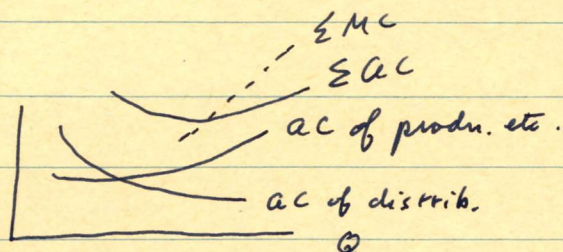


Reply to Milliman

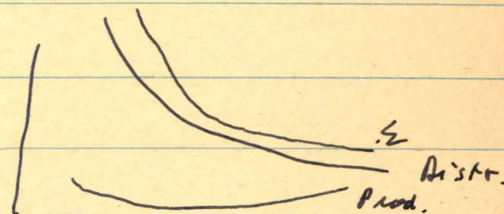
Composite cost of utility

- Δg cost at plant, or of importing
- Δg cost of distrib.



I

More likely



II

In I, if enough demand, a composite price will cover all costs. But that is wrong. Arbitrage results from prodn. to cover neg. result of distrib. So:

- Owner of prodn. input wd. sell elsewhere if cd.
- " " " " is robbed -- is often the public, e.g. wtr.
- Wrong signals given to guide expansion. Too much gain for distr. Too little for prodn. So get inadequate plant, excessive line.

- Utility underpriced at & near load centres
- No criterion how far extend system.

Vignettes

- Met. Service Comm. basis - volume
- Current user charge - add. value. Carmeter's peng.
- Fords demolish VWs, ... so VWs banished?

INDIANA UNIVERSITY

Graduate School of Business

BLOOMINGTON, INDIANA 47405

SCHOOL OF BUSINESS BUILDING

October 27, 1965

AREA CODE 812, TEL. NO. 337-2804

Res. 336-6795

Professor Mason Gaffney
Department of Economics
University of Wisconsin-Milwaukee
Milwaukee, Wisconsin 53211

Dear Mase:

Thank you for your letter of October 21 responding to my reply to your earlier comment. I had been wondering why I have not heard from you (or from Will Lissner for that matter).

I think I understand the concern you feel with regard to the first paragraph of my comment. As you suspect the first sentence of the first paragraph was not meant to sound "belligerent" but intended as a good-natured thrust. Actually, if one were to go back and actually read your original article (entitled, "Land and Rent and Welfare Economics"), they would find the first paragraph quite consistent with the spirit of your original argument. The original article, as you remember, is rather a forthright and "pulling-no-punch" sort of thing. And in fact, it does make some rather sweeping charges and presents some rather strong conclusions. Some of this stems from your very interesting style of writing and some of it stems from the strength of your feeling on questions regarding Ricardian Cameralism.

Well, what do we do about the matter. I suspect the easiest thing might be to delete the first sentence of the first paragraph of my reply to you. This would leave the rest of the first paragraph intact and perhaps would greatly reduce the possibility of interpreting my comments as being "belligerent." How does this strike you? I am sending a copy of this to Will Lissner. Perhaps we ought to let him decide the matter.

2d para. develops theme of "only solution". Overlooks grad. rates.

I think we need to talk more about your invitation from Harvey Perloff. There is a lot to be said for working with him. On the other hand, there are certain limitations or drawbacks. In other words, the matter is a bit complex, and I would need to talk with you at some length regarding the situation there. How do we do this? I don't know. Maybe we ought to try a phone call or perhaps engage in some extended discussion by correspondence. We will save that to a later date. All best wishes.

Sincerely yours,

Jerry

J.W. Milliman
Professor of Business
Administration

cc: Will Lissner

October 21, 1965

Professor Jerome Millmann
Graduate School of Business
Indiana University
Bloomington, Indiana

Dear Jerry:

Thanks for sending your rejoinder. I am glad that we are doing a good job of keeping all this on a civil level, unlike my exchange with Frank Trelease. I do have one small suggestion, which is that your opening paragraph might be misinterpreted by some readers as excessively belligerent. I assume that it does not represent your literal meaning and is intended as a good-natured sally. But anyone who read it in another vein would feel, I think, that my position was being misrepresented.

Since someone has to have the last word in these exchanges, I will let things stand with your rejoinder, only I hope that you will see some virtue in revising the first paragraph.

I tried to get Jack stirred up by sending him a copy but so far he has not bitten.

On another subject, what can you tell me about the pleasure and pain of working with Harvey Perloff? He invited me to spend a couple of years at R.F.F. in the same slot which you occupied, I judge. It seems like an interesting opportunity, but I don't know Harvey awfully well and I would be interested in your confidential assessment of him as a working mate. I notice that he isn't shy about venturing his opinions about what one should and should not be working on. Is this just casual conversation or does he try to follow up?

Sincerely,

Mason Gaffney
Professor of Economics

MG:ej

2-14-63

Mase:

Why don't you write
the definitive piece
which takes both
Millman and
Renshaw apart.

Sam

Reprinted from JOURNAL OF FARM ECONOMICS
Vol. XLII, No. 1, February, 1960

LAND VALUES—A FURTHER COMMENT

J. W. MILLIMAN
Indiana University

IN THE preceding note, Edward F. Renshaw comments upon my paper¹ and points in optimistic fashion toward the possibility of increased use of models of the land market for empirical research in appraising the effects of alternative kinds of public and private investment. My own study of the problem has lead me to be somewhat less enthusiastic. Perhaps the major difference between us lies in Renshaw's belief that a generalized econometric approach to land valuation problems is just around the corner. Although I share the hope for the emergence of such a model I have seen little to date which indicates its immediate likelihood.

Nevertheless there seems to be an increasing awareness that increases in land values may reflect capitalization of economic gains arising from the use of inputs which are priced below their economic worth. It is now becoming clear that the subsidized provision of many public services, os-

¹ J. W. Milliman, "Land Values as Measures of Primary Irrigation Benefits," *J. Farm Econ.*, 41:234-43, May 1959.

tensibly designed to modify the existing distribution of income, may not in fact achieve the desired results in so far as economic "surpluses" from the use of the "free" service become capitalized in the form of higher prices (costs) for complementary inputs which are inelastic in supply. The provision of public health subsidies, for example, may not really lower the total cost of medical care to the recipients if the economic benefits are transformed into higher economic rents for specialized, strategic inputs in the supply of medical services. It is well established that "cheap" water in Western reclamation projects may be largely offset by higher land prices so that irrigators gain only in so far as they are land owners. As I pointed out earlier,² there is no *a priori* reason, however, why economic surpluses from subsidized irrigation water must be capitalized in land values; higher land values are only one of the various possibilities for capitalizing surpluses.³

I am somewhat surprised by Renshaw's implication that the "vastly different standards" used in public and private investments (particularly for reclamation projects) are somehow related to the choice of methods for project valuation, in this case the use of the "budget" method as compared to the "land values" method. Although divergent standards are present, it is not clear what this has to do with the "land values" approach. There is nothing intrinsic in either of the methods in their pure forms which necessarily produces a variation in the implied stringency of the valuation test. That is to say, both methods of project valuation can be abused; both can be given a conservative cast. It does not seem fair to imply that, because *ex post* land values (computed by Renshaw) are lower than *ex ante* benefits calculated by the "budget" method, the difference is due to the *method* used for estimating benefits. It is quite likely that *ex post* calculations by the "budget" method would reveal a similar discrepancy between anticipated and realized benefits.

The important point is that the "budget" and "land values" methods of project valuation are alternatives which have comparable difficulties and deficiencies. Both methods can be employed in *ex ante* and in *ex post* situations; each can be used to check upon the other. Perhaps the formidable difficulties of the "land values" approach can be reduced, as Renshaw suggests, by judicious selection of data and by the incorporation of additional variables in the land market model, but I am skeptical of the view that it can ever be more than an imperfect method of measuring project benefits.

² Milliman, *op. cit.*, p. 239.

³ For an excellent discussion of the relation between capital values and costs see: Armen Alchian, "Costs and Outputs," *The Allocation of Economic Resources—Essays in Honor of Bernard Francis Haley*, Stanford U. Press, 1959, pp. 36-39.

LAND VALUES AS MEASURES OF PRIMARY
IRRIGATION BENEFITS

BY

J. W. MILLIMAN

Reprinted from JOURNAL OF FARM ECONOMICS
Vol. XLI, No. 2, May, 1959

LAND VALUES AS MEASURES OF PRIMARY IRRIGATION BENEFITS*

J. W. MILLIMAN**

University of California, Los Angeles

EVALUATION of existing and proposed irrigation projects requires estimation of benefits and costs in present value terms. Recently a number of studies have appeared which deal with the efficacy of techniques used by federal agencies in project evaluation.¹ It is apparent that current policies and techniques for project planning and valuation can be improved. Among the suggestions for improvement in the techniques of evaluation is the proposal by Edward F. Renshaw to use changes in the values of agricultural lands as indirect or proxy measures of the primary benefits of irrigation projects.² It is the purpose of this paper to explore some of the implications involved in the use of changes in land values as measures of primary benefits stemming from irrigation investment.³ It is hoped that the analysis here will serve to stimulate further investigation of the relation between land values and irrigation benefits.

Measurement of Primary Benefits

The "Green Book" states that:

Primary benefits are the value of the immediate products or services resulting from the measures for which the project costs and associated costs were incurred.⁴

There seems to be general agreement that the primary benefit from any project can be viewed as the worth or value of the output of the project to

* Giannini Foundation Paper No. 175.

** The author has benefited from criticism by J. DeHaven, J. Hirshleifer, and R. McKean.

¹ Roland N. McKean, *Efficiency in Government through Systems Analysis*, New York: John Wiley & Sons, 1958; Edward F. Renshaw, *Toward Responsible Government*, Chicago: Idyia Press, 1957; Otto Eckstein, *Water Resource Development*, Cambridge: Harvard University Press, 1958; John Krutilla and Otto Eckstein, *Multiple Purpose River Development*, Baltimore: John Hopkins Press, 1958.

² Renshaw, *op. cit.*, Chapter VII. See also "Cross-Sectional Pricing in the Market for Irrigated Land," *Agricultural Economics Research*, January, 1958, pp. 14-19; and "An Economic Appraisal of Public Investment in Irrigation," Ph.D. dissertation, University of Chicago, 1957, Chapter VI.

³ It is important to note that estimation of primary benefits stemming from an irrigation project is only part of the evaluation problem. This paper does not deal with questions involving secondary benefits or "extra-market" benefits. Furthermore, it is concerned only with benefits *per se* and not with benefits in excess of or in relation to costs.

⁴ *Proposed Practices for Economic Analysis of River Basin Projects*, report to the Federal Inter-Agency River Basin Committee, prepared by the sub-committee on Benefits and Costs, May, 1950, p. 8.

those who use it. Conceptually, this means that the direct measure of the primary benefits can be found by summing or aggregating the maximum prices which the consumer would pay for the various units of output from the project.⁵ For an irrigation project, the primary benefits are equal to the economic worth of the water to the farmer.⁶

According to this analysis the primary benefits of an irrigation investment could be estimated from the demand curve for the water from the project. To illustrate the nature of the argument, reference is made to Figure I.

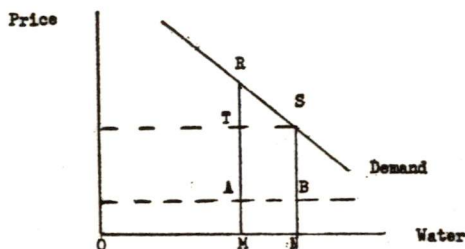


FIG. I

If a project were constructed to supply MN units of irrigation water, the primary benefit of the project would be the value of the water or MRSN.⁷ The present value of the benefit stream could be obtained by the summation of the areas under the demand curve for each time period, discounted by the appropriate rate of interest.

If the demand function for the irrigation water were known, it would be possible to estimate directly the primary benefits stemming from irrigation investment. The difficulty of the matter is that relatively little work has been done on the estimation of the demand function for irrigation water. This deficiency stems in part from the nature and history of econometric studies in agriculture which have concentrated almost exclusively upon the markets for farm products and have neglected the supply and demand elasticities of the various input factors on the production side of agriculture.⁸

⁵ McKean, *op. cit.*, Chapter 10.

⁶ This assumes that the irrigation project is a single-purpose project, i.e., only a supplier of water. The consideration of multi-purpose projects would not change the nature of the argument here because we are concerned only with benefits resulting from irrigation. And also the same logic could be used in the analysis of benefits of each of the outputs of a multi-purpose project.

⁷ It is assumed here that the demand function illustrated by RS connects the maximum prices farmers would be willing to pay for output MN.

⁸ Zvi Griliches, "The Demand for Fertilizer: An Economic Interpretation of a Technical Change," *Journal of Farm Economics*, August, 1958, p. 591.

Another part of the difficulty arises because of the peculiar nature of the market for water in which the pricing system is relegated to a minor role in the allocation process. Most factor inputs in agricultural production are allocated by the price mechanism, in that prices are allowed to clear the market and to equate supply and demand. For various reasons irrigation water, particularly in the West, is often allocated by means other than the price mechanism, so that prices for the water are often "nominal" prices which are less than those which would prevail under free-market conditions.⁹ This means that rationing and quotas are common in the allocation of irrigation water.

Neither of the reasons for the apparent lack of attention given to the demand function for irrigation water appears to involve severe conceptual problems, so it may be possible to make greater use of direct estimation of the economic worth of the water in the future. Presently, the estimation of primary irrigation benefits is accomplished through the use of indirect measures. The most widely used procedure and the one which is currently used by all federal agencies who deal with irrigation water is the "budget" method.

The "budget" method involves the estimation of primary benefits of water by making assumptions as to the crops to be produced on the land and the gross receipts arising from their sale. Then production expenses or farm operation and investment are subtracted from the value of farm products produced. The residual amount is considered equal to the primary benefits and thus the value of the water to the farmer. It is obvious that the "budget" method involves the use of a vast number of assumptions concerning crop yields, output prices, factor costs, and coefficients of production in all future years. The possibilities for errors in estimating and in double-counting are quite numerous.

Recently Renshaw, who was evidently stimulated by D. Gale Johnson's earlier concern with land values,¹⁰ has developed some models based upon crop-value indexes to predict changes in land values resulting from irrigation projects. It is Renshaw's belief that a certain proportion of expected gross receipts are capitalized into land values so that land values can be estimated on the basis of gross farm income. The expected change

⁹ Two important reasons are evident here. One is that water law in most states places a number of restrictions upon the transfer or exchange of water by market forces. See: J. W. Milliman, "The Case for Private Decision-Making in a System of Water Law," The RAND Corporation, P-1483-RC, September 4, 1958. Another important reason stems from the widespread feeling that irrigation water use has important "extra-market" benefits so that the price of water should be a secondary consideration in its use.

¹⁰ D. Gale Johnson, "Allocation of Agricultural Income," *Journal of Farm Economics*, November, 1948, pp. 724-745.

in land values plus the present worth¹¹ (per acre) of the water payment contracts assessed against the land is a measure of the primary benefits of the irrigation project.

The advantages of the Renshaw approach, as compared to the budget method of estimating the primary benefits of irrigation investment, appear on first consideration to be quite substantial:

- 1) The number of variables to be estimated is substantially smaller and involves fewer assumptions and less information.
- 2) The market for land does the discounting so that there exists no problem of how to determine the "correct" rate of discount or how to treat future risk and uncertainty.
- 3) Double-counting and overestimation of benefits may be somewhat reduced.

On theoretical grounds, however, both methods are correct and each should lead to the same values if carried out in the proper manner.

Essentially Renshaw's suggestion involves two assumptions: First, that changes in land values "with" and "without" irrigation reflect a capitalization of expected net income resulting from the water; second, that a crop-value index can be used as a predictor of land values. With both of these assumptions, there is little with which to disagree. It is suggested, however, that study of the theoretical and empirical basis of these assumptions is called for. Renshaw does not offer much theoretical explanation of these assumptions nor does he follow through with a discussion of some of the implications involved, particularly in regard to the former.

With regard to the value of the crop-index method of predicting land values, Renshaw does give a partial evaluation which serves to point toward its chief merits and deficiencies:

Essentially all that a crop-value index can do is to measure the effect on land value of substitutions to crops yielding higher opportunity returns per acre. It will be of little use as a predictor of land value if the real factors that affect land value either are not, or cannot easily be made, a function of cropping pattern by defining crops appropriately in such a way as to pick up differences in income-yielding potentiality.¹²

It is obvious that many important changes in the production function can not be reflected in any precise way in statistics on acreages devoted to the various crops. It is also clear that cropping patterns are only one of many forces which influence land values. The crop-value index may prove to be useful, however, and certainly it deserves extensive study and discussion.

¹¹ Renshaw used an interest rate of 4% per cent, the farm mortgage rate for 1956, as the rate of discount.

¹² Renshaw, "Cross Sectional Pricing - - ." *op. cit.*, p. 19.

The first part of Renshaw's suggestion seems to be of primary importance. It is also the part to which he has given the least attention. The remaining part of this paper is concerned with an examination of the analytical basis for the premise that changes in agricultural land values can be used as indicators of the primary benefits resulting from the provision of irrigation water. What is the theoretical justification of this premise? What are some of the dangers and drawbacks in the use of land values as proxy measures of benefits of irrigation investment?

The Value of Water

If the value of water is to be reflected in land values, as Renshaw suggests, the relationship is probably very simple and direct. Any increase in land values resulting solely from the provision of additional irrigation water must represent a market capitalization of the expected future stream of value received from the water which is *in excess* of the charges for water paid by the farmer. That is to say, land values will increase only to the extent that the value or economic worth of the water exceeds the charges for the water. It follows, furthermore, that economic worth of the water (and thus the value of the new irrigation facilities) can be viewed as a summation in present value terms of two factors:

- 1) The actual or expected revenue stream of the project (the charges for water).
- 2) Changes in actual or expected value of the agricultural land served by the project (abstracting from other factors which affect land values).

Perhaps the nature of the reasoning here can best be explained by reference to Figure I. Earlier it was argued the economic value of MN units of water, or the primary benefit of project supplying this water, can be viewed as the area under the demand curve for the water or MRSN. The argument followed here would hold that, if the farmers were charged an amount equal to MRSN, land values would not increase because of the increment of water supplied. On the other hand, if the farmers were charged less than MRSN, a "surplus" would arise which would tend to be capitalized in higher land values. If the farmers were to receive the water "free," all of the value of the water would be reflected in increases in land values.

Going further, before examination is made of some of the implications of the relationship between the value of water and land values, it follows that, if a market for water is allowed to function, the market price for water will tend to be SN. And the total revenue for MN units of water would be MTSN. In this case water revenues would understate the total value of the water by TRS. The "surplus" (or TRS) would tend to be capitalized by the market and would appear as an increase in land values.

As a practical matter, it can be argued that the "surplus" rising in such cases is likely to be small in relation to the total demand for water, unless extremely large increments of water supply are considered, so that the market value of the water would be a substantial approximation of the full economic value of the water.

The more likely case is that only a nominal price would be charged for the irrigation water, e.g., BN, and the allocation of water would be determined by some sort of non-price rationing. In this instance, the total water revenue might be something like MABN, which would mean that a "surplus" of ARSB would accrue and be reflected in substantial increases in land values. The land value method of measuring irrigation benefits would appear to have most applicability in this case.

Assumptions and Problems

The preceding argument was based upon the supposition that the economic worth of an increment of irrigation water would affect land values only to the extent that the charges for water understated the value of the water. Perhaps it will be useful to examine the assumptions and implications of this argument.

First of all, it is clear that the analysis assumes that agricultural land is a fixed factor and also that it is the only fixed factor. This means that either agricultural uses are the only uses of the land or else that the value of the land in alternative uses is substantially less than its worth in agriculture, so that the "surpluses" appear as capitalized economic rent. If other fixed factors are present, e.g., certain capital equipment, any "surplus" arising from the purchase and use of irrigation water may conceivably be reflected in their values. There is no *a priori* reason why the "surplus" from water must go to land. In these cases increases in land values would understate the economic value of the water.

It might be pointed out in this connection that it may be difficult to show that the nonagricultural uses of land are unimportant. To the extent that land devoted to agriculture is merely an "inexpensive" way of reserving land for future residential (or other) uses on the basis of speculative judgment, it is not evident to what degree changes in agricultural land values would be due solely to the provision of extra irrigation water. This point is part of the general empirical problem discussed below of trying to abstract from changes in land values due to factors other than irrigation water.

Another problem needs to be mentioned here because it involves a relationship which is often overlooked. This is the point that any "surplus" value arising from the purchase of water by the farmer will tend to be capitalized in land values *only* to the extent that the land (or land owner) has some permanent claim to the water. If the water could be withdrawn

or denied to the land (e.g., an irrigation company might find a more profitable outlet for its water), it would be doubtful if the "surplus" would be capitalized in land values. The market value of agricultural land will undoubtedly reflect any uncertainty in the prospective provision of the irrigation water to the land. This means that increases in land values will be a full measure of the "surplus" only if the water is "frozen" to the land. It is thus quite possible that there may be cases where increases in land values would be less than the economic value of the water because of some uncertainty in regard to the future receipt of water.

A more troublesome problem may exist in the fact that the Renshaw analysis is based upon the premise that the major source of "surplus," i.e., economic value in excess of charges, arises from the provision of water. To the extent that the extra production arising from the increment of irrigation water involves increased amounts of other inputs, it is quite conceivable that some "surplus" may arise from their use and be reflected in land values. In this case (which seems realistic) it can be argued that increases in land values overstate the value of the water.

There are two lines of comment which can be made in response to this objection, although it is not clear that either reply really disposes of the problem. One might argue, for example, that the water, i.e., the irrigation project, is the essential "pre-condition" for the increased production and therefore *all* of the increase in land values is *really* due to the irrigation project, despite the fact that "surplus" may accrue to farmer from the purchase of other inputs and from other concurrent or concomitant investment related to farm production. It does not seem that this reply is a valid one. If "surpluses" do arise from other inputs and investments, it is only a semantic argument to resort to the idea of "primary causation" and to attribute all of the surplus to water.

A second line of argument might concede the presence of the problem in a theoretical sense, but deny its practical relevance. It might be argued, for example, that producer surplus arising from the purchase and use of other inputs would likely be negligible because the market prices would closely approximate their economic worth, leaving little surplus to be capitalized in land values. If, however, some of the inputs or collateral services represent a substantial increase in supply, e.g., a new processing plant, there may arise considerable surplus. This is the question which would have to be determined by direct investigation. A similar source of extra surplus might be found where there is provision of added services by public units, particularly those which are supplied at "nominal" prices, eg., "free" highway services. In all of these cases it is very possible that increases in land values would overstate the value of the irrigation project.

At this stage of the analysis, it might be pointed out by some readers

that increases in land values might well involve some double counting or the inclusion of values of the secondary benefit variety. For example, it could be asserted that land values might increase in a nearby town because of the actual or expected increase in business activity resulting from the increase in agricultural production arising from the new irrigation investment.

This paper is concerned only with the attempt to measure primary benefits. It should be understood, therefore, that the argument here applies *only* to changes in the value of agricultural lands and not to changes in the market values of residential land, or other types of property. Increases in property values of adjacent residential lands might be an alternative measure of secondary benefits, however, in the same sense that changes in the values of agricultural lands would reflect primary benefits. On this score it could be pointed out that measurement of secondary benefits by use of changes in land values might be even more difficult than measurement of primary benefits.

For purposes of making an *ex post* appraisal or audit of irrigation projects, using the land value concept, it would seem important that the observer abstract from changes in land values due to factors other than the provision of extra water. This would be difficult when in cases where a number of incremental services are being provided simultaneously and especially if they are "free" to users. Other important changes in the institutional and economic environment within which agricultural production takes place, e.g., the soil bank proposal or changes in the quality of farm management, would also have to be recognized. Changes in the general price level and in the level of interest rates would present additional problems.

It would also seem necessary that the actual and/or expected revenue stream arising from water charges be discounted at the same rate of interest which is implicit in changes in agricultural land value if the two values are to be summated as the theory suggests. Practical difficulties would be present also to the extent that information regarding land values was unreliable or nonexistent. Admittedly a good deal of arbitrariness would be involved in making estimates of general land values in agricultural areas involving wide variations in fertility, location, and climate. To the extent that agricultural land markets were "thin," i.e., few sales taking place, land values would be more difficult to estimate.

In *ex ante* project valuation, the use of land values as indicators of primary benefits would involve the problem of finding the market value of land that would be comparable in all other respects to the nonirrigated land except that it would have water available. If comparability could be assumed, the difference in land values, "with" and "without" water, would be a *partial* measure of the value of the proposed irrigation project in

present value terms. The difference in land values would measure the *entire* value of the water only if the water were "free," e.g., rainfall. To the extent that charges are made for water on the land used as a yardstick, the difference in land values would reflect only part of the value of water. It would be necessary to take into account both the capitalized value of these charges as well as the difference in land value in order to make the correct comparison.

The major problem in any *ex ante* valuation would be the degree of comparability of the two land situations. If one were to demand strict comparability, he would undoubtedly be disappointed. In an apparent effort to reduce the error here, Renshaw makes use of the crop-value index. Whether or not the crop-value index can be a better indicator of probable land values than going directly to the land market in an attempt to find comparable land "with" water is not clear.¹³ The answer probably depends upon the particular circumstances in individual projects.

It would seem, however, that there might be cases where sufficient comparability is present (or where modifications can be made for obvious differences) so that direct reference to the land market could be used for the "with" and "without" comparison. A case in point may arise when the proposed irrigation investment is merely an extension of an existing project so that the new lands to be irrigated are quite similar in location, fertility, and climate to land already under cultivation. Certainly, the use of comparative land values for estimates of probable irrigation benefits would be feasible in cases where quick and rough estimates need to be made so that exact comparability between two land situations would not be required. It is also possible that comparative land values could be used as a check upon estimated primary benefits of irrigation investment derived by either the budget method or crop-index methods of valuation.

Conclusion

The primary benefits arising from an irrigation project can be viewed as the economic worth of the water to the prospective irrigators. Attempts to measure the value of the water directly are hampered by the lack of data concerning the demand function for water and by the fact that the water is often allocated by means other than the market mechanism. As a result indirect measures of the value of the water are used. The most widely used method is one which makes a "budget" study of expected net returns from the land. The necessity of making a number of "heroic"

¹³ A promising method of comparing widely separated lands for agricultural purposes has been suggested by Thornthwaite and is based upon the concept of "potential evapo-transpiration." See his: "Evapotranspiration in the Hydrologic Cycle," *The Physical Basis of Water Supply and Its Principal Uses*, Vol. II. Interior and Insular Affairs Committee, House of Representatives, U.S. Congress, 1952, pp. 25-41.

assumptions concerning future yields, costs, receipts, and production coefficients makes this method cumbersome and unreliable.

Recently, Renshaw has suggested that changes in land values could be used as indirect measures of irrigation benefits. It was claimed that this method offers a great deal of promise because it relies upon fewer assumptions and reduces the possibility of over-counting.

The analysis in this paper indicates that the case for the use of land values as opposed to the "budget" method of measuring primary irrigation benefits may not be as promising as Renshaw suggests. Indeed, the land value method seems to involve an equal number of theoretical and empirical problems which are not easily resolved. It is probably fair to say that both methods require use of "heroic" assumptions. The better method will depend upon the particular circumstances which stem from individual project evaluation problems.

J.W. Milliman
Graduate School of Business
Indiana University
Bloomington, Indiana
September, 1965

Submitted to
American Journal of
Economics and Sociology
Reply to Professor Gaffney

It is indeed remarkable how much controversy can be generated by Mason Gaffney when he finds someone who argues that land-value taxation may not be a panacea for most of the ills of modern urban society. Professor Gaffney is one of the foremost exponents of Ricardian Cameralism. In an excellent article he attempted to synthesize Richardian ground rent theory and welfare economics to "offer society more plausible alternatives than it now faces so distraughtly."¹

Many economists agree with Gaffney that land-value taxation has much to be said in its favor. Nevertheless, it is generally conceded that this tool is just one of a number of devices available for improving the organization and management of urban areas. Moreover, it is clear that the administration of a "pure" tax on economic rent involves operational difficulties which are often comparable to these involved in other policies for promoting and reconciling allocative efficiency and distributive equity.

Professor Gaffney and I have no quarrel on the general question of marginal cost pricing. Certainly his solution to the problem of covering deficits in the case of decreasing average costs of water service has a good deal of merit. My point was, and still is, that a lump-sum tax based upon consumer surplus presumably capitalized in land values is neither the only way, nor necessarily the best way, to handle the problem.

In my article two criticisms of the Gaffney solution were made. First, the theoretical relationships between the size of the deficit and the generation of consumer surpluses are more tenuous than Gaffney appears to admit. Therefore, the bold advice of the Ricardian Cameralist may need to be qualified. Second, Gaffney assumes too readily that consumer surplus will automatically be translated into land values and that these changes in land values can be easily

¹M. Mason Gaffney, "Land and Rent and Welfare Economics," Chapter 8 in Land Economics Research, published by Resources for the Future and the Farm Foundation, 1962. Distributed by the Johns Hopkins Press, Baltimore, Maryland, p. 167.

isolated and detected. In light of these real difficulties I suggested the price discrimination, properly employed, might be an alternative way of capturing sufficient consumer surplus to cover deficits. Actually, there are still other price policies to deal with this matter which also have merit.²

Professor Gaffney's comment on my article does not spend much time dealing directly with the two criticisms. Instead, much of his comment is devoted to criticising a proposal which I never advocated in the first place; namely, that surpluses generated from some segments of the water system should be used to cover deficits of another segment. This would indeed be poor policy but I do not plead guilty to the charge. However, I suggest below that identification of responsibility for generating deficits may not be a clean-cut issue. If we assume that we can specify responsibility for generating deficits, that is if we can correctly allocate all costs to users and segments of water system, then little remains to argue about because straight marginal cost pricing doctrine would handle the matter. On the other hand, the presence of joint or indivisible costs may completely rule out such neat solutions. Apparently, Gaffney is a bit uncomfortable in his comment at this point because he concludes that I do not spell out the proposal.

In reference to my first criticism, Professor Gaffney concedes that the amount of consumer surplus is related to the shape and position of the demand curve. However, he does not go on to acknowledge that the amount of the deficit is largely governed by the shape and the level of the cost curves. I believe that the indirectness of the relationship between the amount of consumer surplus and the size of the deficit ought to make Gaffney pause before he unqualifiedly says that the Ricardian Cameralist "measures and recaptures every last shred of consumer surplus and external economy created by water service---- and applies it to cover the deficits of marginal cost pricing."³

Frankly, I see no reason why all of the consumer surplus should be taken if the aim is merely to cover deficits. Clearly, my diagrams illustrate cases where the consumer surplus may exceed the amount of the deficit. Gaffney goes on to tell us that the Ricardian should continue outwards and reaping all the surplus until the deficit is covered and then proceed no further. Again, I must admit that this bit of advice seems confusing. I do not think anyone would dispute the fact that it would be poor policy to extend service to a particular user when the total value in use did not cover the marginal cost. But this is not the same thing as saying that "we should never extend distribution lines into territory where the consumer surplus will not cover the deficit of marginal

²See Chapter V "Municipal Water Rates" in Water Supply: Economics, Technology and Policy by Hirshleifer, DeHaven and Milliman, University of Chicago Press, Chicago 37, Illinois, 1960.

³Gaffney, op. cit., p. 162.

cost pricing." That is, unless we can clearly assure ourselves that the deficit in question is solely or directly attributable to the particular consumer in question. However, I suggest that the cost functions for urban water service may contain indivisible costs. Therefore, it may not be entirely clear just who is responsible for the so-called deficit. It would seem reasonable to ask in this case that extra consumers cover all of the extra costs attributable to their use and perhaps make some contribution to general overhead or to a general deficit. Marginal cost pricing, correctly administered, would apply the proper spatial constraint when water system costs are a function of space and distance.

It could well be that some of the difficulty between Professor Gaffney and myself at this point is more apparent than real. Both of us appear to be doing a great deal of "armchair" theorizing. I suspect if we had some actual cases before us which would make the cost functions explicit, much of the dispute would disappear. In any event, the issues between us would be a good deal more clear-cut.

Finally, I would like to comment a bit more on the second criticism of the Gaffney solution dealing with the capitalizing of consumer surplus and its measurement in land values. Of course, Gaffney is correct in asserting that price discrimination has a number of difficulties but he apparently exhibits a blind spot in asserting that the market for land is more perfect than the market for water and that, therefore, it would be easier to capture consumer surplus via the land market than through the water market. This is an interesting proposition but it does not appear to be necessarily true. In fact, a good case can be made for the proposition that consumer surpluses may not always be capitalized in land values. Professor Gaffney is strangely silent on this question.

I am sure that this exchange between Professor Gaffney and myself has done a great deal to clarify matters between us. Both of us feel that water rate practices in most American cities subsidize urban sprawl and promote uneconomic use of water. The broad area of agreement between us should serve to draw attention to the need to re-examine public utility pricing practices in light of these serious charges. Clearly, Mason Gaffney does offer us some plausible alternatives.

The University of Wisconsin - Milwaukee

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• DEPARTMENT OF ECONOMICS

10 - 1

Dear Weld -

You may find this
amusing.

Mase

10/5/65

I'm sure not amused. He is
irresponsible and therefore dangerous. He
should be avoided.

W.

a comment on J.W.M. "Costs of Water Distribution" (m 2)

(4)

Professor Milliman and I seem to agree on the basic fact that the average cost of conveying water rises with distance, but falls with volume. We also agree that water rates, like other prices, should be set to equal marginal costs rather than average costs. It is remarkable how much controversy we then generate by combining these opinions in different ways; but it is a friends' quarrel, for we are both seeking to implement the same basic economizing principles.

My chapter, which Professor Milliman discusses, deals with the economics of distributing water from a given source, a local load center. It suggests a method for optimal pricing of the services of the distribution system.^{*} It does not deal with the cost of developing water at the sources, or of importing it from another region to a local reservoir or other load center. Whether or not we have increasing or decreasing or constant costs before the load center, or at the load center, we will have decreasing costs in distribution after the load center. My analysis is addressed only to the last segment -- which is in general the costliest and should dominate ~~the aggregate costs, center.~~

But since Professor Milliman has been so sporting as to meet me on my own grounds, let me return the gesture and meet him on his, which are important and interesting.

My chapter treats the pre-distribution costs by putting a price on water at the point of delivery to the distribution system, the price to equal the marginal cost of water to that point. If there are increasing costs to that point, as is often true where water is relatively scarce, the pre-distribution system would yield

^{*} Prof. M. never does not mention an essential the most distinctive aspect of my proposal, which is to graduate rates with distance from the load center.

a surplus, or rent. Most of the rent is imputable to the scarce raw water at the source, and/or to scarce storage sites.

In answer to Milliman's question of how I would distribute this surplus, I believe it should be collected by the owner of the water rights or other rent-yielding resource (just who does or should "own" water rights is a complex institutional question beyond our present scope). That is necessary for economical pricing of water. To divide up the surplus among owners whose lands lie within the distribution perimeter serves no useful allocated^{ive} purpose. Neither does it balance, as Milliman indicates, the policy of taxing these owners to meet deficits of the distribution system. The deficit-meeting "tax" is balanced by the land owners' receiving water at low rates below average cost. The negative land tax which Milliman (indirectly) proposes would simply turn over to a limited number of land owners the net value of a water right which their town acquired through a political process, usually quite arbitrary from any equity point of view. As we will see, the allocative effects of such a policy would be disastrous.

Milliman's analysis lumps together the three (or more) segments of a water system: collection, storage, and local distribution. In effect, this kind of accounting would use the surplus or rents of the increasing cost segments to cover the deficits of the decreasing cost distribution segment. That would in fact distribute the surplus of the system to the landowners in the distribution perimeter; not as a lump sum, ^{[or negative land tax],} but in water distributed below cost.

Whenever in economic analysis we lump together costs and revenues from separate operations with different characteristics, we lose some accuracy and run the danger of making mistakes. In this case we would be led into ~~the~~ at least two serious mistakes.

1. We could not pay for the rent-yielding water sources or storage sites a price high enough to indicate their economic value to us. Instead, these rents would have to go to meet the deficits of the distribution system.

Under the present system of water rights that problem is usually obscured because a city does not have to pay a market price for scarce waters, nor can it easily sell water rights to others. So there is no obvious need to impute a return to the water resource per se. But Milliman, like myself, is among those who advocate making water rights freely transferable through a market mechanism. For his version of this idea (or mine, which differs in detail) to work correctly, the rents earned by raw water sources must be imputed to these raw water sources and not arrogated to meet deficits elsewhere in the system.

2. We would probably over^{extend}~~build~~ the distribution system, for our accounts would conceal from us that ^{its marginal extensions were}~~it was~~ losing money. Milliman does not spell out his alternative proposal in enough detail, however, to be certain of what criterion he would use for the size and length of his distribution system. It would be useful if he would do so.

Moving now to my own grounds, (the distribution system), Milliman is correct that the amount of consumer surplus depends

P on the slope of the demand curve. But that fact hardly affects my argument, while his own is hard to discover. He stresses that consumer surplus is large relative to the deficits of marginal cost pricing, only to conclude abruptly that consumer surplus may be too small to cover the deficit. The last point, if it is his point, hardly bears on my discussion which emphasized that we should never extend distribution lines into territory where the consumer surplus will not cover the deficit of marginal cost pricing. Milliman is certainly right to emphasize that it is a tricky business to associate an increment of rent or land value with a given public work as cause. When ten or twenty other factors are at work simultaneously, it is too easy to attribute too much of the increment to whatever one is thinking about at the moment. I submit, however, that the chances of error are much less if the local landowners have to pay their full share of the freight, whether in high water rates or taxes or some combination. The gross errors of over-expansion are found where State or Federal government pays the costs, and ^{ur}ports to measure the benefits of the projects in increments to local land values which are not used to pay for the project. Milliman has often made a similar point, and probably would not intentionally support a proposal in which the surplus-yielding segments of a system had to carry the deficits of ^{sub} marginal extensions, whether that system be an integrated water project or the government and economy of the United States.

Concerning the choice between price discrimination and land taxation as alternative methods of tapping consumer surplus,

the latter has the advantage of promoting rapid and compact development of lands within a costly distribution system. The method of price discrimination fails to apply any spatial constraint, although the system costs are primarily functions of space rather than volume of service (recall our initial postulate, costs rise with distance but fall with volume.)¹

In terms of equity, perfect price discrimination would be a highly personal thing. It would require psychoanalyzing every customer and shaking him down for all he was worth -- not a pretty picture if you follow some of the implications. A land tax ~~accomplishes a similar end by~~ ⁵ letting people exhibit their psychic preferences by bidding freely in the market for prized locations within a water service area. The surplus may then be collected in the form of an impersonal tax in rem, ^{rather than} ~~and not in personam~~.

Aside from the above I find little ~~more~~ to dispute and much to applaud in Milliman's paper, which adds to our debt to this pioneer economist who has done so much to promote rational economic use of the world's scarce water supplies.

1. Compare William Vickrey "General and Specific Financing of Urban Services," in Public Expenditure Decisions in the Urban Community, Resources For the Future, 1963, Howard G. Schaller, editor, pp. 64-86. Vickrey writes "The cost of the (water) mains is proportional to their length and relatively independent of the required volume of flow."

September 1, 1965

Professor J. W. Milliman
Institute of Applied Urban Economics
Indiana University
Bloomington, Indiana

Dear Jerry:

Or should I start out "Dear Sir, you cur?" I hope that you will find the enclosed to be of some relevance to your interesting paper. I see that the version which you finally submitted is different from the original, and took most of the wind out of my sails. I was going to tax you for overlooking the fact that I had made such a distinction between lengthening lines and fattening them. We are begining to boil our differences down to such a small residue that there may not be much to argue about any more. I hope our readers will find it entertaining, anyhow.

I really appreciate your taking the trouble to comment on my 1961 chapter, which might otherwise have remained buried in perpetuity.

Sincerely,

Mason Gaffney
Professor

MG bg

Enclosure

7

September 1, 1965

Mr. Will Lissner, Editor
American Journal of Economics
and Sociology
50 E. 69th Street
New York, New York 10021

Dear Will:

Thank you for the opportunity to comment on Milliman's
discussion of my chapter on water rates. I hope that
the enclosed will meet your editorial standards.

Sincerely,

Mason Gaffney
Professor

MG bg
Enclosure

cc - Professor J. W. Milliman

May 27, 1964

Professor J. W. Milliman
Graduate School of Business
Indiana University
Bloomington, Indiana

Dear Jerry:

Thank you for sending another copy of your "Price Policies for Urban Water Supplies." I have been waiting for it to be formally published before I took pen in hand to demolish your criticism of my immortal theories. I hope that that will be soon. At least one part of me hopes that it will be soon. The lazy part is in no hurry at all. When I do get around to rebutting your points, I will suggest that you failed to read my classic words very carefully before demolishing them. The essential point of difference between us has to do with the definition of the term, "decreasing costs." My position is that where the product being produced is transportation, then a homogeneous unit of output is carrying water simply between points A and B. When you carry more water between points A and B, the unit cost goes down. Your counter-argument is that when you carry water from A beyond point B, the cost goes up. But that does not really meet my argument, which has to do with the costs of distribution within a given perimeter.

Maybe we can get into one of these classic journal debates that will go on for twenty years, and push all the junior authors out of the major journals. Wouldn't that be glorious?

Two weeks ago in Los Angeles, I saw Werner Hirsch, and he mentioned the possibility that he might drag you back to Los Angeles to resume your vendetta against the Berkeley group with more leverage than you enjoyed before. It sounds interesting, but I told him I didn't think his chances of getting you were very good. I am sure that will whet his appetite. Werner is full of projects, as usual, and I am sure can offer you something rather interesting. I do not think, however, that he can offer anyone tenure, nor can he offer you freedom from some form of coordination with Siegfried, Mike Brewer and that crew. I do think that Warren Hall would be a good man to work with, although you have expressed some reservations about him in earlier correspondence.

Sincerely,

M. Mason Gaffney
Chairman

MMG bg