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## Efficiency Models Applied to A Market Economy: Economic assumptions that support the analysis of the sector and the determination of best market scenarios for efficient public procurement in Colombia

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### Abstract

*The article presents an analysis of economic models applied to a market economy, focusing on the context of efficient public procurement in Colombia. Edgar Andrés Quiroga Natale begins by highlighting the promotion of "Efficient Public Procurement" in the country, although he notes that the concept of efficiency is not explicitly regulated in public procurement legislation, making it difficult to plan and implement efficient procurement models. The article describes the neoclassical, Paretian, and Keynesian economic models, and their relevance to government procurement in a market economy. The neoclassical model is based on the interaction of supply and demand in a general equilibrium, while the Paretian model postulates that a social situation is efficient if it is not possible to improve someone's situation without worsening another's. On the other hand, the Keynesian model emphasizes the role of the state in economic intervention to increase employment and general welfare. The article concludes that knowledge of these economic models can improve public procurement in various aspects, such as studying market competition conditions, evaluating offers, and identifying more efficient consumption scenarios.*

**Keywords:** *Efficient. Public. Procurement; Economic. Models; Colombia.*

### Introduction

State procurement since the issuance of Law 80 of 1993, with its various reforms and regulations (especially those introduced by Laws 1150 of 2007, 1474 of 2011, and 1882 of 2018; as well as Decrees 1082 of 2015 and 092 of 2017<sup>1</sup>), promotes more and more for an "Efficient Public Procurement". However, the concept of efficiency is NOT a legal concept, and much less is it explicitly regulated in the general statute of public procurement, which makes it difficult for state entities, contractors, and other participants in the "operation" of purchasing, when planning and implementing procurement models that are considered efficient.

Therefore, the studies of the sector, the contracting history, the determination of the fundamentals of the contract price, the construction of the equation, etc., have often been "intuitive" exercises based on an exotic application of custom, far from being technical studies that promote "hundred-sum games" for the parties, designed within the legal and efficient framework.

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The following lines present (not exhaustively), and from an exclusively descriptive point of view, the basic concepts on which some of the most relevant economic models of efficiency (neoclassical, Paretian, and Keynesian) are built, which are applied in market economies and are relevant to government procurement.

## 1. Neoclassical Equilibrium Model

Classical economics laid the foundations of modern economic science through such important and representative authors as Smith (1925; 1958) and Ricardo (1992), whose various contributions are also located in the field of the methodological assumptions of what Becker (1981) would later call the Homo Economicus, creating a model based on the understanding of three basic characteristics of the individual that could be extrapolated to the universal set of consumers, which are: rationality, selfishness, and maximization.

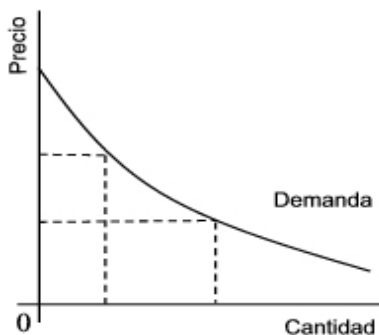
In addition to the above, the classical model proclaimed the essentials of freedom of the individual (which is often intrinsically associated with the concept of efficiency), the non-intervention or minimal intervention of the State in the economy (*laissez faire*, *laissez passer*), and of course, the idea that the market through the confluence of supply and demand forces is the best and most efficient price allocator.

However, it was only when the above theses were "mathematized", and models of their application began to be developed, that what we know today as microeconomics emerged, which was born from the retaking of classical thought but with a great emphasis on marginality, utility, and general equilibrium, which is usually identified with neoclassical economic thought. The most representative authors of this "neoclassical revolution" were Menger (1997), Jevons (1871), Walras (1926), and Marshall (1980).

The following are some of the basic concepts on which the neoclassical general equilibrium theory is built, which are useful for understanding the assumptions of the school of thought under study.

### 1.1. Supply-demand laws and general equilibrium

The neoclassical equilibrium is based on the interaction of two main rules: i) the law of demand: all other things being equal, the quantity demanded of a good decrease when its price increases; therefore, there is an inversely proportional relationship between price and quantity; ii) the law of demand: all other things being equal, the quantity demanded of a good decrease when its price increases.



**Figure 1.** The Law of Demand <sup>2</sup>.

ii) the law of supply: all other things being equal, the quantity of a good offered increases when the price rises, generating an inversely proportional relationship between supply and demand.

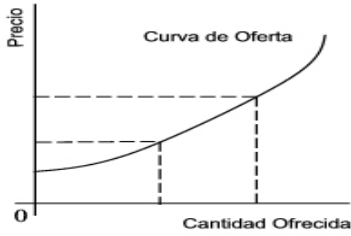


Figure 2. The Law of Supply <sup>3</sup>.

The interaction of these two forces (supply and demand) in a scenario of free confluence, generates that at some point the price reaches a level where the quantity offered and the quantity demanded are equal, generating a general equilibrium.

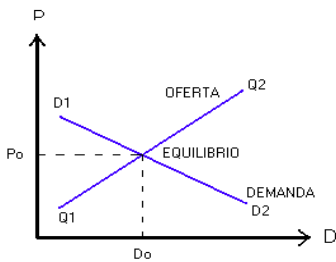


Figure 3. General equilibrium <sup>4</sup>.

### 1.2. Marginal Profit.

Utility, according to a Benthamian view of distribution, is "an abstract measure of the satisfaction or happiness that a basket of goods brings to a consumer" (Mankiw, 2004, p. 284). Therefore, marginal utility refers to the satisfaction that a consumer derives from consuming an additional unit of the good.

The notion of diminishing marginal utility expresses the situation where the greater the quantity consumed, the lower the marginal utility generated by each additional unit of consumption.

Figure 4. Utility and Marginal Utility <sup>5</sup>.

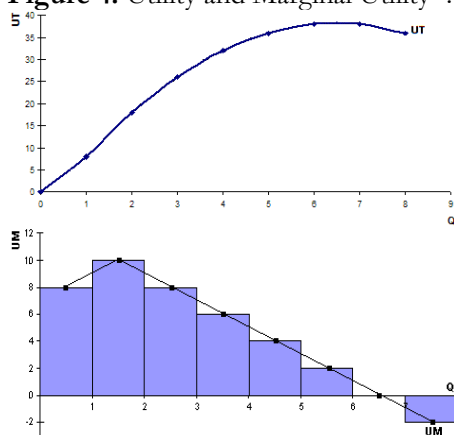
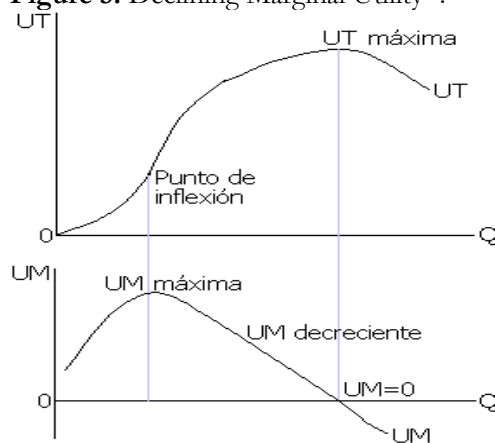
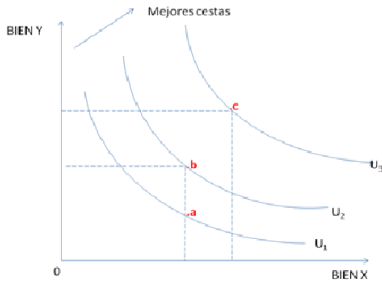


Figure 5. Declining Marginal Utility <sup>6</sup>.



### 1.3. Indifference Curves

Indifference curves in a neoclassical equilibrium model represent the different consumption options that give the consumer the same level of satisfaction within his budget constraint, which is useful for measuring or calculating the marginal ratio of substitution, i.e. "the ratio at which a consumer is willing to exchange one good for another" (Mankiw, 2004, pp. 280-281).



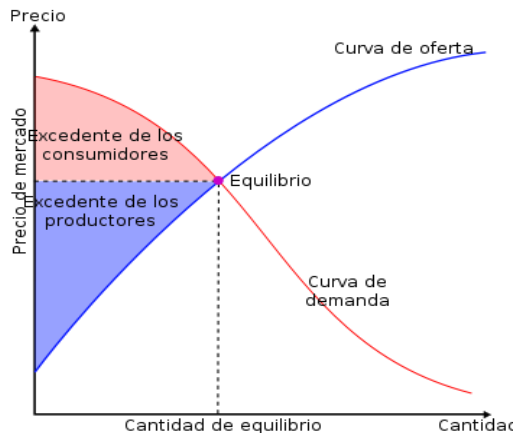
**Figure 6.** Indifference Curves <sup>7</sup>.

According to the model, consumers are rational and utility-maximizing in choosing certain preferences, therefore, these preferences can be ordered according to the principles of transitivity<sup>8</sup>, completeness<sup>9</sup>, and monoticity<sup>10</sup>, and, consequently (under normal conditions), have a negative slope, do not intersect each other and are convex to the origin.

### 1.4. Consumer and Producer Surplus

Consumer surplus is understood as "a buyer's willingness to pay minus the amount he pays" (Mankiw, 2004, p. 8), i.e. there will be consumer surplus when the amount he is willing to pay for a good and/or service is less than what he ends up paying. Producer surplus should be understood as "the amount a seller seeks for a good minus the cost of producing it" (Mankiw, 2004, p. 91).

An economic model that aims at efficient levels of resource allocation with a tendency to equalize producer surplus with consumer surplus is considered to be in equilibrium, achieving not only maximization of the total surplus of the members of a society but also reaching a prima facie equity with respect to those members.



**Figure 7.** Consumer and producer surpluses in an equilibrium model<sup>11</sup>.

## 1.5. Elasticity of Demand and Supply

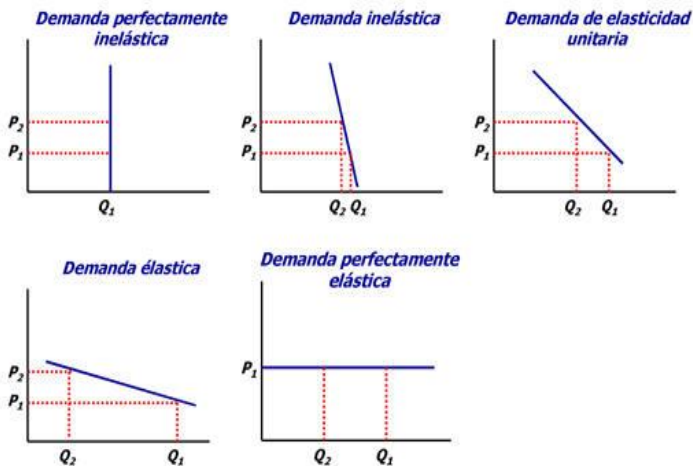
Another concept inseparable from the general theory of neoclassical equilibrium is that of elasticity, understood as the "measure of the sensitivity of the quantity demanded or the quantity offered to one of its determinants" (Mankiw, 2004, p. 56), i.e. the way to quantitatively measure the level of response of suppliers and demanders to the introduction of variables to the direct equilibrium relationship.

The price elasticity of demand is calculated by "dividing the percentage change in the quantity demanded by the percentage change in price" (Mankiw, 2004, p. 56), for example, if the price of soda increases by 30% and the quantity of soda consumed (as a result of the price increase) is reduced by 10%, the elasticity of demand would be equal to:

$$E_{pd}: 30/10$$

$$E_{pd}: 3$$

According to the level of variation of the price elasticity, demand can be: i) perfectly inelastic (when demand is equal to zero); ii) inelastic (when demand is less than 1); iii) unit elastic (when demand is equal to 1); iv) elastic (elasticity is greater than 1); and, v) perfectly elastic (when elasticity is equal to infinity).



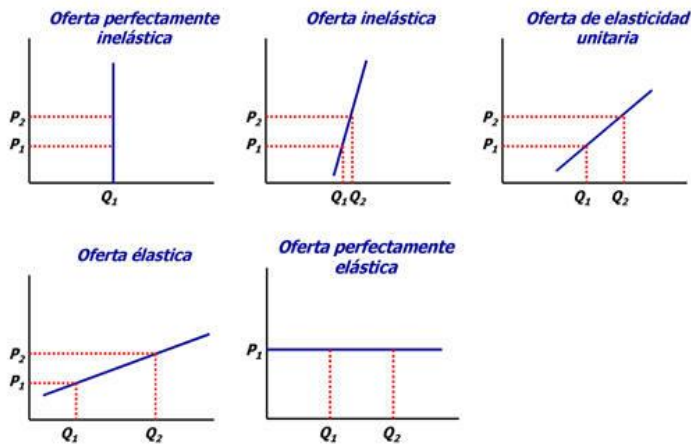
**Figure 8.** Behavior of Price Elasticity of Demand<sup>12</sup>.

The price elasticity of supply is calculated by "dividing the percentage change in quantity supplied by the percentage change in price" (Mankiw, 2004, p. 62). For example, if a 10% increase in the price of cars generates a 20% increase in the production of cars, then the price elasticity of supply is equal:

$$E_{po}: 20/10$$

$$E_{po}: 2$$

According to the level of price elasticity variation, supply can be: i) perfectly inelastic (when elasticity is equal to zero); ii) inelastic (when elasticity is less than 1); iii) unit elastic (when elasticity is equal to 1); iv) elastic (when elasticity is greater than 1); and, v) perfectly elastic (when elasticity is equal to infinity).



**Figure 9.** Behavior of Price Elasticity - Price of Supply <sup>13</sup>.

The concept of elasticity is very useful to establish the levels and impact of variations in the quantities offered and demanded caused by the introduction of variables or determinants that make them change.

## 2. Efficiency Model and Paretian Optimum

The economist Pareto (1906) postulated an efficiency-equilibrium model based on the premise that "(...) a social situation is efficient if it is not possible to make someone better off without making someone else worse off (...)" (p. 33); however, this premise offers two types of interpretations, one relative and the other absolute:

(...) In the relative interpretation, a social situation can only be efficient or inefficient in relation to another. For example, a social situation  $a$  is efficient relative to a social situation  $b$  if all individuals in situation  $a$  unanimously say that they are better off or the same as in situation  $b$ . Conversely, if some individuals in situation  $a$  are better off than in situation  $b$ , but others are worse off, situations  $a$  and  $b$  cannot be categorized in terms of efficiency. On the other hand, in the absolute interpretation of the notion of efficiency, a social situation  $a$  is said to be efficient if there is no other social situation  $b$  in which all individuals unanimously say that they prefer  $b$  to  $a$ . Conversely, a social situation  $b$  is said to be inefficient if there is at least one social situation  $a$  in which all individuals unanimously say that they prefer  $a$  to  $b$  (...). (Castellanos, 2012, p. 16).

Paretian efficiency avoids facing interpersonal comparisons of utility, it is enough to make intra-individual comparisons; however, it is not enough to define the most balanced decision, since the multiplicity of elements that a social situation "X" may have can be such that in relative terms there may be many efficient results but in absolute terms inefficiencies are generated.

This theory, taken in a simple way to the field of consumption (of works, goods or services), could suppose that a good "X" is equal to the sum of the intrinsic elements that compose it, for example, if "X" is composed of the elements  $a$ ,  $b$ ,  $c$  and  $d$ , that is to say,  $X: (a+b+c+d)$ ; then, if a decision  $Y$  is improving elements  $a$ ,  $b$  and  $c$  but worsening  $d$  it could be said that there is relative efficiency with respect to  $a$ ,  $b$  and  $c$  but relative inefficiency in  $d$ ; however if  $X$  is considered in an absolute way, the conclusion will be that the decision  $Y$  is inefficient.

It should be noted that reference is being made to Paretian efficiency and not to the Pareto optimum since the latter involves the problem of choosing the best decision (optimal decision) among all possible efficient decisions. Taken to the field of consumption (of works, goods, or services), it could be stated that a Pareto optimum "implies the ratio of the marginal utilities of the goods for all consumers (...) if such equalization did not occur, then at least one of the consumers, in this model, would not be obtaining the maximum possible satisfaction with his disposable income (...). (Cuevas, 2011, p. 278).

The Paretian optimum differs from other neoclassical theorems, such as the Walrasian equilibrium theorem, not only in its formulation but above all in its application<sup>14</sup>:

Theorem or model of the Paretian optimum	Theorem or model of Walrasian Equilibrium <sup>15</sup>
A feasible assignment $\{(X_a, X_y), (X_b, Y_b)\}$ of a competitive economy, is a Pareto optimum if no other feasible allocation exists $\{(X_a', X_y'), (X_b', Y_b')\}$ such that $U_i(X_i', Y_i') > U_i(X_i, Y_i)$ for all $i$ , and $U_j(X_j', Y_j') > U_j(X_j, Y_j)$ for any $j$ .	Sean <sup>16</sup> : $U_i: R^2 + \text{_____} R$ $(X_i, Y_i) \text{_____} u_i(X_i, Y_i)$ para $i = A, B$ , continuous, monotonically increasing, and strictly quasi-concave utility functions, and $(W_{xA}, W_{yA})$ and $(W_{xB}, W_{yB})$ consumers' initial endowments $A$ and $B$ , respectively. Furthermore, let us suppose that if $P_j = 0$ then $Z_j: (P_x, P_y) > 0$ for $j = X, Y$ <sup>17</sup> . Then there are some positive price pairs $(P_x, P_y)$ such that $Z_x(P_x, P_y) = 0$ and $Z_y(P_x, P_y) = 0$ ; i.e., there is a Walrasian equilibrium for the economy described by these utility functions and initial endowments.

It follows that the Paretian optimum does require an inter-subjective comparison of preferences and satisfactions, which can serve as a tool to measure the different consequences of consumption choices in the market as a whole and thus make more efficient decisions.

### 2.1. Keynesian Equilibrium Model

John Maynard Keynes was one of the most influential economists of the twentieth century who through his major works<sup>18</sup>, founded the modern assumptions of what is now known as macroeconomics.

Keynes refuted the orthodox lesseferist theories (mainly Hayek's thesis) and emphasized the invaluable role of the State in generating intervention policies aimed at increasing the employment rate and, as a consequence, increasing purchasing power, consumption, and general welfare.

However, the Keynesian proposal is not based on absolute State control and direction of the economy, since it considers that this would lead to profoundly inefficient authoritarian models; on the contrary, it proposes that, based on criteria of respect for individual freedom and efficiency, intervention systems be built to guarantee, through increased employment, a better distribution of the scarce resources available in the economy. In a point of discussion, he states:

"(...) Authoritarian state systems today seem to solve the problem of unemployment at the expense of efficiency and freedom. Indeed, the world would not long tolerate unemployment which, apart from brief boom intervals, is associated - and, in my opinion, inevitably accepted - with present

capitalist individualism. But it may be possible, through correct analysis of the problem, to cure the disease while preserving efficiency and freedom (...)" (Keynes, 1990, p. 88).

Starting from the importance of the role played by the State in the economy, Keynes proposes the analysis of the fundamentals of market forces (supply and demand), not from an endogenous explanation that justifies them, on the contrary, he questions Say's law<sup>19</sup> and raises the discussion through the understanding of aggregates that allow redefining the concept of equilibrium. These are:

i) Aggregate Supply (AS)<sup>20</sup>:

$$AS = C + A$$

Aggregate supply equals national income and product.

Aggregate supply equivalent to the volume of employment.

C = Final consumption (food, clothing, etc.).

A = Product investment.

ii) Aggregate demand (AD)<sup>21</sup>:

$$AD = C + I_p + (G - R) + (X - M)$$

Components of aggregate demand (AD) and the solution to unemployment

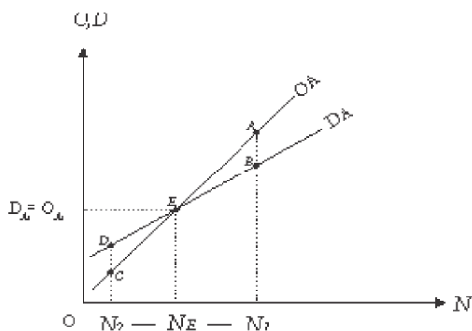
Consumption (C)

Planned investment ( $I_p$ )

Government spending minus taxes (G-R)

Exports minus imports (X-M).

The convergence of aggregate supply and demand generates a new equilibrium scenario as follows:



**Figure 10.** Equilibrium From Aggregate Supply and Demand <sup>22</sup>:

Explaining this equilibrium model, Cuevas (2011) concludes that

(...) In short, at levels of employment greater than  $N_e$  (such as  $N_1$ ) a mechanism is set in motion to decrease the level of employment, and at levels lower than  $N_e$  (such as  $N_2$ ) a mechanism is set in motion to increase the level of employment. This means that  $N_e$  is the equilibrium level of employment (...). (p. 322).

In this regard, Fernández (2007), alluding to the Keynesian model, says:

(...) It is very convenient for those interested in understanding economic policy to familiarize themselves with the uses of these diagrams, while not losing sight of the assumptions behind the curves (...) it should not be forgotten that the shapes of these curves and the magnitude of



their shifts depend on the characteristics of the labor market, the product market and the money market (...). (pp. 61-62).

The understanding of the Keynesian equilibrium model equilibrium, based on the aggregate demand and supply, allows one to make a reading of the different competition scenarios available for the consumer's choice and from there to find the aggregate potentialities of each supplier.

## **2.2. Institutional Theory and Institutional Equilibrium**

Institutional theory (and the new institutionalism) went beyond the study of the existing transaction relations between producers and consumers in the free market scenario, questioning the neoclassical perfect equilibrium model, since they consider that it does not take into account a vital factor for the analysis of economic relations and the way they manifest themselves in the market: Institutions.

The main exponents of institutionalism are North (1990) and Williamson (2009) who, through analytical assumptions such as methodological individualism, utility maximization, bounded rationality, and opportunistic behavior, explained the role played by institutions and institutional design in the way resources are allocated and distributed in a society.

For North (1990) institutions are "(...) restrictions that arise from human inventiveness to limit political, economic and social interactions (...)" (p. 24). These in turn can be formal, such as constitutions, laws, decrees, etc., but there are also informal institutions such as social customs and mores that together form the "institutional environment" on which interactions and/or transactions are limited and/or permitted. Regarding institutional equilibrium, North (1990) points out:

"(...) a situation in which, given the bargaining strength of the players and the set of contractual operations that make up a total economic exchange, none of the players would consider it advantageous to devote resources to restructuring the agreements. Note that such a situation does not mean that everyone is satisfied with the existing rules and contracts, but only that the relative costs and benefits of altering the game between the parties indicate that it is not advisable to do so (...)" (pp. 113 y 114).

This equilibrium (Pinzón notes) on the one hand resembles the concept of unstable equilibria proposed by the general theory of systems, where the points of stability of the system are temporary and mutate according to the adaptation of the organism to its environment; on the other hand, it is also closely related to the Nash equilibrium<sup>23</sup> by the lack of incentives for the agents to change and/or mutate their position.

Institutionalists pay special attention to the time variable and the way it mutates and adapts institutional arrangements, which is very useful for making more detailed comparative analyses of the evolution of certain designs in the short, medium, and long term and how they adapt, especially to the transformations experienced by informal institutions.

Williamson developed a study on the importance of transaction cost analysis in business efficiency that can be extrapolated to different fields of exchange scenarios<sup>24</sup>.

Knowledge of the methodological assumptions of institutionalism is important since it serves as an analytical tool to examine, among other things, the transformations that society is undergoing (informal institutions) about the positive rules that regulate it (formal institutions), and thus to better understand and describe the needs that justify a given consumption choice.

As a corollary of this study, it can be concluded that knowledge of the fundamentals offered by the most relevant models of economic efficiency, applied to government procurement, could make the procurement "operation" more perfectible in the following aspects:

- (i) Based on the knowledge of the laws of supply and demand, it is possible to study the purchasing sector determined with a greater degree of concreteness, if the contracting will have to be advanced in a monopolistic, oligopolistic, monopsonistic, oligopsonistic, in perfect or quasi-perfect competition scenario.
- (ii) The study of the elasticities of supply and demand makes it possible to determine whether the works, goods, or services to be contracted have close substitutes and, consequently, could eventually be replaced by others that, fulfill the same function and with similar qualities, offer more efficient purchase prices.
- (iii) The application of the analysis of indifference curves together with producer and consumer surpluses, allows a better evaluation of the different offers in order to establish the most favorable one, based on absolute and relative comparison analysis. In addition, it offers an analytical tool to detect offers with artificially low prices.
- (iv) The knowledge of utility and diminishing marginal utility allows to establish, for example, what is the necessary quantity of goods, works, or services that need to be purchased, thus avoiding that an additional unit generates a primary scenario of loss or reduction in nominal satisfaction.
- (v) The application of the Paretian optimum helps to carry out an inter-subjective comparison of preferences and satisfactions, generating an efficient mechanism for prospective analysis of the different possibilities of consumption of goods, works, or services through public procurement.
- (vi) The use of aggregate supply and demand contributes to a better understanding of how the trade agreements that Colombia has signed with other States should be applied in order to seek more competitive scenarios.
- (vii) The institutional analysis allows for the construction of much more efficient rules, increasing the level of equilibrium of the contractual equation, understanding that the contract minutes, as well as the preliminary studies and the bidding documents (formal institutions), are part of the contractual corpus.

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#### Footnote

- <sup>1</sup> Although the latter decree does not properly regulate Law 80 of 1993, it is included within the broad concept of the general contracting statute, since it regulates the collaboration contracts and the association agreements that the state entities enter into with the ESAL.
- <sup>2</sup> <http://www.economia.ws/oferta-y-demanda.php> accessed February 02, 2012. 8:00am.
- <sup>3</sup> <http://www.economia.ws/oferta-y-demanda.php> Accessed February 02, 2012. 8.21am.
- <sup>4</sup> <http://gitetur.wikispaces.com/Las+funciones+de+demanda+y+oferta+y+sus+movimientos>. Accessed February 02, 2012. 8:40 am.
- <sup>5</sup> <http://www.auladeeconomia.com/micro-material3.htm>. Accessed April 27, 2102. at 9:00 am.
- <sup>6</sup> <http://www.auladeeconomia.com/micro-material3.htm>. Accessed April 27, 2102. at 9:00 am.
- <sup>7</sup> <http://jaimesuarez10.blogspot.com/2010/08/el-estudio-del-comportamiento-del.html>. Accessed April 02, 2012. 10:00 pm.
- <sup>8</sup> If  $a$  is better than  $b$ ; and,  $b$  is better than  $c$ , then  $a$  is better than  $c$ .
- <sup>9</sup> It is always possible to order "packages or baskets" of possibilities according to preferences.
- <sup>10</sup> Individuals always prefer more to fewer goods and/or services.
- <sup>11</sup> [http://es.wikipedia.org/wiki/Archivo:Economic-surpluses\\_es.svg](http://es.wikipedia.org/wiki/Archivo:Economic-surpluses_es.svg). Accessed February 10, 2012. 5:00 pm.
- <sup>12</sup> [http://es.wikipedia.org/wiki/Archivo:Economic-surpluses\\_es.svg](http://es.wikipedia.org/wiki/Archivo:Economic-surpluses_es.svg). Accessed February 10, 2012, 5:00 pm.
- <sup>13</sup> <http://www.gestiopolis.com/economia/economia-y-sus-conceptos.htm>. Consulted on April 25, 2012, 11:00 pm.
- <sup>14</sup> The following table is based on Monsalve, S. (1999). Introduction to the concepts of equilibrium in economics. Universidad Nacional de Colombia, (pp. 19 y 31).

<sup>15</sup> Named after its creator Leon Walras.

<sup>16</sup>  $\mathbb{R}^2_+$  is the non-negative shear of the Cartesian plane, i.e.  $\mathbb{R}^2_+ = \{(a,b) \in \mathbb{R}^2 / a > 0, b > 0\}$

<sup>17</sup> This hypothesis is known as the axiom of desirability.

<sup>18</sup> For example, the "Treatise on Probability", "Treatise on Monetary Reform", "How to Pay for War", and "General Theory of Employment, Interest and Money", among others.

<sup>19</sup> Every supply generates its own demand.

<sup>20</sup> Following the postulates developed in Keynes. Ob. Cit.

<sup>21</sup> Following the postulates developed by Keynes. Ob. Cit.

<sup>23</sup> This will be studied in the present section.

<sup>24</sup> Regarding the relationship between transaction costs and institutional change, Pinzón argues: "(...) When analyzing the reasons why marginal changes are generated in the institutional environment, it is observed that these are the result of a cost-benefit analysis carried out by each of the agents affected by the current institutional arrangement. Thus, if the resources that must be invested to bring about the change produce benefits greater than the investment, the agent will have reasons to try to carry out the initiative. Otherwise, it is possible that an institutional equilibrium scenario (...)" (Pinzón, 2010, p.95).