ABSTRACT
                This paper provides a clarification of two
factors--the differences in pupil need (as reflected by the
proportion of disadvantaged or handicapped pupils in a district) and
the differences in the prices of school inputs across districts--that
affects the cost of educational services and a conceptual framework
that may be useful in making welfare comparisons across school
districts. Section 1 provides a clarification of what is meant by the
concept of an educational price differential. Section 2 deals with
the impact of wealth disparities on the demand for educational
quality and reveals the extent to which variations in the demand for
educational quality lead to salary differentials for school
personnel. Section 3 examines the sources and nature of the
variations in the cost of educational services. Section 4 presents a
discussion of the economic theory of index numbers along with some of
the problems encountered in the determination of the "true"
cost-of-education index. Finally, section 5 clarifies what is
required in order to calculate a cost index for educational services.
(Author/IRT)

EDUCATIONAL PRICE DIFFERENTIALS:

A CLARIFICATION OF THE ISSUES

by

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There has been much discussion in recent years regarding the implementation
of various school finance reforms. At the center of much of the debate is the
issue of equity in the financing of educational services. Specifically, this
involves the determination of methods by which policy makers can equalize the
distribution of funds to reduce or eliminate entirely the differences in the
quality of educational services attributed to disparities in wealth across local
school districts.[1]/ In effect this effort at equalization means devising state
school aid formulas that would make local school district expenditures per pupil
independent of the wealth of the local community.[2]/ By whatever method wealth
neutrality is established, it is clear that there are two other factors relevant
to school finance reform and the equity issue that must be accounted for, and that,
to some extent, these factors may modify the goal of wealth neutrality as a method of
establishing an equitible school finance system. These two factors are (1) the
differences in pupil-need (as reflected by the proportion of disadvantaged or
handicapped pupils in a district) and (2) the differences in the prices of school
inputs across districts.

It is the purpose of this paper to provide a clarification of how these two
factors affect the cost of educational services and to provide a conceptual frame-
work which may be useful in making welfare comparisons across school districts.
Section I provides a clarification of what is meant by the concept of an educational
price differential. Section II deals with the impact of wealth disparities on the
demand for educational quality and reveals the extent to which variations in the
demand for educational quality lead to salary differentials for school personnel.
The purpose of this analysis is to demonstrate that to some degree the observed
differences in the salaries of school personnel are a matter of choice (i.e., endo-
genous) to school decision-makers in that they reflect attempts to attract better
quality personnel. In Section II the sources and nature of the variations in the
cost of educational services are examined: specifically, those factors which are
not a matter of choice but rather are outside the control of (i.e., exogenous to)

school decision-makers. These exogenous factors involve the differences in both pupil-need and the supply of school inputs across local school districts. Section IV presents a discussion of the economic theory of index numbers along with some of the problems encountered in the determination of the "true" cost-of-education index. Finally, Section V wraps up this discussion by clarifying what is required in order to calculate a cost index for educational services.

I. Educational Price Differentials

Variation in educational expenditures are composed of essentially two elements: (1) variation in the amount of educational services purchased and (2) variation in the price of those educational services. To formalize this conceptualization, let the level of educational expenditures per pupil be denoted by the symbol E, the level of quality of educational services per pupil be denoted by Q (i.e., Q represents the amount of educational services purchased), and the price of a unit of educational quality be denoted by P. Formally, this relationship may be then be written as[3]/

$$E = P \cdot Q.$$

(1)

There are four sets of factors that influence the demand for educational quality (Q). These factors are the same basic elements that go into the determination of the variation of consumer demand. Specifically, the amount of educational services purchased (i.e., demanded) by a given school district is a function of the relative price of educational services (i.e., the price of educational services relative to the prices of all other consumer goods and services), the fiscal capacity of the school district (i.e., local fiscal capacity along with the level of intergovernmental grants-in-aid from state and federal sources), the factors affecting the local tax burden (e.g., the composition of the local tax base with

regard to residential versus business property), and the <u>taste</u> for educational services of the local constituency.[4]/ Presumably, holding all else equal, the higher the relative price of educational services the less will be consumed (i.e., the demand curve for educational quality is negatively sloped) and the communities with greater fiscal capacity will purchase greater amounts of educational quality.

There are two sets of factors that influence the variation in the price (or cost), P, of educational services: (1) those factors that affect the <u>supply</u>, and therefore the prices, of school inputs (e.g., the quantity and quality of teachers' services) and (2) those factors which affect the <u>technology</u> of the educational production process (e.g., the scale of operation and the nature of pupil-needs).

The elements which compose the demand for educational quality (Q) and the determination of educational costs (P) are elaborated upon below.

II. <u>Wealth Disparity, Demand for Educational Quality, and Salary Differentials of School Personnel</u>.

It has been generally observed that wealthy school districts outbid poorer districts in the market for various school inputs. In this regard one might ask whether more of these school inputs necessarily means better quality educational services. There are two issues implicit in dealing with this question. The first question is what do we mean by quality. The second question concerns what we mean by wealth disparity or perhaps differences in fiscal capacity. Let us consider each of these questions in turn.

Ideally, one would like to have some universally-accepted concept of educational quality which would allow for comparisons of the level of educational services across school districts. But who is to define this universal concept of quality: cental (state) policy-makers, researchers, etc.? Even if we could define what the appropriate outcomes should be, how would we measure them and

moreover, how would we assess their relative importance in order to combine them
into an overall quality index? Given the primitive state of the art revealed in
studies of the educational production process, it is only too obvious that
educational quality and technology cannot at this point in time be measured or
assessed in any precise manner.

With this problem of measurement in mind, one might employ a concept analogous
to consumer sovereignty to resolve the issue of what we mean by educational quality.
The concept of consumer sovereignty implies that the wants of the society are
expressed in the market. That is, the consumer not as an individual but as a
collective force in the market determines the pattern of economic activity. If
consumers do not desire a particular good or service, or are unwilling to purchase
it at the offered price, that good or service will go unsold. Applied to the
market for school inputs, this analysis suggests that we rely upon the judgements,
as revealed through market behavior, of local school decision-makers (i.e., those
who represent the consumers of educational services) regarding which school inputs
do or do not contribute to educational quality. For the purpose of analyzing
variations in the cost of educational services, why should researchers or
educational policy-makers, who are in general a considerable distance from the
ongoing process of education, make arbitrary judgements as to what does or does
not constitute school quality? Local decision-makers (i.e., school boards and
school administrators) are not only cosest to the actual production process, but
also are more directly responsible for reflecting the perceptions and preferences
of local constituencies with regard to educational priorities.

Based on these considerations, it would seem appropriate to rely on the
perceptions of those who have been given the responsibility by local citizens to
make decisions about educational quality. If one accepts this premise, then a

market test can be devised which will reveal which school inputs (e.g., which characteristics of teachers) are perceived by local decision-makers to contribute to educational quality.[5]/ The use of such a methodology relieves the researcher or the state policy-maker from having to make judgements regarding this issue and places the issue in the hands of those perhaps most capable of providing a reasonable and credible assessment of what factors affect or contribute to school quality. The empirical methodology involves the determination of which educational inputs are endogenous (i.e., a matter of choice) to school decision-makers. For example, for which teacher characteristics are school officials willing to pay a price on the market and does the level of employment respond to changes in prices and school budgets? If school districts do not desire to purchase a particular teacher characteristic (i.e., because it is not perceived as contributing to educational quality), then that characteristic will not bring forth a price in the market for teachers. Furthermore, for those characteristics which are desired by school districts, the level of employment of that characteristic will respond systematically to price and budget changes and an implicit market price will be revealed.

This empirical methodology is based on a theoretical structure which is elaborated upon in Antos and Rosen (1974). Labor market transactions involve a mutual exchange of labors' productive attributes and the attributes of the work place that define working conditions. To quote Antos and Rosen:

> Teachers sell the services of their labor, but simultaneously purchase utility bearing characteristics of the schools in which they work. On the other side of the bargain, school administrators purchase desired teachers services and jointly sell characteristics of schools and students to their teachers. Every contract quotes a price for the total package of labor services and on-the-job consumption, and the content of the package varies from school to school. Hence, comparisons of wage rates across teacher characteristics and consumption attributes yield a functional relationship from which it is sometimes

possible to impute prices for various dimensions of the underlying
exchange package. The observed relation between salaries, teacher
characteristics and school characteristics is determined by the
market..........(p. 1)

Let us now address the second question of what we mean by fiscal capacity and
of how we measure differences across school districts. The issues related to
what the relevant measures of fiscal capacity are (or should be) are well known.[6]
The relevant consideration in the determination of what should be used as a measure
of a district's fiscal capacity relates to those factors which affect the relative
burden of taxes placed upon local taxpayers to provide a given level of educational
services. In this context, it is suggested that income per taxpaying household
is the relevant determinant of the ability of local residents to undertake a
given burden of school property taxes. That is, property value (which forms the
local tax base for school taxes) is not a good measure of fiscal capacity since
it may be only weakly related to the ability and/or willingness of local residents
to tax themselves for educational services.[7]

Using family income as a measure of fiscal capacity, we may now examine the
extent of difference in the quality of educational services being delivered to
various school districts. These differences will be measured in terms of the
differences in the service levels of school inputs as suggested by the market test
approach outlined above.

Table I presents some empirical estimates of the differences in school
spending per pupil, the salaries of the school personnel, and the demand for the
quantity and quality of teachers services attributed to differences in the levels
of community income (in column 2) and the state and federal grants-in-aid (in
column 3). The estimates are based on a study of resource allocation on a sample
of California elementary school districts for the 19/0-71 school year.[8] For the
purposes of this example, the difference between high and low income districts is

Table I about here

set at $4,000 per household which is approximately equal to the difference

between plus and minus one standard deviations for the sample of elementary dis-

tricts. The empirical results indicate that, ceteris paribus, districts with

higher levels of income per household or larger grants per pupil will tend to spend

more on educational services, pay higher salaries to school personnel, and employ

greater quantities of school inputs per pupil.

Because of the manner in which state, and to some extent federal, grants are

distributed, there is an inverse relations between the level of community income

and grants-in-aid across school districts: higher income communities generally

receive smaller per pupil grants.[9]/ One of the objectives of providing school

districts with state and federal grants-in-aid is to equalize educational oppor-

tunities across districts by compensating for the existing disparities in fiscal

capacity which would otherwise lead to differences in the quality of educational

services supplied to children from different socioeconomic backgrounds. The

estimates indicate that for each $1,000 of community income per household, the

average elementary district gives up $18.02 in grants-in-aid per pupil. If the

net result of this trade-off between income and grants-in-aid leads to an increase

(decrease) in the level of expenditures per pupil, the salaries of school personnel,

and the demand for the quantity and quality of teachers services, then it suggests

that the distribution of grants-in-aid does not (does) compensate districts for

differences in community income. The net differences in resource allocation are

reported in column 4.

Even with the lower level of outside grants, the higher income districts still

spend more on educational services, pay higher salaries, which presumably attract

better quality school personnel, and maintain smaller classes. The increased quality

of school personnel refers not only to the traditional experience and educational

preparation, but also to other teacher characteristics (such as teacher verbal

ability) which are not explicitly accounted for in district salary schedules.

These other teacher characteristics are likely to be accounted for in district

policies in setting starting salaries, ceteris paribus. For example, using

the estimates of the differential in starting teachers' salaries from Table I

along with Levin's (1968) estimates of the implicit market price of teachers

verbal ability, the high income district could purchase close to eight additional

units of teacher verbal ability with the net difference that they are willing to

pay. The implication of this analysis is that the reason wealthier districts pay

higher salaries is because they perceive some additional benefit in terms of their

ability to attract what they view as better quality school personnel.

III. Cost of Education, Salary Differentials for School Personnel, and Variation in the Educational Technology.

There are two sets of factors which lead to variations in the cost of producing

a given quality of educational services: those factors affecting (1) the supply

of school inputs and (2) the technology of educational production. The salaries

of school personnel are the most important source of variation in the cost of

educational services attributed to supply factors. The sets of factors which

determine personnel salaries (denoted below by the vector S) may be divided into

two parts: (i) those factors which are endogenous to school decision-making (i.e.,

the demand factors) such as the choice of personnel quality characteristics (denoted

by the vector q which includes experience, educational preparation, and other

relevant ability characteristics such as teacher verbal facility) and working

conditions (denoted by the vector W which includes, e.g., class size) and (ii)

those factors which are exogenous to school decision-making (i.e., the supply

factors denoted by the vector Z_s) which reflect the relative attractiveness of

employment in a given district (e.g., district size, racial and ethnic composition

of the pupils, and local labor market conditions). Formally, this salary equation,

the parameters of which are determined in the markets for various school personnel, may be expressed as

$$S = s(q, W, Z_S).$$ (2)

In the jargon of the economist, this salary equation (2) is referred to as the market price schedule for school personnel. The parameters (i.e., estimated regression coefficients) of this market price schedule convey to school decision-makers the increment of salary which must be paid in the market for each of the attributes contained in the vectors (q, W, Z_S). These increments must be reflected either explicitly (as would those paid for experience and education) or implicitly (as would those paid for such attributes as teacher verbal ability or district characteristics such as racial composition of pupils) in district salary schedules. For exmaple, Levin (1968) reports that the implicit market price for an additional unit of teacher verbal ability is around $24 while the market price for an additional year of schooling for teachers ia approximately $500. Similarly, Antos and Rosen report that school districts which enroll black students must pay, on the average, a positive salary differential of $5 to $7 for every percentage point of black students in order to attract a given quality of teachers' services.

It is in fact the differentials in the salaries of school personnel attributed to the supply factors which are of concern in the determination of variation in the costs of educational services. As suggested above these supply factors are exogenous to (i.e., outside the control of) school decision-makers. This implies that the value of a dollar's worth of state aid varies across school districts depending upon the conditions which determine the local supply of school inputs. As is indicated in the analysis of wealth disparities above, it is once again necessary to determine what we mean by educational quality.

Some of the previous attempts at constructing an education cost index make

arbitrary assumptions about which characteristics of school personnel should
be held constant in order to construct a cost index.[10] In effect the question
that each of these studies must address is, "Which teacher characteristics affect
the quality of school service?" For example, the NEA and Woollatt indices
assume that teachers' education and experience are related to quality throughout
the full range of these variables, while the New York State Education Department
Index assumes that educational quality is unrelated to education and experience
of teachers.[11]

    In the view of this author, the appropriate question posed by these studies
shoudl be, "Which teacher (or other school personnel) characteristics do local
school decision-makers (i.e., the educational managers and technologists) perceive
as contributing to school quality?" In the spirit of the argument put forth in
Section II, in the absence of some universally accepted notion of educational
quality, it is proposed that we rely upon the judgements, as revealed through
market behavior, of local school decision-makers regarding which school inputs
do or do not contribute to educational quality. It is for this purpose that
empirical investigation of the demand and market price schedules for school
inputs can lead to some statements about endogeneity (i.e., that is which
variables are choice variables for schoo' decision-makers) and hence, can be
a guide as to which characteristics should be included (i.e., are exogenous)
and which held constant (i.e., are endogenous and thus perceived to contribute
to educational quality) in determining the variations in the cost of educational
services. In terms of equation (2) we are specifically interested in isolating
the impact of variation in the supply factors Z_S on the salaries of school
personnel while holding the decision (or endogenous) variables q (personnel quality)
and W (the endogenous working conditions) constant. This will provide policy-
makers with information on the variation in the cost of a given quality of school

personnel across school districts.[12]/

One difficulty encountered in using the market approach to assess educational quality is the constraint on the allocation of resources in school districts resulting from the limitations on the choice of personnel quality imposed by the tenure laws and seniority provisions in union contracts. In effect the provisions of the tenure laws, while allowing districts to choose the number of teachers to be employed, constrain the choice of which teachers (and therefore which combination of quality characteristics q) will be employed. This results from the fact that tenure laws (or union contracts) specify seniority as the basis for the order of dismissal of school personnel--i.e., those with the least seniority being dismissed first in response to a decline in enrollment or the elimination of educational programs. The quality characteristics of school personnel can therefore only be adjusted at the margins through newly hired staff members. The empirical implication of this constraint is that the level of employment of the constrained characteristics will not vary systematically across districts according to variations in the supply and technology factors and/or differences in district budgets.[13]/ It is of interest to note that this author has reported elsewhere some empirical evidence consistent with the hypothesis that the school decision-makers in a sample of unified districts in California are operating on their lower bound constraints for teacher experience.[14]/ That is, because of the constraints imposed by teacher tenure arrangements on district decision-making, school officials are unable to adjust the level of teacher experience downward to its desired (or optimal) level.[15]/ This observation is particularly true for the many districts currently facing declining enrollments. One implication of these empirical results is that school decision-makers would prefer a higher rate of turnover among teachers which would allow for the replacement of the older, relatively more experienced teachers with the newer and more inexperienced teachers. The higher rate of turnover increases the ability of the district to adjust downward the

average level of experience of a teaching staff with "too much" experience.

One way of dealing with this problem is to focus attention on the determinants
of the characteristics of the newly hired teachers across local school districts.
An empirical methodology can be developed to estimate the demand equations for
newly hired teachers and to determine whether or not particular districts are
operating on the constraints imposed by tenure laws.[16]/

A second set of factors which affect the cost of producing a given quality of
educational services are technological factors. Conventional wisdom suggests that
different kinds and combinations of school inputs will be required to provide a
given quality of school services to different kinds of pupils: that is, differences
in pupil composition by, for example, socioeconomic background or racial and
ethnic characteristics. Specifically, one would suspect that the perceptions of
school decision-makers of the relationship between the level of educational quality
and the combinations of school inputs will vary systematically according to some
relevant set of personal characteristics of the student population and perhaps
even with the scale of operation of the school district. For example, most
school officials are likely to believe that it will cost more and require different
patterns of expenditure to provide a given quality of school services to relatively
low socioeconomic pupils. In the jargon of the school finance literature in
education, these so called technology factors might more appropriately be referred
to as pupil-need factors (excluding, of course, the scale affects referred to above).

This analysis is analogous to the development of cost-of-living indices for
families of different composition. It is suggested that both family background and
structure will influence preferences and, hence, the relevant weights used in the
construction of cost-of-living indices. There is a literature which has suggested
both a theoretical and empirical methodology for determining the effect of, for

example, differences in age structure of families on expenditure patterns and, hence, on the cost-of-living.[17]. The cost-of-living for older families will differ from the cost-of-living for younger families due to systematic differences in expenditure patterns which are likely to exist.

For school districts these <u>technological</u> factors affecting the costs of services are determined exogenously to school decision-making since, for all intents and purposes, student composition and the number of pupils within the boundaries of school districts are outside the control of school officials. Once again, a dollar's worth of state aid will vary in the quality of educational services it will buy due to the variations in technological factors across school districts, <u>ceteris paribus.</u>

Ideally, it would be useful if a market test could be devised to determine the impact of pupil-need on educational cost. Such a methodology would involve the determination of the extent to which expenditures need to be adjusted to provide different types of pupils (classified according to need characteristics) with a given quality of educational services by examining the behavior of school district decision-makers in the market for school inputs, i.e., through an examination of variations in the patterns of demand for school inputs attributed to variations in the <u>technology</u> factors. If such a methodology could be devised, it would imply that decisions on expenditure adjustments to account for pupil-need need not be carried out through arbitrary weighting structures developed by centralized authority (e.g., as is currently carried out in most states).

It should be noted at this point that some of the same variables that affect the <u>supply</u> factors also affect the <u>technology</u> factors. For example, pupil composition by racial and ethnic background is likely to affect both the <u>supply</u> factors (e.g., through the higher teachers' salaries necessary to compensate for the apparent nonpecuniary disadvantages of teaching in districts with relatively large proportions of minority pupils) and the <u>technology</u> factors (i.e., by altering the per-

ceived combination of school inputs required to produce a given level of educational quality). Despite the overlap in the factors that affect the <u>supply</u> and <u>technology</u> conditions, appropriate specification of the model will allow for identification of the <u>supply</u> and <u>technology</u> factors separately.

IV. Constructing a Cost-of-Education Index

Given the outline in the previous Section of what elements determine the cost-of-educational services, we can now formalize this structure in order to determine precisely how this relates to the construction of a cost index for educational quality. In this discussion we will define what is meant by a "true" cost index as it would apply to school districts and, in the process, illustrate the difficulties in actually constructing such an index based on available information on educational quality and technology.

To draw on the economic theory of index numbers, a "true" cost-of-education index is defined to be the ratio of the minimum expenditure required in two different <u>supply</u> (cost) and/or <u>technology</u> situations (i.e., either comparing two decision-making units--e.g., school districts--at one point in time or one decision-making unit at two points in time) to provide a given quality of educational services. To compare two school districts at a point in time, it is necessary to specify the cost function for a given district. As in equation (2), we designate Z_S as the (exogenous) <u>supply</u> factors and we let Z_T represent the exogenous technology factors (i.e., pupil-need and district scale). Formally, the cost function for the district may be written,

$$E = E(Q, Z_S, Z_T). \qquad (3)$$

This function describes the minimum expenditure (or cost) necessary to produce a given quality (Q) of educational services given the <u>supply</u> and <u>technology</u> situations described by Z_S and Z_T.

Graphically, this cost situation can be illustrated using the standard isoquant-isocost analysis of economic theory. For expository purposes assume that there are only two school inputs x and y (e.g., teachers and teachers' aides). In figure 1 the curve labeled Q* is an isoqual representing the various combinations of x and y necessary to produce the desired level of quality Q*.[18]/ The further from the origin (0) this curve is situated, the higher

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Figure 1 about here

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the level of quality represented. The curvature of the isoqual reflects the fact that as we trade-off x for y it requires more and more of Y for every unit of x sacrificed to maintain the same level of quality. The isocost curve labeled E* in figure 1 represents the various combinations of x and y that may be purchased for a fixed level of expenditure in the market. The curvature at any point along the isocost curve reflects the rate at which these two inputs can be traded in the market given the factors that determine the supply prices. Based on this analysis, it should be evident that the isoqual reflects the educational technology; and, therefore, the elements of the vector Z_T determine its position and curvature in the (x, y) plane. Similarly, the isocost curve reflects the market supply conditions and therefore the vector Z_S determines its position and curvature in the (x, y) plane. For simplicity the isocost curve has been assumed to be linear.

The equilibrium point in figure 1 occurs at the point corresponding to (x*, y*) where the isoqual and the isocost curve are tangent to one another. This point represents the minimum expenditure necessary to achieve the given level of educational quality. Thus, it corresponds to one point on the cost function (3) where Z_S and Z_T take on the values reflected by the isoqual and isocost curves

in figure 1. It can be seen that (x^*, y^*) is a point of minimum cost for Q^* since any point such as (x', y') requires a larger expenditure corresponding to isocost E' while with an isocost such as E'' we are not capable of achieving quality level Q^*.

Using this analytical framework we are now ready to define the "true" cost index for various supply and technology situations. Consider first two different supply (or cost) situations Z_{Si} and Z_{Sj} facing school districts i and j. It is assumed that the technology conditions are identical for the two districts. In figure 2 the fact that Z_{Si} is steeper than Z_{Sj} reflects the higher relative price of input y in district i. The cost-of-education index C_{ij} between the two

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Figure 2 about here

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districts is then given by the ratio of E_j to E_i (i.e., $C_{ij} = E_j/E_i$) where E_j and E_i represent the minimum expenditure necessary for both districts to produce a level of educational quality equal to Q^*. As indicated in figure 2 district j uses a relatively higher ratio of input y to x (i.e., y_j^*/x_j^*) than does district i (which employs y_i^*/x_i^*) since district j faces a relatively lower (higher) price for input y (x).

Now consider two districts i and j facing identical supply situations (i.e., $Z_{Si} = Z_{Sj}$) but differing technology situations $Z_{Ti} \neq Z_{Tj}$. Suppose district j had a relatively large proportion of disadvantaged pupils who required different amounts (presumably, relative more) and combinations of school inputs in order to achieve the same quality of educational services as the nondisadvantaged pupils in district i. This suggests that both the curvature and the position of the isoqual will differ for district j. This example is illustrated in figure 3.

In general the isoqual for Q_j^* (where $Q_j^* = Q_i^*$) will be further from the origin

than the isoqual for Q_i^*.[19]/ The cost index C_{ij} is once again defined as the

ratio of E_j to E_i as shown in figure 3 (i.e., $C_{ij} = E_j/E_i$).

Using the conceptual framework set out in figures 1, 2, and 3, one can now

demonstrate that our inability to measure educational quality and to identify

the technology prevents the construction of the "true" cost index. In the case

of different supply situations illustrated in figure 2, economists use a fixed

input index rather than the "true" index which is indeterminate without additional

information. Figure 4 illustrates the difference between the fixed input and the

"true" index. The fixed input index is equal to the ratio of E_j'/E_i, while the

true index is E_j/E_i. It can be seen that the difference between the two indices

is that the true index accounts for the fact the school district j is able to

substitute the relatively less costly input y in order to produce the quality

level Q^*. If the relative price that districts have to pay for teachers increases,

then those districts will tend to substitute away from teachers toward other

school inputs such as teachers' aids. The problem is that the fixed input index

does not account for this kind of substitution. The fixed input index ignores the

possibility that the same level of quality may be produced at a lower cost(than

would be true under the fixed input assumption) by substituting teachers' aids for

teachers (or class size). It can be seen that the fixed input index will tend to

overstate the degree to which district j's costs of Q^* exceed district i's costs

of Q^*, i.e., $E_j'/E_i > E_j/E_i$. In fact with an expenditure of E_j' district j could

achieve a level of quality Q' if expenditures were reallocated from input x to input y, i.e., from (x_i^*, y_i^*) to (x_j', y_j').

There is a case in which the fixed input and the true index are equal. Suppose the educational technology exhibited fixed proportions. This would imply that the isoquals were L-shaped, and that only a fixed ratio of school inputs could be used to produce educational services. Thus, any additional units of one input, ceteris paribus, would be redundant and would not yield any additional output (or quality in this case). This situation is illustrated in figure 5. Both the fixed input and the true index are defined by the ratio E_j/E_i.

Figure 5 about here

In the case of the different technology situations illustrated in figure 3, it should be clear that even more information is required to be able to identify the true index. Specifically, we need some information about the impact of our technology (i.e., pupil-need) factors upon the quality production function. Despite the difficulties encountered in such an analysis, there is a methodology which has been developed by economists to deal with the issue of differences in family consumption patterns caused by differences in the composition of households by, for example, age structure. The effort in this literature has been toward the development of what are referred to as "household equivalency scales" which essentially permit welfare comparisons of households of different composition facing the same or different prices of consumption goods.[20]/ Applied to the study of resource allocation in school districts, our efforts would be directed toward, the development of "school district equivalency scales" which would permit us to make quality (welfare) comparisons of school districts with varying compositions of

pupils (classified according to need characteristics) and facing the same or
different prices of school inputs.

IV. Concluding Remarks

It should be evident from the foregoing analysis that an accurate accounting
of the factors that make up a cost-of-education index will require the specification
of a comprehensive model of resource allocation in public school districts.[21]
It is the lack of such a theoretical framework that essentially invalidates
Brazer's (1974) attempt to calculate an educational cost index. His error lies
in his failure to appropriately specify which of the determinants of teachers'
salaries were endogenous and which were exogenous to school district decision-
making. His choice is essentially arbitrary.

In addition it should also be evident that a comprehensive index of the
cost of educational services must account for both the variations in the supply
factors (i.e., those affecting school input prices) and the technology factors
(i.e., the need related characteristics of the pupils and the scale of operation
both of which affect the school district's ability to produce educational
services). To reiterate, our goal should be to develop a "school district
equivalency scale" which reflects the minimum levels of expenditure (per pupil)
required for two districts facing differing supply and/or technology (pupil-need)
conditions to provide equal levels of educational quality. Moreover, it is to be
emphasized that quality as defined in this paper refers to perceived quality.
Perceived quality is based on a market test: that is, the relative values of
various school inputs and the relative impact of various compositions of pupils
on the educational technology are assumed to be reflected by the market behavior
of school decision-makers. Teacher (school personnel) characteristics which are
valued will exhibit employment levels across districts that vary systematically

with differences in _supply_, _technology_, and school budgets and moreover, these valued characteristics will reveal an implicit market price within the context of the _market price schedule_ for teachers (school personnel). Furthermore, it will be observed that pupil characteristics that influence the educational technology will cause systematic variations in the expenditure patterns of school districts.

It is important to note that the local school systems must operate, at least in the long run, on the basis of what is credible to the local community. That is, the evaluation of educational quality carried out by school decision-makers (i.e., their perception of the quality of educational services) must appear believeable to the citizenry. Convention wisdom suggests that inputs are a measure of, or proxy for, educational quality. Therefore, school district decision-makers have been hypothesized to possess an objective function which reflects the apparent contributions of various educational inputs to the quality of educational services. It is up to the decision-makers to convince the community that the districts revealed preferences for these various inputs reflect contributions to educational quality.

At this point this author would like to express a word of warning regarding the proposed market test approach to the assessment of educational quality. Some readers might be tempted to draw the conclusion that by relieving researchers and/or state educational policy-makers from making judgements about what educational quality is, the market test methodology is somehow value free, i.e., the values of researchers and state policy makers are not imposed on the system. However, in all honesty, a value judgement has been made within the context of the market test proposal itself. That is, the advocate (in this case this writer) of the market test is implicitly placing a value on the decentralization of decision-making which is consistent with increased personal freedom and individual choice. In the short run this market approach provides the school decision-makers (who are supposed to represent the preferences of the local constituency) with the power to determine

what school quality is, while in the long run individual families have the option

of voting with their feet by moving to communities that exhibit similar preferences

regarding assessments of education quality.[22]/

In the limit one would perhaps desire to place this assessment of educational

quality directly in the hands of the individual consumer (i.e., families with

school age children in this case) so that a more pure form of consumer sovereignty

could exist in the market for educational services.[23]/ This approach would

obviously require instituting a market for educational services (e.g., through

an education voucher system). However, currently it appears that such a system

of choice is not politically feasible. Furthermore, this choice alternative

is beyond the scope of this paper. Thus, the current system of public education

has been taken as given for the purpose of this paper.

In view of the analysis presented in this paper this writer cannot resist

making some final comments regarding the inappropriateness of the cost-of-living

index currently in use in Florida for the purpose of equalizing the purchasing

power of state school aid. Much of the argument over the Florida Price Level

Index (FPLI) has focussed on such issues as whether or not it is an accurate

measure of the cost-of-living within a given district or whether or not it is

the appropriate adjustor of employee salaries who do not live in the district.[24]/

It is the view of this author that much of this discussion is irrelevant to the

main issue. To be specific, Simmons (1975) suggests that "It (the FPLI) only

assures that the appropriation by the state on a per-pupil basis has equal

purchasing power in each county." (p. 120) The issue is purchasing power with

respect to what--the market basket of goods purchased by consumers? Clearly, in

attempting to provide school districts with equal purchasing power, the relevant

market basket is not that which is purchased by the representative consumer but

the market basket of school inputs purchased by local school districts. The

relevant adjustment in the state aid formula would be one which provided for

. equal purchasing power on the part of local school districts in the market for

school inputs.   The cost-of-living index is but one component in the work-choice

decisions which affect the salaries of school personnel and hence the cost of

educational services.

FOOTNOTES

[1]This issue of equity has been the thrust of the school finance reforms implied by the decisions of the Courts (e.g., in Serrano vs. Priest, the California equal protection suit).

[2]There have been various proposals for revision of state aid formulas in order to resolve this equity issue. Perhaps the most obvious method would be to equalize expenditures per pupil across all districts. Alternatively, Coons et al. (1970) have suggested Power Equalizing as a mechanism to establish wealth neutrality in school finance formulas. However, Feldstein (1975) has demonstrated that the Power Equalizing formula does not in fact provide for wealth neutrality in school spending and he has proposed an alternative method which he shows does establish wealth neutrality.

[3]In fact separation of E into the elements P and Q is easier said than done. However, for the purpose at hand this formalization is a useful abstraction from the real world which will enable us to reveal the nature of the variation in educational expenditures.

[4]For discussion of this model see Barro (1974).

[5]In the subsequent discussion, some difficulties regarding the interpretation of the market test approach are discussed: specifically, the implications of teacher tenure arrangements with regard to discretionary choice of teacher quality by school decision-makers.

[6]For example, see Reischauer and Hartman (1973), pp. 67-72, for a discussion.

[7]One perhaps should use a measure of permanent income or real wealth of individual families in the district which is the usual rationalization for the use of property value as a measure of fiscal capacity. However, as Reishauer and Hartman point out, property value is not a measure of family wealth. It is the equity component of property value that makes up one element of family wealth and the ratio of equity to property value varies systematically across local

communities according to various family characteristics. Moreover, property values is also made up of business as well as residential, property, relative values of which also vary across districts. Finally, as Reischauer and Hartman indicate, variations in property value are much more widely dispersed than variation in family income--in some cases the variation is much as 10,000 to one and within the narrow confines of certain metropolitan areas one can fine variation as much as fifteen to one (see p. 67).

[8]See Chambers (1975).

[9]State grants are largely based on assessed value of property. In the district: the greater the assessed valuation of property, the smaller, in general; will be the state aid. To the extent that property in the district is residential, districts with relatively high assessed valuation of property are generally higher income districts. This result simply reflects the fact that higher income families exhibit a greater demand for housing services. Moreover, both the state and federal governments provide categorical aid of which a substantial portion is directed toward improving educational opportunities for relatively disadvantaged children. Based on these considerations, one would expect higher income communities to be receiving a lower level of state and federal grants-in-aid than lower income communities.

[10]The studies included in this category are Wasserman (1963) and the studies discussed in some detail by Wasserman, pp. 110-121. These studies include "The National Educational Association Index of 1938,""Price Indexes Compiled by Lorne H. Woollatt," and "Indexes Compiled by New York State Education Department."

[11]See Wasserman, pp. 110-127 for a complete discussion.

[12]Variations in the prices of other school inputs are probably a less significant source of educational cost variation due to the fact that they compose only a relatively small fraction of the educational budget. Nevertheless, in order to capture educational cost variations across districts, one must account

for differences in the prices of such components of the budget as instructional materials, construction costs, land prices, and interest charges.

[13]For a complete specification of the model and a detailed discussion of these constraints of tenure on the choice of personnel quality see Chambers (1975).

[14]See Chambers (1975).

[15]The word optimal in this context refers again to this concept of perceived quality. Therefore, teacher experience in these districts is above its perceived optimal (or desired) level.

[16]The methodology essentially involves the estimation of the demand equations for the quality characteristics of newly hired teachers taking into account the fact that the quality characteristics are "limited (i.e., constrained) dependent variables." For a discussion of the estimation procedures see, for example, Nelson (1975).

[17]See Meullbauer (1974) for a theoretical discussion and Parks and Barten (1973) for an empirical application of household composition effects on consumption patterns.

[18]This curve is so named because the prefix iso- means equal or identical. Thus, isoqual refers to equal levels of quality along the curve. Similarly, we can define the term isocost which refers to equal levels of cost along a curve described below in the text.

[19]Note that $Q*$ corresponds to technology vector Z_{Tj} and Q_i^* corresponds to technology vector Z_{Ti} ($\neq Z_{Tj}$).

[20]See Muellbauer (1974) for a detailed discussion.

[21]For a detailed discussion of the factors that compose such a model the reader is referred to Chambers (1975).

[22]Of course, this option of moving is not open to all families on an equal basis. Low income and/or discrimination in housing patterns will tend to reduce and perhaps effectively eliminate this option for some families.

[23]Of course, a certain amount of state intervention would perhaps be
warranted in order to ensure the citizenry that there would be no change in the
nature and flow of external benefits of education to the society at large.

[24]For an exchange between two authors on these issue the reader is referred
to Fox (1975) and Simmons (1975).

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TABLE I

THE DIFFERENTIALS IN EDUCATIONAL EXPENDITURES PER PUPIL, SALARIES OF SCHOOL PERSONNEL,
AND INPUT DEMAND BETWEEN TWO COMMUNITIES WITH AN INCOME DIFFERENTIAL OF $4,000 PER HOUSEHOLD[a]

Elementary School Districts

Dependent Variables (1)	Differentials Due To:		Net Difference (2) + (3) = (4)
	Difference in Community Income (2)	Difference in Grants-in-Aid Per Pupil (3)	
Expend./Pupil	252	-60	192
Starting Tchr. Sal.	230	-45	185
Sal. Incre. for Tchr. Exp.	23	-5	18
Av. Prin. Sal.	865	-168	697
Av. Supt. Sal.	581	-113	468
Av. Class Size	-1.58	0.30	-1.28
Av. Yrs. Tchr. Exp.	0.85	-0.17	0.68
Av. Grad. Credit Hrs. Per Tchr.	4.25	-0.83	3.42

[a] Empirical estimates indicate that for each additional $1,000 of income per household, the average elementary district gives up $18.02 in state and federal grants per pupil. The $4,000 income differential hypothesized above leads to a reduction in grants per pupil of $72.08 (=4 × 18.02) for this sample of elementary districts.
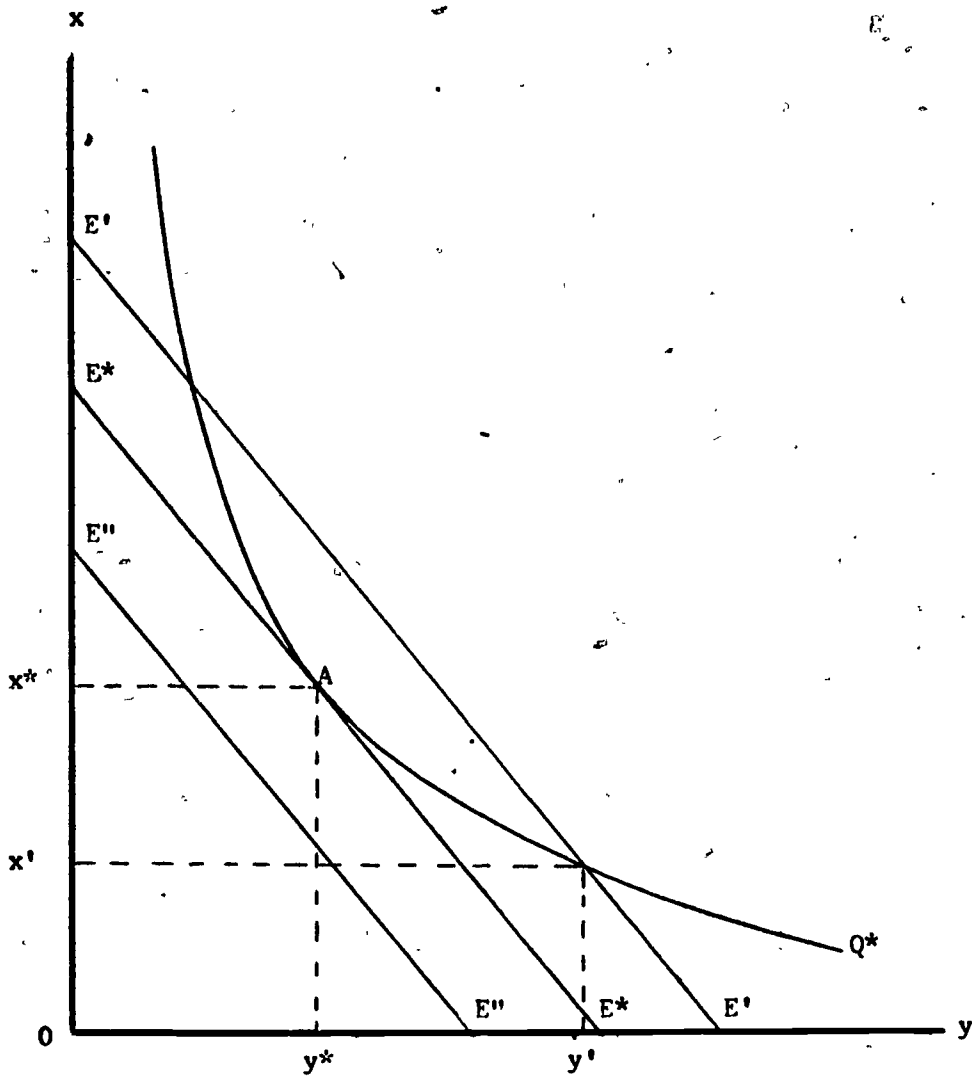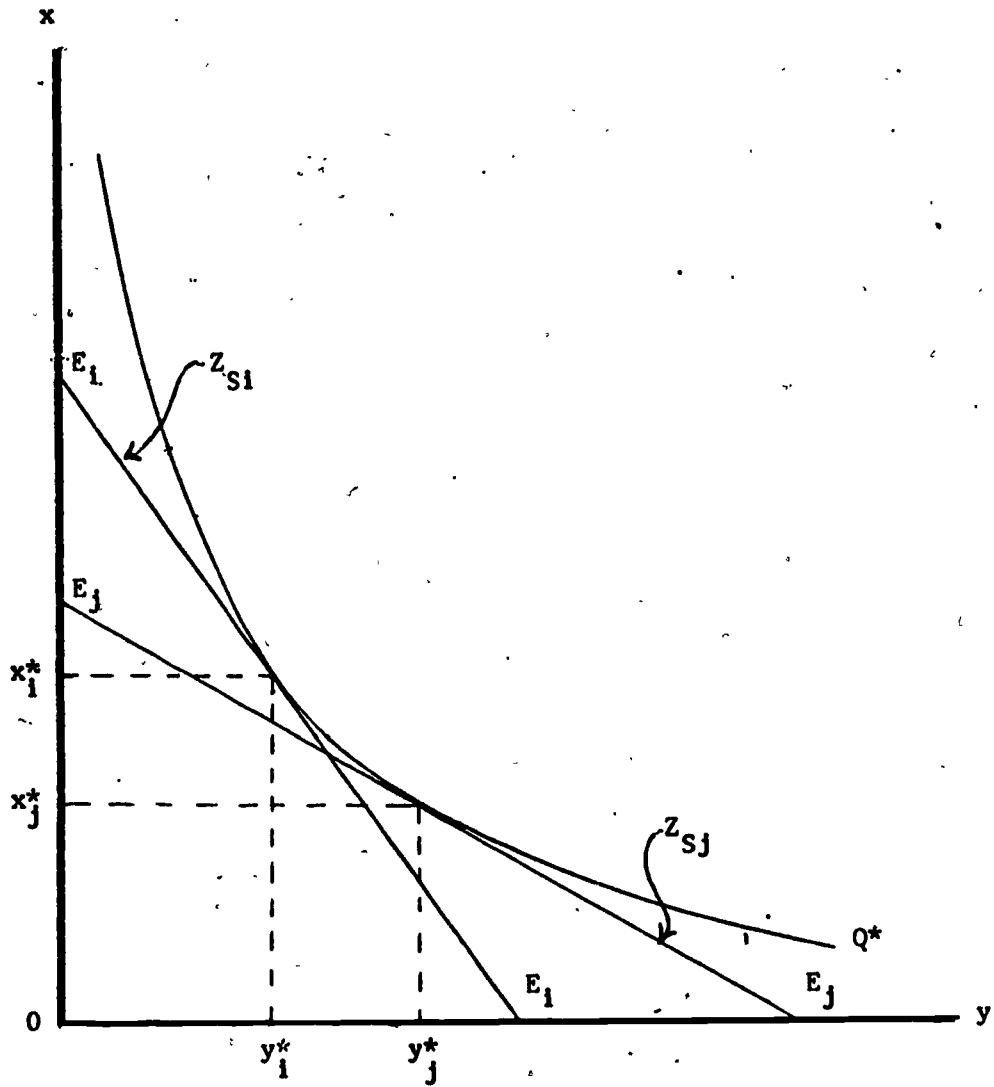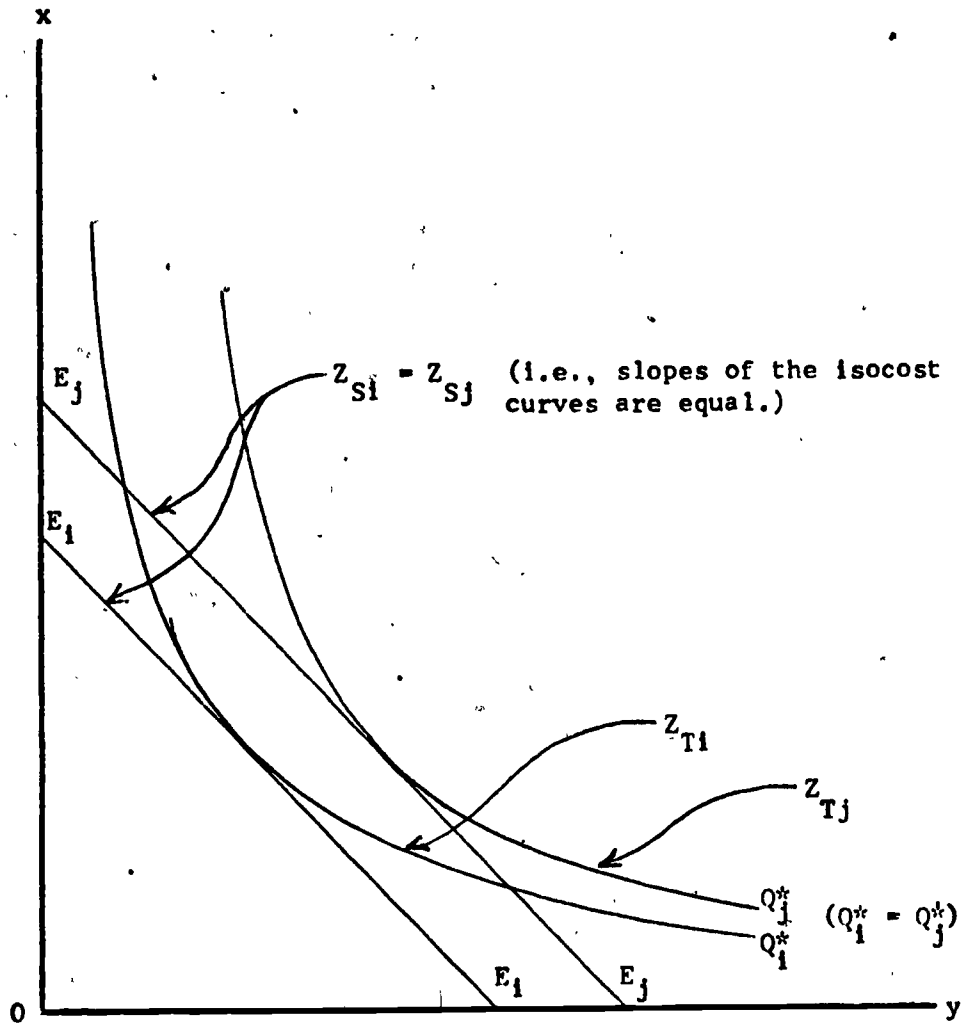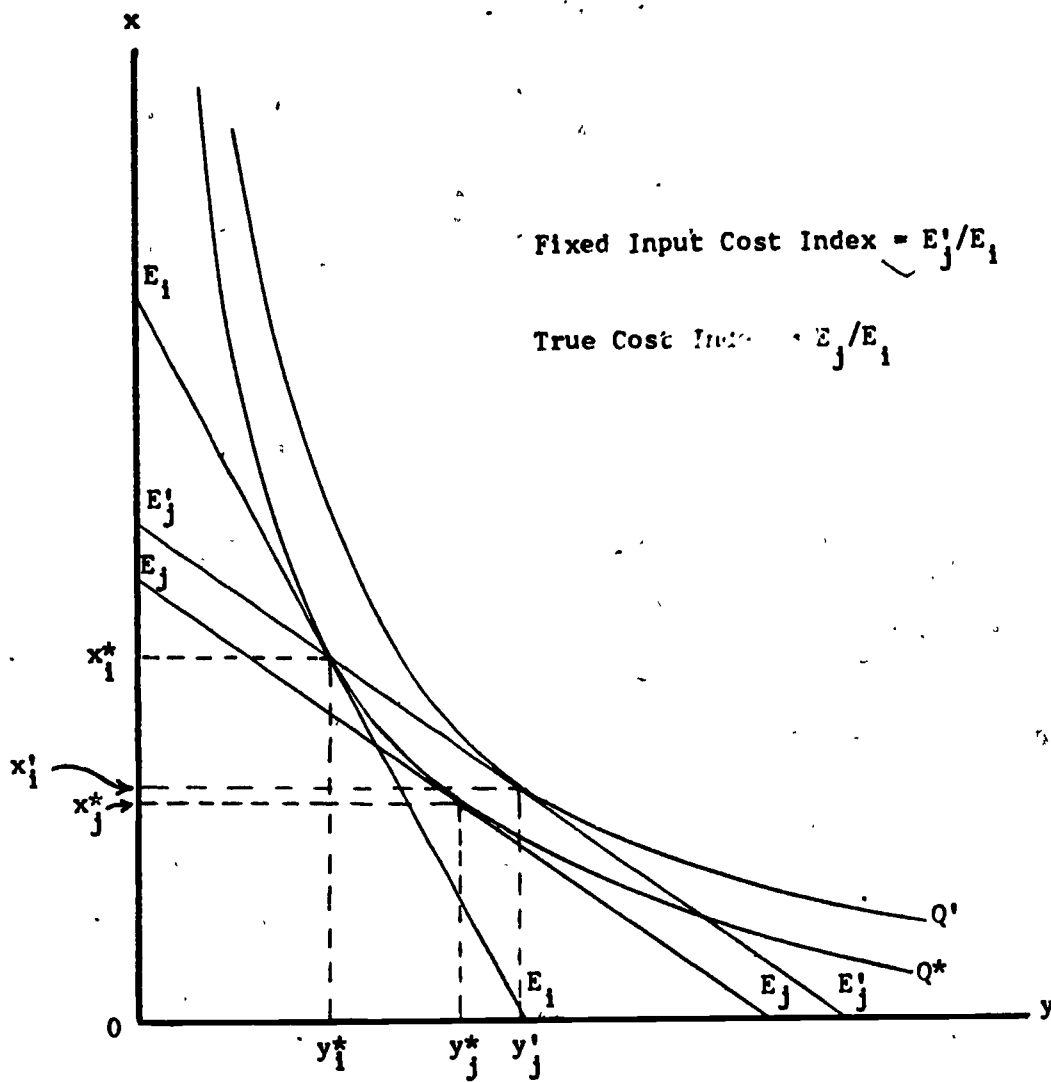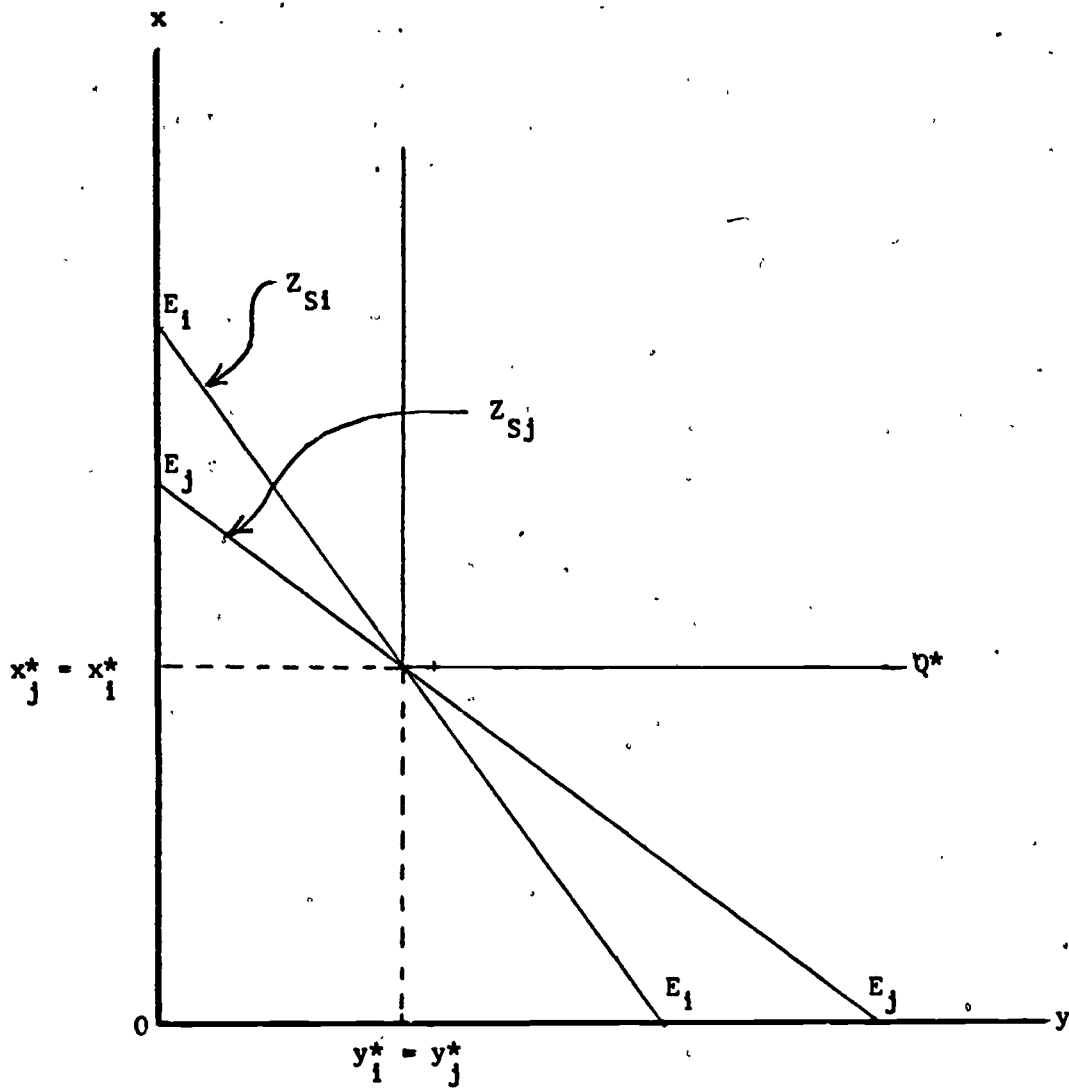
FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4

FIGURE 5