that the asset can be redistributed at this moment from less diligent to more diligent hands for its better use with respect to the Coase theorem (Malakhov 2020). Other words, the used car can be sold.

If we come back to the moment of the purchase of the expected quantity, we can see that the pre-purchase search and the initial *WTC* rise the average costs *AC* from the $w(L+S)_0/Q$ level to the $w(L+S)'_0/Q$ level (Figure 4):

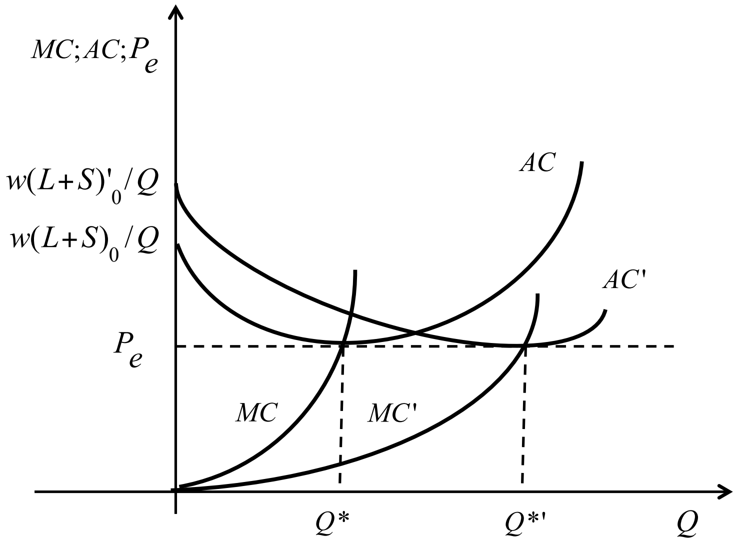

Figure 4. Marginal and average after-purchase costs

The total labor costs on purchase *wL* are fixed by the purchase itself. But the average labor costs are decreasing with the use of an item, or $\partial(wL/Q)/\partial Q<0$. However, the average after-purchase costs are increasing, or $\partial(wS/Q)/\partial Q>0$. The average curve *w(L+S)(Q)* gets the U-shape and once it comes to its minimum value with the corresponding equation $\partial(wL/Q)/\partial Q+\partial(wS/Q)/\partial Q=0$. We know that at this moment the marginal costs $MC=\partial w(L_{const}+S)/\partial Q=\partial wS/\partial Q$ should equalize the average costs *AC*:

$$\frac{\partial w(L+S)/Q}{\partial Q}=\frac{Q(\partial w(L+S)/\partial Q)-w(L+S)}{Q^2}=\frac{\partial wS/\partial Q-w(L+S)/Q}{Q}=\frac{MC-AC}{Q}=0 \quad (14)$$

While the care reduces technological costs, the optimal quantity is greater than without care, or $Q^{*}{}'>Q^{*}$. But when the *WTC* becomes negative, the marginal costs start to rise exponentially. This consideration results in the assumption that optimal quantity to be consumed occurs when the willingness to take care comes to zero. This assumption is quite reasonable because here again the consumer doesn't make cumbersome calculations and he simply compares efforts or costs on maintenance and care $\partial wS/\partial Q$ for the next mile with its average level *w(L+S)/Q*. And when he feels that the next mile will need more efforts than on average, he says to himself that it is enough to take care.

But the most important analytical attribute of this moment is the equality of the marginal and average costs. As we already know, at this moment both marginal and average costs equalize the equilibrium price of the consumption unit and the marginal values of search here of search&care, also become equal.

But it means that the optimal consumption-leisure choice doesn’t take place at the moment of purchase but it occurs at the moment when the consumer stops to take care of the item. This consideration confirms the assumption that the equilibrium level equalizes the *shoppers*' willingness to pay (*WTP*) with the *searchers*' willingness to accept or to sale (*WTA*) (Malakhov 2016). While the willingness to take care exhibits the consumer's diligence (Malakhov 2020), this concept finds the support in the common law where the great or high diligence is presented as the "*diligence that a very prudent person exercises in handling his or her own property like that at issue"* (Black's Law Encyplopedia).

The satisficing purchasing decision really becomes ***necessary*** because it opens the way to the following optimization. When the consumer makes the satisficing purchase under the uncertainty of the price dispersion, he simply substitutes the uncertainty of efforts' efficiency of the pre-purchase search by the certainty of the efficiency of the after-purchase care. Buying the durable item, the consumer knows that its careful use will depreciate a minor or uncertain price reduction of the extended search. And the comparison of marginal after-purchase costs with its average level becomes the ***sufficient condition*** for the optimal consumption-leisure choice.

Conclusion

The unit elasticity rule represents the theoretical concept, limited by strong assumption of zero real balances, inventories, and knowledge as well as by the constant time horizon. It also omits the trial-and-error approach. This rule doesn't mean the continuous movement along the budget constraint. It represents only one trial, a one-time shift of the utility curve from the *T*-point to the level of the quantity demanded because another trial will violate the strong assumption of the zero-level knowledge $S=0$.

The unit elasticity rule is limited also by the assumption of equilibrium wage rate. However, the labor-search-leisure model takes into account the wage rate as the time horizon as variable values, which produce the equilibrium price dispersion (Malakhov 2016, 2019). But even under the equilibrium price dispersion the labor-search-leisure model stays static. The choice of the static analysis is explained by the need to confirm the methodological identity of the labor-search-leisure choice with the classical labor-leisure choice on the one hand and with the classical optimal output choice on the other hand because it reproduces the well-known S-shape function for the costs of production, here with respect to the after-purchase costs (Malakhov 2020).

This reasoning explains why the labor-search-leisure model doesn't take into account the interest rate in particular and the money in the utility function in general. The labor-search-leisure model pays attention to the fact that the concept of the reservation price partly closes the door for money to be included into the analysis of the consumption-leisure choice. The concept of reservation price tells that the trade-off between current and delayed consumption has already been done. In addition, the utility of money limits very important analysis of the leisure-search relationship $\partial H/\partial S$, which produces the concepts of the tedious search for necessities and the pleasurable search for luxuries, when the dual activities like window-shopping, pet's care and gardening take place. However, the interest rate implicitly enters into the model because it extends the price dispersion and money enters indirectly in a form of the reserve for future purchases, which is maximized by the equality of the marginal values of search (Malakhov 2015).

The proof of the unit elasticity rule really has the methodological character. It simplifies the reality in order to discover some internal mechanisms or, like Kenneth Arrow told, special optimality properties of the equilibrium solution, which can be presented in its general form with regard to the production possibility frontier (Malakhov 2020).

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