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The efficient markets paradox: theoretical contributions of Steven C. Salop [1]

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O paradoxo dos mercados eficientes: contribuições teóricas de Steven C. Salop

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Resumo: Neste artigo analisa-se a proposta seminal de Salop (1976), segundo a qual a estrutura de mercado relevante com informação imperfeita não é a de concorrência perfeita, mas sim a de concorrência monopolista, com dispersão de preços. A partir da exposição dos modelos de concorrência perfeita, de concorrência monopolista e do modelo proposto por Salop, além dos principais elementos teóricos desse debate, são apresentadas análises alternativas baseadas nos estudos de Akerlof e de Grossman e Stiglitz. A esse respeito, será mostrado que os resultados propostos por Salop, apesar de considerarem a qualidade constante, são incompatíveis com os pressupostos da economia neoclássica.

Palavras-chave: Competição; Informação; Salop; Dispersão de preços; Sistema de preços.
Classificação JEL: D82; D83.

Abstract: In this paper we analyze Salop's (1976) seminal proposal, in which the relevant market structure with imperfect information is not the one with perfect competition, but the one with monopolistic competition, with price dispersion. From the presentation of the perfect competition model, monopolistic competition model, Salop's model and the main theoretical elements of this debate, alternative analyses based on studies of Akerlof and Grossman & Stiglitz are presented. In this regard, it will be shown that the results proposed by Salop, although considering the quality constant, are incompatible with the assumptions of neoclassical economics.

Keywords: Competition; Information; Salop; Price dispersion; Price systems.
JEL Classification: D82; D83.

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1. Introduction

The aim in this article is to study, analytically, the different market price structures from the perspective of the Information Economy. The basic issues that will be discussed are the following: (a) Given the basic premises of the competitive structure with complete information and incomplete information, is it possible to claim that there is a single point of equilibrium? (b) To what extent can variations in prices be interpreted distinctly by different groups of consumers? (c) What are the limitations of price systems in the transmission of information regarding the qualitative characteristics of goods and services?

With regard to the theoretical scope, the basis for the elaboration of this article comes from the seminal studies of monopolistic competition with incomplete information by Salop (1976). However, regarding the equilibrium model, Herscovici's (2010, 2013, 2015) analysis of Salop is adopted; similarly, a critical analysis of Salop's model is carried out, based on Akerlof (1970) and Grossman & Stiglitz (1976). From other authors, we extract important concepts regarding the topics covered, especially those related to general descriptions of models with complete (STIGLER, 1961) and incomplete information.

As for the structure of the article, besides this introduction and the concluding remarks, in the first section the fundamental characteristics of the models with complete information and also with incomplete information will be presented, as well as the basic premises for the interpretation of the equilibrium model with incomplete information developed by Salop (1976), along with his main implications. From Herscovici's notes, in the second section the equilibrium model with incomplete information proposed by Salop will be discussed, followed by the presentation and analysis of specific topics derived from this same model, such as price discrimination and the relationship between competition and well-being. In the third section, we discuss alternative analyzes by Akerlof and Grossman & Stiglitz. With this, we sought to emphasize throughout the text that the *Salopian* model represents the first moment of the theoretical rupture with Stigler (but also Friedman and Lucas), Akerlof and Grossman & Stiglitz. Besides, the nature of the interpretations of these last three authors is distinct of that proposed by Salop: for those, there is uncertainty regarding the qualitative components, while for this the quality remains constant. In this sense, the efficient markets paradox derives from the fact that price system is unable to reveal all the qualitative characteristics of goods and services, as the qualities vary overtime.

2. Characterization of models with complete information and with incomplete information

In this section we present and discuss three economic models; i) with complete information based on Stigler (1961); ii) with incomplete information from Chamberlin (1933); iii) with imperfect information developed by Salop (1976). These interpretations will clarify some key points for further exam of the question of equilibrium in Salop's model, in section three.

2.1. Model with complete information

In a model with complete information (with perfectly competitive markets), each firm only has to worry about the quantity of goods it wants to produce, as it has no capacity to influence the market, that is, regardless of the quantity produced, it can only offer it at the prevailing price. In turn, it is up to consumers to decide to demand the goods produced by the firms at the market equilibrium price[3]. Therefore, it is concluded that although the market equilibrium price may be independent of the actions of an individual agent in a perfectly competitive market, what determines it is the joint action of all agents in that market (price takers). It is formed from methodological individualism[4] and the postulate of homogeneity. There is no uncertainty with regard to quality.

The homogeneity postulate is an important feature of perfectly competitive markets, implying the absence of uncertainty regarding the quality of goods. "[…] our analysis is restricted to conditions of homogeneity" (STIGLER, 1961, p. 218). Algebraically, this function can be verified in the following equation:

$$p1 = \varphi(q1), \varphi' > 0 , \qquad (1)$$

in which p represents the unitary price and q the quality.

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[3] Also known in the economic literature as continuous market clearing or as a competitive price.

[4] Regarding the analysis of human action from the perspective of individual agents. The postulate of methodological individualism in neoclassical theory implies that the agents' preferences are determined exogenously and that there are no inter-individual relationships, that is, each agent maximizes its utility or profit function regardless of the performance of the other agents. The relationships between the agents are replaced by the existence of the auctioneer (*crieur de prix*, in the terminology used by Walras), which allows confronting and matching supply and demand decisions and thus ensuring continuous market clearing. See Herscovici (2013).

Salop (1976) adopts this assumption of the homogeneity of goods and services, constituting an essential element of neoclassical theory[5]. According to Herscovici (2013, p. 13), "it implies that the pricing system is completely informative", once "quality is determined solely on the basis of prices and, consequently, exchanges are 'transparent'", so "when different types of information asymmetries appear, this homogeneity is no longer verified".

Regarding the homogeneity of goods, the acceptance of prices by consumers usually occurs in markets where firms produce identical products, that is, perfect substitutes for each other. This denotes that none of the firms can raise the price of their own product above the price practiced by the other firms, because, in that case, they would lose all or most of the business. Products with these characteristics are known as commodities[6] (such as minerals, oil, certain agricultural products, among others). The postulate of homogeneity is fundamental to neoclassical logic, as it ensures the existence of a single market price. It is also assumed that there is no uncertainty, as consumers equate the cost of information with its marginal utility (STIGLER, 1961), either in relation to quality ($q1$) or in relation to price ($p1$) (see equation 1).

As Lancaster (1966) points out, the characteristics of goods are identical for all consumers, that is, quality is given and each consumer will choose a basket of goods, according to their subjective, exogenous, and constant preferences. Note that this analysis is based on demand. There is then an objective dimension in determining utility: the characteristics (qualities of goods) are the same for all consumers. The subjective dimension, according to Orléan (2011, p. 62), is explained by the fact that consumer choices are different between various goods, "in such a way that the personal element in the choice of consumption is related to the choice among the characteristics, and not with the allocation of the characteristics to the respective goods".

The price system provides all necessary information regarding the quality of goods and services, once it is "characterized by a price distribution […] for objects that cannot be distinguished (before purchase) other than by price" (STIGLITZ, 1987, p. 8). As Grossman & Stiglitz (1976, 1980) and Stiglitz (1987, 2011) point out, the relaxation of this hypothesis is incompatible with the efficient markets' hypothesis. Each price corresponds to a specific quality for all agents. There is an "objectification" of quality and homogeneity is defined based on a univocal relationship between price and quality. Therefore, the analysis proposed by Stigler is fully compatible with the neoclassical economy.

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[5] The definition of neoclassical theory used in this paper refers to the school of economic thought, which still existed as a neoclassicist content at the time of Salop (1976). Contemporaneously, as discussed by Colander (2000) and Dequech (2007), neoclassical economics as a school of thought no longer exists, although this expression is commonly used to refer to the mainstream economic theory.

[6] For a better understanding of this article, the most convenient is to think of a commodity as a durable good that is purchased only once by each consumer and for which there is no uncertainty regarding the qualitative components.

Another important aspect of perfectly competitive markets is the existence of free entry (and exit) from these markets, since it is assumed that there are no special costs (costs for the incoming firms to establish themselves and that the established firms would not have) that make it difficult for a new firm to enter a sector and produce or leave it if it cannot make economic profits in the long run (*lr*). As a result, in economic activities with this characteristic, buyers can easily switch from one supplier to another, and suppliers can enter or leave the market freely. This assumption is important for competition to be effective, meaning that consumers can easily switch to a rival firm if the usual supplier raises the price (BAIN, 1956; SYLOS-LABINI, 1956). Note that in this assumption is implicit that the firms' profit rates are uniform relatively to the industry, that is, the result is as good as it would be to invest their resources in another activity (there is a normal return rate on their investments)[7].

In this sense, Salop (1976) points out that there is no possibility of establishing a price higher than the monopoly price (*mp*), nor a price lower than the competitive price (*p**). The existence of a minimum and maximum price allows the following results to be formulated: (a) in addition to the maximum monopoly price, the cost of information compensates for the drop in prices for the same quality; (b) while the cost of information is between these two limits, there is a multiplicity of prices, for the same quality; agents will compare the cost of information (in the logic of opportunity cost) with the decrease in prices; (c) below the competitive price, the firm does not realize profits.

2.2. Model with incomplete information

In turn, Salop (1976) uses the monopolistic competition model, first described by Chamberlin (1933) and characterized as follows:

i) Firms compete by selling differentiated products, highly substitutable for each other, but which are not perfect substitutes. In other words, the cross-elasticities of their demands are large, but finite;

ii) There is free entry and exit: it is relatively easy to enter new firms with their own brand names and to leave firms that already operate in the market in case products are no longer profitable. Firms face negative sloping demand curves in monopoly competition [8] – the price charged exceeds the marginal cost (*MC*) in the short term. There is a similarity with perfect competition: as there is free entry, the possibility of making profits will

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[7] In accordance with the Contestable Markets Theory (BAUMOL, 1982). It highlights that from the moment the three conditions of contestability of the markets are verified – i) no barriers to entry (insider firms pay the same rates profit by outsiders); ii) no exit barriers (sunk costs); iii) the firm can enter and exit a given market without suffering retaliation (hit-and-run) – the equality between cost and marginal revenue of oligopolies and monopolies is fully compatible with the existence of increasing returns. This situation meets the conditions of *Paretian* optimality.

[8] In the same way as in the case of monopoly.

attract new firms with competitive brands, which will tend to reduce economic profits to zero in the long run (without fixed factors of production). In this long run equilibrium, the price becomes equal to the average cost (*AC*) (with the demand curve in contact with the *AC* curve at a point above and to the left of the minimum *AC* point). Nevertheless, unlike pure and perfect competition (*PPC*), it does not achieve the equilibrium at the point of minimum average cost. It is noteworthy that Chamberlin's proposal (figure 1) differs from that of the Walrasian model analyzed in the previous section.

Figure 1 - The long run equilibrium of firms in monopoly competition (from the perspective of costs)
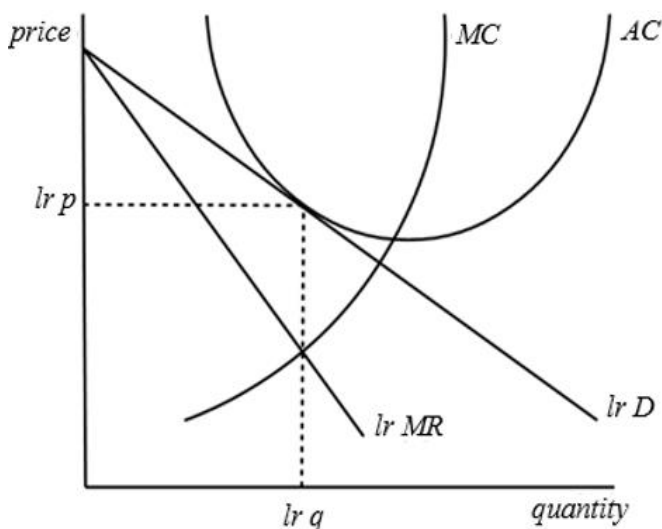
Source: adapted from Chamberlin (1933).

Therefore, the long run equilibrium price (*lr p*) will be higher compared to the case of perfect competition, while the long run quantity produced (*lr q*) will be lower in relation to perfect competition. According to this model, such inefficiency must be confronted with the different consumer gains (in the sense expressed by the consumer Marshallian surplus[9]), resulting from the diversity of products. In this situation of long run equilibrium, there is also no price dispersion.

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[9] It corresponds to the difference between the amount that the consumer would be willing to pay for a certain quantity of a good (reserve price, which is the maximum that the consumer is willing to pay for the commodity) and the amount that is effectively pay. See Marshall (2006).

2.3. Salop and the imperfect information

Based on the models presented before, Salop (1976) proposes a price equilibrium model in which there is price dispersion for the same quality. At this level, uncertainty is related to prices, not quality (unlike the proposal of Akerlof and Grossman & Stiglitz). To develop this model of equilibrium with imperfect information, the author points out a set of basic premises that seek to make it feasible and give it coherence, namely:

i) The utility of any commodity's services is a complex function resulting from the characteristics that specify it. The net utility surplus is equal to the utility of services derived from the commodity, less its information cost and its price. Given the choice between competitive commodities, the "best buy" is the brand that allows the largest net surplus. In other words, there are no problems with the quality of goods[10];

ii) Initially, a consumer has imperfect expectations regarding the net surplus of each good. This prior imperfection stems from your general knowledge, past information and experience. It is useful to think of this as a dynamic learning process. Prior knowledge can be thought of as the distribution of probabilities of a commodity's net surplus. The distribution of this surplus may be an unbiased estimate of a current net surplus (according to rational expectations[11]) or it may be biased due to an incorrect extrapolation from the past, an unobserved change in a commodity specification, random events from the past or ignorance in general. The formation of prior knowledge is impaired if relevant issues are not even known until some information is obtained;

iii) The cost of obtaining information will depend on the technology, production and dissemination of information, the type and number of commodities, as well as prior knowledge and consumer preferences. This will set the speed of the learning process. Obtaining information improves the quality of subsequent distribution. The expected value of an information can be interpreted as the increase in the expected net surplus derived from this same information[12]. The effective cost of information includes its source and non-cash costs, which will depend on consumers (opportunity costs, preferences, analytical skills, experience and understanding of the market). It should be noted that, on the part of the consumer, the purchase of information occurs when the increase in the expected utility is proportionally greater than the cost of the information, because it can find a lower price for the same quality;

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[10] See Alchiam & Demsetz (1973) and Posner (2005).

[11] Hypothesis that agents use all available information. Based on experience and this information, on average, the values of the expected variables correspond to those of the actual variables.

[12] This aspect and its algebraic formalization will be explained in detail in section 3.

iv) For Nelson[13] (*apud* Salop, 1976), exists two ways of obtaining information: through experience goods and through search goods. The experience consists of the knowledge obtained from the use of the commodity. This information can be obtained from personal use or from shared experience or not. It is more likely to occur in the case of cheap non-durable goods of unknown quality that are consumed each period. In the case of experience goods, the information is generally incomplete, as long as there is no sample of any and all commodities (exhaustiveness problem), in addition to the present performance of a certain brand may be random. By search, it is considered the case in which sampling is available before purchase, for example, from specialized magazines, visiting stores, reading advertisements, among others. Price information can be generated from search that, theoretically, can lead to complete information;

v) Depending on the nature of the product (*search goods* or *experience goods*), complete or incomplete information can be obtained, respectively. Complete information is understood as that which allows the consumer to make the best buy available. By incomplete, it is understood as the expected net surplus will be between the average (size sample) and the best buy. To obtain incomplete information, the consumer must choose a price level with a minimum acceptable net surplus, which is his reserve price;

vi) There are important interactions (demand externalities) between consumers in the process. One example is a particular consumer who believes that the demand from other consumers keeps the market "honest" and this makes the price reflect the quality, so there is no need to obtain more information, buying the commodity that occupies the largest market share, assumption based on Smallwood & Conlisk[14] (*apud* SALOP, 1976). Alternatively, if the consumer believes in the principle of the used car market (lemon's market) by Akerlof (1970), everyone will leave this market, as predicted by this model, which is based on the components of the offer.

Having explained the basic premises of Salop's model (1976), this also clarifies that before analyzing the market itself, one must question why, since the marginal costs of distributing information are close to zero and not increasing, competition between information producers does not lead to a drop in price. The answer is, first, that consumers have the same information problem with respect to information sellers in the specific case of commodities. In the case of a journal, for example, each must be evaluated individually and its content analyzed and processed[15]. In addition, since the dissemination of information by each magazine has decreasing average costs, the information industry cannot be competitive in the long run equilibrium. This creates a problem, since the nature of the market for information production (information prices) is not competitive, a fact that affects the entire dynamics of the model.

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[13] See Nelson (1970).
[14] See Smallwood & Conlisk (1975).
[15] Assuming that the average cost of information is decreasing, and the marginal cost is decreasing or zero.

3. Equilibrium

3.1. Salop's equilibrium model

Completed the overview of the functioning of markets with complete and incomplete information, and exposure of the basic premises of Salop for proper interpretation of the equilibrium model in imperfect competition context, here we analyze the behavior and structure of the equilibrium price in the hypothetical commodity market. It should be noted that the algebraic formalization presented in this section, as well as its most relevant notes, comes from a formalization originally developed by Herscovici (2010), based on Salop's model (1976). The arguments – based on the propositions of Akerlof (1970), Grossman & Stiglitz (1976) and Stiglitz (1987), to be presented in section 3 – are in the same way. In this sense, a simple algebraic formalization involves the synthesis of approaches linked to the information economy. Its general mechanism occurs as follows:

$$E1 = U1 - p1 - c1 \tag{a}$$

$$E2 = U2 - p2 - c2 \tag{b}$$

Where **E** symbolizes the consumer's net surplus, **U** the total expected utility, **p** and **c** respectively, the price of goods and services and the cost paid for the information, while **q** symbolizes the quantity of goods and services. Number **1** refers to poorly informed consumers and number **2** to informed consumers.

From this mechanism derives the following interpretation: in equilibrium, E1 = E2, i.e., U1 - (c1 + p1) = U2 - (P2 + c2). Prices vary between pure and perfect competition price (p*) and monopoly price (mp), just as quantities vary between pure and perfect competition quantity (q*) and monopoly quantity (mq). Consequently, as can be seen in figure 2, in Salop's (1976) mechanism there is a unilateral relationship between price and quality (uniform, with homogeneity of goods), with constant quality. In this way, there will be several prices corresponding to the same quality: the dispersion of prices and the imperfections it generates mean that the same good can be sold at different prices. Thus, the homogeneity assumption is not verified, and the model of Salop is configured at the start of the rupture with the assumptions of neoclassical economics. The algebraic and graphical representations of Salop's model (1976) are as follows:

$$p1, p2, .. mp = \varphi(q) \tag{2}$$

Figure 2 - The equilibrium of the Salop model
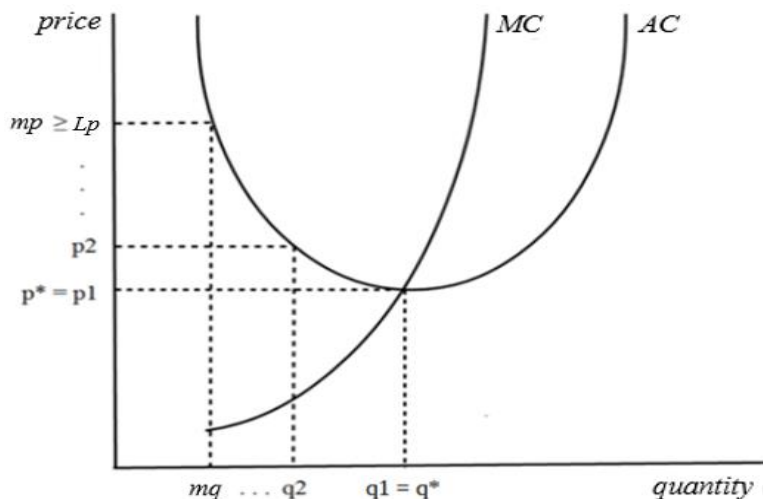
Source: adapted from Salop (1976).

The minimum price (p1) is never below the competitive price (p*), as this would mean negative profit. The effective price cannot be higher than the monopoly price (*mp*). From this, it is possible to deduce two conclusions:

i) If c2 and c1 are greater than zero, there is no competitive equilibrium since there is no single price, that is, when there are costs paid for information, existing for both c1 and c2, there will be impacts and price dispersion, which makes this equilibrium unfeasible;

ii) In the competitive equilibrium, the surplus expected by informed consumers is identical to the surplus expected by poorly informed consumers; c2 - c1 compensates U2 - U1. However, there is the following paradox: if markets are competitive, there is a Pareto optimum, but in this case, there is no way to explain why informed agents assume an additional cost, since their utility is the same as that of poorly informed agents. Thus, there is no way to reconcile economic rationality and market efficiency (STIGLITZ & GROSSMAN, 1976).

In turn, there are the following possibilities:

i) If $c_2 = c_1 = 0$, the competitive situation occurs in which $p_1 = p_2 = p^*$, and therefore, $U_1 = U_2$;

ii) To $c_2 > 0$ e $c_1 = 0$, and if the proportion of informed agents is significant, we have that $U_2 - c_2 = U_1$, which allows us to infer that $U_2 > U_1$, denoting the consumers' preference for the present over the future, which means that the informed ones consume before the little informed. However, poorly informed consumers benefit from the positive externalities produced by informed consumers and the equilibrium is competitive. In addition, the percentage of informed and uninformed agents in this model is undetermined. In this case, there is no reason to be informed, which leads to an equilibrium without stability[16] (STIGLITZ, 1987);

iii) To $c_2 > c_1 > 0$, the equilibrium is not competitive since there is more than one price. In the case of search goods, the equilibrium occurs from two-price equilibrium (TPE). In the case of experience goods, there is definitely no complete information; there are as many prices as there are types of consumers.

Finally, this mechanism allows us to understand why when $c_2 > c_1 > 0$, equilibrium is not competitive with only one price. A firm can increase its price above the competitive one without decreasing the number of consumers: for consumers with little information, the increase in information costs necessary in search of a cheaper similar product does not compensate for the difference in prices. In contrast, above a certain critical value, the increase in prices encourages agents to buy information, with which the increase in costs related to the purchase of information compensates for the fall in prices. There are three mechanisms involved in such an analysis:

Proposition 1: prices oscillate between a minimum price, designated by the competitive price (p^*), and a maximum price (limit price, Lp), designated by the monopoly price (mp);

Proposition 2: the higher the price, the greater the incentive for consumers to buy information in order to find a lower price. This constitutes equality in the surplus of each type of consumer. Therefore, $U_2 - p_2 - c_2 = U_1 - p_1 - c_1$, since $p_2 < p_1$, and $c_2 > c_1$. ($p_2 - c_2 = p_1 - c_1$);

Proposition 3: when it comes to search goods, the equilibrium is distinguished by the existence of two prices (TPE): that paid by poorly informed consumers and that paid by informed consumers. Conversely, when it comes to experience goods, there is a specific price for each type of consumer.

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[16] According to the model presented in section 3.3.2 of this article.

Figure 3 - Price dispersion cycles
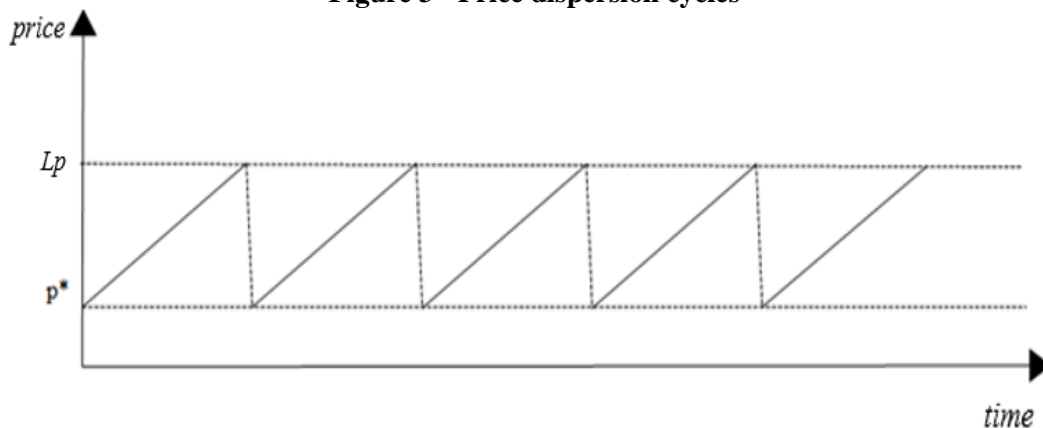
Source: adapted from Salop (1976).

According to figure 3, prices can vary between competitive price (p*) and limit price (Lp). The frequency and regularity of each cycle will depend on the speed of adjustment to changes in prices, company inputs and consumer learning. It is worth noting that there is nothing to guarantee that the behavior of the cycles will have this type of regular behavior described in figure 3, as it could perfectly assume any other format and thus be "chaotic" without prejudice to Salop's (1976) interpretation of the price oscillation. This analysis only allows us to state that the cycle manifests itself from the alternation between upward and downward price movements, but does not provide any information about a possible temporal regularity.

An interesting example is the dynamics of captive markets. It is assumed that there are consumers who have more information about a particular brand that they are consuming in the present compared to other brands that they have consumed in the past or have never consumed. This information asymmetry will give each firm's market power over current risk-averse consumers as long as they have moving costs[17]. If these moving costs are high enough, the entire firm can act as a full-fledged monopolist over its market follow-up. Some "deviant" firm may find it profitable to "compensate" these moving costs by charging a lower price, winning consumers who in turn become more captive as their information about past experiences fades. For this reason, this "deviant" firm can raise its prices down to the monopoly level. Therefore, it is necessary to make the following observation: the mechanism highlighted by Salop necessarily implies that competition is a competition by prices. In fact, the search for paid information is motivated by the search for a lower price, in which the quality (and usefulness) of the goods is constant (HERSCOVICI, 2010).

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[17] Costs linked to uncertainty with regard to quality, due to a change of brand.

In this sense, it can be said that Salop's proposal can be understood as a first refutation of the Paretian concept and, consequently, of the postulate of neoclassical homogeneity. The dispersion of prices and the imperfections it generates mean that the same good can be sold at different prices, that is, there is no homogeneity because there are several prices corresponding to the same quality. As quality is constant, the difference between consumers lies in price dispersion. There are no information asymmetries with respect to demand.

Regarding moving costs, Akerlof (1970) shows that due to the inefficiency of the price system to provide the appropriate signals, in terms of the quality of goods and services, certain institutions are indispensable to reduce the uncertainty related to this phenomenon: the brand it is a guarantee with regard to quality.

In this sense, Salop's proposal differs from those of Akerlof and Grossman & Stiglitz, as for Salop what motivates the search for information is the difference between the different prices and costs of information, with the quality remaining constant. Thus, if the price increases beyond a certain critical value, agents will be prompted to seek information.

3.2. Price discrimination and competition *versus* well-being in the Salop model

In the last subsection was explained the most important points of the model with Salop's imperfect information (1976), based on the formalization and respective notes of Herscovici (2010). In this subsection will be presented and explained some relevant topics that should be considered for the understanding of the model as a whole, such as: the role of price discrimination and the case of competition *versus* well-being, both reinterpreted from Salop (1976).

3.2.1. Price discrimination

As, for Salop, there is no uncertainty with regard to quality, the consumer compares search costs with the decrease in prices achieved: thus, a greater dispersion of prices implies higher search costs and a greater rigidity of the demand curve. A monopolist can also use price dispersion of the type of search costs to discriminate prices against unidentifiable consumers with inelastic demand curves (meaning high monopoly prices, in this case). If it allows price dispersion (through allegedly heterogeneous products, for example), consumers with high search costs will seek less information, tending to pay higher effective prices. Assuming that these consumers have even more inelastic demand, price dispersion will act as a discriminatory price linked to the demand for the commodity that the monopolist produces (SALOP, 1976).

3.2.2. Competition *versus* well-being

The existence of many similar brands tends to increase effective search costs. Supposing that a consumer must buy from any brand to be able to gauge its usefulness (in the case of experience goods). The optimal demand would consist of sampling the brands, at random and without replacement, until a preferred one is purchased. In this sense, the entry of a competing firm has two compensatory effects. The usual effect of an entrant increases the choice and decreases the prices, but increases the search costs. On the other hand, in the case of random sampling and without replacement, small groups are more interesting than large ones.

For example, supposing that there are three firms and the consumer evaluates the net surplus of these three brands as 5, 10 and 15. If he chooses a sample at random and without replacement three times, he will surely find the maximum utility of 15. If the number of firms doubles and the distribution of the utility level remains identical (therefore: 5, 5, 10, 10, 15, 15), then a random sample with no replacement five times is necessary to obtain a level of 15 with absolute certainty. A sample of size 3, on the other hand, will give a maximum expected utility of only 13.33.

In equilibrium, the higher cost tends to lead to higher prices, *ceteris paribus*. Thus, the net effect of increased competition may be to either increase or decrease prices, with a possible exchange between competition and well-being. The economy of well-being is understood here as the synthesis between Walras (pure and perfect competition), and Pareto's optimum (social efficiency).

4. Analyzes from Akerlof (1970), Grossman & Stiglitz (1976) and Stiglitz (1987)

4.1. Akerlof's analysis (1970)

Akerlof's (1970) analysis presents itself as a substantial advance in refuting Pareto's optimum and, therefore, in the efficiency that results from a PPC state. Based on the concepts of moral hazard and adverse selection (information asymmetries), his proposal shows that the price system is unable to transmit information regarding qualitative characteristics free of charge, that is, the qualities of goods and services vary.

An adverse selection situation exists when, *ex-ante*, one side has more information than the other: there is an informational income on the part of certain agents, which allows the appropriation of extra income. Moral hazard appears when, under a given contract, *ex-post*, the behavior of the contracted individual cannot be fully observed: the insurance market is characteristic of this type of situation. These analyzes also apply to the financial, services and labor markets. Algebraically, according to Herscovici (2010, 2015), the mechanism proposed by Akerlof corresponds to the following equation:

$$p1 = \varphi(q1,...,qn) \tag{3}$$

The information asymmetries are explained by the relations between producers and consumers: on the other hand, "dishonest" producers generate negative externalities for the honest, and the latter positive externalities for the former. The analysis in terms of externalities is related to the components of the offer. On the contrary, for Grossman & Stiglitz, externalities are related to the components of demand (HERSCOVICI, 2014, 2015).

Note that in the model of Akerlof (1970) the behaviors of sellers and consumers produce important distortions in the relationship between quality and prices: as the relative share of "dishonest" sellers increases, this distortion increases, and this can cause the disappearance of that market (*thin market*) (HERSCOVICI, 2020). From the model of Akerlof (1970), the differentiation between honest sellers and dishonest sellers can be represented as follows:

$$Qm1 = \Omega(\alpha.O1, \beta.O2) \tag{a}$$

with $dQm1/dO1 > 0$ and $dQm1/dO2 < 0$, (for the same price)

Qm1 represents the average quality on the market, O1 and O2, respectively, the quantities of quality 1 and quality 2 goods sold. For the same price, we must have q1 > q2; α represents the relative share of honest sellers and β the relative share of dishonest sellers ($\alpha + \beta = 1$). Index 1 relates to honest sellers and index 2 relates to dishonest sellers. The average quality on the market is as follows:

$$Qm1 = \alpha.q1 + \beta.q2 \tag{b}$$

Akerlof's conclusions are as follows: the simple game of the market translates into a drop in the proportion of dishonest sellers and, consequently, the disappearance of that market.

4.2. Alternative analysis of Grossman & Stiglitz (1976) and Stiglitz (1987)

The analysis of Grossman & Stiglitz (1976) and Stiglitz (1987) shows that the price system is not able to reveal all the qualitative features of goods and services, which implies inhomogeneity. There are information asymmetries among different groups of consumers, that is, they come from demand. Algebraically this is represented as:

$$p1 = \varphi(q1, q2) \tag{4}$$

Therefore, there is no reason for agents to buy a certain amount of information if the price system disseminates qualitative information free of charge to less informed agents. This problem raises two questions:

i) The hypothesis of market efficiency can be refuted based on the existence of free riders, a situation in which one or more economic agents end up enjoying a certain benefit from a good, without having contributed to obtaining it. The free rider can also be defined by the fact that it takes advantage of the externalities produced by certain agents, as in the case of speculative markets in Herscovici (2014, 2015) and also by the fact that the agents are not interested in revealing their true preferences;

ii) The solution proposed by Grossman & Stiglitz is to state that the net surplus of the informed agents is greater than that of the poorly informed agents; this difference outweighs the information costs. For each price there is a certain corresponding quality, resulting in a direct relationship between both. But in this case, the markets are no longer efficient, in the sense of Pareto.

The formalization of the Grossman & Stiglitz solution is as follows:

$$E2 = U2 - (p2 + c2) > E1 = U1 - (p1 + c1)$$

$$p1 > p2$$

$$c2 > c1$$

$$U2 > U1$$

For informed agents, the increase in gross utility does more than offset the eventual increase in (p2 + c2).

Thus, it appears that if the first works developed within the scope of neoclassical theory were founding (STIGLER, 1961; SALOP, 1976), although their explanatory limits soon appeared, arising from the fact that they maintained the main postulates of neoclassical economics, that is, the absence of uncertainty and the presence of homogeneity of goods and services. If the neoclassical economy is able to study the imperfections of information, it cannot consider information asymmetries.

Concluding remarks

From the presentation of the models and the theoretical debates arising from them, it is worth highlighting the following general aspects, paying attention to the following progression:

1. Based on the concept of complete information (STIGLER, 1961) and incomplete information, the proposal of continuous market clearing forms the basis of neoclassical logic. This market structure is guided by methodological individualism and because there are no barriers to the entry (and exit) of firms, also assuming compliance with the postulate of homogeneity, which ensures the existence of a single market price (without price dispersion). These characteristics are necessary and sufficient to verify Paretian optimality, that is, the efficiency of the markets. This normative approach thus justifies the extension of the logic of competitive markets to various areas of social production.

2. For Salop (1976), the relevant market structure with regard to information is not that of perfect or imperfect competition, but that of monopolistic competition. As emphasized throughout the text, the mechanism highlighted by Salop necessarily implies that competition is implemented based on prices. For this reason, the search for paid information is motivated by the search for a lower price, for the same level of quality, that is, of utility. In this reasoning, the net surplus of different types of consumers is, *ex-post*, the same. Therefore, it is concluded that the level of information of consumers interferes in the analysis of the behavior of prices, with the possibility of dispersing them and also of having more than one point of equilibrium. Thus, it can be said that the mechanism proposed by Salop can be understood as a first refutation of the Paretian concept and, consequently, of the postulate of neoclassical homogeneity. There are no information asymmetries in Salop, and yet, markets are not competitive. The results proposed by Salop, despite considering the constant quality, are incompatible with the neoclassical theory, which has the law of the single price as a characteristic (STIGLITZ, 1987).

3. In the analysis of Akerlof (1970), although there is still only one price, the qualities of the products in this market structure vary. His proposal, based on the components of the offer, shows that the price system is unable to transmit information regarding the qualitative characteristics of goods and services, free of charge, systematized based on the concepts of moral hazard and adverse selection. These information asymmetries allow the appropriation of rents by the agents who hold relevant information. In this way, there is a substantial advance towards the refutation of the postulate of homogeneity and, consequently, of Pareto's optimum.

4. Grossman & Stiglitz (1976) e and Stiglitz (1987) point out that the price system is unable to reveal all the qualitative characteristics of goods and services, as the qualities vary overtime, which implies in the efficient markets paradox. This leads to a second paradox, namely, that, *ex-post*, the net surplus of the informed agents is the same as that of the poorly informed agents. In this case, the efficiency of the markets and the optimal Pareto that correspond to it are incompatible with the hypothesis of microeconomic rationality. In this sense, these authors completely refute the postulate of homogeneity.

Last but not least, it is worth noting that, as seen in the course of this article, information about the qualitative components of goods and services and the behavior of agents is, by nature, incomplete, which allows to affirm the existence of behavioral uncertainty and, consequently, that prices do not reveal the information[18]. In this sense, the dispersion of prices – information imperfections – by Stigler and Salop is intrinsically different from the uncertainty regarding quality expressed by Akerlof (1970), Grossman & Stiglitz (1976) and by Stiglitz (1987), since a rupture with the neoclassical economy is implemented, as the imperfections of information systematically correspond to asymmetries which are incompatible with Pareto's optimum. Therefore, there is no epistemological continuity between Stigler, Akerlof and Stiglitz; the beginning of the epistemological rupture occurs with Salop's studies. These alternative approaches allow the inclusion of new and important components in the models, making economic analyzes more robust and realistic, in which information becomes a fundamental component to be treated by economic theory.

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[18] In certain cases – as in the efficiency wage theory, for example – the quality of the service depends on the agents' behavior; this behavior depends, in turn, on prices.

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