

Long-Run Industry Supply Curve and Producer Surplus

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Abstract

This paper uses the notion of Ricardian rents to resolve the confusion about the relationship between producer surplus and industry supply curve. Producer surplus is profits if it is not capitalized and is Ricardian rents if it is capitalized.

Classification of JEL: L13

Keywords: profits, Ricardian rents, producer surplus

I. Introduction

The long-run competitive industry supply curve can be presented as upward-sloping, horizontal, or even downward-sloping. But, when one reads the chapter on producer surplus in a textbook, the figure always shows that supply curve is upward-sloping. Therefore, it is intuitive to conclude that producer surplus exists only when the technology exhibiting decreasing returns to scale, but it does not exist in constant returns economies. This may perhaps give rise to confusion as follows: "How come producer surplus cannot occur in constant returns economies?"² The resolution of this confusion requires a cautious investigation of the essence of long-run producer surplus, and inevitably involves the concept of Ricardian rents. This is because upward-sloping supply essentially results from Ricardian rents accruing to inframarginal firms. Also, these rents are the returns to some unique factors, such as personality of the owner or good location of the plant that creates cost advantage of the firm. The resulting surplus is profit if it is not capitalized and is Ricardian rent if it is capitalized. This article emphasizes that a delineation of how producer surplus is derived from supply curve as well as under what conditions it can be made possible to sustain is important for economics learners to understand the essence of producer surplus. Ignorance of this issue may cause inconsistencies that leave researchers feeling confused rather informed. Based on the previous idea, the purpose of this paper is to identify the potential inconsistency in the standard treatments of producer surplus and to suggest more consistent and productive pedagogical approach while being careful to recognize the source and nature of the surplus. To be effective, this approach must not only be internally consistent but also must conform to what one learns elsewhere in a standard introduction course.

II. Production Factors in the Long-Run

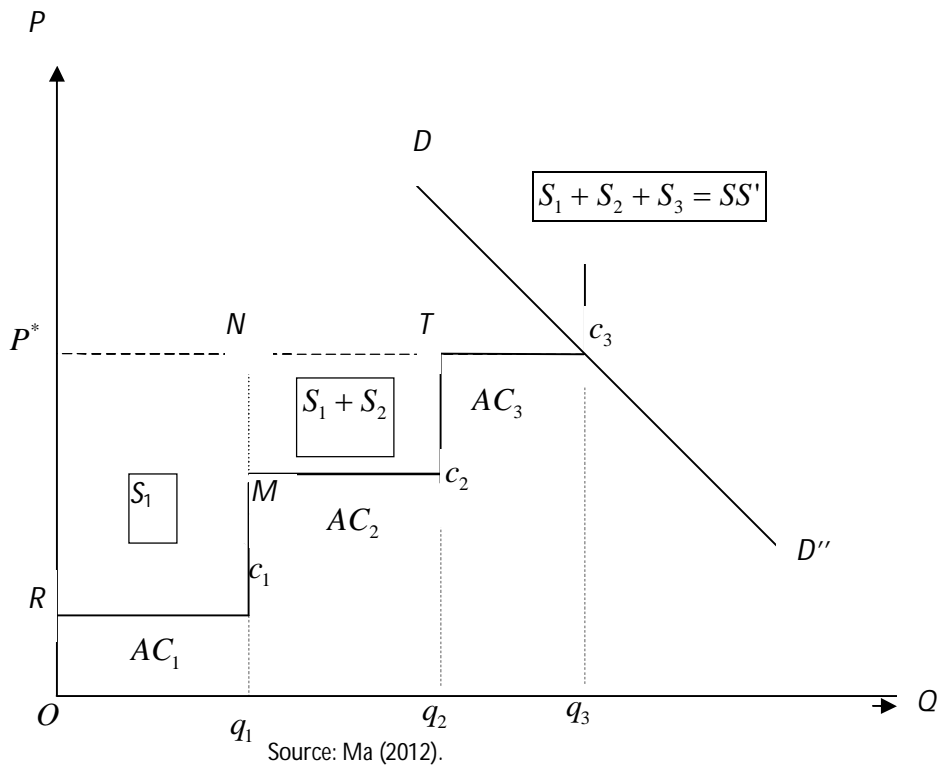
Producer surplus is the amount above the supply curve but below market price. The main insight should include the following: (1) In constant (or increasing) returns economies, producer surplus is zero; (2) But, in decreasing returns economies, producer surplus is positive.

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² One might be further frustrated with the following confusion. What will happen to producer surplus if production exhibits increasing returns? Will producer surplus become negative? Why do producers agree to trade if they suffer? Actually, the original meaning of Marshall's producer surplus (Marshall 1920, pp.810-11) is nothing related to the conception of scale economies. Producer surplus is simply used to explore the effects of differential cost advantage (or production efficiency) on the economic welfares.

(3) If one considers the fact that more efficient firms earn more Ricardian rents in competitive markets, then most industries exhibit decreasing returns. Nevertheless, the pedagogical approach has to clarify the time horizon very carefully so as to maintain consistency and to avoid misunderstanding. Generally, the introductory textbooks assume two production factors: labor (L) and capital (K). The former can be varied in both short-run and long-run, but the latter can only be adjusted in the long-run.³ If, in the long-run, each firm faces the same and constant factor prices, then both L and K are available in perfectly elastic supply. In such a situation, production function exhibits constant returns technique, and thus the long-run competitive supply curve would be horizontal and there would be no producer surplus. This is because total revenue equals opportunity cost which consists of all the foregone benefits of the next best alternative in the production process. It makes almost no difference between staying in the business or not. Basically, this kind of treatment implicitly assumes that all firms have the same production function or efficiency frontier such that no one has a technological advantage over any other. Since there are many firms free to enter and exit the business at any time, all firms make zero surpluses or any forms of profits in the long-run. However, when teaching the chapter on producer surplus, one should discard this assumption in the first place, and should allow for the possibility that firms are various in cost advantage. This could be done by introducing another production factor, for convenience, calling it entrepreneurship (E) which is various across firms, and its supply is fixed in the long-run. This factor includes some very specialized entrepreneur elements such as personality of the owner, monopoly right granted by the government, good location, or even Fellowships of the Royal College of Surgeon, etc. It cannot be bought on the market, since it is an exclusive attribute of each individual firm. As a result, it should be treated as a private talent and is available in fixed supply even in the long-run.⁴ This inevitably makes the production function vary from one firm to another. It is, therefore, seen that firms exhibit different efficiency (cost advantage). This specification allows for an appropriate scope to explain the essence of producer surplus in the case of constant returns to both K and L .

Figure 1: Producer Surplus (Discrete Case)



³ In the short-run, SMC (short-run marginal cost) is the increase in the expenditure on L , if output increases one unit. In competitive market, firms set price equal to SMC , and industry supply curve is the aggregate MC which is presented as upward-sloping because marginal product of L decreases with output, while K being fixed. The price- AC discrepancy is short-run profit contribution, and profit is this amount minus fixed cost (or quasi-rents). These conceptions are discussed at length in most textbooks, for example, Hubbari and O'Brien (2006), Liberman and Hall (2005), and Parkin (2003).

⁴ Note that K is variable in the long-run.

III. Does Producer Surplus Occur in Constant Returns Economies?

The previous idea can be explained by Ma (2012), who use an upward-sloping industry supply curve SS' in Figure 1 that is sketched by ranking outputs from the lowest-cost firm (i.e., firm 1) to the highest cost firm (i.e., firm 3) along the horizontal axis. Owing to the limited demand, the high cost firms cannot enter into the market unless all low cost firms have used up their capacities. In Figure 1, Oq_1 is the quantity supplied by the lowest-cost firm; q_1q_2 is the quantity supplied by the next lowest-cost firm; and so on. In this figure, firm 1's supply curve (S_1) is depicted as ORc_1M , which is horizontal in the situation of constant returns to scale ($MC = AC$). Similarly, the supply curves of firm 2 and firm 3 would be depicted as Pc_2T and Tc_3 , respectively. Any point on Rc_1 , Mc_2 and Tc_3 denotes the AC of that particular firm. Thus, the long-run AC for firm 1, 2 or 3 becomes c_1q_1 , c_2q_2 , and c_3q_3 . Evidently, this positive slope of industry supply curve is driven by the firms' different cost advantage in operational efficiency.⁵ Then, following the standard treatment, I designate expenditures on L and K as total cost of firm 1, which is the area under firm 1's supply curve between the origin and q_1 . Thus, the producer surplus for firm 1 (or firm 2) is total revenue minus total cost; that is P^*Nc_1R (NTc_2M). However, this specification leaves firm 3 with zero surpluses. Marshall (1983, p. 811, f.2) called this supply curve as 'particular expenses curve,' which is based throughout on the assumption that the aggregate output is Oq_3 and firms with different efficiency pay out the same and constant prices for inputs L and K . Therefore, producer surplus exists even in the case of constant returns to factors which are available in elastic supply (L and K).⁶ Finally, as the number of firms increases, the discrete structure of SS' in Figure 1 gradually evolves into a continuous case outlined in Figure 2 in which industry's producer surplus takes the area of P^*SE .

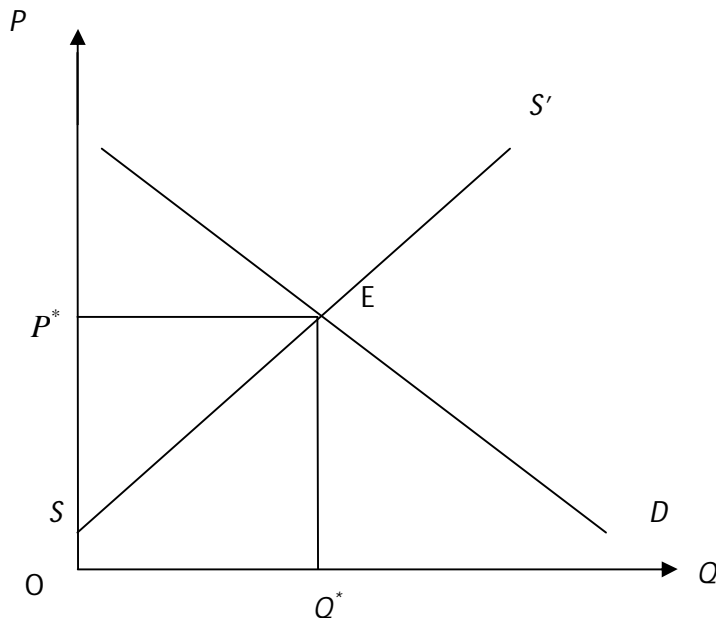


Figure 2: Producer surplus (continuous)

⁵ The fact that firms seem to be making profits in the long-run might contradict the well-known property of profit being zero in the long-run equilibrium of competitive markets. But, one can resolve this paradox by regarding the surplus as a 'cost', and then analyzes the nature of this cost from the viewpoint of Ricardian rents. This will be done in the last section of this essay.

⁶ For this reason, producer surplus takes shape as the area between the equilibrium price and the supply curve, a curve that slopes upward as a result of placing the firms in order of diminishing efficiency.

IV. Producer Surplus and Ricardian Rents

Finally, some time have to be spent on explanations of the essence of producer surplus or Ricardian rents. In the long-run, this surplus can exist only when one input, E , is fixed or less than perfectly elastic in supply. An equilibrium expansion of output will result in a rise in the price of E relative to K and L , and, therefore, firms have to use more K and L . This, in turn, increases the costs of K and L . In contrast, when all factors (E , K and L) are variable or perfectly elastic in supply, one cannot derive the producer surplus, since the production function exhibits constant returns to scale as Figure 3 depicts. *Theoretically*, producer surplus is zero in the case of constant returns to scale. However, *in the real world*, industries with scarce 'most efficient firms' are more plentiful than those with 'equally efficient firms'.⁷ In addition, E contains some specialized entrepreneur skills and hence cannot be traded in the market, not to mention the possibility that it is perfectly elastic in supply. Therefore, one can safely claim that the production function exhibits decreasing returns to scale even in the long-run. From both theoretical and practical perspectives, producer surplus is always positive as Figure 2 show. One may also firmly trust that any transaction definitely benefits both prouder and consumer as long as it is bilaterally voluntary and informed, and there would be no contradictory message about the existence of surplus in the long-run equilibrium.

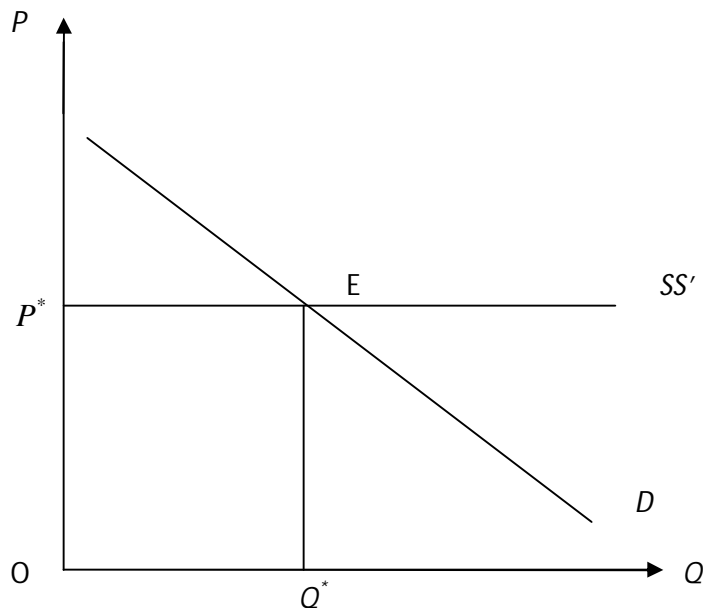


Figure 3: Producer surplus (constant

V. Conclusion

Producer surplus involves a potential contradiction with the maintained hypothesis that perfect competition ensures zero profits in long-run equilibrium. With this regard, this paper can be concluded by using a question: "What is the difference between producer surplus and profit?" Basically, this puzzle arises from the confusion between profits and rents. Producer surplus is derived therefrom being in the nature of the rents attributable ultimately to the specialized factors that confer cost advantage on firms employing these factors. The source of the rents is always a cost advantage. The resulting surplus is profits if it is not capitalized and is Ricardian rents if it is capitalized. Therefore, the puzzle can be easily resolved by the latter approach which can define things so that, even though the assumption of 'equally efficient firms' does not hold, profits still equal zero in a long-run equilibrium. This is done by saying that what a firm with a cost advantage earns are not profits, but rather Ricardian rents to its entrepreneurship (E). These rents come off the top as costs to be paid for input E such that the firm is back to earn zero profits.

⁷ See Mishan (1968) and Sanderson and Winter (2002).

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