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*A comment on the law of supply
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M. Northrup Buechner

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Abstract: Graduate economics departments have largely abandoned the law of supply and demand (henceforth, The Law). Nevertheless, The Law continues to be taught in all undergraduate economics programs, and it is accepted as the fundamental law of price throughout the world. This paper explains how the modern conceptions of demand and supply as schedules have driven The Law from graduate economics. A reinterpretation of the meaning of supply and demand is suggested as the basis for bringing The Law back into the corpus of economic theory, that is, supply and demand should be conceived of the same way Adam Smith and the whole classical school conceived of them— as simple quantities.

Keywords: supply, demand, competition, oligopoly, market structure

Introduction

Graduate economics departments have largely abandoned the law of supply and demand (henceforth, The Law). Indeed, it does not appear in most graduate microeconomics textbooks [1]. Nevertheless, The Law continues to be taught in undergraduate economics programs, and it is accepted as the fundamental law of price throughout the world.

This paper explains why The Law has vanished from graduate economics and suggests a reinterpretation of The Law as a basis for bringing it back into the corpus of economic theory. The paper is divided into two parts. Part I reviews modern economics' theory of price, focusing on the facts of market prices that have nullified The Law as a means of explaining market prices. Part II offers a reinterpretation of The Law that is consistent with how prices change when demand or supply change.

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The law of supply and demand in modern economics' theory of price

Market structure

The theory of price in modern economics revolves around the division of the economy into four types of market or industry, each with its own theory of price. The distinguishing feature of these markets is the *structure* of the industry. 'Market structure' is the concept at the root of modern economics' theory of price.

There are two aspects to market structure, as it is understood in modern economics: (1) the number and relative size of the firms producing a product, and (2) the differences in the products produced by the firms in the industry. On this basis, modern economics identifies four types of market or industry: (1) pure or perfect competition, (2) monopolistic competition (3) oligopoly, and (4) pure monopoly. Only the first three will be considered here; they constitute more than 99% of the firms in the economy.

Pure competition

Pure competition consists of many, many firms, all of them producing an identical product. In the standard interpretation, the distinguishing feature of pure competition is *powerlessness*. This powerlessness consists of the inability of any individual firm to control the price for its product. No firm sets its price. Instead, the price is given to the firm by the impersonal forces of the market; that is, by the conditions of supply and demand.

Modern economists hold that The Law determines price *only* in purely competitive markets. This is because a supply schedule and a supply curve make sense only in pure competition where the price is given to sellers by some outside source. When the price is given to the firm, a schedule can be drawn up of the quantity the firm would choose to sell at each of a series of prices that might be given to it. When a firm sets its own price, a supply schedule is meaningless because the firm does not decide what quantity to produce and sell at a given price. Rather, in the standard interpretation, the firm must choose the profit maximizing price and quantity simultaneously.

In pure competition, nobody on the demand side has any control over the price either. Each buyer is like a customer in a retail store; the price is given to him and his choice is only whether or not to pay it.

The difficulty with this interpretation of The Law is that, in a purely competitive market, there is no way to explain how the price comes to be the equilibrium price. If neither the buyer nor the seller has any control over the price, if neither of them can set a price or give a price or select a price or make a price, there is no way to explain how the price comes to be. If there is no way to explain how the equilibrium price comes to be, there is no basis for believing that the price that does come to be will be the equilibrium price.

Nevertheless, undergraduate economics' professors (and texts) still teach The Law to their students. The standard argument is this: Suppose the market price exceeds the equilibrium price. Then the quantity supplied exceeds the quantity demanded, firms are producing more goods than they can sell, inventories are accumulating, and every firm has a motive to cut its price in order to increase sales. Consequently, it is said, firms will bid down the price to the equilibrium price where they are able to sell all they want to sell. A similar argument is made for below equilibrium prices, though in such cases, it is often said that consumers will bid up the price in the face of a shortage.

This argument ignores the defining condition of pure competition, that neither the firm nor its customers have any control over price. A firm bids its price down by setting a lower price. This requires that the firm has the *power* to lower its price, which means that the price is *not* given to the firm. Similarly, consumers can bid up a price by offering a higher price, but this requires that consumers have the power to offer a higher price, that they do not take the price as given and outside their control. In applying The Law, the only way to explain how the equilibrium price is established is to ignore the basic premise of pure competition and assume that firms have control over price.

If instead, we adhere to the actual meaning of pure competition, the meaning that makes it possible to define a supply curve, then in principle, there is no way to explain how or where the price is set, because no one sets it. This difficulty has been recognized by a number of economists, some of them prominent [2].

The modern interpretation of The Law is built on a logical contradiction. In order to derive a supply curve, the firm can have no control over the price it receives for

its product. But if no firm has any control over its price, there is no way to explain the origin of the price. The implications of this contradiction are not trivial.

Economists say that at the market price, the quantity demanded will equal the quantity supplied, but they cannot say how or why such a price will come to be established in the market. Nor can they say how or why the price will change when either demand or supply changes. In modern economics, The Law is the basis for holding that there will be neither shortages nor surpluses at market prices, but The Law gives no *factual* basis for holding that prices have that attribute.

It is absurd, but The Law is the closest thing modern economics has to a general theory of price. It is absurd because The Law is restricted to pure competition, which, if it could be said to exist at all, would be limited to agricultural markets. Agricultural markets account for something like one percent of aggregate output. A general theory of price that explains (actually, that does not explain) the price of one percent of the economy's output is not a general theory.

Monopolistic competition and oligopoly

Economists think of monopolistic competition as consisting of many, many firms producing slightly different products. Monopolistic competition has as many firms as pure competition, but the product of each firm is a little different from the product of every other firm. Retail stores are often given as examples of monopolistically competitive firms.

According to the theory of monopolistic competition, each firm sets its own price, but the firms are *independent*, that is, neither the price nor any other competitive action taken by one firm can affect the quantity sold by other firms. The reason for this, it is alleged, is that there are so many firms in the market that a change in price by any one of them will have no effect on any of the others.

In contrast, an oligopoly has just a few firms producing the same product or different products. The defining characteristic of oligopoly is a small enough number of firms so that the competitive actions taken by one firm (cutting price, improving quality, improving service, etc.) may affect the quantity sold by other firms and cause them to undertake similar actions in response. Economists call this characteristic *interdependence*. Its consequence is a condition of rivalry among the firms in an oligopoly. By tradition, this market condition usually is ascribed to

national markets dominated by a few large firms, such as the automobile, steel and aluminum industries.

Modern economics' conception of market structure, as reflected in the preceding paragraphs, is invalid. It is not true that retail firms are independent of one another. The relevant market for such firms is local, not national, and within their local markets, dry-cleaners, drugstores, groceries, and shoe stores are interdependent [3]. Each dry-cleaner knows approximately what prices its competitors are charging, and the quality of their work. Each firm can and does respond when its competitors change those conditions. Each firm is likely to give some consideration to how its competitors will respond if it initiates a change in quality or price. This fact must be recognized: *There are no price-setting firms whose choice of price is independent of the price charged by their competitors.* There is nothing in reality that corresponds to the economic model of monopolistic competition [4].

The markets that traditionally are called monopolistically competitive are actually oligopolistic. Local retail firms are just as interdependent as the giant firms that traditionally are designated oligopolies. Probably 95 per cent of markets in reality are oligopolistic in the sense that a change in price by one firm can affect the sales receipts of other firms and cause them to change their prices too. Logically, the theory of price for monopolistic competition and oligopoly must be the same theory. What is that theory?

Modern economics' theory of price for oligopoly

Economists generally recognize that modern economics has no theory of price for oligopoly. Given the ubiquity of oligopoly in the real world, the significance of this hiatus in price theory can hardly be overstated. The cause, it is alleged, is the interdependence of oligopolistic firms. Because oligopolies set their prices, no supply curve can be defined, and interdependence makes it impossible to define a demand curve as well.

This problem of the demand curve must be made unmistakable. A firm's demand curve gives the schedule of quantities the firm can sell at each of a series of prices. It tells us what quantity the firm's customers will buy (demand) at each price the firm might charge. The problem is that in an oligopoly, the quantity a firm can sell at each price depends on what prices its competitors charge at that price.

For example, if Ford Motors lowers the price of its cars, General Motors, Chrysler, Toyota, Nissan, etc. may match its reduced price, or they may ignore it, or they may undercut the lowered price, or they may even raise price instead [5]. Since there are several competitors, they may all do something different, for example, GM matching the price reduction, Chrysler ignoring it, Toyota undercutting it, Nissan raising price. And they may do each of these things in different degrees. This means that at any particular price, Ford Motors can sell an unlimited number of alternative quantities, depending on the prices its competitors charge at the same time. In principle, there is no way to know in advance how competitors will respond to a change in price. Thus, there is no way to predict what quantity the firm will be able to sell at any price other than the current price.

The current price/quantity combination could be taken as one point on the firm's demand curve. But it is impossible to identify another price/quantity combination without a change in price. In fact, for all intents and purposes, oligopolistic firms do not have demand curves. Since they do not have supply curves either, both demand and supply are meaningless in relation to oligopolistic firms. The law of supply and demand is moot.

This is the issue on which the theory of oligopoly has foundered. For the preceding reasons, modern economists believe that we are helpless to derive a price theory for oligopoly. This is not because an oligopolistic firm can *never* know how competing firms will respond to a change in price (or some other competitive action). In fact, firms often do know such things. For example, in the 1950s, General Motors knew that Ford and Chrysler would follow any price change by GM. Of course, that has not been true for a long time—and that is the point. There is no response *in principle* that can be counted on, no response that is *known* always to be the same. Consequently, no *general* theory of price is possible for oligopoly. All that can be done, and all that has been done, is to derive specific, narrow theories on the basis of either (1) restrictive assumptions about the response of competitors (e.g., the kinked demand curve), or (2) assumptions that are true only in narrowly defined sub-markets and time periods.

Economists responded to this dead end by adopting game theory, which is based on and assumes interdependence. Game theory has dominated graduate economics for about the last forty years, and by now, most of its value for understanding price has been exhausted. No general theory of price for oligopolies has appeared.

Implicit in the preceding is this basic insight: the 'interdependence' of oligopoly is the defining condition of competition. *Oligopoly is the competitive case*. It is totally unrecognized by modern economists, but this represents a catastrophe for the profession. Economists cannot use The Law to explain the functioning of competitive firms, and such firms constitute 95 percent of the economy.

Ideas have consequences. The pillar supporting market prices has been pulverized in theory, and it is only a matter of time before it is pulverized in the public mind as well.

The law of supply and demand reformulated

In what follows, only those cases where the price is set by an individual or a business will be dealt with explicitly. Negotiated prices will be ignored since they would needlessly complicate the exposition.

The conception of supply as a schedule is coherent only in pure competition— where the theory of price in which it participates is incoherent. Demand as a schedule has been ejected from the theory of price in competition (oligopoly) because competitive firms do not have demand schedules.

To rescue the law of supply and demand from oblivion, the concepts of supply and demand as schedules have to be abandoned. Both supply and demand should be thought of the way the classical economists thought of them (see Adam Smith's theory of price), and the way businessmen think of them: as simple concrete quantities— as the quantity demanded and the quantity supplied per time period. (In what follows, all references to supply and demand should be taken as assuming a specific period of time.) In other words, any distinction between quantity demanded and demand should be given up, and likewise for quantity supplied and supply.

Defined as the quantity demanded, demand can be applied to any real-world firm or industry, including oligopolies. An increase in demand should be defined as an increase in the quantity demanded, and a decrease in demand as a decrease in the quantity demanded. Such changes can be caused by a change in the price of the product, or changes in the prices of competing products, or changes in the price of complementary goods, or changes in income of the customers, or changes in tastes, or changes in any number of other things. The important point is that, when demand is understood in this way, there is no difference in the effect on demand of changes in price and changes in other factors.

Defined as quantity supplied, supply also is meaningful and applicable across the economy. Its restriction to pure competition is ended. An increase in supply should be defined as an increase in the quantity supplied and a decrease in supply should be defined as a decrease in the quantity supplied.

Orthodox economists treat the relation between price and demand and between price and supply as completely parallel relations, that is, they hold that a change in demand is a change in the quantity demanded at every price and a change in supply is a change in the quantity supplied at every price. Treating both demand and supply as schedules causes them to miss this fundamental difference: demand is in the hands of the firm's customers and is determined by what they do; supply is in the hands of the firm and is determined by what the firm does. Consequently, the relation between changes in price and changes in supply is completely different from the relation between changes in price and changes in demand.

Changes in all the factors that traditionally are interpreted as shifting the short-run supply curve (most prominently, the unit cost of production) do not shift anything. Instead, they change the price the firm wants to charge— which changes the quantity the firm's customers buy— which changes the quantity the firm sells— which changes the quantity the firm produces. Only these last two can be taken as changes in supply.

For example, if the manufacturers of steel raise their prices, then the manufacturers of automobiles will raise their prices, sales of automobiles will fall, and the automobile producers will cut back on production. A change in supply is an indirect effect of a change in price, affecting the firm's supply by means of a change in demand.

In other words, when a firm changes its selling price, it directly causes a change in quantity demanded via the law of demand. If the unit costs of a firm increase and the firm raises its price, the quantity supplied decreases in response to (or in anticipation of) a decrease in the quantity demanded.

The law of demand

The law of demand says that an increase in price will reduce the quantity that people want to buy and a decrease in price will raise the quantity people want to buy. This law is true and important. Its application is virtually universal across the economy. The few alleged exceptions are inconsequential. But the law of demand

does *not* say that every firm has a schedule of quantities it can sell at various prices, and the proposition that firms rely on such schedules is false.

Contrary to modern economics, there is no necessity to conceive of the law of demand as a schedule or a curve or a mathematical formula. More important, conceiving of the law in that way nullifies its value. The law of demand is entirely intelligible as it stands, as expressed in the first sentence of this section, and as the classical economists understood it. In that form, it is invaluable in understanding and explaining many economic phenomena (see Alchian and Allen, Ch. 5, 1972).

The law of supply

The law of supply says that at higher prices, firms want to produce and/or sell larger quantities and at lower prices, firms want to produce and/or sell smaller quantities.

There is no such law.

In the real world, the only way a firm's selling price can rise is if the firm raises it. If a firm raises its price, the law of demand says the firm can sell less and consequently, the firm will want to produce less, not more. Blinder et al (1998) found that 89% of the firms in the economy have constant or falling unit costs as they increase output. What keeps them from increasing output is not a higher price.

Alternatively, the only way a firm's selling price can fall is if the firm reduces it. If a firm reduces its price, the law of demand says the firm can sell more, and in fact, normally a firm reduces its price because it *wants* to sell more. This means that the quantity supplied does not decrease with decreases in price. It increases.

To apply The Law to the real economy, the law of supply should be abandoned, along with the distinction between supply and quantity supplied. Apart from the effect of changes in price on demand, there is no fixed relation between price and quantity supplied for all business firms. Consequently, no meaningful supply schedule can be drawn up and the *ceteris paribus* assumption, while still relevant to the law of demand, is irrelevant to the law of supply. There is no law of supply.

The law of supply and demand

What is The Law that follows from the preceding? If one accepts these concepts of supply and demand that are meaningful for firms, markets, and industries across the economy, what does one have?

This is the fundamental meaning of The Law: In a free economy, every market price reflects the facts of demand and supply that are relevant to that product. The critical conclusion is that prices are determined by facts, prices reflect facts, and therefore, prices are objective. Prices are not the result of whims or wishes or arbitrary choice. They are the result of and reflect the facts of supply and demand. The proof of that conclusion is that everyone who sets a price must consider the conditions of supply and demand if his price-setting is to be successful.

The primary corollary of the law of supply and demand is that at every market price, the quantity demanded will equal the quantity supplied, that free markets will tend to have neither shortages nor surpluses. This is the standard interpretation of the law. Its proof is that it is always unprofitable for firms to produce more than they can sell and that it is usually unprofitable for firms to produce less than they can sell [6].

Secondary corollaries of the law of supply and demand consist of what happens to price when demand and supply change. An increase in supply (that is, the quantity supplied) reduces the price because larger quantities can only be sold at lower prices (the law of demand). This conclusion coincides with orthodox theory. However, the effect of a decrease in supply differs from orthodox theory. When the aggregate supply offered for sale in a market decreases, firms may raise their prices, particularly if their profits have been deficient at the old price. But, if the quantity supplied declines because a competitor has gone out of business, the remaining firms are more likely to increase output than raise price.

Neither do changes in demand lead to the standard results in this reformulation. The view throughout modern economics is that increases in demand raise the price and decreases in demand reduce the price. That is not true. Firms normally respond to an increase in demand by increasing their output and to a decrease in demand by decreasing their output. Increases in demand usually raise price only when the firms' unit costs are rising. This tends to occur primarily when firms' outputs approach capacity.

Commodity markets

There are markets in the economy where the law of supply and demand in its orthodox form is true. It is difficult to characterize these markets except to say that they embrace very large numbers across a wide population or geographical area. The market for babysitters is an example, but the most widespread and important

markets of this kind are commodity markets, where the price is set by speculators in futures markets. The spot price, that is the current price, is the future price nearest in time, adjusted for the current cost of delivery to the customer (such as transportation and insurance costs).

In these markets, price responds to changes in demand and supply the way the traditional theory says it responds, that is, an increase in expected demand raises the price and a decrease in expected demand lowers the price, while an increase in expected supply lowers the price and a decrease in expected supply raises the price (that is, 'expected' by the speculators.) However, these concepts of supply and demand are distinct from the standard schedules of orthodox economics. Changes in prices in futures markets are in response to expected changes in the *quantity* demanded and expected changes in the *quantity* supplied. Speculators have no notion of demand and supply as schedules.

In commodity markets, individual firms are not responding to increases and decreases in the quantity their customers want to buy, deciding what to supply and in what quantity, and determining what price to charge. Consequently, it is not surprising that the effect of changes in demand and supply is different. Nevertheless, the moment to moment changes in prices in commodity markets can only be understood in terms of demand and supply thought of as quantities.

Conclusion

Thinking of demand and supply as quantities makes The Law relevant and intelligible across the economy. However, this reformulation of The Law has a drawback: it does not lend itself to graphical representation or to mathematical modeling—it cannot be conceived as crossing lines on a graph. The equilibrium price cannot be solved for by simultaneous equations. Consequently, it will be of no interest to those economists for whom mathematical modeling is the standard of economic significance. This will be the case until the math-fad passes.

Properly understood, The Law is not a theory of price determination. It is a theory of the characteristics of prices established in a market economy. *That is an enormous contribution.* But The Law does not and cannot tell how the market price comes into existence. This means that the concept of The Law as constituting impersonal market forces determining prices independently of individual human beings also should be abandoned. That concept is a fantasy and it stands in the

way of a genuine understanding of how markets function. *There are no impersonal market forces setting prices anywhere in the economy.*

Every price originates in the mind or minds of individual human beings (including speculators) and comes into existence only by their choice. Any theory of price must start with that fundamental fact.

Endnotes

[1] See, e.g., Jehle and Reny 2011; Kreps 2013; Mas-Colell, Whinston, and Green 1995; Riley 2012. The standard diagram appears on page 1 of Kreps, but there does not seem to be a reference to it in the rest of the book.

[2] E.g., Arrow 1959, 41-43; Fisher 1983, 12, 21, 47, 49; Fisher 1987, 26-7; Guerrien 2002; Hahn 1987, 137; High 2001, xxxviii; Janssen 1993, 111; Mas-Colell 1980, 121; Scitovsky 1971, 15. Of these, only Fisher and Guerrien see this problem as fundamental. 'It is not too strong to say that the entire theory of value is at stake' (Fisher 1987, 27).

[3] This point is touched on by Silberston 1970, 557.

[4] See Cohen and Cyert 1965, 225-6, for exactly this point. Also see Hall and Hitch 1939, 21 and Blaug 1978, 415.

[5] In a research paper, a student reported a dry cleaner who raised his price in response to a price reduction by a competitor.

[6] See Haddock and McChesney 1994 for cases where firms found it profitable to keep price unchanged when they could not produce all they could sell.

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