Economic Supply and Demand with Data Analytics Functionalities

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Opinion Article

ABSTRACT

The primary goal of this article is to start a discussion about the possibility to connect supply and demand with data analytics functionalities in the frame of a dynamic system environment. So, a number of classical supply and demand topics, concepts, and definitions, as well as state-of-the-art data analytics concepts are reviewed firstly. Then, the critical modeling problem of both concepts "supply" and "demand" using system dynamics is introduced, analyzed, and examined. Finally, supply, demand, big data and data analytics are considered in a system dynamics modeling environment.

Actually, the proposed paper provides an initial approach (introduction) to the main (basic) procedures, analytical approaches and methods of data and big data analysis. In particular, a framework to help program staff in their job and approaches on supply and demand issues using big data procedures and methods is presented. Accordingly, this article aims to support the work of data analytics and statistics staff across various content areas with big data functionalities.

This article was created because the state-of-the-art concept "*using data and information in meaningful and smart ways*" includes many opportunities and possibilities and obviously a great deal of information is involved. Doubtless, some of this information has a great complexity and it is highly dependent upon specialized data, information and knowledge like the "data analytics" concept. However, there are many ways of "using data in smart ways" that are more primitive and that involve relatively simple enough procedures.

Hence, the purpose of the current paper is to provide data analytics functionalities in supply and demand applications with a contemporary framework for thinking about, working with, and benefiting from an increased ability to use big data smartly and efficiently.

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Finally, the current paper should be characterized as a knowledge generation opinion article which recommends the inclusion of data analytics and distributed technology in supply and demand industry in order to enhance functionalities and compatibility to state-of-the-art ICT.

1. INTRODUCTION

The current article introduces an approach on using system dynamics to model supply and demand [1] with smart data analytics functionalities [2,3]. It is well known that classical economics theory presents a simple model of the interactions among price, supply, demand, trading, corporate social responsibility (CSR), etc. [4-7]. This model is static without smart capabilities and dynamic functionalities. From the economics bibliography, the supply and demand curves -which are used in most economics textbooks [2,3]- show the strict dependence of both concepts "supply" and "demand" on the "price" (the data parameter); but these concepts do not provide adequate and smart information on how e.g. "equilibrium" is reached, the "time scale" is involved, etc. Obviously, classical economics theory has been unable to clarify the explanation of all the issues involved in the "supply-demand-data" line. Additionally, the effects of excess or inadequate inventory are often not discussed in detail [2,8-11].

In the real world economic and business applications, the market price (as the primary "data") is affected by the inventory of goods (manufacturers functionality) rather than the rate at which the manufacturers provide goods. If the manufacturers are supplying goods at a rate equal to the consumer demand, then the static classical theory would propose that the market is in a "equilibrium state". However, what if there is a tremendous surplus in the store supply rooms? The manufacturers have (a) to lower the price and (b) to decrease the production to return the inventory to a desired level [2,12,13,14].

This paper introduces a smart model that incorporates elements from classical economics, big data theory, and Information and Communication Technologies (ICT), as well as several real-world assumptions (e.g. market trading, "equilibrium state", etc.). This model will be used to examine some of the interactions among demand, price, supply, and data analytics [15,16,17].

1.1 Learning Objectives

The proposed smart model inspired by the "TAC-12 Handbook" which is used in training sessions offered by the Migrant and Seasonal Head Start Technical Assistance Center (TAC-12) [2]. Utilizing this Handbook, we propose how: (1) to use a wide variety of big data for smart planning and smart decision-making purposes; (2) to begin to develop abilities to use big data to describe program operations and practices with data analytics functionalities; (3) to observe basic techniques of data analysis to real-life Head Start examples; and (4) to identify and articulate trends, techniques, methods, and patterns in big data gathered over the time [1,2,3].

1.2 Guiding Principles for Approaching Data Analytics

The following five (5) principles are used in the proposed approach for a smart "supply-demand-data" modeling:

1. To provide information to program staff from a variety of different education, backgrounds and experience levels.
2. To comfort, confidence, and competence smart practices in data analytics.
3. To create a "smart-value-added" approach that presents tactics andstrategies (e.g. tectic and strategy approaches based on DLT-distributed ledger technology), values (e.g. classic currency like USD and EUR, digital currency like Visa and AmEx, cryptocurrency like bitcoin and litecoin, etc.), concepts (e.g. smart contracts, blockchain technology), procedures (i.e. introducing new routines and functions in supply and demand chain), methods (i.e. introducing a smart low-cost methodology), and techniques (i.e. executive routines to enhance supply and demand functionalities) in the context of real-life examples and applications.
4. To appreciate and evaluate that the "learning" always takes time.
5. To provide opportunities to "reduce the burden" in a smart data analysis model.

2. DATA ANALYTICS IN SUPPLY & DEMAND

In the following subsections both "Demand" and "Supply" will examined for a smart data analytics approach.

2.1 Demand

According to economic theory [2] "Demand" is the rate at which consumers want to buy a product. Economic theory holds that demand consists of two main factors ("taste" and "ability to buy"). (1) The "Taste", which is the desire for a good, determines the willingness to buy the good at a specific price. (2) The "Ability to buy" means that to buy a good at specific price, an individual must possess sufficient wealth or income [2,18,19]. It is important to specify at this point that these two factors of demand depend on the market price (the "data" concept in the proposed model). Hence, when the market price for a product is high, the demand will be low; and when the market price is low the demand is high. At very low prices, many consumers will be able to purchase a product. However, people usually want only so much of a good [1,2,3,20]. Obviously, acquiring additional increments of a good or service in some time period will yield less and less satisfaction. As a result, the demand for a product at low prices is limited by taste and is not infinite even when the price equals 0.

As the price increases, the same amount of money will purchase fewer products. When the price for a product is very high, the demand will decrease because, while consumers may wish to purchase a product very much, they are limited by their ability to buy [1,2,21]. The curve in Fig. 1 shows a connection functionality between the "price" of a good and the "quantity" which consumers are willing to purchase in a given time period. This is known as the so called "*The simple demand curve*" [1,22,23]. The simple demand curve seems to imply that "price", as a data parameter, is the only factor which affects the "demand" and the involved functionalities in data analytics applications. These factors are assumed to be constant over the time period in which price causes supply and demand to a stabilize level [2,23].

A real life example should come from the real estate industry (e.g. short term residential and commercial rentals supported by companies like Airbnb or Booking.com). Here the demand is a complicated dynamic function and the data analytics functionalities should explain better the situation and enhance productivity and prediction modeling.

Please note that the convention in economic theory is to plot the "price value" on the vertical axis and the "rate of purchase" on the horizontal axis. This behavior toward acquiring additional increments of a good is called "diminishing marginal utility" [2,3,20].
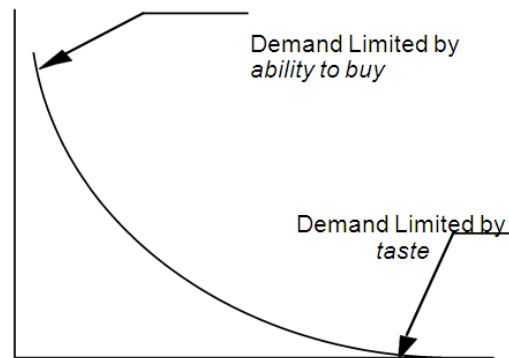

Fig. 1. Demand – The demand curve (Rate of purchase)

The curve in Fig. 1 shows the rate at which consumers wish to purchase a product at a given price. This simple demand curve seems to imply that the "price" is the only factor which affects "demand". In smart data analytics applications, the "Demand" factor is connected with statistical data interpreting the trend of the market in this domain.

2.2 Supply

Obviously, at higher prices, more of the goods will be available to the people. Hence, the suppliers will be able to enjoy a profit despite the higher costs of production. In a real market, when the inventory is less than the supply, management will raise both the supply of their product and its price as well. The short-term increase in supply causes costs to rise, leading to a further increase in price. The supply curve - shown in Fig. 2- slopes upward because each additional unit is assumed to be more expensive to make than the previous one, and therefore requires a higher price to justify its production.

Additional smart functionalities should be achieved (a) by giving to personnel extra overtime hours and payment; (b) by conducting

original research in data analytics concepts related to "supply" and "demand"; (c) by contracting to an outside source rich in information and communication functionalities; and (d) by increasing the load on current equipment.
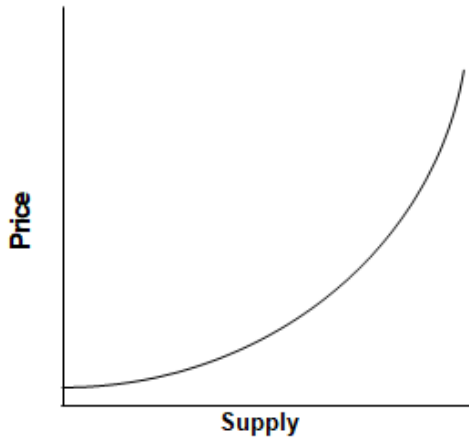

Fig. 2. Supply – The supply curve

At high prices, there is more incentive to increase production of a good. The Fig. 2 represents the short-term approximation of the traditional economic theory. In smart data analytics applications, the "Supply" factor is connected with statistical data interpreting the trend of the market in this domain.

A real life example should come from the real estate industry (e.g. short term residential and commercial rentals supported by companies like Airbnb or Booking.com). Here the supply is a complicated dynamic function and the data analytics functionalities should explain better the situation and enhance productivity and prediction modeling.

2.3 Smart Modeling - Interaction between "Supply" and "Demand"

The "Demand" is defined as the quantity (or amount) of a good or service people are willing and able to buy at different prices; while the "Supply" is defined as how much of a good or service is offered at each price [2]. In a smart model they are interacted each-other to control the market. Actually, buyers and sellers react in opposite ways to result in a change in the "price" (the "data" in the proposed model). When price increases, the willingness and ability of sellers to offer goods will increase, while the willingness

and ability of buyers to purchase goods will decrease [3].

A smart data analytics approach should called a schedule of demand and supply. For each price, it indicates how much quantity is demanded by the consumers per week, and how much is supplied per week. Notice that as price decreases, demand increases and supply decreases. Eventually demand exceeds supply [2,6,7,8].

3. CONCLUSION

The economic theory traditionally presents a model of "supply" and "demand" that explains the equilibrium of a single product market without any relation and influence from the big data concept involved in the business process [3,17,18].

Real world dynamic applications state that the availability of a product, rather than its rate of production, affects the market "price", "supply" and "demand". This means that the inventory ("registry" or "backlog") of a product is a major determinant in setting price and regulating demand [4,5]. To explore better the dynamics of "supply" and "demand" we introduce the introduction of the data analytics concept in the "Supply & Demand Chain".

Hence, to better study the behavior of the market, we examined three (3) major components: "supply", "demand", and "price" in a data analytics framework. Obviously, there will be a series of exercises to help us understand the proposed model [2,3].

4. FURTHER EXPLORATION

Obviously, no one system dynamics model is totally complete. We believe that the proposed model is adequate for the current business activities in the supply-and-demand domain, but there are many-many possibilities for enhancing it even more (for instance, by incorporating artificial intelligence procedures for data capturing, evaluation and interpretation). One possibility is to include the effect of available registry on demand or supply. The current model assumes that if a product is not currently available, the consumer will simply place an order and wait for the product to arrive, creating as a result a negative inventory, registry or backlog.

In future extensions we should include smart data structures based on meta-data to increase the flexibility of the supplier. This would allow for increased production without raising the cost. The extension possibilities, based on artificial intelligence and meta-data structures are unlimited [3,4,6].

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because I do not intend to use these products as an avenue for any litigation but for the advancement of knowledge.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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