

APPENDIX B: ECONOMIC RENT MEASUREMENT ISSUES

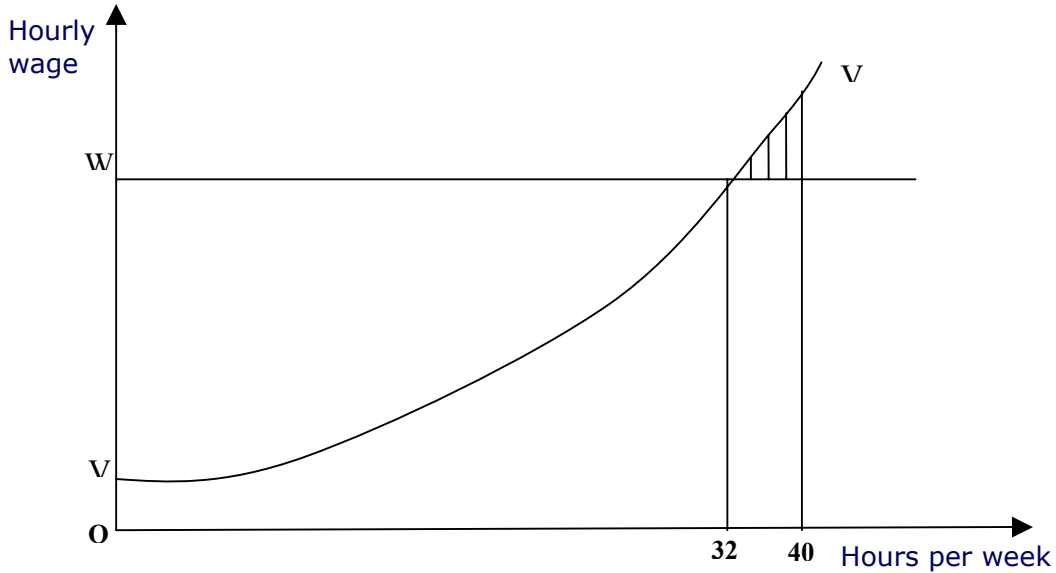
In general, the smaller the changes in price, the more accurate an estimate of consumers' surplus or economic rent, will be and the better the measurement of the individual's demand and supply curves or consumer surplus or economic rent curve. In the case of a person's demand curves, there is presumption that the welfare effects are small. However, in the case of an individual's demand curve there is an assumption that a person's current expenditure is spread over a variety of goods each of which—with perhaps, the exception of housing—absorbs only a small proportion of his total income. Indeed, as living standards rise, the variety of goods offered by the market increases along with an increase in a person's real income. One might surmise therefore that the welfare effect will become less important an ingredient in his price-demand curve for any single good.

Supply Curve Issues: The case is otherwise for the individual's supply curves, in particular for his supply of productive services, say the supply of labor, skilled or unskilled. If he supplies to the market only one sort of labor, the welfare effect arising from a change in the price of this sort of labor falls entirely on this quantity. It then exerts a preponderant effect. Backward-bending supply curves for individual workers are not untypical, a fact which would seem to make the measurement of economic rent rather awkward.

But there is a countervailing feature in connection with individual supply curves, which tends to restore measurability. Notwithstanding the mathematical convenience in postulating an economy in which each individual contributes, in general, to all goods in the economy, spreading his total effort among them—as he spread his income among all goods—on the equi-marginal principle, this postulate is recognized as unrealistic. Nor is it a necessary condition for the model of perfect competition, which is quite consistent with the more realistic assumption that the worker is constrained in his chosen employment to work a given number of hours, and between stated times. (He may of course be offered overtime work, though again it will be subject to constraints on the days and times.) For this reason, there is little point in conceiving of the worker's rent from his employment in precisely analogous terms as his consumer's surplus.

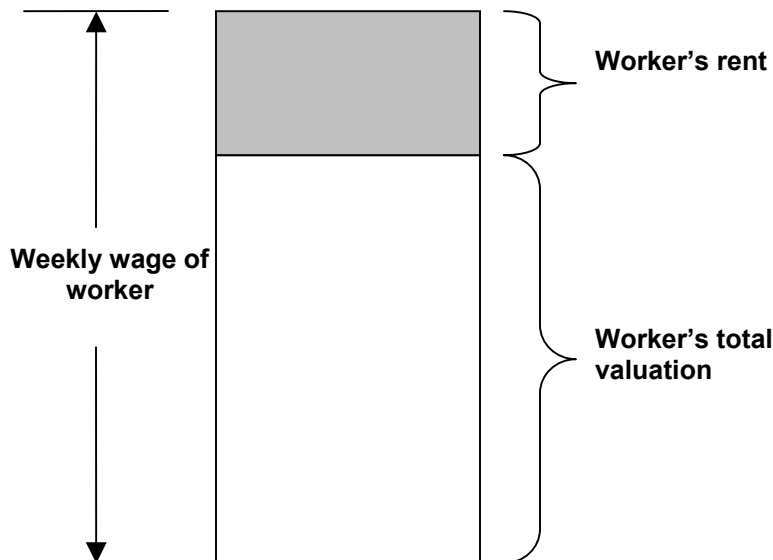
In picturing consumers' surplus, we think of the excess marginal valuation over price of the first unit bought, of the second unit bought, of the third, and so on until, with the purchase of the n th unit the excess is zero. Explicitly ignoring welfare effects, the analogous procedure for rent would be the excess of supply price over the marginal valuations, or minimal sums acceptable to the workers, for each of a number of successive units offered until again, for some m^{th} unit offered, the excess becomes zero. But the worker is not permitted to choose his hours of work on an equi-marginal principle. If, on the contrary, he were allowed, his rising marginal curve VV , in Exhibit B1, would intersect the wage-rate line, W , as, say, 32 hours. His rent would then be the dotted area above VV and below the line W . If however, the job offered a 40-hour week, and no less, he would be constrained to work 8 longer hours than the 32 he would choose in the absence of any constraint; and for these 8 hours the wage offered is below his successive marginal valuations. On these 8 unwanted hours extra he suffers a loss equal to the shaded triangle. His net rent is therefore the dotted area minus the shaded area. And, since he is offered the job as an all-or-nothing proposition, he will accept the job only if the difference between the two areas is positive.

Exhibit B1



Since all workers finding employment in this occupation will be obliged to work the 40-hour week, irrespective, of whether they would prefer to work fewer or more hours, the net rent from working the 40-hour week is, for any one of them, the first area less the second area (if any). Letting the worker's weekly (disposable) pay be represented as the area of a unit column with height equal to weekly wage rate, as in Exhibit B2, the rent is the shaded rectangle measured from the top of the column. By gradually raising the weekly wage and observing the numbers that enter the industry, in response to the higher wage, a supply curve of labor to the industry is generated, and from this we are able to identify the rent of those employed.

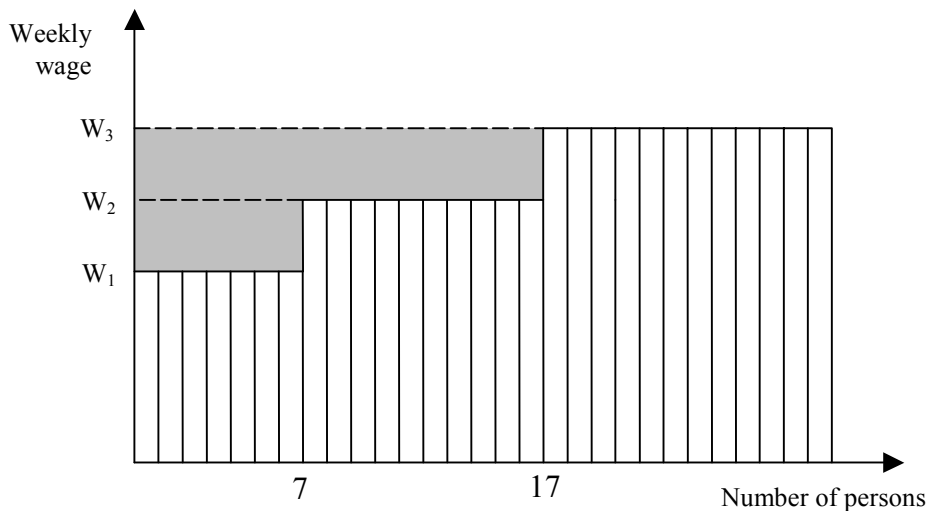
Exhibit B2



Thus in Exhibit B3, if at the lowest wage W_1 , seven persons just agreed to work, they make no rent. If now the wage rises to W_2 and in response, another ten persons are just willing to enter the industry, the first seven enjoy amongst them a rent equal to the dotted rectangle ($W_2 - W_1$) times the distance 0-7, and the next ten persons between them make a rent equal to ($W_3 - W_2$) times the distance 7-17, and so on. We are able to do this because no worker is allowed to alter the number of hours he gives to the industry in response to changes in the wage.

Once large numbers of persons are involved, the stepped supply curve gives way to a smooth supply curve. The corresponding dotted area above this supply curve can then be used as an approximate measure of the aggregate rent enjoyed by those employed in the industry. Its magnitude can be interpreted as the largest sum they would be willing to pay to be in this occupation at the existing wage rate, given all the other opportunities open to them. An estimation of such rents would always be entered as a benefit in any cost-benefit analysis of a project if it were known that a wage lower than the existing wage (necessary to attract enough workers to operate the enterprise) would yet suffice to attract some workers¹²⁶.

Exhibit B3



This area above the industry, or project, supply curve of a factor, which may be used as a measure of rent of the factors employed there, is to be distinguished, in general, from the area above the supply curve of a firm or industry.

There are, nonetheless, particular circumstances in which the area above the supply curve for an industry, or firm, can be properly interpreted as a measure of rent. First, there is Ricardian rent in which labor and capital, both of them available in any amount at constant prices, are applied, in fixed proportions to a given quantity of land. The supply curve of the resulting product, say corn, rises, not because of any changes in the supply prices of the variable factors, labor and capital, since as just stated, their supply prices remain unchanged. The supply curve of corn rises simply because the best land is limited in supply, and, as the price of corn rises with an increasing demand, it becomes worthwhile to bring into cultivation inferior lands. Even if there is only one quantity of land, though limited in

¹²⁶ In estimating the rent of the industry's workers by such a supply curve of labor, it is not necessary that labor offered be equally efficient. If, as the industry expanded, the subsequent workers were less efficient than the original ones, costs to the industry would indeed rise. But the measure of workers' rent remains unaffected.

amount relative to demand, rent will accrue to it once the marginal cost of a bushel of corn rises above its average cost—as it eventually will, because of diminishing average returns to additional ‘doses’ of labor and capital. In these circumstances, the area between such a supply curve and the price of the product provides a measure of the rent accruing to the owner of the fixed factor, land. Increases in such rents arising from the introduction of an investment project are accordingly entered on the benefits side of the analysis.

Secondly, there is the case in which the area above the supply, or cost, curve has to be identified as quasi-rent. For over a short period, during which the capital employed by the industry, or firm, is in the specific form of plant or machinery, it is deemed to be fixed in amount, and to have no alternative use. In this short period, then, it partakes of the nature of land, and all its earnings above those necessary to induce it to remain in the occupation are to be regarded as rent. In this short period, if the price of the product rises above the per unit variable cost of the product, the resulting excess receipts over the total of these variable costs are quasi-rents; such positive sums make a contribution to the industry’s or firm’s, overheads or capital costs.

The above two instances are clear examples of economic rent to a scarce factor. They enter as part of the benefit of producing a given amount of goods during either a short or a long period. Thus, if a given piece of land is used to grow a new crop, or to site some new project, any rise in the rent of the land is to be entered on the benefits side of the scheme. If, within a short period, some investment in the industry, or firm, causes its variable costs to fall, the additional quasi-rents that result are also to be entered on the benefit side.

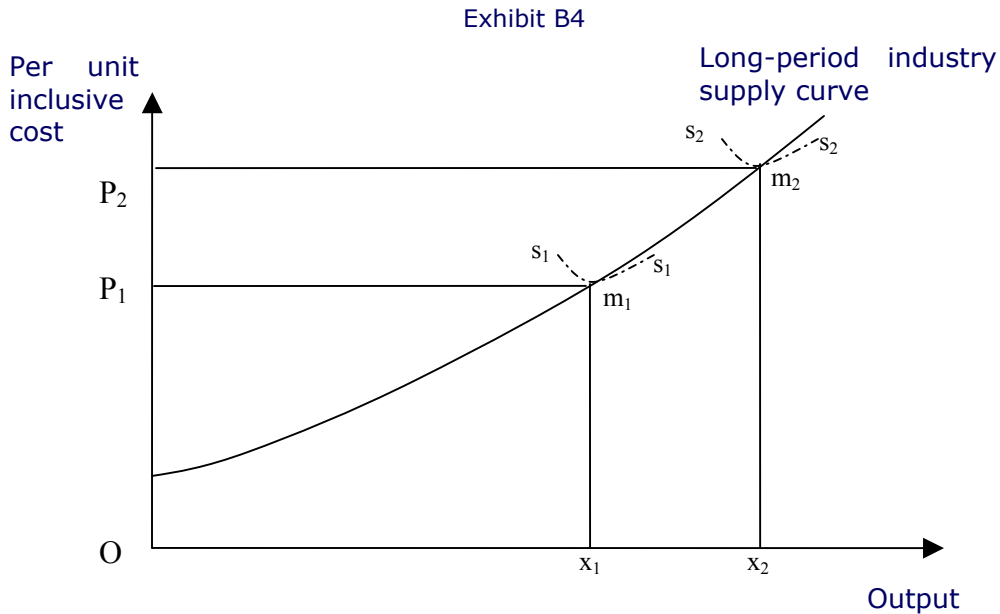
The case is quite different, however, when the long-run supply curve of a good is produced by two or more factors that are imperfect substitutes and may, indeed, be used in varying proportions. To appreciate the difference with the minimum of effort, let us follow the standard textbook procedure and, first, assume that all firms in the industry are of equal size and efficiency. In that case, the rise in the supply price of the good reflects the growing scarcity of the factor that is insensitive to the product. With only two factors, say labor and capital, the production of a larger amount of a good x will entail a rise in net price of capital relative to labor, where capital is used more intensively in x than it is used in the production of other goods. Owing to the greater proportion of capital used in x as compared with its proportion, on the average, in other goods, the per unit cost of x rises relative to the unit cost of other goods.¹²⁷

Any point along this rising supply price for the product indicates the minimum average (inclusive) cost for each of the firms in the industry and, therefore, the minimum average (inclusive) cost for that output. Thus at output OX_1 , in Exhibit B4, the minimum average inclusive cost for all firms is given by x_1m_1 . A typical long-period envelope curve for such a firm is represented as S_1S_1 . At the larger output OX_2 , the minimum average inclusive cost for the industry is given by x_2m_2 , and the typical long-period envelope curve for the firm is represented by S_2S_2 . Clearly then this long-period industry supply curve cannot be interpreted as a net gain by the producers of this particular good since each of them makes zero (x) profit¹²⁸ in long-period equilibrium. It is in fact a curve of average cost including rent.

¹²⁷ Put otherwise, if there are more than two goods in the economy, the expenditure on capital, as a per cent of total factor expenditure, is, for x , above the average per cent for the economy as a whole. X ’s increased proportional expenditure on the higher-priced factor, capital, results therefore in a higher-than-average rise in (relative) costs.

¹²⁸ Normal return on capital is not profit, any more than the normal return on labor. In the long-period equilibrium, at any point on the industry supply curve, expenditure on factors (both labor and capital) is deemed to be just covered by revenue, leaving no profit, positive or negative, to induce firms to move into, or out of, the industry.

But if it is a curve of average cost including rent, is it also a curve of marginal cost excluding rent—as indeed is the supply curve in the case of Ricardian rent? The answer is yes, in the sense that the sum of money represented by the area above this curve could be captured by a perfectly discriminating monopsonist, albeit one that produces all the different products that make use of these two (or more) factors.



Since real rentals (the price of units of capital) rise and—unless there are increasing returns to scale—real wages fall as the output of x is expanded we are able, under particular monetary assumptions, to calculate the rise in the money rentals, and the fall in money wages, corresponding to increased amounts of capital and labor required by some given increase in the quantity of the product x . We can then associate the increase in the area above the supply curve of x with the increased amounts of the two factors employed in the x industry when each factor is multiplied by the increase, or decrease, of its income. More specifically, the addition to the area above the supply curve for x is made up of the gains of only those units of capital now employed in x less the losses of only those workers now employed there. These gains and losses in x are clearly only a part of the total gains and losses accruing to the factor classes as a whole since they are also employed in other industries.

It is certain therefore that any increase in the area above the supply curve for x is not to be associated with a net gain by either factor or by both factors taken together.

Thus, so far as the shifts of the demand curves are concerned, say from product y to product x , attempts to measure net benefits arising in the x industry—or to be more ambitious, net benefits arising in all industries that use the two (or more) factors—are hardly practicable, especially where, as is likely, a larger number of factors are involved. Indeed, such a shift in demand implies no more than a movement from one part of the

production boundary to another. It is a movement that, in general, raises the earnings of some factor classes and lowers those of others. However, one need not infer that there are net gains to society as a whole.

If, on the other hand, the area above the supply curve of x increases solely in consequence of a downward shift in this curve, the result, say, of an improvement in technology, it need have no effect on factor prices. In this technically neutral case, the increased area does indeed count as a benefit. In so far as the reduction in the cost of producing x is passed wholly to the consumers, the gain will be measured as an increase in consumers' surplus. In so far as some part of this gain is withheld by the producer, for a time at least, it partakes of monopoly rent.

Conclusion: It is the Ricardian interpretation that is being applied at an aggregate level in this study. For a competitive transportation project a supply curve can be defined that overcomes the deficiencies of an individual's economic rent and is a sufficient and close enough substitute in the transportation factor (supply) market, that income impacts are unlikely to apply. As a result, the economic rent analysis performed for this study is within the limits of applicability of this technique.