

Estimation of Economic Rent as a Measure of Factor Owners' Welfare

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Several studies have attempted to measure social gains or losses of various sorts of economic phenomena by partial welfare analysis. In such an analysis, the concepts of consumers' and producers' surpluses are the most commonly used analytical tools. Although the validity of each of these concepts has been debated, consumers' surplus is considered more meaningful than producers' surplus [Berry, Mishan]. But all of the controversy concerning validity and meaningfulness of these concepts has been on the conceptual level. The empirical evidence is lacking.

This paper focuses on some of the theoretical controversies that surround one of these two concepts—producers' surplus or more appropriately economic rent.¹ It is argued that in certain instances economists have committed fundamental theoretical errors in specifying economic rent. For the first time, empirical evidence is presented on some of the controversies that surround this concept. The analysis suggests that in generating a valid welfare measure of factor owners, the empirical problems may be as thorny and formidable as the conceptual problems. Specifically, the objectives of the paper are 1) to present evidence that estimates of economic rent could be significantly different depending upon the nature of

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¹In this paper the term economic rent is used instead of the term producers' surplus. The latter term, as argued by Mishan [1968], is misleading. It is misleading since the term "producer" carries connotations of an entrepreneur, and consequently the producers' surplus measure may suggest profits of some sort. The term economic rent is more appropriate in that it suggests returns to factor owners who may or may not be the entrepreneurs.

supply curve as well as the concept of rent employed, and 2) to show that the use of statistically estimated supply curves in measuring changes in economic rent and welfare of factor owners could yield inaccurate estimates.

Theoretical Setting

Theoretical controversy concerning specification of a valid measure of changes in well-being of factor owners has focused on three basic issues. First, what supply curve is to be employed; second, what concept of economic rent is relevant; and third, what conditions must hold for the measure to be valid. Although this paper will not address the last issue, a brief comment is in order. Berry has attempted to establish a symmetry between producers' surplus and consumers' surplus. He has indicated that "there is little reason to believe that the set of conditions which make the consumers' surplus measure meaningful are better satisfied in the real world than the (almost) symmetrical set which make the producers' surplus measure relevant [pg. 79]."² He has failed to note, however, that production of some products, particularly of agricultural crops, is very risky. For such products, specification and estimation of supply curves would be more problematic than that of demand curves. Consequently, the estimation of economic rent may be less precise compared to the measure of consumers' surplus in the case of agricultural industries.

Economic theory suggests that two types of supply curves and three alternative measures of economic rent may be employed to estimate changes in the factor owners' welfare. Supply

² One additional condition noted by Berry is that in the case of producers' surplus, each industry should be producing under constant returns to scale.

curves may be of short run or long run nature, whereas economic well-being may be measured as Ricardian, Paretian, or Marshallian rent.³

Concerning supply curves, Mishan [1968] has suggested that the area above the short run industry supply curve has a clear meaning and is relevant as a measure of Marshallian rent. However, he has indicated that the area above a rising long run supply curve carries no economic significance. Shepherd disagreed with Mishan. He rightfully distinguished between the Ricardian and the Paretian concepts of economic rent and maintained that, in deriving welfare propositions, economists are correct to view the area above the long run supply curve as a relevant measure of economic rent in the Paretian sense.

Despite the controversy over whether the rather restrictive conditions hold in the real world or not, and what supply curve and concept of economic rent to employ, one conclusion seems inescapable: the statistically estimated supply curves might yield biased measures of changes in economic rent, and hence, in economic well-being of factor owners. This may be due to two reasons. One, such supply curves often have either positive quantity-intercepts implying zero marginal costs of production at initial output levels or positive price-intercepts significantly different from marginal costs.⁴ In figure 1a, which is similar to the figure in Schmitz and Seckler, both of the supply curves suggest that certain minimum level of output can be produced at zero, or even negative, marginal costs [see Appendix]. Since that is rarely the case in the real world, the social gain specified by Schmitz and Seckler as the area IHGF (resulting from shift in the supply curve from S^0 to S^1 due to a technological innovation) could be biased.⁵

³The three concepts of economic rent may be defined as follows: Ricardian rent is the excess amount earned by a factor over the sum necessary to induce it to do its work [Wessel]. Paretian rent is excess earnings over the amount necessary to keep the factor in its present occupation [Wessel]. Marshallian rent is a surplus above that necessary to elicit the productive services of a resource specific or fixed in supply to the industry in the short run [Mishan].

⁴Even if intercept is "forced" to equal marginal costs, the slope or curvature of the "true" and estimated supply curves may not be identical.

⁵Several other references also could be cited where social gains or losses have been specified and/or estimated on the basis of similar supply curves. Furthermore, such studies have rarely indicated whether the estimates are based on short- or long-run supply curves.

Second, often production (supply) are not available at very low and very high prices. Thus, in most cases the supply curves are estimated on the basis of mid-range observations on prices and quantities with the implicit assumption that a similar trend or relationship holds at lower as well as at higher prices. This assumption, through convenient, is untenable on the basis of economic reasoning. Thus, measurement of changes in economic rent from supply curves estimated by extrapolating the relationship that holds at mid-range prices and quantities would not be accurate.⁶

The measurement problem of the sort noted above could, however, be avoided by estimating welfare changes as changes in quasi-rent.⁷ For example, in figure 1b, assume that when long run supply curve is S^0 , B is a point on AVC curve. If due to an exogenous increase in average variable cost, the supply curve shifts to S^1 , E would be the point on the new AVC curve. Assuming that the industry is perfectly competitive and points C and F are also on LAC curve, change in quasi-rent would equal the area $P^0 ABC - P^1 DEF$.

In light of the above discussion, it would be interesting to discover whether estimates of changes in economic rent and the well-being of factor owners based on alternative approaches are equal to, or differ from, one another. And if they differ, what are the implications of such differences. These questions are the subject of inquiry of the following section.

Results

To investigate some of the issues raised in the previous section, the study focused on the case of factor owners employed in the production of annual rye grass seed in Oregon. After harvest,

⁶A parallel question arises then of why would empirically estimated demand curves yield relatively more accurate estimates of consumers' surplus. Perhaps the consumers' surplus measure would be less precise, too, in the case of a new product or in cases where aggregate demand curve shifts due to exogenous changes. But often times consumers' surplus is estimated for price changes along a given demand curve; for example, for a price change similar to that from P^0 and P^1 in figure 1a. And both supply and demand curves can be estimated with fair accuracy in that range—the range where most of the data could be observed.

⁷Quasi-rent as defined here is measured as price of rye grass minus average variable cost times output.

Fig. 1a. Gains from a technological innovation.

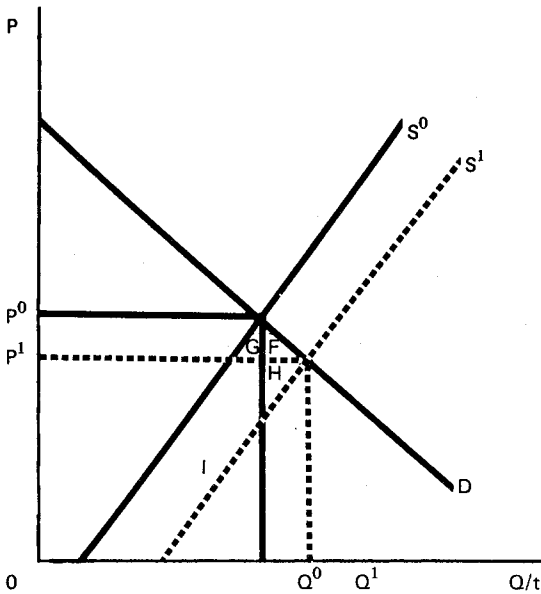
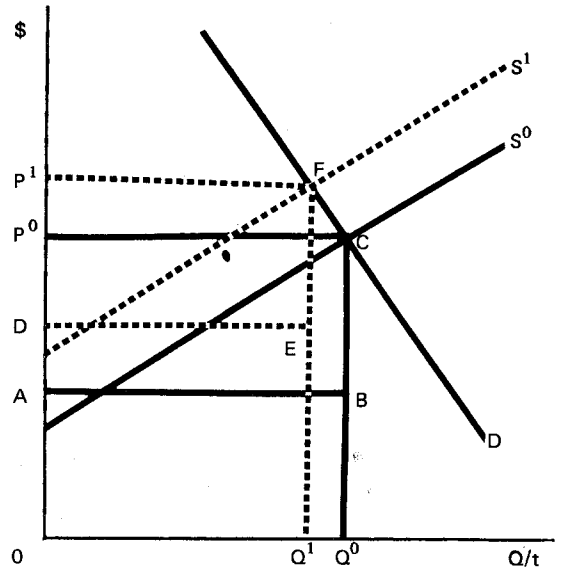


Fig. 1b. Decrease in quasi-rent due to an exogenous increase in variable costs of production.



grass straw and residue are disposed of by open burning in the fields. Approximately one million tons of grass straw are burned annually causing serious seasonal air pollution problems in Oregon [Brar and Conklin]. The Oregon legislature passed a bill stipulating phasing out of burning over a period of three years starting with 1975. This would increase costs of grass seed production [Conklin and Bradshaw]. Other things equal, in the short run, earnings in grass seed production would decline. In the long run, some resources may leave the industry and total quantity of the seed produced would decline. Assuming that demand does not change, seed price would rise. Consequently, the burning ban to control air pollution would decrease rents to owners of specialized resources.

To measure the effect on the factor owners' well-being by alternative approaches, both short run and long run supply curves were estimated [Brar]. It was assumed that costs of production would increase by \$13 per acre⁸ [Conklin and Bradshaw], and there would be a parallel upward shift in the industry supply curve. Under this assumption, new equilibrium price and output were predicted. By employing the estimated

⁸Conklin and Bradshaw have estimated that the cost increase due to next best alternative residue removal technique would vary from \$5 to \$10 per acre. However, with recent inflation, the \$13 per acre cost increase is most realistic.

demand and supply equations, Paretian, Marshallian, and quasi-rent were predicted under the existing conditions.⁹ The initial Paretian rent was measured as the area above the long run supply curve and below the equilibrium price; Marshallian rent equalled the area between short run supply and price; and quasi-rent was estimated as specified in figure 1b. Similarly, after the burning ban rents were estimated employing new, predicted prices and outputs. Changes in factor owners' economic well-being were then estimated as changes in Paretian, Marshallian, and quasi-rent. Changes in Paretian and quasi-rent also were estimated for supply situations of varying elasticity to study the relationship between elasticity of supply and the factor owners' welfare.¹⁰ The results presented in table 1a and 1b suggest the following observations:¹¹

⁹To measure quasi-rent, cost estimates were obtained from Conklin and Fisher.

¹⁰Magnitude of coefficient of elasticity could vary depending upon the model specification, functional form, nature of the data, and method of estimation. Therefore, it was thought appropriate to determine the extent and the sensitivity of changes of various measures of economic rent to changes in elasticity.

¹¹One limitation of the results needs mention. The supply equations employed in this study were not derived from cost curves. Instead, short- and long-run elasticities were estimated from a simple dynamic model of supply relationships similar to the Nerlove formulation.

1. Table 1a reveals that the initial and after burning ban estimates of Paretian and quasi-rent are very significantly lower than the corresponding estimates of Marshallian rent.

2. Both absolute and relative changes in quasi-rent are very large compared to changes in the other two measures of rent. Although both Marshallian and quasi-rent give changes in well-being in the short run, the large differences between estimates are truly noteworthy.¹² Of course, decreases in quasi-rent, among other things, would depend upon relative share of variable and fixed costs in total costs of production. Therefore, these differences may not be as pronounced in the case of other industries.

3. As the supply curve becomes more inelastic, absolute decreases in Paretian rent become larger, whereas, decreases in quasi-rent become smaller

¹²Marshallian rent is a type of quasi-rent, too. As defined by Mishan [1968] and measured here, it is the area above short run industry supply curve and below equilibrium price. However, to confuse the matter, in another reference he defines it as excess receipts over the total of variable costs [Mishan, 1973]. But Ferguson has suggested that Marshallian quasi-rent cannot be illustrated by means of conventional cost diagrams. Thus, the quasi-rent defined here and in the textbooks is not equivalent to Marshallian rent.

Table 1a. Comparison among measures of economic rent

Measure of Rent	Estimated Rent		Decrease in Rent	
	Initial	After ban	Absolute	Percent
----- thousand dollars -----				
Paretian	3,251	2,507	744	23
Quasi-rent	2,670	234	2,436	91
Marshallian	7,330	6,645	635	9

(table 1b). Furthermore, the decrease in quasi-rent under elastic supply situation is very pronounced.¹³

4. With a decrease in the elasticity of supply, the relative change in Paretian rent first increases and then decreases. On the other hand, the relative change in quasi-rent continues to decline. It dropped from 91 percent to 5 percent when elasticity of supply changed from 1.73 to 0.50.

Conclusions and Implications

Using the same estimated supply and demand relationships, changes in rent and economic well-being of factor owners were estimated by different approaches suggested by economic theory. These changes, both absolute and relative, were found to be significantly different depending upon 1) the length of the run of supply curve; 2) the concept of economic rent employed; and 3) the elasticity of supply. The most striking difference was observed between two measures of economic well-being in the short run. Changes in quasi-rent were most sensitive to changes in elasticity.

On the basis of the evidence presented in this paper, it is difficult to conclude as to which of the three measures is "more valid." But it is very likely that Marshallian rent overestimates the "true" rent. This measure of rent is estimated from short run supply curves. Such curves are generally inelastic, intersect the quantity-axis, and in the real world the existence of their lower part is extremely

¹³The estimates of Paretian and quasi-rent in the case of elastic supply were based on the actual estimated long run elasticity. The other two supply situations were hypothesized for comparison purposes only. The supply equations under all situations were estimated such that they passed through the 1967-69 average prices and quantities with elasticity equal to estimated or hypothesized coefficient at that point.

Table 1b. Comparison between changes in Paretian and quasi-rent by elasticity of supply (E_s)

Elasticity of Supply	Paretian Rent				Quasi-Rent			
	Estimated rent		Decreases in rent		Estimated rent		Decreases in rent	
	Initial	After ban	Absolute	Percent	Initial	After ban	Absolute	Percent
----- thousand dollars -----								
Elastic (=1.73)	3,251	2,507	744	23	2,670	234	2,436	91
Unitary	6,296	4,692	1,605	25	2,670	2,435	235	9
Inelastic (=0.50)	9,651	7,995	1,657	17	2,670	2,529	141	5

uncertain for reasons discussed in the text and the appendix. Thus, inclusion of the area above the supply curve, part of which may not exist, will obviously inflate the estimates.

The paper suggests that the statistically estimated supply curves could provide biased estimates. Furthermore, evidence is provided suggesting that precise estimates of changes in the well-being of factor owners are difficult to make even if the restrictive theoretical conditions hold. Since such estimates are often used to calculate benefit-cost ratios of alternative policies, the choice of an appropriate policy could vary depending upon the nature of the supply curve and the measure of rent employed.

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Appendix

In the text, it has been indicated that supply curves which intersect the quantity axis imply that certain minimal levels of output can be produced at zero, or even negative, marginal costs. The purpose of this appendix is to elaborate on this point and reason why that may not be the case in the real world.

Assume that all markets are perfectly competitive and there are no externalities. Under these assumptions, the short-run industry supply curve would be given by horizontal summation of that part of marginal cost curves of all the firms in the industry lying above average variable cost curves.

In figure 2a, if the industry supply curve S intersects the quantity axis at L , then L also would be the minimum point on the industry AVC curve. Given that AVC curve is "U-shaped", then to the left of point L , MC curve must lie below AVC curve and hence, theoretically, must be negative for certain level (s) of output. But in the real world it is almost impossible to support or verify the existence of this sort of cost curves.

In the real world, one would expect the minimum point on the industry AVC to lie above L , say at M . If marginal cost curve is given by KMS , then MS would be the industry supply curve in the short-run. This supply curve is reproduced in figure 2b. For any price less than OT , no production would be forthcoming and factor employment in the industry would be zero. Obviously, then any measure of rent that includes area along the LM segment of the supply curve, overestimates the "true" rent. In this case, precise estimate of the rent would be given by the area $PTMN$. An implication of the above specification is that an accurate estimate of rent and factor owners' welfare is extremely difficult without some knowledge of costs of production.

Fig. 2a. Short run supply curve which intersects quantity-axis and its relationship to AVC and MC curves.

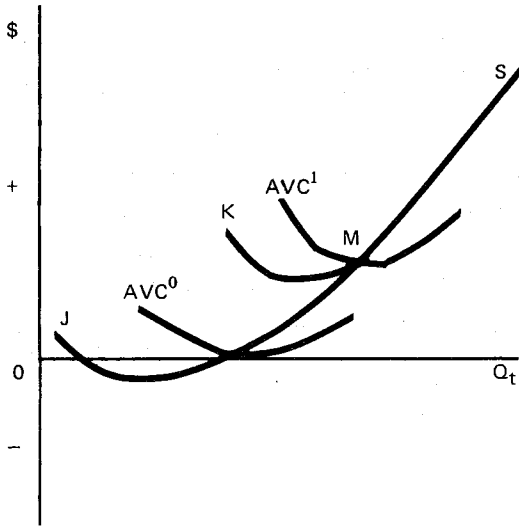


Fig. 2b. Relevant segment of short run supply curve and specification of economic rent.

