

# Implications of the bertrand model



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In 1893 French economist Joseph Bertrand developed his Bertrand model of competition from his review of Antoine Cournot's study of a Spring Water duopoly. His criticism lay with how firms in oligopolies compete. In his model firms compete with prices rather than Cournot's quantities. (REFERENCE TO SPANISH JOURNAL) The model consists of two firms who set prices simultaneously and independently (HUGH GRAVIELLE AND AY REES, MICROECONOMICS), Jean Tirole explains this as when one firm sets its price it is ignorant to its rival's price, rather it "anticipates" what they will charge.

It is assumed products are homogeneous and perfect substitutes (ECONOMICS) and due to the nature of the product the firm supplying output at the lowest price will gain the entire market demand. (GB!) This firm will have to supply all the forthcoming demand at the price they have set; gb1 from this an important assumption of the model is that there are no capacity constraints, that both firms have the same marginal cost, which remains constant, and that demand is linear.

GB2 As stated, the entire market demand for homogeneous products will go to the firm offering the lowest price, although if both firms were to sell at the same price "a sharing rule must be assumed" GB2. Using an example from the (let's suppose the market demand for a homogeneous product is given by,  $Q = 120 - p$  (where  $Q$  is quantity demanded and  $p$  is price charged). The marginal cost (MC) for both producers is,  $C = \$30$ , and both producers sell output at  $p = c = \$30$ . The demand for each producer is  $Q = 0.5 * 120 - p = 45$ .

Let's say producer A increased their price to  $c = \$31$ , the entire market demand would transfer to producer B who would now have a demand

function of  $Q_b = 120 - c = 90$ , while producer A would have zero demand.

However if producer A had reduced their price to  $c = \$29$ , they would capture the entire market demand through charging the lowest cost, however they would make a \$1 loss in each product sold. From this, the Nash equilibrium for the Bertrand model lies where  $P = MC$ , with demand so heavily influenced by price producers do not want to be undercut by rivals.

With  $P = MC$  no rival will undercut as zero profits are preferable to negative profits, and any firm trying to charge above the MC and make positive profits will receive no sales. The suggestion is the addition of one firm restores perfect market competition (Jean Tirole, 1998), moving the market from monopoly power and profits (maximum inefficiency) to perfectly competitive (maximum efficiency). It had been deemed a paradox as it is difficult to believe that two firms in a duopolistic market can make zero profits.

We are able to resolve Bertrand's paradox through relaxing one of the three integral assumptions of the model (intro to industrial org I. M. B Cabrail). In order to analyse its practical relevance and its implications, this essay will now give examples of where the paradox can be deconstructed. The first example of a solution comes from a combination of two assumptions, the first is the absence of capacity constraints, and the second firms make decisions independently.

In the model whichever firm is charging the lowest price will receive the entire market demand, and is "expected to supply all forthcoming demand at the price it has set" (old xavior). There are few situations in the real world where one firm could satisfy the demand of the whole market. Using the

previous example, producer B gained the entire market demand ( $Q = 120 - 30 = 90$ ). Let's assume producer B has a capacity constraint below 90 units.

There is now a proportion of the market that can only be satisfied by producer A, who can use monopoly power and make positive profits as the only producer. (managerial Economics a strategic approach). This example shows how with the inclusion of a common real world problem, Bertrand's proposed equilibrium of price equal to marginal cost is deconstructed. A second implication of capacity constraints is their effect on collusion between firms. Collusion reduces market competitiveness, firms tactically agree to set prices above particular levels and to not to engage in price wars,(REF).

A positive relationship between excess capacity and collusion was identified by David and Deneckere, who found excess capacity is a "prerequisite for stable collusion" while it provides a "stronger bargaining position within cartels" (QUOTE TO JOURNALS THAT ARE ON JUBILEE AND WOLF). These effects have been seen in oil cartel OPEC, which has existed since the second world war and where the largest producer, Saudi Arabia can flood the market if small producers "cheat" on their quotas. (paul Pijush).

Through years of controlling supply and therefore price the cartel will receive one trillion dollars in revenues this year, (Wall street post). The prisoners dilemma is "a particular game between two captured prisoners that illustrates why cooperation is difficult to maintain even when mutually beneficial" (REF). It helps to demonstrate the logic behind Bertrand's Paradox. Both firms would benefit from charging a price higher than

marginal cost, however at this level both firms have an incentive to undercut one another. (managerial economics).

If the rules of the game can be changed each agent would receive a higher revenue payoff. (Global Business Mike W peng). Two companies who saw this were General Electric (GE) and Westinghouse. In the early 1960s these two companies controlled over 98% of the US market for large turbine generators. Prior to purchase, electric utilities would negotiate with GE and Westinghouse who, as in Bertrand competition, competed on price.

Government owned utilities accounted for twenty five percent of the market share and by law had to purchase from the cheapest provider and publish the price.

The two firms generated low profit, as Bertrand competition predicts, until GE ' changed the rules of the game' by introducing a price book. The process effectively set a higher market price and guaranteed higher profits, the price publishing behaviour continued successfully until 1975 when the US Department of Justice investigated the industry. Price books were ruled to breach anti-competition laws and the firms were fined. The book, Technology and Transformation in the American Electric Utility Industry by Richard F.

Hirsh goes into this example in much greater depth. This is an important example as it demonstrates that Bertrand competition can exist in the real world. However the assumption of zero profits, or in the example, low profits encourages companies to collude to set higher prices and make positive profits. The Bertrand model also assumes that with the entrant of a second

firm into the market, and the subsequent Nash equilibrium, price equal to marginal cost, removes the need for policy makers to intervene.

However from the previous example this is obviously false as policy makers did have to intervene and sanctions were made. To stress this point, another example; Pakistan's Federal Cabinet moved powers of oil price fixation to the Oil Companies Advisory Committee in 2001, through flawed policies profits of the duopolists Pakistan State Oil and Shell Pakistan increased by 232% between 2001 to 2005. which lead to further state involvement to enforce price restrictions and encourage competition. (competition reporter. 25, 05, 2009).

In the Bertrand model we assumed that both firms had the same costs of production which remain constant. It is an extreme assumption that two firms would incur exactly the same costs when producing their products, let us now assume that one firm had a cost advantage, i. e. firm A can produce marginally less expensively than firm B ( $c_A$

Firm A however could price at a level just below firm B's price, for example  $P_B - \epsilon$  ( $\epsilon$  being a small number). The result would see firm A satisfying all market demand, assuming no capacity constraints, while making a positive profit on output, (managerial economics). This example expects that some firm(s) should make positive profits within equilibrium, which contradicts Bertrand's theory. Another assumption which needs to be addressed is the absence of sunk costs in Bertrand's model. Sunk costs may be defined as costs that cannot be avoided by going out of business, i. e. they are the costs incurred to enter a market place (real estate market analysis- method and

applications, John M. Clap). Without sunk costs any firm can enter any market without financial risk; however this situation is very rarely seen in real world scenarios. There would be no incentive for a firm to enter into a market which displays Bertrand competition if the market had significant sunk costs. For a Bertrand market to be productively efficient, pricing must always be at marginal cost.

This requires the simultaneous entry of two or more firms, who on simultaneous entry will remove any possibility of gains from the market. The market price will be zero and the sunk costs will never be regained, there would be no benefit to joining only a cost. REFERENCE JOURNAL It is more likely that either one firm enters that market, charging a non-competitive monopoly price and positive profits, or no firms enter and the product is not produced or sold. Both scenarios lead to a reduction in consumer surplus while questioning the practical relevance of Bertrand's assumption.

The assumption that both firms produce a homogeneous product, which leads consumers to purchase from the cheapest producer on every occasion (as decisions are based solely on price). (Managerial economics, 2nd ed). Has been seen in real world business, notably from the previous example of GE and Westinghouse, although this assumption does not always apply. The location of producers and the transport cost associated with purchase are features that differentiate products in the eyes of consumers. Yet they are excluded from the Bertrand model but included in the Hotelling model (introduction to industrial organisation).

Location is an example of horizontal product distribution, occurring when the market offers a range of similarly priced products which ease consumers hunt for their preference (K. Geroge et al. 2005). Suppose there are two hot dog vendors either ends of a beach, vendor A and vendor B. Each vendor sells an undifferentiated product at the same price, however if a customer is closer to vendor A they would rather purchase from vendor A than vendor B, as they would not have to walk as far. Now let us suppose that vendor B charges  $p_B = c_B$  and vendor A charges  $p_A = c + \epsilon$  ( $\epsilon =$  a small number).

Under the Bertrand model of competition vendor B would receive the demand for the entire market, however the Hotelling model argues that vendor A will retain customers located closer to A. This is because the price differential more than offsets the transportation costs associated with the purchase from vendor A, in this example the time customers spend walking. (theory of industrial organization) this demonstrates that zero profit is no longer the equilibrium price, as a firm selling at a price above marginal cost retains demand.