



**INNOVE CENTER**  
Economie & Développement

**Working Paper**

**DT/08/2022**

**Essay on a theory of exchange and prices formation  
in the market for goods and services**

***Adama Zerbo***

*Economist, PhD  
Engineer Statistician Economist,  
InnoVe Center*

[www.innoVe.center](http://www.innoVe.center)

[de@innoVe.center](mailto:de@innoVe.center)

[adamazerbo@yahoo.fr](mailto:adamazerbo@yahoo.fr)

# Essay on a theory of exchange and prices formation in the market for goods and services

by

**Adama Zerbo<sup>1</sup>**

*Economist, PhD*

## **Abstract:**

This paper aimed to propose a theory of exchange and the formation of the prices of goods and services in any market. The theoretical essay is based on the postulate of the general theory of the firm according to which the company operates based on the compromise between the stakeholders. Thus, the process of the exchange is a process of compromise between the producer/seller and the buyer about their purposes: (i) the profit margin unit, (ii) the volume of the transaction and (iii) the economy that the buyer desires to realize on his maximum willingness-to-spend in the exchange. The mutually advantageous transaction is the solution of the maximization of the exchange compromise function, under the constraint of the maximum willingness-to-spend of the buyer. Several lessons have been highlighted. First, the compromise process will not result in a sale agreement if there is an incompatibility of the capacitive desires of stakeholders with respect to the price or quantity of the good. On the other hand, if there is a compatibility of the capacitive desires of the stakeholders, the intermediate stages of the process of the exchange and the formation of the prices consist of alternate offers of the stakeholders which converge towards the mutually advantageous transaction, by confrontation of their capacitive desires. Second, the mutually advantageous transaction is such that: (i) the seller's capacitive desire to earn an additional unit on the profit margin unit is equal to the buyer's capacitive desire to save on the quantity of the good purchased and (ii) the seller's capacitive desire to increase the volume of the transaction by an additional unit is equal to the buyer's capacitive desire to save on the price of the good. Third, if the compromise function of the exchange is a Cobb-Douglas function, then: (i) the price of the traded good is proportional to the ratio between the amount of the buyer's maximum willingness-to-spend and the volume of the transaction ; (ii) a producer/seller can realize a higher and higher profit margin unit, provided that the desirability of the product is higher and higher; it is the whole challenge of the big and expensive advertising campaigns carried out continuously by companies on their products.

## **Résumé : Essai d'une Théorie de l'échange et de la formation des prix sur le marché des biens et services**

Ce papier s'est fixé pour objectif de proposer une théorie de l'échange et de la formation des prix des biens et services sur des marchés quelconques. L'essai théorique développé s'est basé sur le postulat de la théorie générale de la firme selon lequel l'entreprise fonctionne sur la base du compromis entre les parties prenantes. Ainsi, le processus de l'échange est un processus de compromis entre le producteur/vendeur et l'acheteur portant sur leurs objectifs : (i) la marge unitaire, (ii) le volume de la transaction et (iii) l'économie que l'acheteur désire réaliser sur sa volonté maximale à dépenser dans l'échange. La transaction mutuellement avantageuse est solution de la maximisation de la fonction de compromis de l'échange, sous contrainte de la volonté maximale à dépenser de l'acheteur. Plusieurs enseignements ont été mis en évidence. Premièrement, le processus de compromis de l'échange n'aboutira pas à un accord de vente s'il y a une incompatibilité des désirs capacitifs des parties prenantes par rapport au prix ou à la quantité du bien à échanger. En revanche, s'il y a une compatibilité des désirs capacitifs des parties prenantes, les étapes intermédiaires du processus de l'échange et de la formation des prix sont constituées d'offres alternées des parties prenantes qui convergent vers la transaction mutuellement avantageuse, par confrontation de leurs désirs capacitifs. Deuxièmement, la transaction mutuellement avantageuse est telle que : (i) le désir capacitif du vendeur de gagner une unité supplémentaire sur la marge unitaire est égal au désir capacitif de l'acheteur de réaliser des économies sur la quantité du bien acheté et (ii) le désir capacitif du vendeur d'augmenter le volume de la transaction d'une unité supplémentaire est égal au désir capacitif de l'acheteur de réaliser des économies sur le prix du bien. Troisièmement, si la fonction de compromis de l'échange est une fonction Cobb-Douglas, alors : (i) le prix unitaire du bien échangé est proportionnel au rapport entre le montant de la volonté maximale à dépenser de l'acheteur et le volume de la transaction ; (ii) un producteur/vendeur peut réaliser un taux de marge de plus en plus élevé, à condition que la désirabilité du produit soit de plus en plus élevée ; c'est tout le défi des grosses et onéreuses campagnes publicitaires exécutées continuellement par les entreprises sur leurs produits.

**Keywords:** Exchange, Prices.

**Mots clés :** échange, prix

**JEL classification:** D11, D21, P22

<sup>1</sup> All my gratitude to Mr. Karfa FAYAMA and Mr. Léon B. HIEN for their relevant comments on the draft of this paper.

---

---

## *Summary*

<b>1. Introduction</b>	<b>4</b>
<b>2. Literature review on price formation</b>	<b>4</b>
1. <i>Classic conceptions of price determination</i>	5
2. <i>Neoclassic conception of price determination</i>	5
3. <i>Determination of the general price level in the quantity theory of money</i>	6
4. <i>Post-Keynesian conceptions of prices</i>	6
5. <i>Lessons to be learned from the literature review</i>	7
<b>3. Essay of a theory of exchange and price formation</b>	<b>7</b>
1. <i>The postulate of the General Theory of the Firm</i>	7
2. <i>The compromise function of exchange</i>	8
3. <i>Mutually advantageous transaction for the stakeholders of the exchange</i>	11
4. <i>Identification of the different possible situations before a probable sales agreement</i>	13
a. Comparison of capacitive desires of stakeholders	13
b. Different possible situations in an exchange compromise process	14
5. <i>Intermediate stages of the process of exchange and price formation</i>	15
<b>4. A specification of the compromise function of exchange</b>	<b>18</b>
<b>5. Conclusion</b>	<b>20</b>
<i>Bibliographic references</i>	<b>22</b>

## 1. Introduction

How are prices formed in the market for goods and services? At first glance, this question may seem without scientific interest nowadays because at least three major economic theories have already dealt with it: the classical theory (Adam Smith, David Ricardo), the neoclassical theory (Léon Walras, Stanley Jevons, Francis Edgeworth ) and the quantity theory of money (Irving Fisher). However, these theories dealt with price determination and neglected the mode of price formation which, according to Barrère (2002), remains a black box. Indeed, if the study of price determination is limited to the factors that influence prices, the study of price formation consists in specifying the processes through which prices materialize, and therefore in introducing the actors who set or influence prices, their behavior, the revisions and changes that occur, the intermediate stages (Barrère 2002).

Thus, understanding the mode of price formation in the market for goods and services therefore has a scientific interest, but above all it has an economic and social interest. First, on a scientific level, elucidating the mode of price formation not only makes it possible to make theoretical advances, but also to offer modelers relevant instruments allowing them to better integrate price formation into their economic models and to improve the results of the simulations. From an economic point of view, understanding the mode of formation of the prices of goods and services would be a step forward for the business world in their marketing policy, since fixing the price of an emerging product entails significant risks for the company. On the social level, the policies of subsidies and/or levies (taxation) on prices, and the distribution of wealth in general, could be improved with more in-depth knowledge of how prices are formed.

In view of these multiple interests, this paper aims to deal with the mode of formation of the prices of goods and services. More specifically, it aims to provide a theoretical framework capable of identifying the processes through which exchange takes place and prices materialize between sellers and buyers, as well as their behavior. This paper is positioned as a continuation of the theoretical reflections undertaken on the firm which have made it possible to update a relevant and realistic theory on the behavior of the firm in the labor market and in the capital market (Zerbo A. 2016, 2018a , 2018b, Zerbo A. and Hien L. 2019). Thus, in accordance with the general theory of the firm, the company (here the producer/seller) is defined as an entity composed of several stakeholders (employer, employees, lenders, shareholders, suppliers and customers) who owns assets, contracts and promotes compromise in order to create wealth for the benefit of all stakeholders. Also, to better reflect reality, it is considered that stakeholders make choices that are intentionally rational, but inevitably limited, in particular because of the limits in their ability to access and process information, as well as the limits imposed by the institutional, legal, relational and social environment (Williamson 1975). In other words, it is not a question here of postulating for a specific type of market (perfect competition, monopoly or oligopoly) to develop the theory of exchange and price formation, but rather of developing a general theoretical framework of exchange and the formation of the prices of goods and services, from which situations of pure and perfect competition, monopoly or oligopoly can arise as special cases.

Before embarking on the essay of the theory of exchange and price formation, the first section of this paper reviews the literature ranging from basic theories of prices determination to recent post-Keynesian developments. The second section is devoted to the proposal of a new theory of exchange and prices formation, based on a deductive approach and optimization tools. The last section adopts a specification of the general theoretical framework proposed to draw more lessons from it.

## 2. Literature review on price formation

As indicated in the introduction, price theory is abundant on the determination of prices; it remains stingy about the formation of these prices. Three basic theories have dominated the literature relating to the determination of prices: the classical theory (Adam Smith, David Ricardo), the neo-classical theory

(Léon Walras, Stanley Jevons, Edgeworth) and the quantity theory of money. Alongside these basic theories, post-Keynesian approaches to price formation are developing.

### **1. *Classic conceptions of price determination***

For classical economists, exchange takes place in pure and perfect competition markets and the formation of prices is based on the distinction between the natural price and the market price. For Adam Smith, the natural price depends on rent, wages and profits; while the market price depends on the quantity of supply and the quantity of demand expressed at the natural price. For Ricardo, price formation obeys two laws (Martin 1982). The first law regulates natural prices independently of the market and the second law ensures market prices which, under the influence of supply and demand, can temporarily deviate from natural prices. Thus, for Ricardo, the price has three types of determinants: (i) the value, namely the quantity of socially necessary labor, (ii) the production process which makes it possible to transform the value into production price, (iii) the contingencies (fluctuations in demand) which makes it possible to move from the production price to the market price. Thus, in the Ricardian conception, the active role of supply and demand is excluded on the market price, the natural price being influenced by the laws which determine profits and wages. But, for Thomas Malthus, both the natural price and the market price are determined by what he calls "the great law of demand and supply", given the pure and perfect competition in the markets for goods and services (Malthus 1836, Martin 1982, Costabile 1983).

### **2. *Neoclassic conceptions of price determination***

Like their predecessors, neoclassical economists consider that exchanges of goods and services take place under conditions of pure and perfect competition; taken individually, the economic agents cannot influence either the quantities or the prices. But they abandon the distinction between the natural price and the market price in price formation. For them, prices result directly from the confrontation of global supply and demand in a framework of pure and perfect competition. These aggregate supply and demand results from the maximization of producer profit and consumer utility respectively, knowing that neither individual producers nor consumers have any influence on prices. The determinants of prices are therefore consumer preferences, income and production technologies. The Walrasian model of general equilibrium is the culmination of neoclassical theory of price determination.

In this Walrasian model, the confrontation of supply and demand causes the price adjustments that are necessary to obtain equilibrium. This confrontation is reduced to equations of equality between global supply and demand in the various markets, the resolution of which makes it possible to determine the relative price vector of all desirable goods exchanged in the economy. Thus ignored, the adjustment mechanism is neutral both in the determination of prices and quantities traded. It is as if the resolution of the system of equal supply and demand equations occurs before the start of any transactions between economic agents, which requires a highly centralized social organization. As a result, it must be recognized with the theoreticians of imbalances and information (Clower 1965 and 1967, Leijonhufvud 1968) that the Walrasian model could only shed light on the static functioning of perfectly centralized auction markets and where organizational mechanisms such as the auctioneer who provides almost perfect, free and instantaneous information.

Unlike Walras, Edgeworth conceives that the price results from a succession of transactions between economic agents. Thus, before obtaining the Walrasian equilibrium, these successive transactions give rise to haggling and differentiated prices according to the bargaining power of the co-contractors, as well as to real transfers of goods. In this conception, the price is a function, among other things, of the bargaining power of the economic agents at the time of the haggling and the transaction. Thus, a good can have differentiated prices depending on the individual and the transaction. Despite its realism, Edgeworth's conception was less successful than the Walrasian conception of exchange because it is more complex to represent and solve mathematically.

### 3. *Determination of the general price level in the quantity theory of money*

Based on Ricardo's quantity theory which relates to the relationship between the quantity of money, the quantity of goods and services exchanged and the level of prices, Irving Fischer has proposed an equation of exchanges (relation 1) which relates the money supply (M), the quantity of goods and services exchanged (Q) and the price level (P) through the velocity of circulation of money (V). The trade equation simply states that the total value of goods and services exchanged in an economy is equal to the money supply multiplied by its velocity of circulation (Warren 1911).

$$MV = PQ \quad (1)$$

As Tétinier (1943) points out, this relation makes it possible to calculate each factor of the equation as a function of the other three factors; it allows in particular, which is its main interest, knowing the quantity of money, the speed of circulation and the volume of transactions, to determine the level of prices. Thus, the general price level is necessarily given by relation (2).

$$P = V \frac{M}{Q} \quad (2)$$

But, as Irving Fisher points out, the exchange equation alone does not imply any causal relationship. It does not indicate whether prices are a simple result of the quantity of money, its velocity of circulation and the volume of transactions, or whether they can vary for causes of their own, bringing with them other factors (Tétinier 1943). Thus, the exchange equation cannot be interpreted as a relationship highlighting the process of price formation or its determinants.

### 4. *Post-Keynesian conceptions of prices*

Among the price theories succinctly presented above, Walrasian conception of price determination is relatively the most widely used because, perhaps, of the attractive and relatively simple character of its mathematical formalization and especially of the greater complexity of the others conceptions of prices such as Edgeworth's conception. However, given the lack of realism of the neoclassical model, some post-Keynesian approaches to price formation have been developed.

For post-Keynesians, prices are fixed before any transaction; they are not intended to balance supply and demand on the market (Tricou 2008). Because for them (Dallery, Eloire and Melmiès 2009), any entrepreneur who wishes to enter a market and engage in a transaction process with the aim of making sales must first announce a price. For some post-Keynesians (Lavoie 2004), prices result from a collectively conditioned construction. For them, companies observe and follow each other; a hierarchy is therefore established between leader companies and follower companies. The leaders freely set their prices, which allow them to generate a profit margin that fully satisfies them, given their constraints. Conversely, the follower companies, without having any other choice, align themselves with the prices of the leaders and are satisfied with the resulting profit margin, given their production costs.

So, according to post-Keynesians, the price is made up of two elements: the cost of production and the profit margin. This implies that price setting is conditioned by three types of interdependent relationships (Dallery, Eloire and Melmiès 2009): (i) a relationship with suppliers/employees that influences costs and profit margins through the bargaining power of the contractor; (ii) a relationship with consumers that depends on the positive or negative sanction of aggregate demand; (iii) a relationship with competitors that may be implicitly cooperative. In relation to this last point, White (1981, 2002) maintains that companies collectively construct the quality scale within which they distribute themselves in the appropriate price ranges.

Thus, in the heterodox conception, price formation is conditioned by mutually conflicting relationships between the stakeholders, the concrete resolution of which presupposes reaching a compromise between them (Dallery, Eloire and Melmiès 2009).

### ***5. Lessons to be learned from the literature review***

Classical and neoclassical theories of prices are essentially focused on the determination of prices. They are not concerned either with the process by which these prices are formed, or with the behavior of the players who set these prices. The post-Keynesians try to rectify the situation, but their developments on price formation remain at the embryonic and/or fragmentary stage.

However, the literature review on price theory provides some elements to begin the construction of a theory of exchange and price formation. First, we must recognize with Edgeworth the existence of haggling in economic transactions, as well as the existence of differentiated prices according to bargaining power of stakeholders of exchange. Then, there is unanimity that emerges on the fact that the level of supply in relation to demand plays a more or less important role in price formation. Finally, let us agree with the heterodox, the formation of prices is, among other things, conditioned by mutually conflicting relations between the stakeholders whose solution is compromise.

For the General Theory of the firm, the company operates on the basis of the compromise between the stakeholders so that each stakeholder feels satisfied in order to fully play his role and, thus, to ensure the performance of the company over time. The compromise process can be subdivided into several phases: the primary compromise (employer - employees), the capital compromise (manager - shareholders - lenders), the supply compromise (company - suppliers) and the exchange compromise (company - customers). The first two phases of the compromise process have been treated and have provided new theoretical results, some of which have been the subject of empirical evidence (see Zerbo, A. 2018a, 2018c, 2022). Thoughts on the supply compromise are forthcoming, while the exchange compromise is the subject of this paper.

## **3. Essay of a theory of exchange and price formation**

The elaboration of the theory of exchange and price formation takes place in several phases. First, the postulate of this theory is further clarified. Then the stakeholder objective-function is defined, and its properties are described. Third, the mutually advantageous transaction is inferred from the compromise program of the exchange and analyzed. Fourth, the possible situations of the relations between the stakeholders before a possible sale agreement are identified. Finally, the intermediate stages of the process of exchange and price formation are apprehended and analyzed.

### ***1. The postulate of the General Theory of the Firm***

The general theory of the firm is based on the idea according to which the company is an entity, composed of the employer or the team of managers, the workers and possibly the shareholders, which holds assets, signs contracts, develops and manages specific know-how, promotes compromise between stakeholders, produces goods and/or services to generate income which is distributed to said parties. The company also maintains privileged relationships with banking and/or financial institutions, suppliers and its customers to guarantee its performance over the long term.

Thus, contrary to the neoclassical conception, the company does not only serve the interests of the employer, namely the maximization of profit. It aims to satisfy all stakeholders so that it performs sustainably in its creating value function. Although opposed, the interests of the stakeholders are interdependent: each direct stakeholder in the company (employer, employees, shareholders and lenders) has an interest in ensuring that the other parties feel satisfied so that their own interests are preserved. The same is true for indirect stakeholders (suppliers and customers). For example, Coca-Cola customers wish to have quality products at lower prices, but they also have an interest in Coca-Cola

company being able to generate profits to avoid filing for bankruptcy synonymous with the disappearance of their favorite drink. As for all the direct stakeholders of Coca-Cola company, as well as its suppliers, everyone has an interest in ensuring that customers feel satisfied. Otherwise, sales will fall sharply, which could lead to lower profits or even losses, lower orders from suppliers, layoffs of staff, lower wages, inability to honor bank commitments and distribute dividends to shareholders.

As a result, the interests of the company's stakeholders are certainly a priori opposed, but interdependent. These mutually conflicting relationships force the company to operate from compromises between the stakeholders (negotiations, agreements, contracts, conventions, customer loyalty cards). As Zerbo (2016, 2018a, 2018b) points out, the compromise does not exclude the adoption of strategic or opportunistic behaviors by the stakeholders: information asymmetries, imbalance of bargaining power between the stakeholders favor such behaviors. Also, because of the changes that may occur in the relationships between the stakeholders, particularly at the institutional and informational level, the compromise is dynamic/changing.

Thus, the general theory of the firm considers that the firm is characterized by an implicit function of compromise, namely a function of collective utility of the stakeholders, which it seeks to optimize so that each stakeholder feels satisfied. This is in line with Williamson's principle of limited rationality (Williamson 1975) according to which actors make choices that are intentionally rational, but inevitably limited because of limits in their ability to access and process information, as well as limits imposed by the institutional, legal, relational and social environment.

Like a state of compromise, the function of compromise is characterized by the state of the institutional and legal, informational, economic, social and relational environment in which the company operates. The measurable purposes of the stakeholders constitute the arguments of the compromise function. Thus, gross profit, wage rate and employment are, among others, the compromise function arguments considered in the primary compromise. The retained earnings, the volume of investment, the capital return rate, interest rate, financial guarantees are the arguments considered in the capital compromise. With regard to the compromise of the exchange, the profit margin of the seller, the volume of goods and services exchanged and the savings made by the buyer on the transaction carried out are, among others, the arguments of the compromise function to be consider.

Also, knowing that the principle of negotiation is to converge the positions of the stakeholders, intermediate solutions are preferred over extreme solutions, which implies that the set of compromise possibilities is convex, i.e. the compromise function of the firm is concave.

## ***2. The compromise function of exchange***

The compromise process of exchange takes place in the market for goods and services between producers/sellers and buyers. Contrary to the neoclassical approach, the market for goods and services is characterized by many imperfections that influence the behavior and, thus, the decisions of the stakeholders involved in the exchange.

First, like other markets, the market for goods and services is characterized by imperfections/asymmetries of information on production costs, prices and quantities of supply and demand for a good. On the one hand, buyers do not have the ability to know exactly the production costs, prices and supplies of all producers/sellers for a given good. On the other hand, producers/sellers also lack the ability to know exactly the level of customer demand, their willingness-to-pay for a given good, and the costs and prices of competitors. Also, if we can admit that producers/sellers have relatively more capacities than buyers to carry out calculations/studies to act rationally, we must recognize that their capacities to make rational choices are more limited than “superhuman capacities” of the neoclassical economic agent who would be able to know everything, to calculate everything instantaneously and to anticipate everything and, thus, to make “purely rational choices”.



Second, the market for goods and services is characterized by: (i) the presence of legal institutions and legal texts that regulate exchange/competition and regulate the prices and/or profit margins of certain goods, (ii) the presence of consumer associations and professional organizations of producers/sellers aiming to defend the interests of their members, (iii) the existence of formal or informal, tacit or explicit social norms on exchange, such as the social conception of usury in trade (usury profit margin), the social relationship (predation or altruism) that producers/sellers have with their social environment. Also, the price of certain goods is administered in several economies of the world by the Government, particularly in the sectors of energy and water, staple foods.

Third, the market for goods and services is also characterized by the possibility of bargaining over prices and quantities and/or by the formalization of loyalty relationships that give rise to price reductions that can take various forms. Bargaining can be explicit/direct or implicit/indirect. Direct bargaining in the market for goods and services is when the buyer engages in direct negotiation with the seller on the price and/or quantity of a good that he wishes to buy. While implicit or indirect bargaining in the market for goods and services is the fact, for example, that buyers, despite having the means, are relatively more reluctant to buy a good (in normal quantities) because they believe that its price is high; therefore, sellers revise the price of that good downwards in order to increase sales. Another implicit or indirect bargaining technique is the fact that, for certain products, producers/sellers display decreasing unit prices with the quantity purchased. For example (i) one unit of the good at \$10, two units at \$16 and three units at \$21; (ii) one ticket of the show at \$50 against \$75 per couple; (iii) or even advertisements of the type: 3 at the price of 2. These are modern techniques of haggling at the initiative of the seller who indirectly tells the potential buyer that he has the possibility of benefiting from a reduction in unit price of the good, if he buys a larger quantity. On the other hand, market research in general and consumer willingness-to-pay research, as well as test-price approaches to a new product are anticipatory bargaining techniques that allow the seller to set the price of a product, considering the haggling that the buyer could do if he had the opportunity.

In such a context of the market for goods and services, the exchange therefore takes place based on the compromise between the producers/sellers and the buyers. In a given transaction, the seller wishes to sell a quantity  $Q$  of the good desired by the buyer and releases a profit margin unit  $m$ ; while the buyer wishes to acquire a certain quantity  $Q$  of this good and make savings  $S$  in the transaction compared to the amount  $R$  of his maximum willingness-to-spend for the purchase of this good. More specifically, the buyer, before committing to the transaction of a good, sets a maximum budget  $R$  not to be exceeded for the purchase of this good; but he wishes to acquire the desired quantity of this good and to make the maximum possible savings on this budget. Obviously, there is an asymmetry of information between the seller and the buyer: the buyer knows exactly neither the profit margin unit wanted by the seller nor the unit cost of the good; the seller also does not know the amount of the buyer's maximum willingness-to-spend nor the amount of savings he wishes to make.

Then, for the exchange of a given good, the relationship between the seller and the buyer can be apprehended by an implicit compromise function (denoted  $V$ ) which depends on the profit margin unit  $m$ , the quantity  $Q$  of the good exchanged and the amount  $S$  of the savings that the buyer wishes to make in the transaction, as expressed by relation (3).

$$V = V(m ; Q ; S) \quad (3)$$

The structure of the compromise function of the exchange depends on (i) the legal, institutional, economic and social environment in which the transaction takes place, (ii) the social and human capacities and characteristics of the buyer and the seller, as well as (iii) the characteristics of the good. To illustrate this, we consider (for simplicity) that the compromise function of the exchange of a good is of the Cobb-Douglas form as given by relation (4) where  $\alpha$ ,  $\beta$  and  $\delta$  are positive parameters and less than 1.

$$V(m ; Q ; S) = m^\alpha Q^\beta S^\delta \quad (4)$$

The parameter  $\alpha$  corresponds to the elasticity of the seller's preference/capacity with respect to the profit margin unit. This elasticity is influenced by the factors mentioned above. Indeed, if, for example, the institutional environment is characterized by a strong asymmetry of information on profit margins to the detriment of buyers and/or by legal texts which favor high profit margin units and/or the seller has a strong spirit of "predation or greed" and/or the unit cost of the product is high and/or the good is rare and/or the seller benefits from a monopoly situation for the good (higher bargaining power), then the seller's desire and power to make more profit margin will be relatively higher. Which means that, for a given transaction vector  $(m, Q, S)$ , the derivative of the compromise function with respect to the profit margin unit given by relation (5) will be relatively higher, i.e. the parameter  $\alpha$  will be higher.

$$\frac{\partial V}{\partial m} = \alpha \frac{V}{m} \quad (5)$$

Conversely, if, for example, the institutional environment allows good dissemination of information on prices and profit margin units and/or there are legal texts that limit profit margin units on the good and/or the seller has a spirit of altruism towards the buyer and/or consumer associations are powerful so that, through their actions, they manage to limit the profit margin units and/or the supply of the good is abundant and/or competition between sellers is relatively strong for this good, then the seller's desire and power to make more profit margin unit will be relatively lower. In other words, the derivative of the compromise function with respect to the profit margin unit given by relation (5) will be relatively lower, i.e. the parameter  $\alpha$  will be lower. At the limit, in a situation of pure and perfect competition (neoclassical hypothesis), the parameter  $\alpha$  would be equal to 0.

About the parameter  $\beta$ , it measures the desirability of the good concerned by the exchange. For example, if the good is strongly desired in general and by the buyer in particular, the buyer's desire to acquire an additional quantity and the seller's desire to sell an additional quantity will be relatively higher. That is, for a given transaction vector  $(m, Q, S)$ , the more the good is desired, the higher the derivative of the compromise function with respect to the quantity of good given by relation (6) will be. In other words, the higher the degree of desirability of the good, the higher the parameter  $\beta$  will be; the lower the level of desirability of the good, the lower the parameter  $\beta$  will be. At the limit, for an undesirable good, the parameter  $\beta$  would be equal to 0.<sup>2</sup>

$$\frac{\partial V}{\partial Q} = \beta \frac{V}{Q} \quad (6)$$

Advertising and design of the product are factors that aim to increase the level of desirability of the product, namely the parameter  $\beta$ . It would be interesting to see in the rest of this reflection if from this parameter of desirability, we can identify the reason why producers/sellers put so much effort into the advertising and the design of their products.

Finally, if the buyer is stingy enough and/or his uncertainties about the future are such that he remains fairly prudent about spending and/or his bargaining power is relatively high, then his desire and power to make savings in relation to a given transaction will be relatively higher. That is, the derivative of the compromise function of the exchange with respect to the amount  $S$  of the savings made in the transaction (relation 7) will be relatively higher for a given transaction vector  $(m, Q, S)$ . In other words, the more the buyer is stingy or cautious in relation to his expenses, the higher the parameter  $\delta$  of the compromise function will be relatively high. Conversely, the more the buyer has an expansive behavior in terms of spending, the lower the parameter  $\delta$  of the compromise function will be.

$$\frac{\partial V}{\partial S} = \delta \frac{V}{S} \quad (7)$$

<sup>2</sup>We will see later that for an undesirable good (i.e.  $\beta = 0$ ), there is no transaction, the seller's profit margin unit is equal to  $-Cu$  and the buyer's economy is equal to  $R$ .

In summary, with this specification of the compromise function, it emerges that in general, the structure of a compromise function depends, among other things, on (i) the institutional, legal, informational, economic and social environment, (ii) the state of competition, (iii) the desirability of the good, (iv) the relation to the money of the buyer and the seller, as well as (v) the relative bargaining power of stakeholders.

The derivative of the compromise function with respect to the profit margin unit  $m$ , to the transaction volume  $Q$  and to the savings  $S$  desired by the buyer translate respectively both the desire and the power (i) of the seller to increase the additional unit of the profit margin unit, (ii) the seller to increase the transaction volume by one additional unit and (iii) the buyer to increase his savings on the transaction by one additional unit. Thus, in the following analysis, this desire coupled with power is designated by the terms “capacitive desire” and “capacitive preference”.

### 3. *Mutually advantageous transaction for the stakeholders of the exchange*

In relation to the exchange they are trying to conclude, the seller and the buyer come to an agreement only if they are mutually satisfied. Therefore, the mutually advantageous transaction is the result of the maximization of the compromise function of exchange with respect to the profit margin unit  $m$ , the quantity  $Q$  of the good and the amount  $S$  of the savings to be made, under willingness-to-spend constraint of the buyer. Let  $C_u$  be the unit cost of the good, then the compromise program is given by relation (8). As a reminder, given that the principle of bargaining is to converge positions, intermediate solutions are preferred by the stakeholders over extreme solutions. This implies that the set of possible compromise points is convex and, thus, the compromise function of the exchange is concave. This characteristic of the compromise function guarantees the mathematical existence of an optimal compromise point which may or may not be within reach of the stakeholders.

$$\begin{cases} \text{Max}_{m; Q; S} V(m; Q; S) \\ u/c \quad (C_u + m)Q + S \leq R \end{cases} \quad (8)$$

The first-order conditions of this compromise program are given by the system of equations (9) where  $p$  denotes the unit price of the good and is equal to  $C_u + m$ .

$$\begin{cases} \frac{\partial V}{\partial m} = Q \frac{\partial V}{\partial S} \\ \frac{\partial V}{\partial Q} = p \frac{\partial V}{\partial S} \\ pQ + S = R \end{cases} \quad (9)$$

The first-order conditions (system of equations 9) indicate that the mutually advantageous transaction ( $m^*$ ,  $Q^*$ ,  $S^*$ ) is such that, on the one hand, the capacitive desire of the seller to earn an additional unit on the profit margin unit is equal to the capacitive desire of the buyer to save on the volume of the transaction (1<sup>st</sup> equation) and, on the other hand, the capacitive desire of the seller to increase the volume of the transaction by an additional unit is equal to the capacitive desire of the buyer to save on the price of the good (2<sup>nd</sup> equation). The last equation simply indicates the saturation of the buyer's maximum willingness-to-spend constraint.

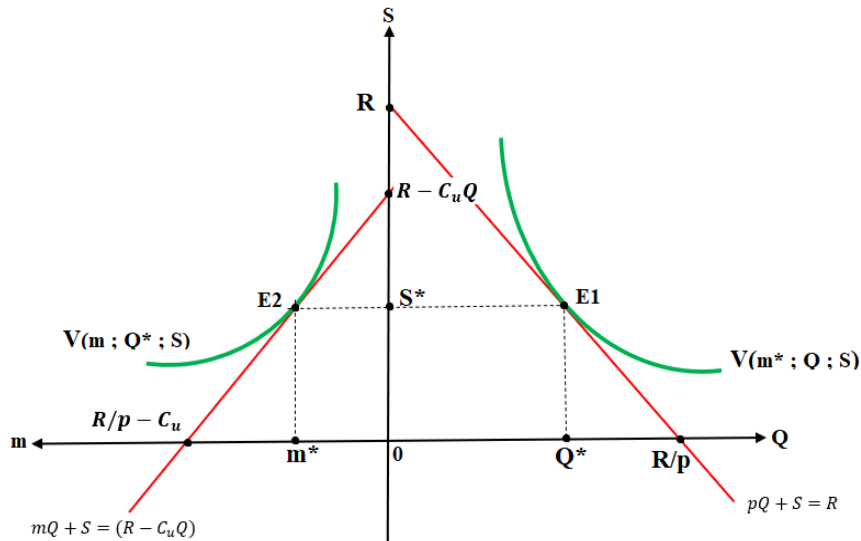
The first-order conditions of the compromise program of exchange (system of equations 9) can be rewritten in a form that brings out the marginal rates of substitution (MRS) of savings  $S$  that the buyer wishes to realize in the exchange with respect to profit margin unit  $m$  and transaction volume  $Q$  respectively (system of equations 10).

Presented in this way, the first-order conditions of the compromise process of exchange indicate that the mutually beneficial transaction vector  $(m^*; Q^*; S^*)$  corresponds to the point in space  $(m; Q; S)$  where the indifference surface of the exchange is tangent to the constraint surface of the buyer's maximum willingness-to-spend.<sup>3</sup> Given that the representations are more complex in a space with more than two dimensions, we consider two juxtaposed planes in the rest of the analysis, namely the planes  $(Q; S)$  and  $(m; S)$ .<sup>4</sup>

$$\begin{cases} MRS_{S/m} = Q \\ MRS_{S/Q} = p \\ pQ + S = R \end{cases} \quad (10)$$

Considering these plans, the first-order conditions of the system of equations (10) point out that the mutually advantageous transaction  $(m^*; Q^*; S^*)$  corresponds to the points of tangency of the buyer's constraint line with the indifference curve of exchange respectively in the  $(Q; S)$  and  $(m; S)$  planes, as shown in Graph 1.

**Graph 1: Mutually beneficial transaction for seller and buyer.**



Source: This Paper.

On this graph 1, E1 and E2 are the points of tangency of the constraint line of the buyer with respectively the indifference curve of the exchange in the plane  $(Q; S)$  and the indifference curve of the exchange in the plane  $(m; S)$ . Thus, given the compromise function of the exchange of the stakeholders and the maximum willingness-to-spend of the buyer in the exchange, the points E1 and E2 correspond to the mutually advantageous situation for both parties.

Before obtaining a possible mutually advantageous transaction vector  $(m^*; Q^*; S^*)$ , several situations may arise. Since in fact, not all haggling situations result in a sales agreement, it is reasonable to think that there are situations for which there cannot be an agreement between the seller and the buyer. So, to understand the processes through which exchange and price formation materialize, we must first identify all possible situations preceding a possible sale agreement.

<sup>3</sup> Like an indifference curve in a plane, the indifference surface is the set of points in space for which the utility is constant and equal to a given value. Also, the buyer's constraint surface corresponds to the set of points for which  $mQ + C_u Q + S = R$ .

<sup>4</sup> The choice of these two planes is imposed by the MRS of the system of equations 10.

#### 4. Identification of the different possible situations before a probable sales agreement

The first-order conditions relate to the result of the process of compromise between the seller and his client, namely the point  $(m^*; Q^*; S^*)$ . To identify the process that led to this result, we first examine the cases where the first two equations of the first-order conditions (system of equations 9) are not verified, which amounts to comparing the capacitive desires of the stakeholders. Then, we cross-reference these cases to identify the situations that can lead to a sales agreement and those that cannot lead to an agreement.

##### a. Comparison of capacitive desires of stakeholders

Thus, in the first case, we consider that the capacitive desire of the seller to earn an additional unit on the profit margin unit is not equal to the capacitive desire of his customer to save on the volume of the transaction. In the second case, we consider that the capacitive desire of the seller to increase the volume of the transaction by an additional unit is different from the capacitive desire of the buyer to save on the price of the good. Note that for each of these cases, there are two situations: the capacitive desire of the seller can be higher or lower than that of the buyer.

*Case 1: If the seller's capacitive desire for profit margin is different from the buyer's capacitive desire for transaction volume*

In this first case we consider that the capacitive desire of the seller to gain an additional unit on the profit margin unit is different from the capacitive desire of the buyer to save on the volume of the transaction, namely  $\frac{\partial V}{\partial m} \neq Q \frac{\partial V}{\partial S}$ . In this case, two sub-cases are possible: either the capacitive desire of the seller is higher, or it is lower than that of the buyer.

First, consider that  $\frac{\partial V}{\partial m} > Q \frac{\partial V}{\partial S}$  for a transaction vector  $(m, Q, S)$ . It means that the price and transaction volume offers made by the buyer to the seller are such that the seller's capacitive desire to earn an additional unit on the profit margin unit is higher than the buyer's capacitive desire to make savings on transaction volume. This means that for this transaction vector  $(m, Q, S)$ , the seller is relatively less satisfied than the buyer. This situation does not therefore correspond to a balance because the seller will not agree to conclude a sales agreement in these conditions. He will ask his client to increase his offers of price  $p$  and/or desired quantity  $Q$ . The compromise function being concave,  $\frac{\partial V}{\partial m}$  decreases when the buyer increases his price offer  $p$  ( $p = C_{v+m}$ ) and  $Q \frac{\partial V}{\partial S}$  increases when the desired quantity  $Q$  increases. The seller will refuse the exchange and will request an increase of the offers of price and/or quantity of his customer as long as he is not satisfied, namely if:  $\frac{\partial V}{\partial m} > Q \frac{\partial V}{\partial S}$ . He will only accept the exchange when he feels as satisfied as the buyer.

Now suppose that  $Q \frac{\partial V}{\partial S} > \frac{\partial V}{\partial m}$  for a transaction vector  $(m, Q, S)$ . It means that the price and/or quantity offers made by the seller to his customer are such that the buyer's capacitive desire to save on the quantity of the good is higher than the seller's capacitive desire to earn an additional unit on the profit margin unit. This means that the buyer is relatively less satisfied than the seller. This situation does not correspond to an equilibrium because the buyer will not agree to conclude a purchase agreement in these conditions. He will ask the seller to lower his price offer and/or he will decide to reduce the quantity to be purchased. The compromise function being concave,  $\frac{\partial V}{\partial m}$  increases when the seller offers lower prices and  $Q \frac{\partial V}{\partial S}$  decreases when the desired quantity decreases. The buyer will refuse to enter into a purchase agreement until he is satisfied, namely if:  $Q \frac{\partial V}{\partial S} > \frac{\partial V}{\partial m}$ . He will only agree to make the exchange if he feels as satisfied as the seller.

*Case 2: If the seller's capacitive desire for transaction volume is different from the buyer's capacitive desire for price*

In this second case, the capacitive desire of the seller to increase the volume of the transaction by an additional unit is considered to be different from the capacitive desire of the buyer to save on the price, namely  $\frac{\partial V}{\partial Q} \neq p \frac{\partial V}{\partial S}$ . Here too, two sub-cases are possible: either the capacitive desire of the seller is higher, or it is lower than that of the buyer.

First, suppose that  $\frac{\partial V}{\partial Q} > p \frac{\partial V}{\partial S}$  for a transaction vector (m, Q, S). This means that the price and transaction volume offers made by the buyer to the seller are such that the capacitive desire of the seller to increase the volume of the transaction by an additional unit is higher than the capacitive desire of the buyer to save on the price. This means that for this transaction vector (m, Q, S), the seller is relatively less satisfied than the buyer. This situation does not therefore correspond to a balance because the seller will not agree to conclude a sales agreement under these conditions. He will ask his client to increase his offers of price p and/or desired quantity Q. The compromise function being concave,  $\frac{\partial V}{\partial Q}$  decreases when the client increases his offer of quantity Q and  $p \frac{\partial V}{\partial S}$  increases when the customer increases his price offer p. The seller will refuse the exchange and will request an increase of the offers of price and/or quantity of his customer as long as he is not satisfied, namely if:  $\frac{\partial V}{\partial Q} > p \frac{\partial V}{\partial S}$ . He will only accept the exchange when he feels as satisfied as the buyer.

Now suppose that  $p \frac{\partial V}{\partial S} > \frac{\partial V}{\partial Q}$  for a transaction vector (m, Q, S). This means that the price and/or quantity offers made by the seller to his customer are such that the buyer's capacitive desire to save on the price is higher than the seller's capacitive desire to increase the volume of the transaction. This means that the buyer is relatively less satisfied than the seller. This situation does not correspond to an equilibrium because the buyer will not agree to conclude a purchase agreement in these conditions. He will ask the seller to lower his price offer and/or he will decide to reduce the quantity to be purchased. The compromise function being concave,  $\frac{\partial V}{\partial Q}$  increases when the buyer reduces the quantity of the good and  $p \frac{\partial V}{\partial S}$  decreases when the seller offers lower prices to the customer. The buyer will refuse to enter into a purchase agreement until he is satisfied, namely if:  $p \frac{\partial V}{\partial S} > \frac{\partial V}{\partial Q}$ . He will only agree to make the exchange if he feels as satisfied as the seller.

***b. Different possible situations in an exchange compromise process***

The analysis of the cases above shows that before the conclusion of a mutually advantageous sales agreement, several situations, corresponding to the intersection of the four analyzed sub-cases, may arise during the compromise process. The different possible situations of an exchange compromise process are summarized in the cross table below (Table 1).

Table 1 shows that the negotiation process will continue with the possibility of reaching a sales agreement if and only if one of the stakeholders of the exchange is relatively less satisfied with the offers of both price and quantity than the other stakeholder, i.e. if the capacitive desires of one in relation to the price and quantity offered are higher than those of the other.

Table 1: The different possible situations of an exchange compromise process

	$\frac{\partial V}{\partial m} > Q \frac{\partial V}{\partial S}$	$Q \frac{\partial V}{\partial S} > \frac{\partial V}{\partial m}$
$\frac{\partial V}{\partial Q} > p \frac{\partial V}{\partial S}$	<p>The buyer finds more satisfaction with the price and volume of the transaction offered, while the seller is not satisfied with these offers.</p> <p>The capacitive desires of the seller are relatively higher than those of the buyer. Then, <b>the negotiation will continue and may lead to a sales agreement.</b></p>	<p>Both the seller and the buyer find more satisfaction with the price, but they are both dissatisfied with the volume of the transaction (at this price, the buyer wants to reduce the quantity to buy, while the seller wants the quantity purchased to be higher).</p> <p>Then, <b>the negotiation will stop if the buyer refuses to adjust his price offer upwards. There is no possibility of reaching a sales agreement.</b></p>
$p \frac{\partial V}{\partial S} > \frac{\partial V}{\partial Q}$	<p>Both the seller and the buyer are more satisfied with the volume of the transaction, but they are both dissatisfied with the price (the buyer finds the price too high, while for the seller, the resulting margin does not satisfy him).</p> <p>Then, <b>the negotiation will stop if the upward adjustment of the transaction volume is not an option. There is no possibility of reaching a sales agreement.</b></p>	<p>The seller finds more satisfaction with the price and volume of the transaction, while the buyer is not satisfied with these offers.</p> <p>The capacitive desires of the buyer are relatively higher than those of the seller. Then, <b>the negotiation will continue and may lead to a sales agreement.</b></p>

Source: This Paper.

Conversely, the negotiation process will stop without the possibility of concluding a sale agreement if both stakeholders are simultaneously dissatisfied with the sale price (respectively with respect to the quantity to be exchanged) and the buyer refuses to adjust upwards the quantity of the good to be purchased (respectively his price offer). In these cases, there is an incompatibility of the capacitive desires of the seller and the buyer. This leads us to specify in the definition below the notion of “incompatibility of the capacitive desires of the stakeholders of the exchange”.

**Definition 1:** Let be a transaction vector (m, Q, S). There is an incompatibility of the capacitive desires of the stakeholders of the exchange with respect to the price if we have:  $\frac{\partial V}{\partial m} > Q \frac{\partial V}{\partial S}$  and  $p \frac{\partial V}{\partial S} > \frac{\partial V}{\partial Q}$ . There is an incompatibility of the capacitive desires of the stakeholders of the exchange with respect to the quantity to be exchanged if we have:  $\frac{\partial V}{\partial m} < Q \frac{\partial V}{\partial S}$  and  $p \frac{\partial V}{\partial S} < \frac{\partial V}{\partial Q}$ .

### 5. Intermediate stages of the process of exchange and price formation

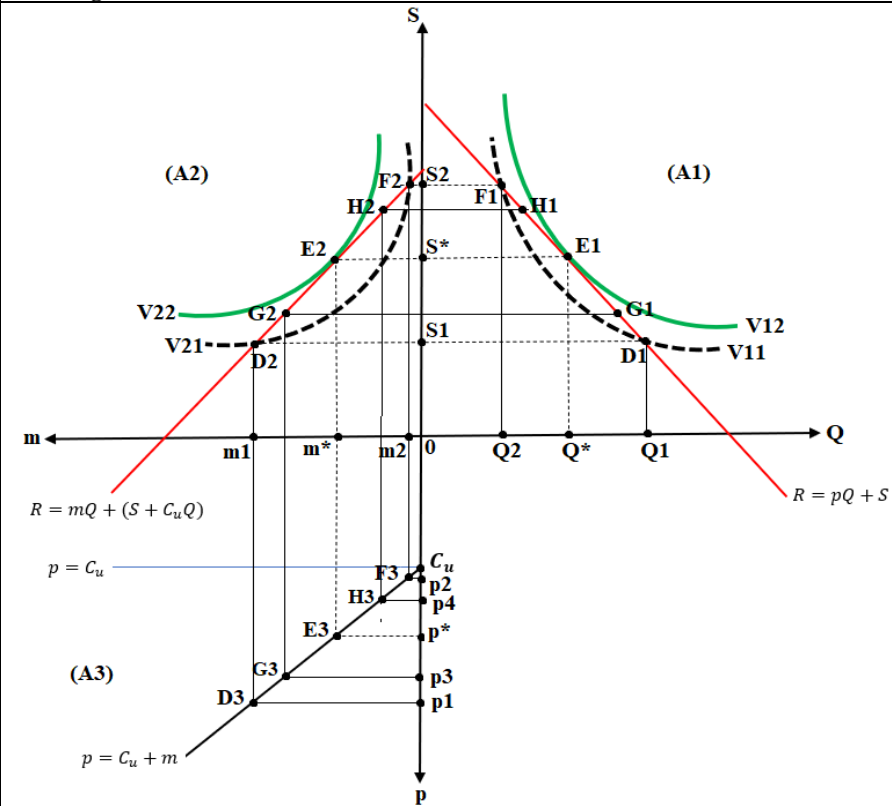
The analysis of the intermediate stages uses the graphical method based on the results of the two previous subsections, in particular the system of equations (10). Recall that these equations indicate that the sales agreement corresponds, on the one hand, to the point of tangency of the buyer's constraint line with the compromise indifference curve of the exchange in the plane (m; S) and, on the other hand, at the point of tangency of the buyer's constraint line with the compromise indifference curve in the plane (Q; S). Thus, we represent these two situations in the two juxtaposed planes, and we add a third plane (m; p) which allows us to deduce the unit price from the profit margin unit (graphs 2).

Graph 2a shows: (i) two compromise indifference curves in the plane (Q; S), denoted V11 and V12 respectively, (ii) two other compromise indifference curves exchange in the plane (m; S), denoted V21 and V22, as well as the buyer's constraint line in the two planes; (iii) the line giving the price as a function of the profit margin unit in the plane (m; p). Also, graph 2a presents five different situations corresponding respectively to the triplets of points (D1; D2; D3), (E1; E2; E3), (F1; F2; F3), (G1; G2; G3) and (H1; H2; H3).

Before starting the analysis of the stages, we point out that during the haggling between the seller and the buyer, the offers of a stakeholder to his counterpart correspond to a point of intersection of an indifference curve and buyer's willingness-to-spend constraint line. However, each stakeholder makes the most advantageous offer for him considering his previous offer which was refused by his counterpart.

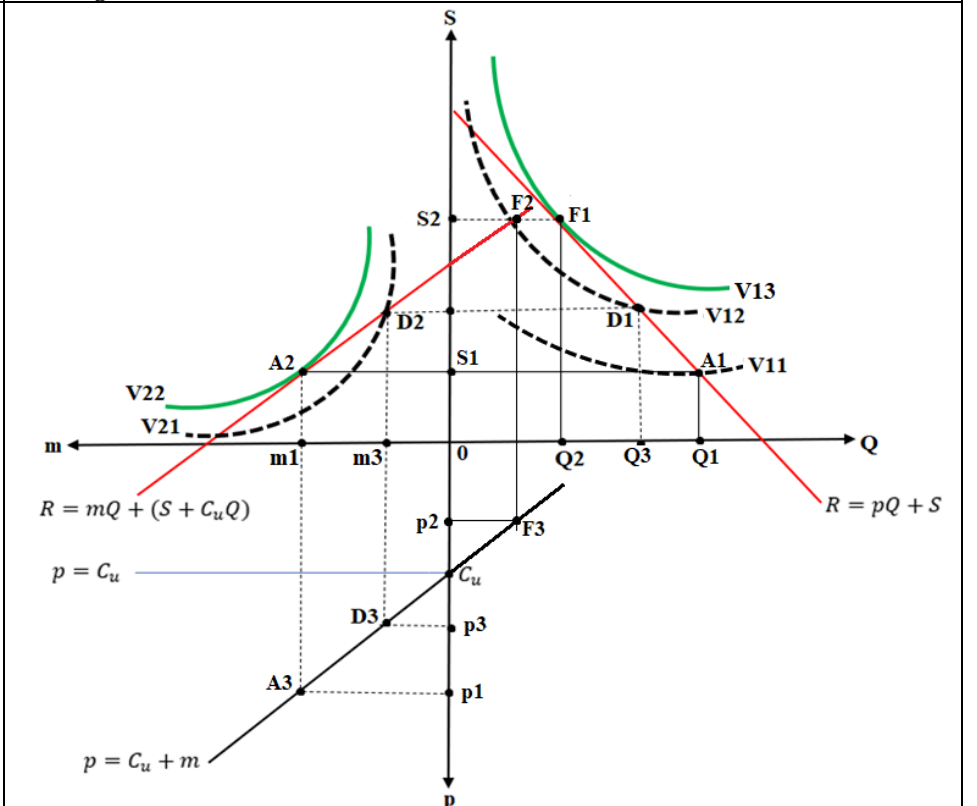
**Graphics 2: Process of exchange and price formation**

**Graph 2a: Case of compatibility of the capacitive desires of the stakeholders of exchange**



Source: This Paper.

**Graph 2b: Case of incompatibility of the capacitive desires of the stakeholders of exchange**



Source: This Paper.



In this graph 2a, we therefore consider that the exchange process begins with the seller's transaction offer ( $m_1; Q_1; S_1$ ). This transaction offer corresponds to the triplet of points ( $D_1; D_2; D_3$ ) on graph 2a. At point  $D_1$  in the plane ( $Q; S$ ), the indifference curve slope (MRS) is less than the slope of the buyer's constraint line, namely  $p$ ; which means that the capacitive desire of the buyer to save on the price is relatively higher than the capacitive desire of the seller to increase the volume of the transaction. Also, at point  $D_2$  in the plane ( $m; S$ ), the indifference curve slope (MRS) is less than the slope of the buyer's constraint line, namely  $Q$ ; which means that the capacitive desire of the buyer to save on the quantity of the good to be purchased is relatively higher than the capacitive desire of the seller to gain an additional unit on the profit margin. Thus, the buyer is less satisfied than the seller with respect to the transaction offer ( $m_1; Q_1; S_1$ ) made by the seller because the price  $p_1$  is relatively high (see quadrant (A3) of graph 2a). Then, the buyer will not accept the seller's offer; he will ask the seller for a price reduction and/or decide to reduce the quantity to be purchased, by making an offer to the seller.

The buyer will make a transaction offer that gives him more satisfaction, namely above the points of tangency of the indifference curves with the constraint line (above  $E_1$  and  $E_2$ ). Suppose then that the buyer's offer is the transaction vector ( $m_2; Q_2; S_2$ ) in graph 2a, corresponding to the triplet of points ( $F_1; F_2; F_3$ ). At point  $F_1$  in the plane ( $Q; S$ ), the indifference curve slope (TMS) is greater than the slope of the buyer's constraint line, namely  $p$ ; which means that the capacitive desire of the seller to increase the volume of the transaction is relatively higher than the capacitive desire of the buyer to save on the price. Also, at point  $F_2$  in the plane ( $m; S$ ), the indifference curve slope (TMS) is greater than the slope of the buyer's constraint line, namely  $Q$ ; which means that the capacitive desire of the seller to earn an additional unit on the profit margin is relatively higher than the capacitive desire of the buyer to save on the quantity to be purchased. Thus, the seller is less satisfied than the buyer with the transaction offer ( $m_2; Q_2; S_2$ ) made by the buyer because the price  $p_2$  is relatively low (see quadrant (A3) of graph 2a). Then, the seller will not accept the buyer's offer; he will request from the buyer an increase in his price offer and/or the quantity to be purchased, by making a new offer. Like the buyer, the seller will make a new offer which certainly gives him more satisfaction, but less than his first offer.

Then, this second offer of the seller would correspond to the points of intersection of new indifference curves and the constraint line in the planes ( $Q; S$ ) and ( $m; S$ ), and located respectively between  $D_1$  and  $E_1$ ,  $D_2$  and  $E_2$ . If the seller's new offer does not coincide with points  $E_1$  and  $E_2$ , and corresponds for example to the triplet of points ( $G_1; G_2; G_3$ ) whose associated price is  $p_3$ , the buyer will not agree and will also make a new offer which would correspond to points located respectively between  $E_1$  and  $F_1$  in the plane ( $Q; S$ ) and between  $E_2$  and  $F_2$  in the plane ( $m; S$ ). Failing to coincide with the mutually advantageous triplet of points, the second offer of the buyer can be for example the triplet of points ( $H_1; H_2; H_3$ ) whose associated price is equal to  $p_4$ .

Contrary to the prices  $p_1$  and  $p_2$  corresponding to the first offers of the stakeholders, the prices  $p_3$  and  $p_4$  resulting from their second offers frame more closely the mutually advantageous price  $p^*$ . Thus, iteratively, the compromise process of the exchange makes the positions of the seller and the buyer converge towards the triplet points of equilibrium ( $E_1; E_2; E_3$ ) whose associated price is  $p^*$ .

In the graph 2b, three situations of a compromise process corresponding to the triplets of points ( $A_1; A_2; A_3$ ), ( $D_1; D_2; D_3$ ) and ( $F_1; F_2; F_3$ ) are represented. We also suppose that the bargaining process begins with the seller's offer which corresponds to the triplet of points ( $A_1; A_2; A_3$ ) whose associated price is  $p_1$ . With this offer of the seller, we see that at point  $A_1$ , the slope of the constraint line of the buyer is greater than the slope of the indifference curve of the exchange. This means that the buyer is not satisfied with the price  $p_1$  announced by the seller; he then makes his offer to the seller which corresponds for example to the triplet of points ( $F_1; F_2; F_3$ ) whose associated price is  $p_2$ . The seller will not accept the exchange at price  $p_2$  because this price is lower than the unit cost of the product.

The prices  $p_1$  and  $p_2$  result respectively from the points  $A_2$  and  $F_1$  which are the points of tangency of the indifference curves of the exchange in the planes ( $m; S$ ) and ( $Q; S$ ) of graph 2b. This means that  $p_1$  is the seller's minimum price (reserve price) and  $p_2$  is the buyer's maximum price (reserve price). Since the seller's reserve price is higher than the buyer's reserve price, the bargaining stops because there is an

incompatibility of desires with respect to the price of the good. Thus, for the triplet of points (D1; D2; D3) for example, we see that the slope of the indifference curve is less than the slope of the constraint line of the buyer at point D1 and that the slope of the indifference curve is greater than the slope of the buyer's constraint line at point D2. This means that, on the one hand, the capacitive desire of the buyer to save on the price is relatively high and, on the other hand, the capacitive desire to earn an additional unit on the margin is relatively high. This effectively indicates that there is an incompatibility of the capacitive desires of the stakeholders in the exchange with respect to the price. Because of this, the seller and the buyer cannot come to a mutually advantageous sales agreement.

#### 4. A specification of the compromise function of exchange

The purpose of this section is to deepen the reflections to learn more about the process of exchange and price formation, by specifying the compromise function of exchange. To do this, we adopt the specification used in the previous section given by relation (4) and repeated below (relation 4 bis).

$$V(m; Q ; S) = m^\alpha Q^\beta S^\delta \quad (4 \text{ bis})$$

The compromise process program is given by relation (11): the compromise function is maximized with respect to the margin  $m$ , the volume of the transaction  $Q$  and the economy  $S$  desired by the buyer.

$$\left\{ \begin{array}{l} \text{Max}_{m; Q; S} (m^\alpha Q^\beta S^\delta) \\ u/c \quad (C_u + m)Q + S \leq R \end{array} \right. \quad (11)$$

The first-order conditions of this program give the system of equations (12) whose first two equations express the savings desired by the buyer on the transaction as, on the one hand, a proportion of the total profit margin  $mQ$  and, on the other hand, a proportion of the total value of the transaction  $PQ$ .

$$\left\{ \begin{array}{l} S = \frac{\delta}{\alpha} mQ \\ S = \frac{\delta}{\beta} pQ \\ pQ + S = R \end{array} \right. \quad (12)$$

From this system of equations (12), we first obtain the relations (13) and (14) which express, on the one hand, the price according to the volume of the transaction and the willingness-to-spend of the buyer, and on the other hand, the profit margin unit depending on the volume of the transaction, the buyer's willingness-to-spend and the unit cost of the good.

$$p = \frac{\beta}{\beta + \delta} \frac{R}{Q} \quad (13)$$

$$m = \frac{\alpha}{\alpha + \delta} \left( \frac{R}{Q} - C_u \right) \quad (14)$$

Note that if the buyer has perfect information about the price of the good, his willingness-to-spend would be exactly equal to  $PQ$  and, thus, his capacitive desire to economize on the transaction would be zero, namely  $\delta = 0$ . The relation (13) would indicate in this case that the price is equal to the relationship between the buyer's willingness-to-spend and the volume of the transaction; the relation (14) would indicate that the profit margin unit is equal to the difference between the  $R/Q$  ratio and the unit cost.

However, as the information is imperfect and the buyer's environment is characterized by uncertainties, particularly about the future, we have  $\delta > 0$ . Consequently, the price is lower than the R/Q ratio and the profit margin unit is less than  $R/Q - C_u$ .

At the macroeconomic level, if we reason in terms of a "representative consumer", the relation (13) could be a simple and relevant way of establishing a relationship by product between price, household income and the total volume of their transactions. The same is true for relation 14.

The complete resolution of the system of equations (12) makes it possible to obtain the mutually advantageous transaction vector for the seller and the buyer ( $m^*$ ;  $Q^*$ ;  $S^*$ ), corresponding to the sales agreement concluded between the stakeholders of exchange. This mutually advantageous transaction vector is depending on the buyer's willingness-to-spend R and the unit cost of the product  $C_u$ , as expressed by relations (15), (16) and (17).

$$m^* = \left( \frac{\alpha}{\beta - \alpha} \right) C_u \quad (15)$$

$$Q^* = \left( \frac{\beta - \alpha}{\beta + \delta} \right) \frac{R}{C_u} \quad (16)$$

$$S^* = \left( \frac{\delta}{\beta + \delta} \right) R \quad (17)$$

The relation (15) point out that the profit margin unit of a product is a proportion of its unit cost. The relation (16) indicates that the volume of the transaction is a proportion of the ratio between the buyer's willingness-to-spend and the unit cost of the product.

According to the expression given by relation (16), the volume of the transaction increases with the maximum willingness-to-spend of the buyer and decreases with the unit cost of the good. Also, the more the good is desired (i.e. the higher  $\beta$  is), the higher the volume of the transaction will be; but the higher the elasticity of the capacitive preference of the seller with respect to the profit margin unit (i.e. the higher is  $\alpha$ ), the lower the volume of the transaction will be. Moreover, the more the buyer is "stingy" (i.e. the higher  $\delta$  is), the lower the volume of the transaction will be.

The relation (17) indicates that the savings made by the buyer in the exchange on his maximum willingness-to-spend increase with said willingness-to-spend. Also, the more the buyer has a high bargaining power and/or the more he is "stingy" (i.e. the higher  $\delta$  is), the higher the savings made in the exchange will be; but the more the good is desired (i.e. the higher  $\beta$  is), the lower the savings achieved will be.

From the relation (15) and knowing that  $p^* = m^* + C_u$ , we deduce the expressions of the mutually advantageous price and the mutually advantageous margin rate (denoted  $Tm^*$ ) given respectively by the relations (18) and (19).<sup>5</sup>

$$p^* = \left( 1 + \frac{\alpha}{\beta - \alpha} \right) C_u \quad (18)$$

$$Tm^* = \frac{\alpha}{\beta - \alpha} \quad (19)$$

---

<sup>5</sup> The profit margin rate is defined as the ratio between the profit margin unit and the unit cost

The relation (19) point out that the profit margin rate is a function of the elasticity of the seller's capacitive preference for the profit margin unit and the degree of desirability of the good. Also, this relationship shows that the elasticity of the seller's capacitive preference for the profit margin unit is constrained by the level of desirability of the good: for the profit margin rate  $Tm^*$  to remain positive, the level of desirability of the good  $\beta$  must be always greater than the elasticity of the capacitive preference of the seller for the profit margin unit, namely  $\alpha$ . Indeed, if  $\beta < \alpha$  (if the seller is too greedy for a very undesired product), then  $Q^*$  would be negative (relation 16), which simply means that the buyer would refuse to make the exchange in these conditions. Also, in this case, the profit margin rate (relation 19) would be negative. At the limit, if a producer launches into the production of an undesirable good ( $\beta = 0$ ), his sale would be zero and the profit margin unit would be negative and equal to  $-C_u$ , and the relation (17) indicates that the buyer's savings on the transaction would simply be equal to the amount of his willingness-to-spend (i.e. the buyer refuses to spend in such conditions).

Conversely, if the desirability level of the product is greater than the elasticity of the capacitive preference of the buyer for the profit margin unit, i.e. if  $\beta > \alpha$ , then the profit margin rate  $Tm^*$  would be positive. We note that the profit margin rate increases if the degree of desirability of the good  $\beta$  and the elasticity of the seller's capacitive preference with respect to the profit margin  $\alpha$  increase simultaneously so that the difference between the two parameters ( $\beta - \alpha$ ) remains positive and constant or positive and decreasing. This means that a producer/seller can achieve a higher and higher profit margin rate if the desirability of the product is higher and higher. This is the whole challenge of the big and expensive advertising and commercial communication campaigns that companies are continually doing: to increase the desirability of the product in order to be able to increase the profit margin unit or, in the worst case, maintain it at an acceptable level.

## 5. Conclusion

This paper aimed proposing a theory of exchange and the formation of the prices of goods and services in any market. The theoretical essay developed is based on the postulate of the general theory of the firm according to which the company operates on the basis of the compromise between the stakeholders. Thus, the process of the exchange is a process of compromise between the producer/seller and the buyer concerning their purposes: (i) the profit margin unit  $m$ , (ii) the volume of the transaction  $Q$  and (iii) the savings  $S$  that the buyer wishes to achieve in this transaction compared to the amount of his maximum willingness-to-spend in the exchange. The transaction vector  $(m^*; Q^*; S^*)$  mutually advantageous for the stakeholders of the exchange is the solution of maximizing the compromise function under the constraint of the buyer's maximum willingness-to-spend. Several lessons have been learned from the analysis of the first-order conditions of this compromise program.

First, the existence or not of a mutually advantageous transaction vector  $(m^*; Q^*; S^*)$  depends on the compatibility of the capacitive desires of the stakeholders. If there is an incompatibility of the capacitive desires of the stakeholders with respect to the price or with respect to the quantity to be purchased (too low for the seller, but too high for the buyer), then the compromise process of the exchange will not result in a sales agreement. On the other hand, if there is a compatibility of the capacitive desires of the stakeholders, the haggling will continue and the positions will converge towards a sales agreement corresponding to the mutually advantageous transaction vector  $(m^*; Q^*; S^*)$ .

Secondly, the process of exchange and price formation is characterized by several successive stages corresponding to alternating offers from the seller and the buyer, which, given the asymmetry of information, can converge rapidly or slowly towards the mutually advantageous transaction. During an intermediate stage, one of the stakeholders makes a transaction offer which is relatively more advantageous to him than his counterpart, but which is less favorable to him than his previous offer; also for this offer, his capacitive desires remain lower than those of his counterpart; who will refuse and in turn make a new offer. Thus, iteratively, the alternate offers of the stakeholders converge towards the mutually advantageous transaction vector, by confronting the capacitive desires of said stakeholders.

Third, the transaction vector  $(m^*, Q^*, S^*)$  is mutually advantageous if and only if: (i) the capacitive desire of the seller to earn an additional unit on the profit margin unit is equal to the capacitive desire of the buyer to save on the quantity of the good purchased and (ii) the capacitive desire of the seller to increase the volume of the transaction by an additional unit is equal to the capacitive desire of the buyer to save on the price of the good.

Fourth, from the specification of the compromise function of exchange in the form of the Cobb-Douglas function, it follows that (i) the unit price of the exchanged good is proportional to the ratio between the amount of the maximum willingness-to-spend of the buyer and the volume of the transaction; (ii) the profit margin unit is proportional to the difference between, on the one hand, the ratio of the buyer's willingness-to-spend in relation to the volume of the transaction and, on the other hand, the unit cost of the good exchanged; (iii) the profit margin rate is equal to the ratio between the elasticity of the capacitive preference of the seller for the profit margin unit (level of greed of the seller) and the difference between the degree of desirability of the good and said elasticity; (iv) a producer/seller can realize a higher and higher profit margin unit, provided that the desirability of the product is higher and higher; it is the whole challenge of the large and expensive advertising and commercial communication campaigns carried out continuously by companies on their products.

***Bibliographic references***

- Barrère, C. 2002. Comprendre la formation des prix contemporains : les limites de l'analyse marxienne. In *Le capitalisme contemporain : des théorisations nouvelles ?* L'Harmattan 2002.
- Clower, R., W. 1965. Classical Monetary Revisited: A Reply. *Economica*, 32(125).
- Clower, R., W. 1967. A reconsideration of the Microfoundations of Monetary Theory. *Western Economic Journal*, n°6, pp.1-8.
- Costabile, L. 1983. *Natural Prices, Market Prices and Effective Demand in Malthus*. *Australian Economic Papers*, 22(40), pp. 144-170.
- Dallery, Th., Eloire, F., Melmiès, J. 2009. *La fixation des prix en situation d'incertitude et de concurrence : Keynes et White à la même table*. *Revue Française de socio-économie*.
- Eloire, F. 2008. Les dynamiques de l'échange social sur un marché de producteurs, pp. 67-77, in LECOUTR, Management et réseaux sociaux, ressource ou outil de gestion ? Hermès Lavoisier, Paris.
- Keynes, J. M. 1936. *Théorie générale de l'emploi, de l'intérêt et de la monnaie*. Traduction de J de Largentaye. Payot.
- Lavoie, M. 2004. *L'économie postkeynésienne*, Editions La Découverte, coll. Repères, Paris.
- Leijonhufvud, A. 1968. *On Keynesian Economics and the Economics of Keynes*. Oxford University Press, London.
- Malthus, T., R. 1836. *Principles of Political Economy*, New York, Ed. Kelley, 1951.
- Martin, C. 1982. *Demande et formation des prix dans la théorie classique : le débat entre Ricardo et Malthus*. *Cahiers d'Economie Politique*. N°7, pp 31-50. Presses Universitaires de France.
- Tétinier, G. 1943. *La circulation de la monnaie et le niveau des prix*. *Journal de la société statistique de Paris*, tome 84 (1943), p. 206-224
- Tricou, F. 2008. *La loi de l'offre et de la demande, une enquête sur le libéralisme économique*. Presses Universitaires du Septentrion, Villeneuve d'Ascq.
- Warren, M., P. 1911. *Fisher's The Purchasing Power of Money*. *American Statistical Association*, Vol. 12, No. 96, pp. 818-8
- White, H. 1981. *Where Do Markets Come From?* *American Journal of Sociology*, 87 (3), pp. 517-587.
- White, H. 2002. *Markets From Networks. Socioeconomic Models Of Production*. Princeton University Press, Princeton.
- Williamson O. E., 1975. *Markets and Hierarchies, Analysis and Antitrust Implications*. The Free Press, New York.
- Zerbo, A., 2016. *Essai d'une théorie générale de la firme*. Document de travail n°175, GED/LARE-Fi, Université de Bordeaux. Pessac, France.
- Zerbo, A., 2018a. *La demande de travail de la théorie générale de la firme : évidences empiriques*. Document de travail n°177, GED/LARE-Fi, Université de Bordeaux. Pessac, France.
- Zerbo, A., 2018b. *Essai d'une nouvelle représentation macroéconomique du marché du travail*. Document de travail n°178, GED/LARE-Fi, Université de Bordeaux. Pessac, France.
- Zerbo, A., 2018c. *Evidences empiriques sur la formation de l'équilibre sur le marché du travail : cas des pays de l'OCDE*. Document de travail n°179, GED/LARE-Fi, Université de Bordeaux. Pessac, France.
- Zerbo, A., Hien L. 2019. *Théorie générale de la firme : la décision d'investissement*. Working Paper DT/01/2019. Innove Center.
- Zerbo, A., Hien L. 2020a. *General Theory of the Firm: Business Investment Decision*. Working Paper DT/02/2020. Innove Center.
- Zerbo, A., Hien L. 2020b. *A Specification of the General Theory of the Firm: Employment and Profit, Investment and interest rates*. Working Paper DT/04/2020. Innove Center.
- Zerbo, A. 2022. *Quand la baisse des taux d'intérêt freine l'investissement privé : Evidences empiriques aux Etats-Unis et au Japon*. Working Paper DT/06/2022. Innove Center.