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Comparisons of Total Factor Productivity in the U.S. Electric Industry

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COMPARISONS OF TOTAL FACTOR PRODUCTIVITY IN THE U.S. ELECTRIC INDUSTRY

by

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Since the onset of the recession in the 1970's, consumers have frequently expressed frustration with what appear to be ever-increasing utility bills, blaming what they perceive as unnecessarily high rates on industry

inefficiency. From the industry perspective, inefficiency is not only the problem which has developed since the recession. The more critical issue is the industry's transition from a noncompetitive environment to a competitive one. In the past, the electric utility industry did not have to compete because each utility operated in an exclusive service territory, and each was regulated by the government. However, currently the industry is experiencing increased competition, both indirect and direct.

The indirect competition has taken the form of alternative energy sources such as natural gas and such new technology sources as solar, wind, co-generation power, etc. Electric utility companies have also experienced direct competition among themselves for industrial and commercial customers. The latter has resulted because the price of electricity significantly influences management decisions about where to locate their plants.

Thus, efficient operation of electric generation is an extremely important task both for customers and industry. Productivity measures, then, are vital to the industry's economic well-being.

This study used three different models to measure and compare the total factor productivity of 95 electric utility companies from 1974 to 1984: the translog econometric model, the superlative index model, and the Craig and Harris model.

First, the translog econometric model was applied to investigate characteristics of the production structure for the electric utility industry. Next, the total factor productivity was calculated using each of the three models. Finally, the superlative index model was applied for bilateral and multilateral comparisons to the following categories: industry as a whole, six regions, five types of generation, and four different output levels.

The study's findings are as follows:

- The U.S. electric utility industry operates under constant returns to scale.
- The Craig and Harris model tends to underestimate productivity compared to the econometric model and the superlative index model.
- After the oil shock in 1973-74, the electric industry experienced some improvement in the total factor productivity until 1976. However, there are no observed productivity improvements during the more recent years.
- Among the different regions, productivity increased for companies in the Great Lakes, northeastern, north central, and southeastern regions between 1974 and 1984. Companies in the south central and western regions indicated decreasing productivity for the same period.

- In terms of types of generation, productivity improvements were made over time from 1974 to 1984 for all the types of generation except for the one by gas, which showed a drastic decline.
- Decreasing productivity was not observed for the study period from 1974 to 1984 with respect to companies of different output levels.
- Until 1983, companies in the south central region outperformed those in other regions; however, the total factor productivity of the southeastern region surpassed that of the south central region in 1984.
- From 1974 to 1978, a significant improvement was noted in the total factor productivity for those companies classified as mixed generation with nuclear power, but the TFP declined drastically after the 1979 nuclear accident.
- Companies with the largest electricity generation in recent years were not necessarily the most productive. The medium sized companies showed the best productivity performance, and companies with relatively lower output generation tended to be least productive.

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CHAPTER I

INTRODUCTION

Since the onset of the recession in the 1970's, consumers have frequently expressed frustration with what appear to be ever-increasing utility bills, blaming what they perceive as unnecessarily high rates on industry inefficiency. Some observers have questioned whether the utility industry has adequate incentive to operate at maximum efficiency and to provide reasonable rates for its consumers.

From the industry perspective, inefficiency is not the heart of the problem which has developed since the recession. The real issue is the transition from a non-competitive environment to a competitive one. In the past, the electric utility industry did not have to compete because each utility operated in an exclusive service territory and each was regulated by the government. However, currently the industry is experiencing the effects of enormous indirect and direct competition.

The indirect competition has taken the form of alternative energy sources such as natural gas and such new technology sources as solar, wind, co-generation power, etc.

Electric utility companies have also experienced direct competition among themselves for industrial and commercial customers. The latter has resulted because the price of electricity significantly influences management decisions about where new industry should be located.

Thus, both for customers and for the industry itself, efficient operation of electric generation is an extremely important task. Productivity measures, then, are vital to the industry's economic well-being.

Traditionally, electric utility performance measures have included capacity utilization, growth rate, heat rate, production expense per KWH, and KWH sales per employee. But these are all microcosmic measurements, determined only by an analysis of the various operational subsystems. Very recently, the National Association of Regulatory Utility Commissioners (1984 and 1986) and such researchers as Cowing, Small, and Stevenson (1981) have suggested that so called total factor productivity (TFP), which takes a macrocosmic view would be a more appropriate concept of measuring productivity. TFP is designed to measure the productivity of an economic entity as a whole, rather than to simply measure the productivity of individual factors, as traditional performance measures do.

The literature contains three models which can be used to measure total factor productivity: the translog econometric model, the superlative index model, and the Craig and Harris model.

The translog econometric model, proposed by Christensen, Jorgenson, and Lau (1971), employs econometric estimation to compute TFP growth. In the superlative index model (Diewert 1976), the TFP index is derived directly from the observed data rather than from econometric estimation, but is still consistent with the economic theory of production. By contrast, the Craig and Harris model (Craig and Harris 1973) uses a ratio between total output and total input to indicate the magnitude of total factor productivity.

The empirical application of this study is twofold: (1) to compare and contrast the three models previously defined, and (2) to utilize the superlative index model for productivity analysis of 95 privately-owned U.S. electric utility companies from 1974 to 1984. Theoretical foundations and empirical implications of the three models for measuring total factor productivity are given in Chapter II.

Before the productivity comparisons are made, the production structure of the U.S. electric industry must be analyzed; the translog econometric model is used to make such an analysis. The results are reported in the first section of Chapter IV.

Using the three models, measures of productivity for these U.S. utility companies are calculated and compared in the second section of Chapter IV. The superlative index model is shown to be the most preferable of the three models for measuring productivity performance. This study demonstrates the use of superlative index numbers as a powerful tool for productivity comparisons. The underlying reasons for the productivity differences of the industry are investigated in the third section of Chapter IV.

Specifically, the study postulates the following hypotheses:

A. Productivity differences exist among regions.

B. Productivity differences exist by means of electric generation, e.g., gas, non-nuclear, and nuclear, etc.

C. Productivity differences exist by level of electric generation.

Data used in this study are discussed in Chapter III. The appendices present the corresponding data sets which are applied for various empirical productivity comparisons.

CHAPTER II

THREE MODELS OF MEASURING TOTAL FACTOR PRODUCTIVITY

Total factor productivity (TFP) is generally defined as the measurement of efficiency in the production process where all inputs are transformed into one or more outputs. Technological change can be defined as the change in output due to improvements in production process efficiencies. TFP growth can be defined as technological change in an entity over time, and TFP difference can be defined as the technological change between two entities at a given time. The former allows time series comparisons, and the latter permits cross sectional comparisons.

A production function with technological change can be expressed as

$$Y = f(X_1, \ldots, X_n, t), \tag{1}$$

where Y is total output and X_i is input of the ith factor. The term, t, is a time indicator denoting technological change.

With technological advancement due to increased knowledge, new innovations and/or techniques, the production process can generate a higher level of output than previously attainable with given inputs. Similarly, it can produce the same level of output with less quantity of inputs than what is previously required.

It is important to distinguish between a movement along the production function and a shift of the production function. In general, technological change is defined as an inward shift in input space of the production-isoquant frontier (Stevenson 1980). Movement along the production function, on the other hand, associates changes in output with changes in input quantity.

The duality theory elaborated by Diewert (1974), suggests that there are two approaches for measurement of total factor productivity growth: the primal approach and the dual approach. The primal approach employs a production function and measures the productivity which can be defined as the change in output that is not associated with changes in input quantity. Using a logarithm of each variable except t for the production function (1), the following formula can be obtained:

$$\ln Y = f(\ln X_1, .., \ln X_n, t). \qquad (2)$$

Mathematically the concept of technological change in terms of the primal rate of total factor productivity is defined by the partial derivative of the equation (2), $\delta lnY/\delta t$ (Dogramaci 1983).

On the other hand, the dual approach of measuring total factor productivity employs the dual of production function (1) and measures <u>cost diminution</u> as technological change that is not associated with changes in the prices of inputs.

The dual cost function with technological change is

$$C = g(P_1, \ldots, P_n, Y, t), \tag{3}$$

where C is total cost, and Y is total output. P_i is the ith factor price, and t is a time indicator denoting technological change. Using a logarithm of each variable in the cost function (3) except t yields

$$lnC = g(lnP_1, \ldots, lnP_n, lnY, t). \tag{4}$$

Given factor prices, technological progress allows a firm to produce the same level of output at a lower cost. Therefore, the dual rate of total factor productivity can be measured as the negative rate of cost diminution with a given output level and factor prices: $-\delta lnC/\delta t$ (Gollop and Roberts 1981).

Under the assumptions of profit maximization or cost minimization, the production function and dual cost function approaches are equivalent in terms of specifying the underlying production technology (Cowing and Stevenson 1981). Determination of which function to use, however, depends on whether the level of output is endogenous or exogenous. The direct estimation of the production function is appropriate when the level of output is endogenous, and estimation of the cost function is appropriate when the level of output is exogenous.

Three models will be used to measure total factor productivity, namely the translog econometric model, the superlative index model, and the Craig and Harris model.

The translog econometric model proposed by Christensen, Jorgenson, and Lau (1971) employs econometric analysis for the translog production function where technological change can be calculated from the function's parameters. The major advantage of this approach is that the interpretation of econometric estimation provides useful information not only about technological change but also about other production structure characteristics such as elasticities and scale effect. One disadvantage might be the possibility of multicollinearity among independent variables, which would lead to inefficient estimation of the parameters. Furthermore, this model becomes unworkable in the event of very large numbers of inputs and outputs.

Alternatively, information of total factor productivity index can be derived directly from observed data by using the superlative index model. This non-parametric approach applies index number theory to productivity analyses using input and output aggregation indexes. Diewert (1976) showed that a superlative index, called the Tornqvist index, can be used for measuring the TFP difference.[1] A major advantage of this model is the simplicity of index calculation based on the solid foundation of production theory. It has a further advantage over the econometric model in that it can be implemented even if the number of inputs and outputs becomes very large.

Finally, the Craig and Harris model (1973) also directly employs the observed data to derive a measure of total factor productivity as a ratio between total output and total input where total input is defined as the arithmetic sum of all individual inputs. This output-input ratio provides a TFP index to indicate the efficiency of the production process. Although this index is easy to calculate, there is no economic theoretical foundation. In particular, this model is required to assume very restrictive conditions such as perfect substitution among all factor inputs implied by the simple construction of the total inputs discussed above.

[1]As demonstrated in Diewert (1976), the Tornqvist index is derived from a "flexible" aggregator function. Here an aggregator functional form is considered "flexible" if it can provide a second order approximation to an arbitrary twice differentiable linear homogeneous production function. An index number is "superlative" if it is consistent with a "flexible" aggregator functional form under the assumption of perfect competition with cost minimization or revenue maximization behavior.

The following sections describe each of the three models in terms of their theoretical foundations and empirical applications.

THE TRANSLOG ECONOMETRIC MODEL

As discussed previously, there are two approaches to specifying a production structure: a primal production function approach and a dual cost function approach. For the study of electric companies, the cost function approach is appropriate because electric utility companies do not usually choose the level of production to maximize profits. Rather, they supply electric power which is demanded at regulated prices, keeping the output level and input prices exogenous. For similar reasons, Christensen and Greene (1976) recommend the cost function approach for utility company analyses. Their study used the translog function to specify the cost structure of the utility companies. The translog cost function which is a second order of approximation of the true cost function, has the advantage of being linear in the parameters, but imposes no *a priori* restrictions on the scale factors and the elasticities of substitution.

The following presents the basic theory of a translog cost function, followed by a brief discussion of its empirical estimation. Model interpretation through parameter estimates is shown for (1) analyzing production structure, (2) measuring factor substitution and price effect, (3) measuring scale effect, and (4) measuring technological change. Finally, a literature review covering the empirical applications of translog econometric models is discussed.

<u>The Model</u>

For a firm which produces one output using n factors, the translog cost function with technological change can be written as:

$$\begin{aligned} \ln(C) = {} & \beta_0 + \sum_i \beta_i \ln(P_i) + \beta_y \ln(Y) + \tfrac{1}{2}\beta_{yy}(\ln(Y))^2 \\ & + \tfrac{1}{2}\sum_i\sum_j \beta_{ij}\ln(P_i)\ln(P_j) + \sum_i \beta_{yi}\ln(Y)\ln(P_i) \\ & + \beta_t(t) + \tfrac{1}{2}\beta_{tt}t^2 + \beta_{ty}t\ln(Y) \\ & + \sum_i \beta_{ti} t\ln(P_i), \end{aligned} \qquad (5)$$

where $C = \sum_i P_i X_i$. P_i denotes the price of ith factor, and X_i denotes the corresponding quantity. Y is the quantity of output, and t is the time indicator of technological change.

In order to model a well-behaved cost structure (i.e., one consistent with cost minimization behavior), two assumptions are maintained. The first assumption is the symmetric condition,

$$\beta_{ij} = \beta_{ji}, \qquad \text{for all i and j.} \qquad (6)$$

The second assumption is that a cost function must be homogeneous of degree one in all prices, that is cost must increase proportionally when all prices increase proportionally at a given output level and technology. This implies the following coefficient restrictions (Berndt and Wood 1975):

$$\sum_i \beta_i = 1,$$
$$\sum_j \beta_{ij} = 0, \qquad (7)$$
$$\sum_i \beta_{yi} = 0,$$
$$\sum_i \beta_{ti} = 0.$$

From Shephard's lemma (Shephard 1953), the derived factor demand functions can be computed by partially differentiating the cost function with respect to the factor prices; that is, $X_i = \delta C/\delta P_i$, or in terms of the factor shares:

$$S_i = P_iX_i/\sum_i P_iX_i = \delta \ln C/\delta \ln P_i$$
$$= \beta_i + \sum_j \beta_{ij}\ln(P_j) + \beta_{yi}\ln(Y) + \beta_{ti}t. \qquad (8)$$

Estimation

It is possible to estimate the parameters of the cost function (5) with restrictions (6) and (7) using ordinary least squares (OLS). However, since the cost function has a large number of parameters to be estimated, multicollinearity that results in inefficient parameter estimates may be a problem.

Christensen and Greene (1976) recommend that the restricted cost function (5) (with (6) and (7)) and the cost share equations (8) be jointly estimated using a technique of seemingly unrelated regression. By including the cost share equations in the estimation procedure, this technique has the effect of increasing additional degrees of freedom without adding any restricted regression coefficients. Therefore, this approach will result in more efficient estimation of parameters than if OLS were simply applied to the cost function.

Applications

Much information about the characteristics of the production structure and technological change can be analyzed from parameter estimates of the cost and factor share system, (5)-(8).

Analyzing Production Structure. The structure of production can be analyzed by a direct imposition of restrictions on the coefficients of the cost function. First, for a homothetic production function requires that:

$$\beta_{yi} = 0, \text{ for each factor } i. \qquad (9)$$

A homothetic production structure can be further restricted to be homogeneous if

$$\beta_{yy} = 0, \text{ and } \beta_{ty} = 0. \qquad (10)$$

In particular, a constant returns to scale production structure is essentially a homogeneous production function of degree one. That is,

$$\beta_y = 1. \qquad (11)$$

These restrictions can be statistically tested by using the likelihood ratio (chi-square) test between restricted and unrestricted likelihood values. If these restrictions are accepted, the production model can be simplified with fewer coefficients.

Measuring Factor Substitution and Price Effect. From the cost function, Allen partial elasticities of substitution (see Allen 1938 and Uzawa 1962) can be computed between factor i and j using the formula:

$$\sigma_{ij} = CC_{ij} \;/\; C_iC_j, \qquad (12)$$

where C_i and C_{ij} are the first and second partial derivatives of the cost function with respect to factor prices, i.e. $C_i = \delta C/\delta P_i$ and $C_{ij} = \delta^2 C/\delta P_i \delta P_j$.

For the translog cost function (5), cross- and own-price elasticities of substitution are expressed as:

$$\sigma_{ij} = (\beta_{ij} + S_iS_j) \;/\; S_iS_j, \text{ and} \qquad (13)$$

$$\sigma_{ii} = (\beta_{ij} + S_i(S_i-1))/S_i^2. \qquad (14)$$

The price elasticity of factor i with respect to the price of factor j is:

$$\varepsilon_{ij} = \sigma_{ij} * S_j. \qquad (15)$$

The own-price elasticity of factor i is:

$$\varepsilon_i = \sigma_{ii} * S_i. \qquad (16)$$

Measuring Scale Effect. Scale effect (Sc), which is defined as the relationship between input and output change (Christensen and Greene, 1976), is usually measured as follows:

$$Sc = \delta lnC/\delta lnY. \qquad (17)$$

If Sc < 1, then economies of scale exist; If Sc = 1, then constant returns to scale exist; otherwise (Sc > 1), diseconomies of scale exist.

For the translog cost function (5), the scale effect (Sc) is derived as:

$$Sc = \beta_y + \beta_{ty}t + \beta_{yy}ln(Y) + \sum_i \beta_{iy}ln(P_i). \qquad (18)$$

The measure of technological scale bias (TSc) can be obtained by differentiating Sc with respect to t (Stevenson 1980):

$$TSc = \delta Sc / \delta t. \quad (19)$$

If TSc < 0, then minimum efficient firm size (MES) is increased; If TSc = 0, then there is no change in MES; otherwise,(TSc > 0), which indicates that MES can be obtained at a lower level of output.

Measuring Technological Change. As discussed earlier, technological change can be defined as pure productivity growth resulting from the learning and adaption of new technologies. This change is the result of a shift of the production or the cost function, rather than a movement along the production function. For the translog cost function (5), technological change can be calculated as a negative rate of cost diminution (RCD). Mathematically,

$$\begin{aligned} RCD &= -\delta \ln(C)/\delta t \\ &= -(\beta_t + \beta_{tt}t + \beta_{ty}\ln(Y) + \sum_i \beta_{ti}\ln(P_i)). \end{aligned} \quad (20)$$

If there is a constant rate of technological change, or Hicks neutral technology, then the following parameter restrictions must be satisfied:

$$\begin{aligned} \beta_{tt} &= 0, \\ \beta_{ty} &= 0, \\ \beta_{ti} &= 0. \end{aligned} \quad (21)$$

If the technology is not Hicks neutral, then it is interesting to measure the contribution of each factor as a result of advance in technology.

In addition to the scale bias mentioned above, <u>factor bias</u> of technological change is defined as:

$$\delta S_i/\delta t = \delta(\delta \ln(C)/\delta t)/\delta \ln(P_i) = \beta_{ti}. \tag{22}$$

Technological change is <u>ith factor saving</u> if $\beta_{ti} < 0$; and <u>ith factor using</u> if $\beta_{ti} > 0$. If $\beta_{ij} = 0$, the technological change is said to be <u>neutral</u> in the use of ith factor.

The formula of RCD or (20) can be further differentiated by lnY and t, respectively:

$$\delta RCD/\delta \ln Y = -\beta_{ty} \tag{23}$$

$$\delta RCD/\delta t = -\beta_{tt}. \tag{24}$$

In other words, the parameter B_{ty} simply indicates the scale bias of technological change as mentioned above, while β_{tt} refers to the dynamic change of technology over time.

As defined earlier, total factor productivity indicates the efficiency of the production process in which all inputs are transformed into one or more outputs. Dogramaci (1983), among others, showed that the total factor productivity growth, ΔTFP, can be measured as a partial derivative of the production function with respect to t, or the rate of cost diminution divided by the scale effect from the translog cost function (see also Ohta 1974). Mathematically,

$$\Delta TFP = \delta \ln Y/\delta t = (-\delta \ln C/\delta t)/(\delta \ln C/\delta \ln Y)$$
$$= RCD/Sc \qquad (25)$$

If the production structure is constant returns to scale, then clearly:

$$\Delta TFP = RCD. \qquad (26)$$

Literature Review

Norsworthy and Malmquist (1983) measured total factor productivity and labor productivity growth in the Japanese and U.S. manufacturing sectors for the years 1965-73 and 1973-78. They used the gross output framework to analyze productivity growth in the two countries and to assess labor productivity in Japan. They concluded that Japan's remarkable labor productivity growth record was attributable in large part to capital stock growth. By comparing the patterns of input growth in Japan and the U.S., they suggested that the productivity "miracle" in Japan is not so miraculous after all because it is largely explained by a higher rate of growth of capital and materials per worker.

For a more micro study of productivity, Gollop and Roberts (1981) applied the translog cost function to investigate the productivity growth of eleven electric companies between 1958 and 1975. They found that the average annual rate of total productivity decreased from 6.5% in the 1958-1966 period to -4.2% in the 1973-1975 period for these companies. In addition, they found that the underlying technology exhibited substantial increasing returns to scale in the selected sample.

The translog econometric model has been applied in various studies which investigated not only productivity but also production structures. Christensen and Greene (1976) estimated the existence of economies of scale for the U.S. electric power firms based on cross-section data for 1955 and 1970. They found that there were significant economies of scale for almost all firms in 1955; however, most of these firms were operating under the constant returns to scale condition in 1970.

There have been other applications Friedlaender, Spady, and Chiang (1981), for example, analyzed the structure of technology in the trucking industry. Nadiri and Schakerman (1981) investigated production structure and technological change in the Bell system. Greene (1983) updated his previous study (Christensen and Greene 1976) regarding the production structure of the U.S. electric companies by adding data up to 1975.

THE SUPERLATIVE INDEX MODEL

If one is only interested in measuring productivity of a firm or industry, one can compute productivity indexes directly from the observed data without using econometric estimation. The Tornqvist index can be derived from either the translog production function or its dual translog cost function. These two approaches for calculating the Tornqvist index are essentially equivalent based on the duality theory discussed in the previous section. The Tornqvist index is a superlative index that is consistent with a flexible aggregator functional form providing a second order approximation to an arbitrary twice differentiable production or cost function.

In this section, the basic theory of the superlative index is discussed in terms of (1) bilateral comparisons and (2) multilateral comparisons. Empirical applications of index numbers are presented in the literature section.

The Model

Total differentiation of the production function (2) by t obtains

$$d\ln Y/dt = \sum_i (\delta \ln Y/\delta \ln X_i)(\delta \ln X_i/\delta t) + \delta f/\delta t. \qquad (27)$$

where Y is output and X_i is the ith factor input. $\delta \ln Y/\delta \ln X_i$ is the elasticity of output with respect to the ith factor input. The term, $\delta f/\delta t$, is the shift of the production function; that is, the TFP growth or change. Under the condition of perfect competition for a profit maximizing or cost minimizing firm, the term $\delta \ln Y/\delta \ln X_i$ equals factor share, S_i (Diamond, McFadden, Rodriguez 1978). Then, we can rewrite the equation (27) as:

$$d\ln Y/dt = \sum_i S_i(\delta \ln X_i/\delta t) + \delta f/\delta t. \tag{28}$$

Therefore, the rate of output growth $d\ln Y/dt$ is decomposed into (a) combined growth of factor inputs $\sum_i S_i(\delta \ln X_i/\delta t)$ and (b) technological change $\delta f/\delta t$. The latter can be expressed as the residual between the change in output index and the share weighted sum of changes in aggregate input indexes, denoted Δ TFP.

$$\Delta TFP = \delta f/\delta t = d\ln Y/dt - \sum_i S_i(\delta \ln X_i/\delta t). \tag{29}$$

For the empirical study which uses discrete data, the above continuous measurement of TFP growth (29) can be approximated by use of the output and input indexes of each two data points (Caves, Christensen, and Tretheway 1981).

For a single output firm using multiple inputs, the index of logarithmic difference[2] in output between entities k and l, $\ln Q^{kl}$ is defined as:

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[2]If comparison is made across time, k and l are replaced by t and t+1.

$$\ln Q^{kl} = \ln Y^k - \ln Y^l. \quad (30)$$

Similarly, the index of logarithmic difference in total input between k and l, $\ln q^{kl}$, is simply the sum of the average-share weighted logarithmic input difference:

$$\ln q^{kl} = \tfrac{1}{2}\sum_i (S_i^k + S_i^l)(\ln X_i^k - \ln X_i^l). \quad (31)$$

Then the total factor productivity differences between k and l is:

$$\begin{aligned} \Delta TFP^{kl} &= \ln Q^{kl} - \ln q^{kl} \\ &= \tfrac{1}{2}\sum_i (S_i^k+S_i^l)((\ln Y^k-\ln Y^l)-(\ln X_i^k-\ln X_i^l)) \\ &= \tfrac{1}{2}\sum_i (S_i^k+S_i^l)(\ln Y^k/X_i^k - \ln Y^l/X_i^l). \quad (32) \end{aligned}$$

For individual components of ΔTFP, the ith factor productivity difference between k and l is:

$$\Delta FP_i^{kl} = \tfrac{1}{2}(S_i^k+S_i^l)(\ln Y^k/X_i^k - \ln Y^l/X_i^l). \quad (33)$$

The above indexes, called <u>bilateral translog indexes</u>, serve for pairwise comparisons of the output, input, and productivity difference.

This method of index comparison is attractive due to the simplicity of its calculation, yet it still provides a sophisticated measurement based on production theory. As indicated in Caves, Christensen, and Diewert (1982b), the superlative index can be computed by using only price and quantity data for the production technology with constant and decreasing returns to scale. However, knowledge of the degree of returns to scale is necessary for computing these indexes in the case of production technology with increasing returns to scale.

The use of bilateral index comparison requires information about entities k and l only. Introduction of the third entity, m, will result in three bilateral comparisons. However, such bilateral comparisons do not necessarily maintain a transitive relationship. In particular,

$$\Delta TFP^{kl} \neq \Delta TFP^{km} - \Delta TFP^{lm}, \text{ for k, l, and m.} \qquad (34)$$

In order to maintain the transitivity property for the index, it is necessary to modify the construction of the bilateral index. First, the output index of the entity k relative to the output of all entities, $\ln Q^k$, can be defined as the geometric mean of the bilateral output index between k and each of the entities (Caves, Christensen, and Diewert 1982a). That is:

$$\begin{aligned} \overline{\ln Q^k} &= 1/N \sum_n \ln Q^{kn} \\ &= 1/N \sum_n (\ln Y^k - \ln Y^n) \\ &= \ln Y^k - \overline{\ln Y}, \end{aligned} \qquad (35)$$

where N is total number of entities under comparison and $\overline{\ln Y}$ is the geometric mean of the output:

$$\overline{\ln Y} = 1/N \sum_{n} \ln Y^{n}. \tag{36}$$

Similarly the total input index of the entity k relative to the total input of all entities is:

$$\begin{aligned}\overline{\ln q^{k}} &= 1/N \sum_{n} \ln q^{kn} \\ &= 1/2N \sum_{n}\sum_{i} (S_{i}^{k} + S_{i}^{n})(\ln X_{i}^{k} - \ln X_{i}^{n}) \\ &= 1/2 \sum_{i} (S_{i}^{k} + \overline{S_{i}})(\ln X_{i}^{k} - \overline{\ln X_{i}})\end{aligned} \tag{37}$$

where $\overline{S_{i}}$ and $\overline{\ln X_{i}}$ are respectively, the arithmetic mean of the ith factor share and the geometric mean of the ith factor quantity:

$$\overline{S_{i}} = 1/N \sum_{n} S_{i}. \tag{38}$$

$$\overline{\ln X_{i}} = 1/N \sum_{n} \ln X^{n}. \tag{39}$$

Information about all entities is included in the construction of $\overline{\ln Q^{k}}$ and $\overline{\ln q^{k}}$ for each economic entitity k. Thus they are referred as <u>the multilateral output index</u> and <u>the multilateral input index</u>, respectively.

In order to compare the output difference between entities k and l, the difference must be computed between the multilateral output indexes of k and l, denoted $\ln Q_*^{kl}$, or

$$\ln Q_*^{kl} = \overline{\ln Q^k} - \overline{\ln Q^l}. \tag{40}$$

Similarly, the multilateral index of input difference, $\ln q_*^{kl}$, is approximated as:

$$\ln q_*^{kl} = \overline{\ln q^k} - \overline{\ln q^l} \tag{41}$$

Finally, the multilateral index of the productivity difference is defined by the difference between the change in output and input as:

$$\begin{aligned}\Delta TFP_*^{kl} &= \ln Q_*^{kl} - \ln q_*^{kl} \\ &= (\overline{\ln Q^k} - \overline{\ln Q^l}) - (\overline{\ln q^k} - \overline{\ln q^l}) \\ &= \tfrac{1}{2}\sum_i (S_i^k+\overline{S_i})(\ln Y^k/X_i^k-(\overline{\ln Y}-\overline{\ln X_i})) \\ &\quad -\tfrac{1}{2}\sum_i (S_i^l+\overline{S_i})(\ln Y^l/X_i^l-(\overline{\ln Y}-\overline{\ln X_i})).\end{aligned} \tag{42}$$

Particularly, the ith factor component of the multilateral index of productivity difference between k and l is:

$$\begin{aligned}\Delta FP_{i*}^{kl} &= \tfrac{1}{2}(S_i^k+\overline{S_i})(\ln Y^k/X_i^k-(\overline{\ln Y}-\overline{\ln X_i})) \\ &\quad -\tfrac{1}{2}(S_i^l+\overline{S_i})(\ln Y^l/X_i^l-(\overline{\ln Y}-\overline{\ln X_i})).\end{aligned} \tag{43}$$

The most important property for the construction of the multilateral index of productivity difference is the transitivity. It is clear now that:

$$\Delta TFP_*^{kl} = \Delta TFP_*^{km} - \Delta TFP_*^{ml}, \quad \text{for any } k,\ l, \text{ and } m. \qquad (44)$$

As discussed above, the bilateral index is a useful technique for measurement of the productivity change between two entities. In particular, it is useful for chain comparisons of productivity over time. However this index does not have a transitivity property. For example, a direct comparison of firm m and firm l might indicate that firm m is less productive than firm l, even though the third firm k is more productive than firm l and less productive than firm m. This lack of transitivity is possible because large difference in weights (factor share S_i) may be applied to two specific entities for comparison.

The multilateral index provides a solution to this intransitivity problem in the bilateral index by allocating weights that are not specific to the entities being compared. However, the construction of the multilateral index loses some <u>characteristicity</u> because this index is not based on the specific economic condition between the two entities under comparison. Drechsher (1973) observed that there is no perfect solution for maintaining both transitivity and characteristicity at the same time. Caves, Christensen, and Diewert (1982a), however, noted that the superlative index constructed according to (42) can maintain the transitivity and a high degree of characteristicity for making multilateral comparisons.

Literature Review

This section presents some of the recent applications of the index approach to productivity comparison at the international, interregional, and interindustrial levels.

Jorgenson and Nishimizu (1978) used the superlative bilateral index model to compare changes in the U.S. and Japanese manufacturing industry's productivity levels for the period 1954-74. In 1952 the Japanese technology level was only one-fourth of the U.S. level; this gap was reduced to less than half during the period 1952-59. The relative level of Japanese technological advancement increased rapidly to reach approximately 90% of the U.S. level by 1968. The gap in the technology level between the two countries was eliminated between 1968 and 1973.

With regard to the individual factor productivities, Jorgenson and Nishimizu (1978) argued that the average growth rate in labor input in the two countries is roughly similar for the period 1960-74. However, the average annual growth rate of capital in Japan was nearly threefold that of the U.S., and Japanese productivity grew at a rate of four times that of the U.S. during this period. They concluded that the narrowing gap between U.S. and Japanese output levels during this period was due to an increase in the relative capital intensity of production in Japan and to Japan's rapid increase in the technology level. In particular, the acceleration of growth in Japan was largely due to a growth of capital input relative to labor input. Therefore, differences in production efficiency between Japanese and the U.S. manufacturing industries were primarily attributed to differences in the level of the capital investment.

Caves, Christensen, and Swanson (1980) applied the superlative index model to analyze the productivity of the U.S. railroads for the period 1951-74. They encountered two difficulties in using this model. First, U.S. railroad output prices do not necessarily reflect marginal costs because the prices are regulated. Second, it is not appropriate to assume constant returns to scale in the railroad industry. Therefore, they applied the model which does not require the assumptions of competitive pricing and constant returns to scale. Specifically, in order to weight the output growth rates, the cost elasticities with respect to outputs were used rather than revenue shares. On the other hand, the railroad industry purchases inputs in the unregulated market; therefore, cost shares provide satisfactory estimates of cost elaticities with respect to factor prices. Mathematically, the negative rate of cost diminution in measuring technological change is:

$$-(\ln C_t - \ln C_{t-1}) = \tfrac{1}{2}\sum_i ((\delta \ln C/\delta \ln Y_i)_t + (\delta \ln C/\delta \ln Y_i)_{t-1})(\ln Y_i^{t} - \ln Y_i^{t-1}) - \tfrac{1}{2}\sum_j (S_j^{t} + S_j^{t-1})(\ln X_j^{t} - \ln X_j^{t-1}), \qquad (45)$$

where C is total cost, Y_i is the ith output, and X_j is the jth factor input.[3] S_j is the ith factor share, t is the time, and $\delta \ln C/\delta \ln Y_i$ is the marginal cost elasticity with respect to output i. In this equation, all variables are observable from the data except for the elasticities of cost with respect to the outputs. These elasticities were econometrically estimated from a cross sectional cost function.

Caves et al found that railroad productivity grew at the average annual rate of 1.5 percent during the period 1951-74. If the conventional measurement procedure was used with the assumption of the marginal cost pricing and constant returns to scale, they found productivity growth to be 3.6 percent per year. The lower estimate of 1.5 percent is the better representation of railroad production because the modified model uses estimated cost elasticities rather

[3]The model considered by Caves, Christensen, and Swanson (1980) consists of multiple outputs and multiple inputs. Outputs are freight and passenger services. Inputs are labor, structures, equipment, fuel, and materials.

than revenue shares as output weights in productivity computation. This observation is very important to avoid overestimation of productivity.

Caves and Christensen (1980) applied the same model which was used in the study of Caves, Christensen, and Swanson (1980) to present a case in which the effects of property rights can be isolated from the effects of regulations in noncompetitive markets. They compared the postwar productivity performances of the Canadian National (CN) and Canadian Pacific (CP) railroads to test the underlying notion that public ownership is inherently less efficient than private ownership.

They measured both the rate of growth of total factor productivity and the relative levels of the TFP for CN and CP during 1956-75. They found that CN achieved larger gains in productivity than CP since 1956. Also, CN had a level of productivity approximately 90% as high as CP in the late 1950s, but the gap had been eliminated by 1970s. They concluded that the effects of competition had been sufficient to overcome any tendency toward inefficiency resulting from public ownership.

Denny, Fuss, and May (1981) investigated the relative efficiency and rates of growth of total factor productivity in the regional Canadian two-digit manufacturing industries for the period 1961-75 by applying the method of bilateral index numbers. Mathematically, the productivity growth over time from t to t+1 is measured by the formula:

$$\mu_{t,t+1} = (\ln C_{t+1} - \ln C_t) - (\ln Q_{t+1} - \ln Q_t) - \tfrac{1}{2}\sum_k (S_{k,t+1} + S_{k,t})(\ln W_{k,t+1} - \ln W_{k,t}), \qquad (46)$$

where C is total cost and Q is total output, W_k is the price, and S_k is the share of factor k. Similarly, the difference in regional efficiency between i and g is measured by:

$$\theta_{ig} = (\ln C_i - \ln C_g) - (\ln Q_i - \ln Q_g) - \tfrac{1}{2}\sum_k (S_{ki} + S_{kg})(\ln W_{ki} - \ln W_{kg}). \qquad (47)$$

Their result showed that efficiency levels of manufacturing in Ontario tended to exceed those in all other regions except British Columbia. The absolute differences are quite small in most cases except for the Atlantic region, which was least affected by the manufacturing productivity slowdown during the 1970s.

The method of bilateral and multilateral superlative index numbers was applied by Lin and Oh (1986) to compare the productivity differences among eight Asian countries: Hong Kong, Taiwan, Korea, the Phillippines, Thailand, Malaysia, Singapore, and Indonesia for the period 1970-81 based on nine outputs (agriculture, mining and quarrying, manufacturing, utilities, constructions, trade, transport, communication, and government and others) and three factor inputs (labor, physical capital, and working capital). Mathematically, the model for the bilateral index is described as:

$$\log Z^{kl} = \tfrac{1}{2}\sum_{j}(U_j^k+U_j^l)(\log Y_j^k/X^k-\log Y_j^l/X^l), \qquad (48)$$

where Y_j is the quantity, U_j is the share of the output j, and X is the total factor input. The multilateral index is given as:

$$\log Z_*^{kl} = \tfrac{1}{2}\sum_{j}(U_j^k+\overline{U_j})(\log Y_j^k/X^k-(\overline{\log Y_j}-\overline{\log X}))$$
$$-\tfrac{1}{2}\sum_{j}(U_j^l+\overline{U_j})(\log Y_j^l/X^l-(\overline{\log Y_j}-\overline{\log X})). \qquad (49)$$

where variables with bars indicate the mean of those variables over the eight countries under study. The bilateral index number is used for chain comparisons of total factor productivity for each country over time, while the multilateral index number is used for a comparison of total factor productivity differences in the nine output sectors, and a comparison of labor and capital productivities.

Lin and Oh found that total productivity for all countries generally increased over time during this period, except during the years of high inflation and recession for

Hong Kong and the Phillipines. Singapore maintained a strong position in the trade and transport sectors in terms of various measurement of productivity. The total factor productivity of Singapore's finance sector grew exponentially during the late 1970s. Lin and Oh predicted that Singapore would surpass the productivity level of the current leader, Hong Kong, if Singapore continued the current trend. Korea and Taiwan had enjoyed productivity increases in the manufacturing, utility, and construction sectors. Indonesia and Malaysia showed their prominence in the mining and quarrying sector. Among these eight countries, labor productivity was increasing at the same time that physical capital productivity was decreasing. This trend implies that the pattern of economic development is toward capital intensive technology.

THE CRAIG AND HARRIS MODEL

Another simple way to measure productivity is to compute the output per unit of input (Craig and Harris 1973). This technique can be applied directly to observed data without statistical estimation of underlying production structure.

The Model

Riggs (1981) suggests that ideally the productivity measurement should be aggregated so that a firm's total productivity is the combined productivity of all factors. The measure should be understandable and reasonably easy to calculate, it should be accurate enough to present a realistic assessment, and it should be insulated from changes in monetary values and external disruptions.

The productivity model developed by Craig and Harris (1973) seems to satisfy these criteria. An index for total factor productivity is obtained by dividing total output (net sales, dividends from securities, interest income, and other income such as rentals) with total input (labor, capital, materials, and other miscellaneous goods and services). Mathematically the total factor productivity (TFP), according to Craig and Harris, is written as:

$$TFP = Y / (X_k+X_l+X_m+X_q), \qquad (50)$$

where Y is total output and k is capial input, l is labor input, m is material input, and q is other miscellaneous inputs. If monetary values such as current dollars are used in this equation, the observed data must be adjusted by appropriate deflators.

Using a logarithm for both sides of equation (50) yields:

$$\ln TFP = \ln(Y) - \ln(X_k+X_l+X_m+X_q). \qquad (51)$$

Time differentiation of (51) gives the following continuous measurement of total factor productivity growth:

$$d\ln TFP/dt = d\ln Y/dt - d\ln(X_k+X_l+X_m+X_q)/dt. \qquad (52)$$

For empirical studies in which only discrete data are available, total factor productivity growth can be approximated as:

$$\Delta TFP = (\ln Y_{t+1}-\ln Y_t) -(\ln(X_k+X_l+X_m+X_q)_{t+1}-\ln(X_k+X_l+X_m+X_q)_t). \qquad (53)$$

Comparing the Craig and Harris model to the superlative index model, the former uses simple additive aggregation over factor inputs to derive the measurement of total factor, while the latter uses a translog aggregation. The Craig and Harris model implicitly assumes perfect substitution among the factors, which is unrealistic.

Literature Review

Recent studies done by the National Association of Regulatory Utility Commissioners (1984 and 1986) applied a variation of the Craig and Harris model to measure the performance of electric utilities. These NARUC studies investigated the total productivity of each of the 117 electric utility companies for the period 1972-84 and then derived the productivity growth for each firm over time. For identifying the total factor productivity, output is the total kilowatt-hours sold, and inputs are labor, fuel, capital, and other miscellaneous factors. The productivity index based on the Craig and Harris model measures productivity in terms of kilowatt-hours generated per dollar value of the inputs. Percentage change in the index is calculated to analyze the improvement in efficiency of electric utilities over time. Note that inter-firm productivity comparisons using time series data like the NARUC studies are not recommended for the Craig and Harris model. This is because a highly efficient firm might indicate a small improvement in its productivity while a highly inefficient firm might indicate a moderate improvement in its productivity. This over-simplified variation of the Craig and Harris model is not suitable for cross sectional comparisons of productivity difference among electric utility companies.

CHAPTER III

HISTORY, DATA IMPLEMENTATION, AND RESEARCH PLAN

This chapter presents a brief history of the electric utility industry, followed by data implementation, and a discussion of the research plan for this study.

A BRIEF HISTORY OF THE INDUSTRY

During the 1950's and 1960's, the electric industry was prosperous. Power generation plants were added with assurance because the electricity demand was continuously growing. Moreover, the electric industry enjoyed economies of scale that resulted in the lowering of electricity prices by the generation of more electricity.

The 1970's proved to be turbulent for the industry. Based on the Christensen and Greene (1976) investigation, economies of scale did not exist anymore. Declining block rates made the situation worse because additional sales of electricity became less profitable. New technology did not seem to help lower the generation cost. Nevertheless, utility companies kept adding more plants during the early 1970's based upon the previous trend of growing demand. This created problems of excess capacity in later years.

Capital spending increased for other reasons as well. The public became more aware of environmental quality and pollution became a cause for concern. This concern pressured utility companies into using a better quality of fuel which was more expensive and into building more expensive plants to reduce pollution. The result is that the industry could no longer reduce the cost of electric generation.

During the study period from 1974 to 1984, several important events considerably affected the industry. In 1973 the oil-producing countries in the Middle East cut off petroleum shipments to the United States, causing oil prices to severely escalate. These increases in oil prices radically affected the electric utility industry because many utilities were relying on oil as a main source of fuel. Rising fuel costs increased the price of electricity, which in turn suppressed the demand for electricity. As a result, electricity generation in 1974 dropped from previous years.

In addition to the problems of rising cost and decreasing sales, the industry also faced the problem of excess spending on capital construction. The building of new plants created a financial burden in ensuing years. One example was the construction of nuclear power plants by the Washington Public Power Supply System (WPPSS) beginning in 1969, at the very end of the utility industry's golden age. Rising energy costs in the 1970's suppressed the demand for electricity and encouraged the use of alternative energy sources. During the 1980's, the northwest region faced a large surplus of electricity rather than the shortages that were previously forecasted. In June 1983, WPPSS discontinued the construction of its nuclear power plants. This default left a 2.25 billion dollar debt incurred by the construction of a series of overbudgeted nuclear power plants that were no longer needed (Munsen 1985).

Another incident was the omission of dividends by Consolidated Edison in April 1974 due to severe financial problems. The utility stock market was shocked, and by September 1974, prices of the average utility stock fell 36 percent and bond rating was also declining (Hyman 1983). These events placed tremendous financial pressures on the industry.

On March 28, 1979 the industry faced the country's first major nuclear disaster due to a malfunction of the cooling system at the Three Mile Island plant. Nuclear power had touted as a major alternative power generation source in the wake of problems described above. Less expensive nuclear fuel cost was supposed to compensate for the expensive nuclear plants. However, the Three Mile Island accident totally destroyed the confidence of many planners and managers in the use of nuclear power for the future.

From a financial point of view, investors were reluctant to own securities of nuclear-oriented utilities because accidents such as Three Mile Island could wipe out their investment. General Public Utilities, which owns the Three Mile Island plant, could not pay dividends after the accident. This accident made it more difficult for utilities to build nuclear power plants, not only because of construction delays and cost overruns imposed by new regulations, but also because of intensified environmental opposition.

DATA IMPLEMENTATION

The data for this study were obtained and constructed from the UTILITY COMPUSTAT II which contains approximately 200 of the largest utilities and 100 utility subsidiaries, 150 of which are electric utility companies. The study used only the investor-owned electric utility companies which had all the required data available for the years from 1974 to 1984. Holding companies were excluded from the analysis due to data inconsistencies. Based on these requirements, 95 electric utility companies were selected for this study.

Appendix A lists the required company data for this study. In particular, data needed for econometric analysis and productivity comparison among the three models were drawn from Appendix A for each of 95 private electric companies for the years 1975, 1978, 1981, and 1984.

Appendix B lists the industry's averages of factor prices and shares as well as the industry's aggregate quantities of factors and output. The following section briefly discusses the industry summary of electricity output, three factor employment, and cost share based on the data listed in Appendix B.

Output

Output is measured in million kilowatt-hours generated. Figure 1 below graphically displays the total electricity generation from 1974 to 1984. Electricity generation dropped in 1974 due to the Arab oil embargo of 1973-74. This was the first time since 1946 that a year-to-year decline occurred (Hyman 1983). From 1975 to 1978, the electricity generation increased at an annual rate of 5 or 6 percent. However, the rate of increase in the generation slowed down between 1979 and 1981. In 1982 the generation dropped by 4 percent from the previous year. The generation started to increase again by 3 and 4 percent in 1983 and 1984.

Fuels

Types of fuel such as coal, oil, gas, and nuclear are converted to BTU equivalents. The average price of fuel is calculated by dividing the total fuel cost by the total BTU. For the utilities generating electricity by hydro power and other sources, the price of fuel was adjusted using

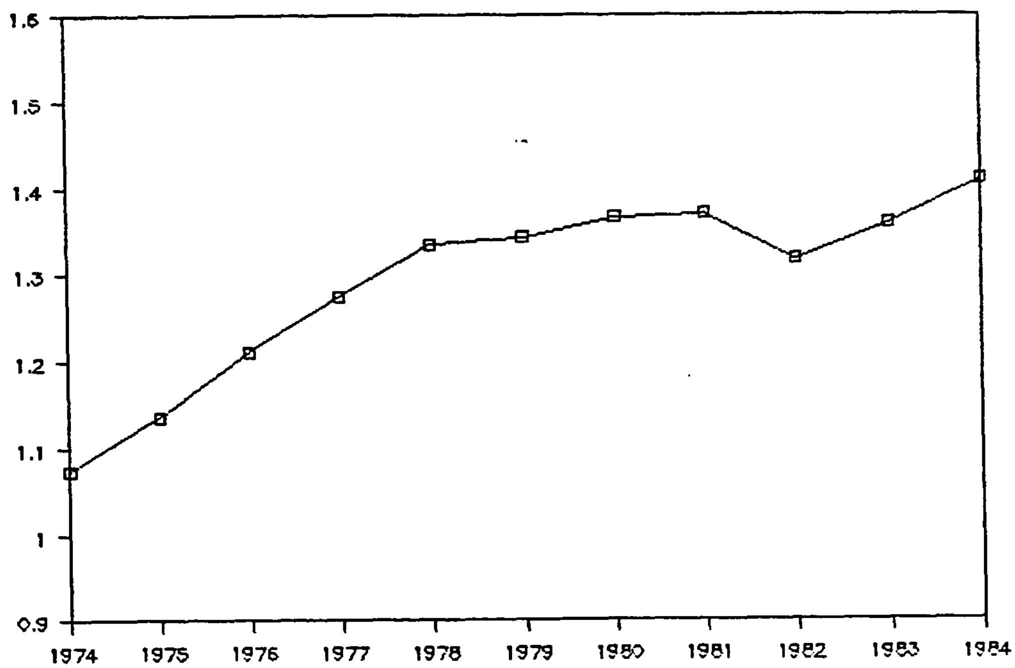

Figure 1. Total electricity generation by the electric industry (trillion KWH).

the weighted average based on the hydro and non-hydro portions because water is assumed to be at no cost to generate electricity.

Figure 2 below graphically illustrates the use of fuel from 1974 to 1984. The use of fuel in generating electricity increased continuously from 1974 through 1978, and it was relatively stable for the next three years. In 1982 fuel input dropped from the previous year. It then increased again between 1982 and 1984.

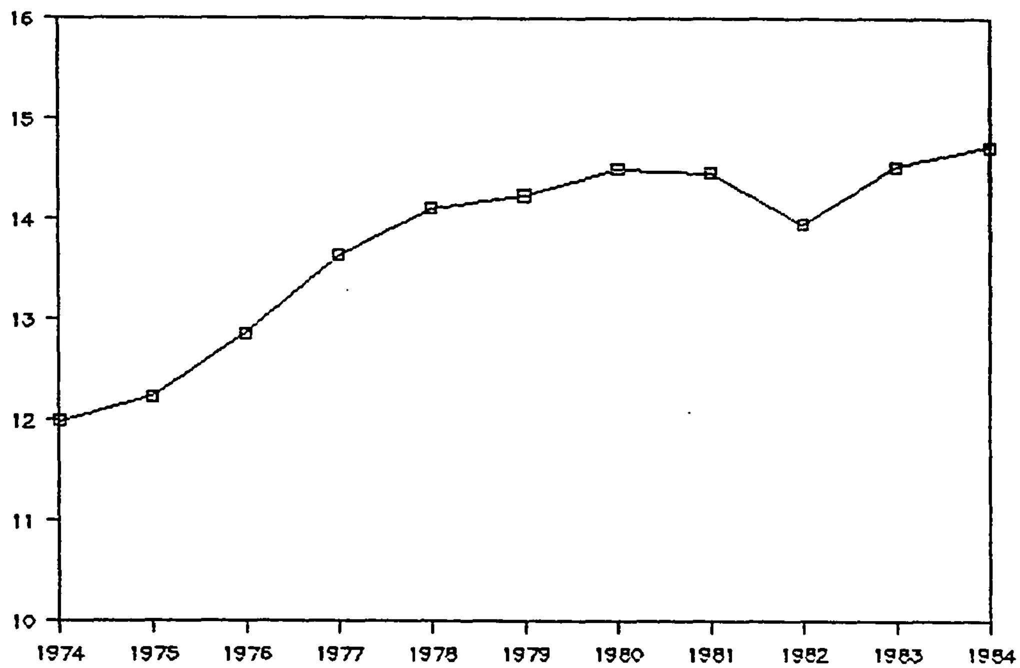

Figure 2. Total fuel input for the electric industry (quadrillion BTU).

Labor

The labor cost for each firm is based on the sum of total salaries and employee pensions and benefits. In order to determine the price of labor, the total labor cost is divided by the number of average employees.

From 1975, the amount of labor employment in the industry increased continuously until 1983 and 1984 when the rate of increase in labor input slowed down. Figure 3 below graphically shows the labor employment from 1974 to 1984.

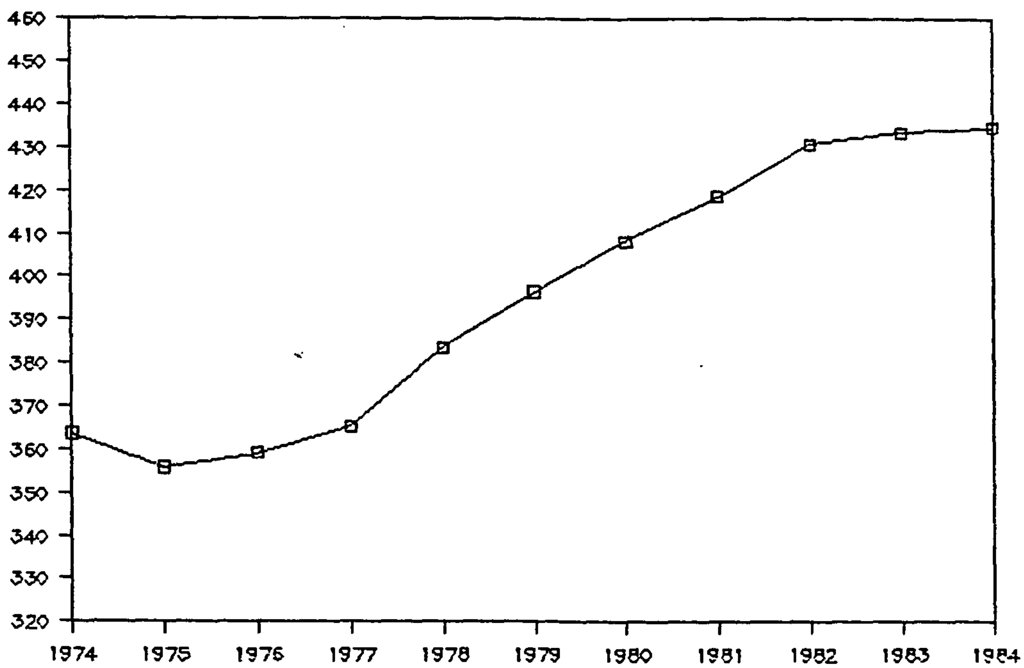

Figure 3. Total labor input for the electric industry (thousand persons).

Capital

The price of capital is calculated based upon the utility's cost of capital (CR) and the depreciation rate (DR). The firm's financial cost of capital, CR, is estimated as the weighted sum of the long-term debt interest rate, the preferred and preference stock dividend rate, and the required return on equity capital, where each factor is weighted by its respective capital structure. The price of capital is the sum of CR and DR. Capital quantity consists of all the electric plant assets including production plants, transmission plants, and distribution plants.

Figure 4 below graphically shows the amount of capital used in the industry from 1974 to 1984. The use of capital input dropped from 1974 to 1975 and then increased steadily from 1975 through 1979. There was a relatively small increase from 1979 to 1980, followed by a slight decline in 1981. Another round of sharp increase of capital input occurred between 1981 and 1984.

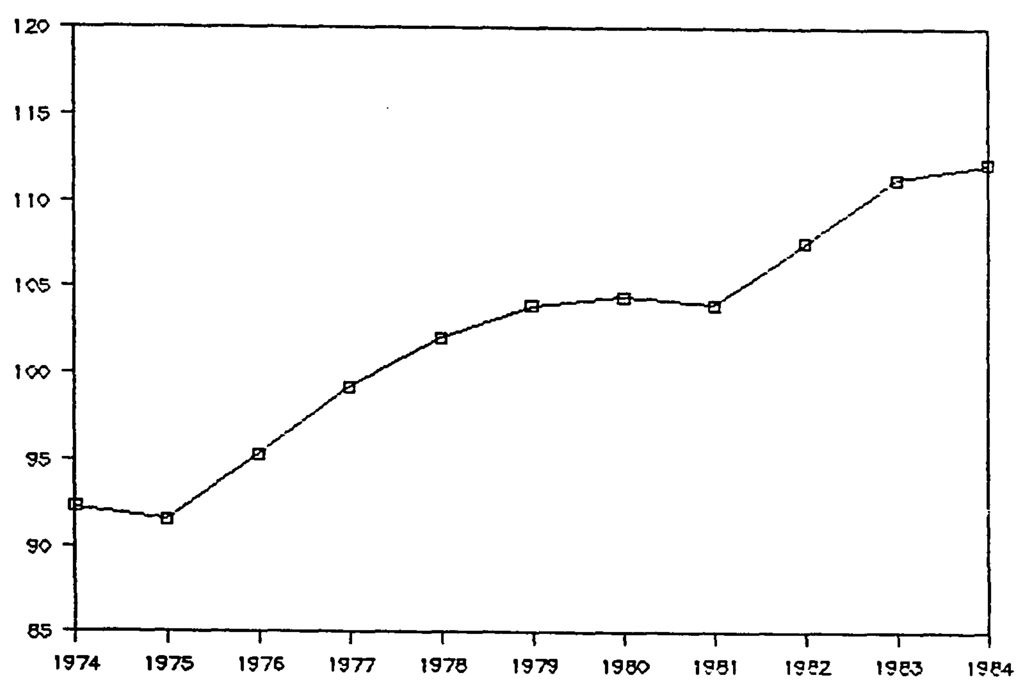

Figure 4. Total capital input for the electric industry (billions of 1974 dollars).

Total Cost

Total cost is defined as the sum of capital, labor, and fuel expenditure. The cost structure of the industry is plotted in Figures 5 and 6. The total cost of electricity generation increased continuously from 1974 to 1984, due to the increasing fuel cost between 1974 and 1981 as well as the increasing capital cost between 1981 to 1984.

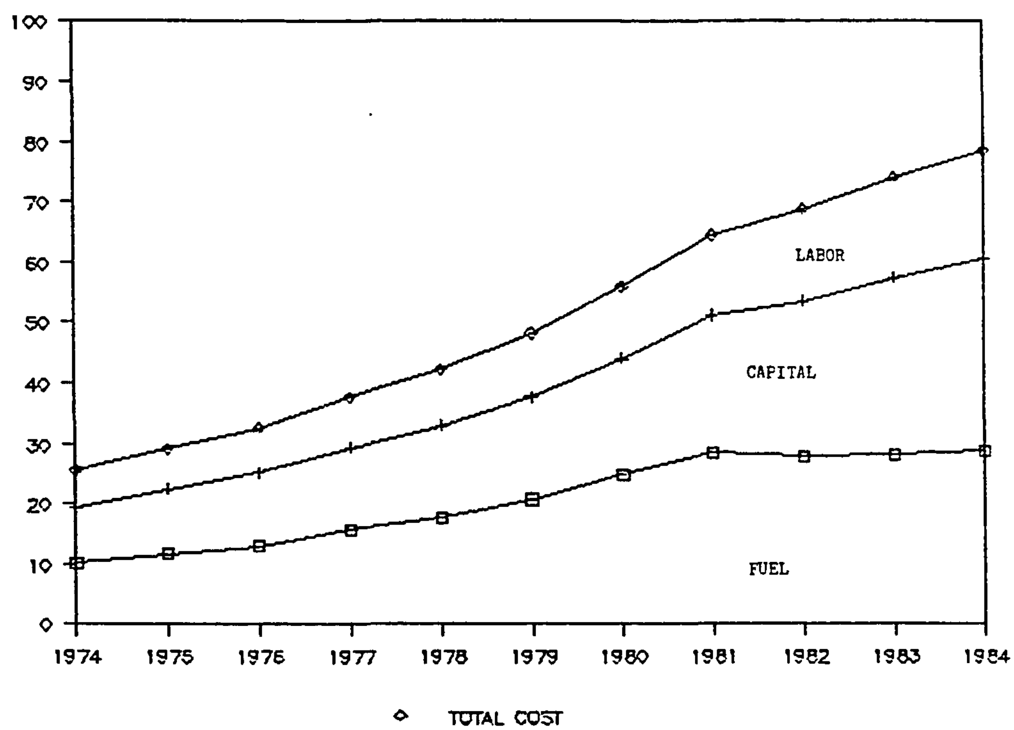

Figure 5. Total cost and factor cost for the electric industry (billion dollars).

The share of fuel increased from 40 percent of total cost in 1974 to 44 percent in 1981 mainly due to the rapid increase in fuel price. The shares of labor and capital factors decreased from 1974 to around 1981 and then both increased in the following years from 1981 to 1984. The share of capital became the largest in 1983 and 1984, accounting for approximately 40 percent of the total cost.

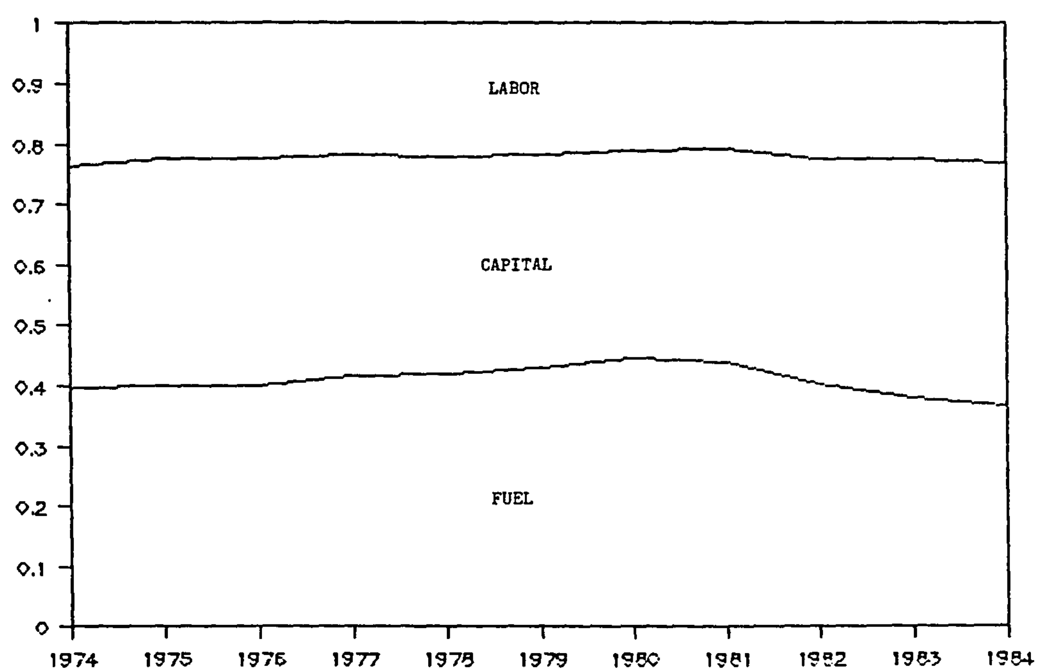

Figure 6. Factor share distribution for the electric industry.

RESEARCH PLAN

It is important to measure the scale effect if the industry's production structure does not correspond to constant returns to scale. In this study, using the translog econometric model, the restricted translog cost function (5), (6), (7), and its derived cost share equations (8) will be simultaneously estimated to investigate the production structure of the electric utility industry in the U.S. for 1975, 1978, 1981, and 1984. The TFP growth for each company can be calculated based on equation (25).

Using the same data as the econometric model, the superlative index model (equation 32) and the Craig and Harris model (equation 53) will also be used to measure the productivity change over time for each company. In Chapter IV, the results of applications of these three models will be compared and the advantages and disadvantages of each model discussed.

After the superlative index model is shown to be the most appropriate for analyzing the productivity performance of the electric utility industry, the bilateral superlative index will be used for productivity comparisons of the industry as a whole over time from 1974 to 1984. The same model will also be applied for each one of the six regions, five types of generation, and four different output levels to analyze productivity over time.

Furthermore, the multilateral superlative productivity index (42) will be constructed for comparing productivity differences in regional characteristics, generating types, and production levels.

Constructing from the data in Appendix A, Appendices E, F, and G list data sets based on company classifications according to region, type of generation, and output level. These sets of data are then used for measuring the productivity performance for each category.

CHAPTER IV

EMPIRICAL RESULTS

This chapter presents the empirical results of the U.S. electric utility companies. The purpose of the first section is to econometrically estimate the production structure of the electric utility industry based on the pooled time series - cross sectional data on years 1975, 1978, 1981, and 1984 for 95 privately owned companies.

The following section empirically compares and contrasts the productivity measurements based on the three models: the econometric model, the Craig and Harris model, and the superlative index model. Productivity changes over time are calculated based on these models using the same data set (see Appendix A).

Finally, the superlative index model is used in comparing productivity performances of the industry as a whole, and their differences due to regional characteristics, generation types, and production levels. The data used in this section are listed in Appendices B, E, F, and G.

PRODUCTION STRUCTURE OF THE INDUSTRY

Cost Function: Estimation and Hypothesis Testing

It is obvious that there has been considerable change in the cost structure of production due to the changes in input prices, especially in rising fuel prices in the 1970's and rapidly increasing capital costs in the 1980's. The purpose of this section is to analyze selected characteristics of the U.S. electric power generation industry. Specifically, production structure, factor substitution and price effect, scale effect, and technological change of the industry are investigated using techniques of statistical estimation and hypothesis testing.

Data used for the econometric analysis are drawn from Appendix A for each of 95 private electric utility companies for the years 1975, 1978, 1981, and 1984.

Coefficients of the translog cost function (5) are estimated from this set of pooled time series data. The technique of seemingly unrelated regression (Zellner 1962) is used to estimate the total cost function and three cost share equations (capital, labor, and fuel). Because of the linear dependency of the system (the sum of the shares equals one), the fuel cost share equation is not directly estimated. Parameter estimates and t-statistics of the omitted fuel share equation can be calculated using the linear homogeneity restrictions and symmetric conditions (see Chapter II, equations (5), (6), and (7)).

In Table I, the coefficient estimates of the econometric model are presented. Almost all the coefficients are significant based on the t-statistics.

TABLE I

PARAMETER ESTIMATES

Variables		Coefficient	Std. Error	T-Statistics
CONSTANT		-2.0194	0.1986	-10.1682
β_l	$\ln P_l$	0.1578	0.0514	3.0693
β_k	$\ln P_k$	0.4776	0.0495	9.6403
β_e	$\ln P_e$	0.3646	0.0278	13.0832
β_y	$\ln Y$	0.6414	0.0386	16.5937
β_{yy}	$(\ln(Y))^2$	0.0418	0.0022	9.4680
β_{ll}	$\ln P_l \ln P_l$	0.0817	0.0104	7.7826
β_{kk}	$\ln P_k \ln P_k$	0.0904	0.0097	9.2840
β_{ee}	$\ln P_e \ln P_e$	0.1297	0.0041	31.7511
β_{lk}	$\ln P_l \ln P_k$	-0.0212	0.0096	-2.1986
β_{ke}	$\ln P_k \ln P_e$	-0.0692	0.0044	-15.7405
β_{le}	$\ln P_l \ln P_e$	-0.0605	0.0042	-14.4438
β_{yl}	$\ln Y \ln P_l$	-0.0254	0.0021	-11.9885
β_{yk}	$\ln Y \ln P_k$	0.0130	0.0022	5.7459
β_{ye}	$\ln Y \ln P_e$	0.0124	0.0023	5.3201
β_t	t	0.0283	0.0151	1.8743
β_{tt}	t^2	-0.0050	0.0007	-3.4694
β_{ty}	$t \ln Y$	0.0008	0.0014	0.5765
β_{tl}	$t \ln P_l$	0.0010	0.0009	1.1273
β_{tk}	$t \ln P_k$	0.0022	0.0010	2.2233
β_{te}	$t \ln P_e$	-0.0032	0.0011	-2.8335

$R^2 = 0.9234$

By using logarithmic maximum-likelihood ratios between restricted and unrestricted functions $-2*(LL_R - LL_U)$, various hypotheses can be tested in order to identify the specific production structure. The notations LL_R and LL_U are the logarithmic maximum-likelihood values based on the restricted and unrestricted cost functions respectively. Chi-square distribution was used to test the hypotheses of production structure, with the degree of freedom to be the number of restrictions imposed. In particular, the results of test statistics for homotheticity and unitary elasticity of substitution are presented. Recall that the restriction of homotheticity requires $\beta_{yl}=\beta_{yk}=\beta_{ye}=0$, and unitary elasticity of substitution restricts $\beta_{kk}=\beta_{kl}=\beta_{ke}=\beta_{le}=\beta_{ll}=\beta_{ee}=0$. Table II summarizes the results of testing these two hypotheses.

TABLE II

RESULTS OF HYPOTHESIS TESTINGS

	Hypothesis	
	Homotheticity	Unitary elsticity of substitution
Log likelihood ratio	144.13	1098.61
Degree of freedom	3	3
Critical chi-square (5% significant level)	11.35	11.35

Both hypotheses are rejected at the 95% confindence level, clearly indicating that the production structure of the U.S. electricity generation corresponds to nonhomotheticity and nonunitary elasticities of substitution.

Factor Substitution and Price Effect

Based on the production function which exhibits nonhomothetic and nonunitary elasticity of substitution, Tables III and IV display elasticities of factor substitutions (based on equation (13), Chapter II) and own-price elasticities (based on equation (16), Chapter II). The results show that there are small substitutions among factor inputs. Moreover, the own-price elasticity of demand for fuel is very small. The net effect is that the total cost would increase continuously as the cost share of fuel increases. This implication is basically consistent with that of Greene (1983) in which he computed elasticities from 1955 to 1975 in five year increments.

Scale Effect

The scale effect based on the general production function (as specified in Table I) for five groups of different output levels is derived according to equation (18) of Chapter II. As mentioned earlier in Chapter II, the measure of scale effect is described as constant returns to scale if the scale effect is one. If the scale effect is greater than one, diseconomies of scale exist; if it is less than one, economies of scale exist.

TABLE III

ELASTICITIES OF SUBSTITUTION AT MEANS
(VARIOUS YEARS)

	capital & labor	capital & fuel	labor & fuel
1975	0.70864	0.47077	0.18358
1978	0.68742	0.46850	0.21448
1981	0.64385	0.48700	0.22986
1984	0.72609	0.47311	0.15538
ALL	0.69150	0.47484	0.19583

TABLE IV

OWN PRICE ELASTICITIES AT MEANS
(VARIOUS YEARS)

	capital	labor	fuel
1975	-0.37228	-0.35738	-0.23077
1978	-0.37732	-0.35297	-0.22371
1981	-0.36916	-0.33974	-0.23935
1984	-0.36028	-0.36428	-0.23893
ALL	-0.36976	-0.35359	-0.23319

Table V summarizes the findings of scale effect within the five groups of output levels for each year in terms of means and standard errors.

TABLE V

SCALE EFFECT (VARIOUS YEARS)

	LEVELS	output range (million KWH)	median output	mean Sc	std Sc
1975	1	67- 3650	1953	0.8367	0.0545
	2	3729- 8153	6164	0.9057	0.0094
	3	8550-16282	13167	0.9356	0.0128
	4	16416-58823	33746	0.9778	0.0167
	ALL		8555	0.9127	0.0592
1978	1	81- 3846	2118	0.8426	0.0570
	2	4142- 9350	7544	0.9140	0.0095
	3	9359-19319	14665	0.9450	0.0129
	4	19841-67451	39902	0.9837	0.0192
	ALL		9427	0.9201	0.0602
1981	1	112- 4552	2281	0.8552	0.0563
	2	4563- 9816	7007	0.9186	0.0126
	3	10684-18582	15583	0.9518	0.0113
	4	19075-60257	34822	0.9899	0.0193
	ALL		10762	0.9277	0.0582
1984	1	126- 4445	2501	0.8547	0.0538
	2	4494-10770	7328	0.9217	0.0126
	3	10927-20052	16612	0.9529	0.0093
	4	20057-60428	39503	0.9890	0.0199
	ALL		10974	0.9284	0.0575
1975 - 1984	ALL			0.9223	0.0591

The results of Table V indicate that there are economies of scale or increasing returns to scale for all years. However, scale effect declines as output level increases; it also declines over time, except for 1984. Statistically, the mean of scale effect is more significant at the lower output levels than at the higher output levels; however, overall the scale effect is not statistically significant from 1975 to 1984. Therefore, one can conclude that the industry is operating under constant returns to scale as a whole.

An alternative way to analyze scale effect is to calculate the average cost for a range of outputs by holding factor prices at their means. This cost curve represents the cost of electricity producing for a typical (i.e., average) firm (see Christensen and Greene 1976).

The average cost curves of the industry are plotted for 1975, 1978, 1981 and 1984 in Figures 7 through 10. The optimum output level, Y*, can be derived by setting the average cost equal to the marginal cost. Equivalently, this requires the scale effect to be one.[5] Therefore the logarithmic optimum output for the cost function (5) is:

$$\ln Y^* = (1-(\beta_Y + \beta_{tY}t + \Sigma\beta_{iY}\ln P_i))/\beta_{YY}. \qquad (54)$$

The optimum output of the industry is shown in Table VI.

TABLE VI

OPTIMUM OUTPUT (SELECTED YEARS)

Year	Optimum output (MMKWH)
1975	60338
1978	57817
1981	49916
1984	50199

[5] From the condition that average cost equals to marginal cost, or $C/Y = \delta C/\delta Y$, this is exactly the condition $\delta \ln C/\delta \ln Y = 1$ in the logarithmic form.

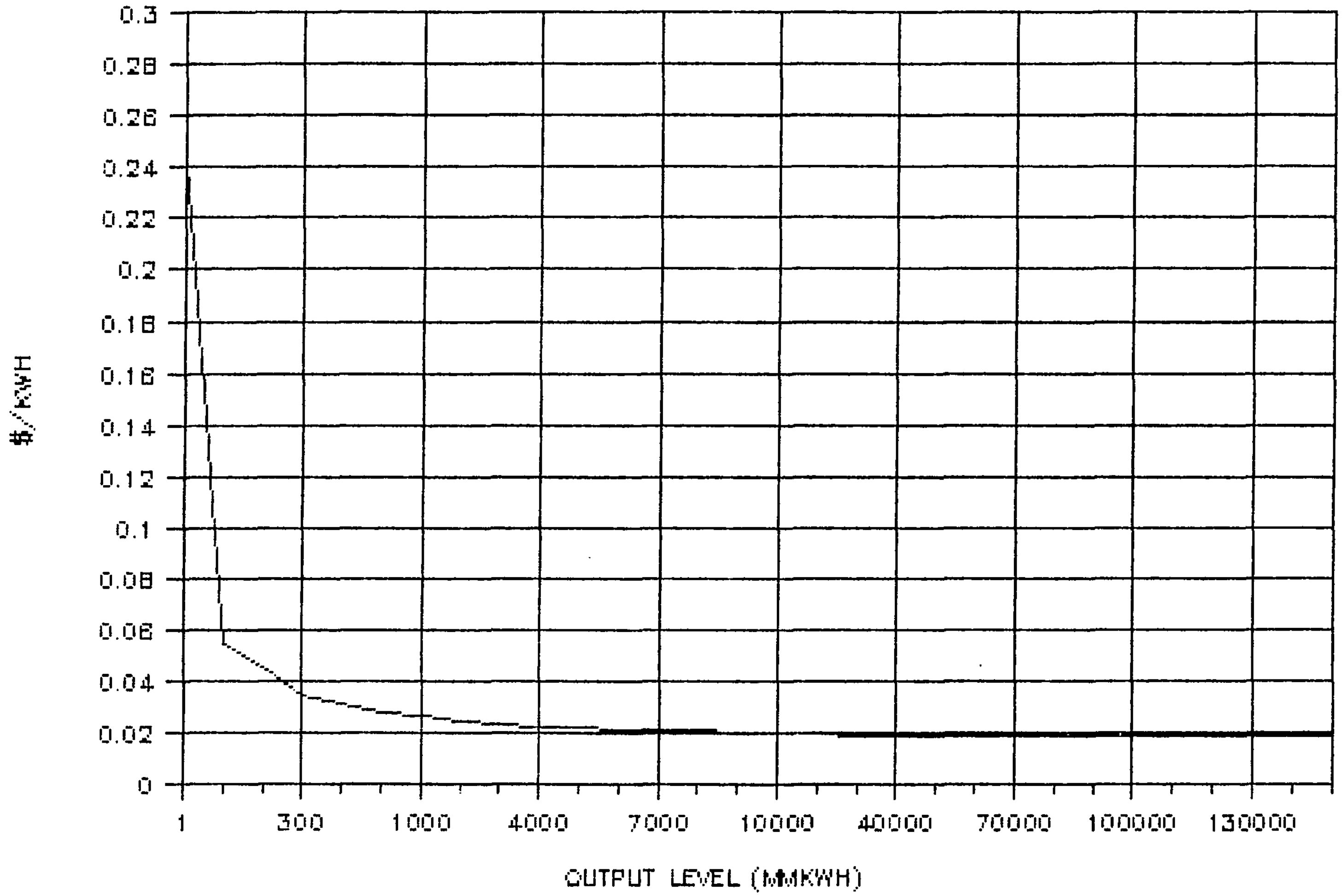

Figure 7. Estimated average electricity cost, 1975

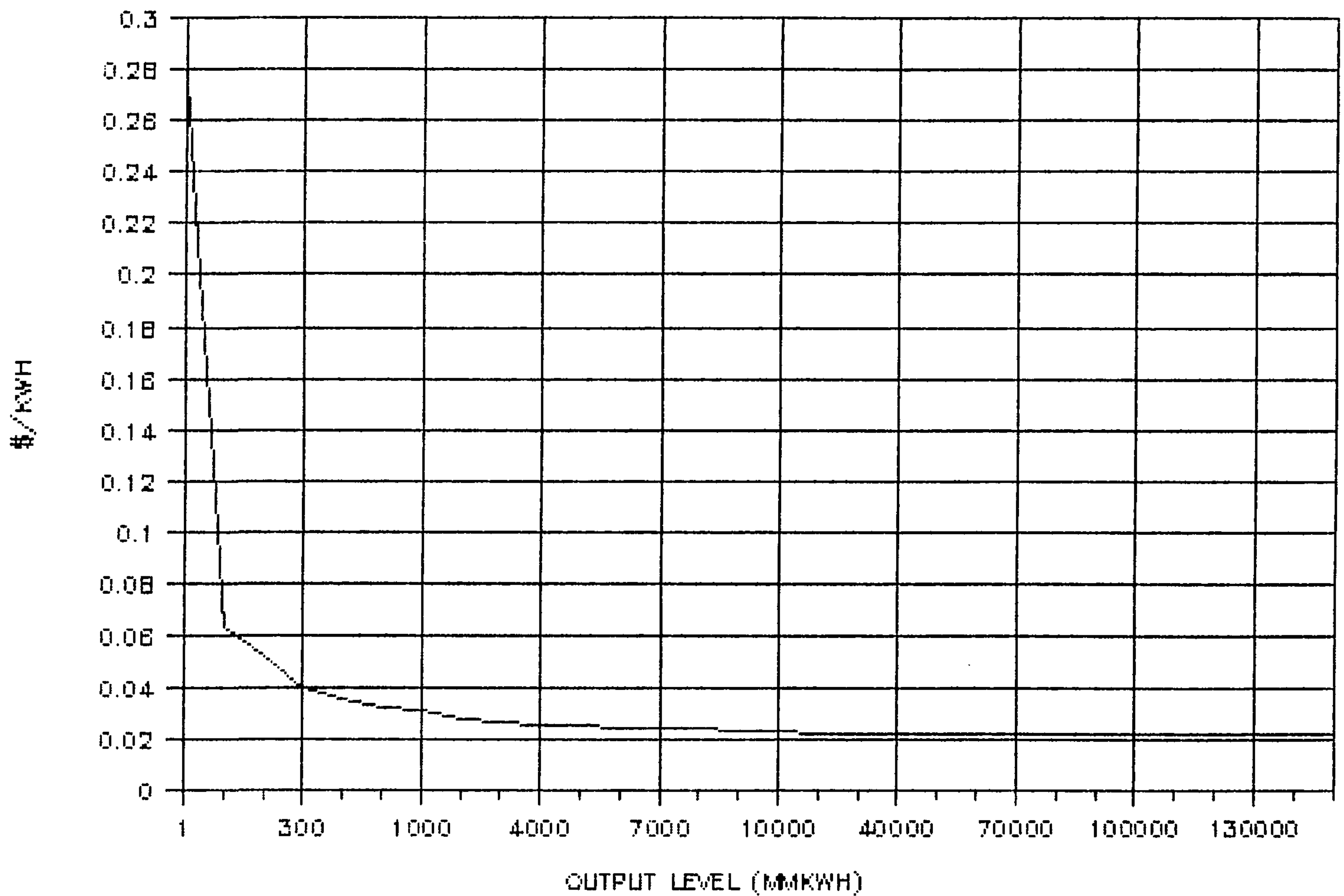

Figure 8. Estimated average electricity cost, 1978

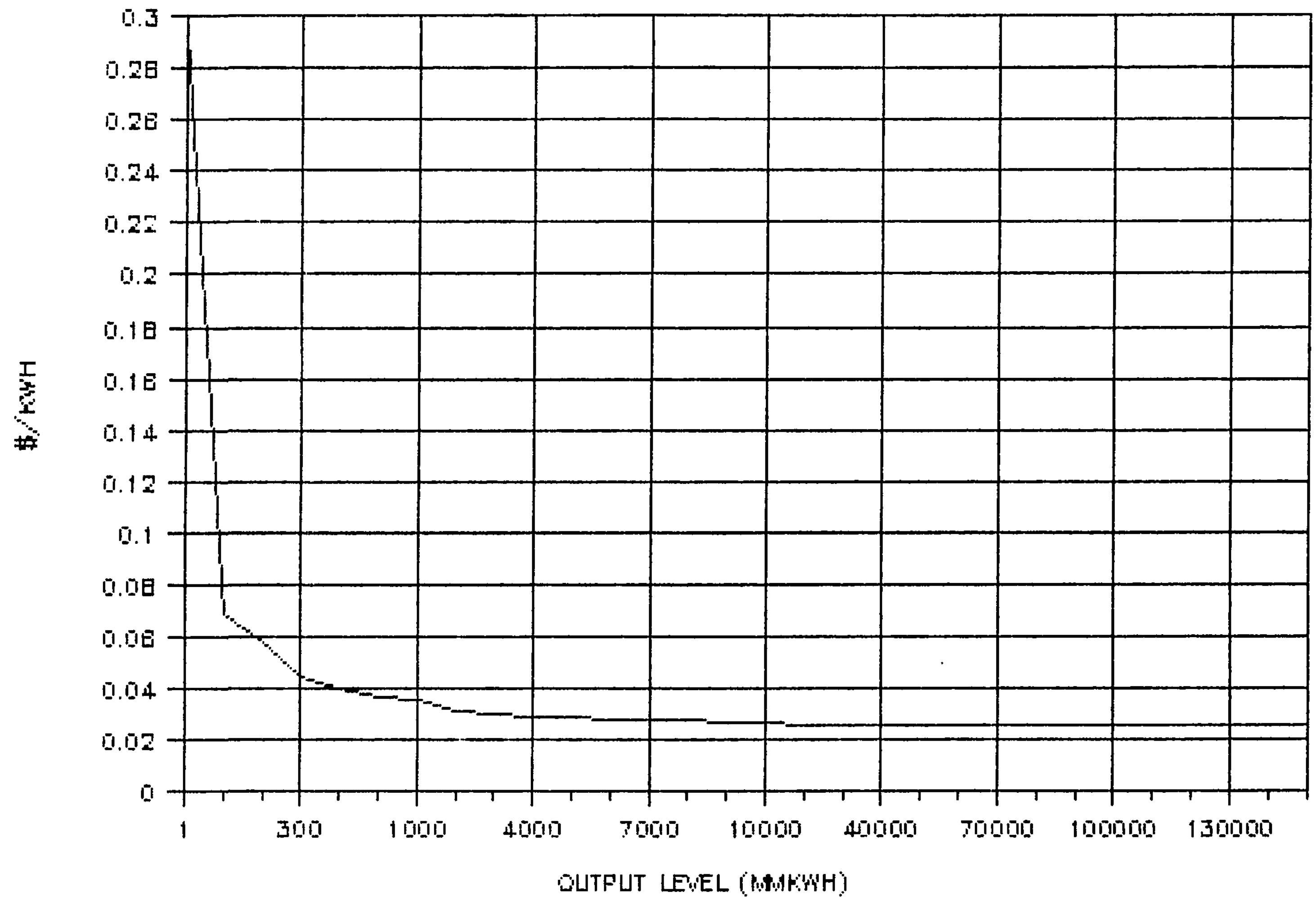

Figure 9. Estimated average electricity cost, 1981

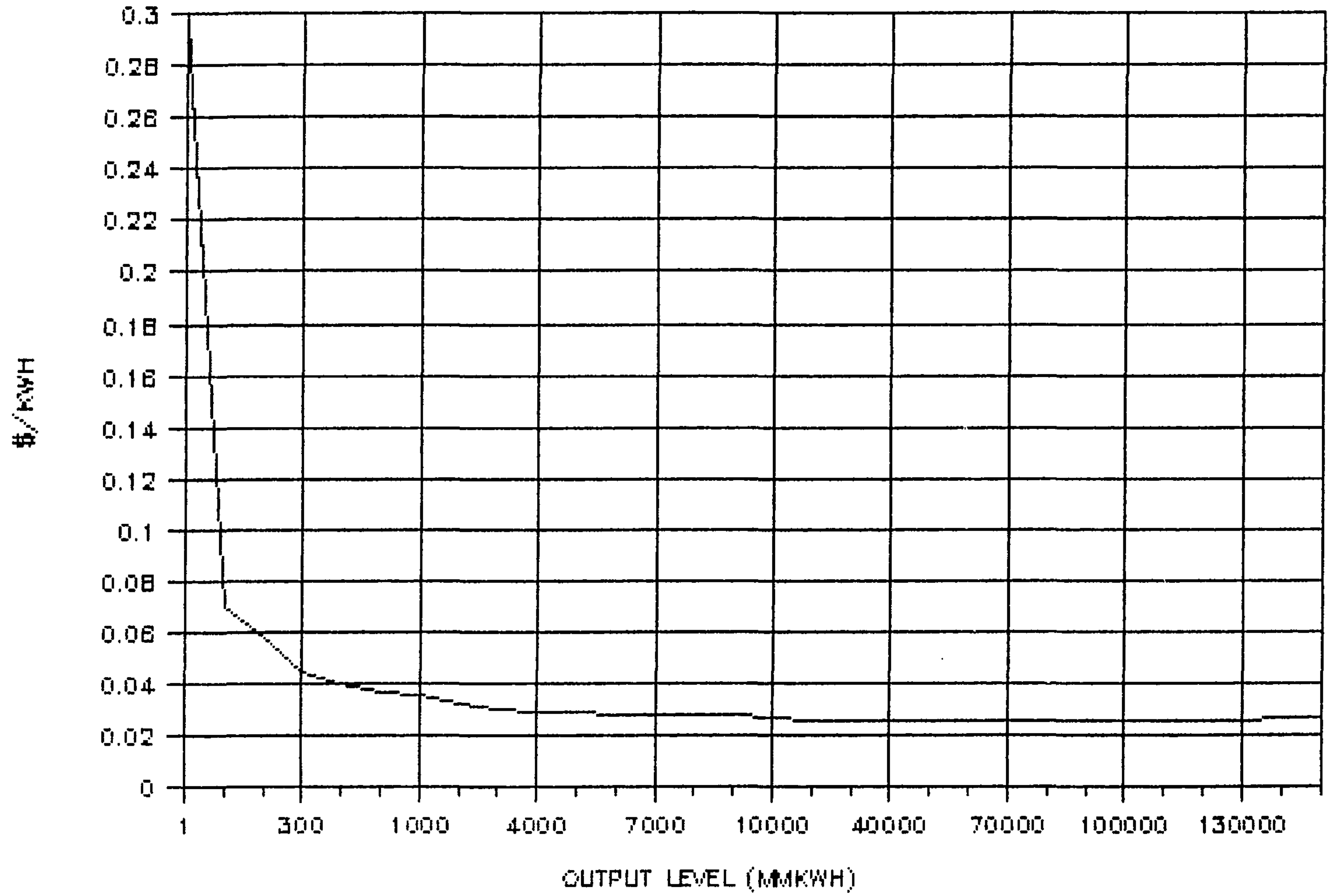

Figure 10. Estimated average electricity cost, 1984

If equation (54) is partially differentiated by t, the dynamic change in the optimum output level can be defined. From the parameter estimates of Table I:

$$\delta \ln(Y^*)/\delta t = -\beta_{ty}/\beta_{yy} = -0.019. \quad (55)$$

It is then clear that the optimum output level has been slightly declining over time at a rate of about 1.9 percent every four years.

As Figures 7 to 10 show, the average cost curves sharply decline at the lower range of outputs. The curves then become flat after 1000 million KWH range. A comparison of the cost curves with the distribution of each company's actual output shows that most firms in 1975, 1978, 1981 and 1984 operated in the flat area of the cost curves. Statistically this flat area of the cost curve can be defined by the estimated scale effect plus and minus 1.96 of its standard error at 95 percent of confidence level (see Table V). For example, the output level can be calculated for the mean of scale effect of 0.9127 as follows:

$$\ln Y = (0.9127-(\beta_y + \beta_{ty}t + \Sigma\beta_{iy}\ln P_i))/\beta_{yy}. \quad (56)$$

Table VII also shows the results of the upper and lower bounds (million KWH) from the estimated scale effect of the cost curve for each year. In other words, they cover the flat areas of the average cost curves ranging from $0.02 to

$0.03 per KWH between the lower and upper bounds for the industry demonstrating no significant economies or diseconomies within the region. As a matter of fact, only six or seven companies operated outside this flat region in 1975, 1978, 1981, and 1984.

TABLE VII

LOWER AND UPPER BOUNDS OF MEAN SCALE EFFECT
(Million KWH, VARIOUS YEARS)

	1975	1978	1981	1984
Lower bound	466	508	578	611
Mean scale effect	7474	8549	8852	9053
Upper bound	119889	143848	135687	134188

Technological Change

Technological change can be measured as a negative rate of cost diminution as shown by equation (20) (see Chapter II). In the 1970's, the measure of technological change was negative; however, it became positive in the 1980's, indicating that the productivity for the electric utility industry declined in the 1970's but improved in the 1980's.

Total factor productivity growth can be calculated using equation (25) in which the rate of cost diminution is adjusted by scale effect (That is, $\Delta TFP = RCD/Sc$). In Table VIII, declining total factor productivity is indicated in 1975 and 1978, whereas increasing productivity in 1981 and 1984.

TABLE VIII

TOTAL FACTOR PRODUCTIVITY GROWTH
(VARIOUS YEARS)

	1975	1978	1981	1984
RCD	-0.02982	-0.01490	0.00043	0.01455
Sc	0.91270	0.92010	0.92770	0.92840
TFP	-0.03268	-0.01619	0.00046	0.01567

By examining the measure of technological change in more detail, it is clear that this measure is affected by changes in factor prices. The factor bias of technological change computed according to equation (22) is presented in Table IX.

TABLE IX

FACTOR BIAS OF TECHNOLOGICAL CHANGE

		Coefficient	Std. error
Labor	(β_{tl})	0.0010218	0.00091
Capital	(β_{tk})	0.002196	0.00099
Fuel	(β_{tf})	-0.003217	0.00114

The results indicate that technological change for the industry is fuel-saving, capital-using, and labor neutral. Accordingly, an increase in the price of labor does not significantly affect technological change. An increase in the price of capital leads to declining technological change, but an increase in fuel prices promotes technological progress.

PRODUCTIVITY COMPARISONS OF THE THREE MODELS

In this section, the TFP growth of each company from 1975 to 1984 is calculated for the three models: the translog econometric model, the superlative index model, and the Craig and Harris model. The purpose of these calculations is to empirically compare and contrast differences in productivity measurements among these three models. The results of total factor productivity changes over time for each company are presented in Appendix C.

For the Craig and Harris model, TFP is simply measured by dividing the total output by the total cost of factors. In order to compare the Craig and Harris model with the other two, its logarithmic productivity change is calculated between adjacent periods, t and t+1, using equation (53) from Chapter II.

The translog econometric model requires estimation of the coefficients of the cost function (5) with the imposed assumptions of linear homogeneity in prices (7) and the symmetric condition in the second order coefficients (6). The TFP measurement of equation (25) is the rate of the total factor productivity change at time t. However, for compatibility with the results of other models, the average TFP changes between the adjacent periods, t and t+1, were calculated and reported.

The superlative index model is designed to measure the TFP change without econometric estimation. The TFP change is calculated directly from observed data based on equation (32).

A comparison of the patterns of the TFP changes from the translog econometric model and the superlative index model show that the former demonstrates improved productivity over time (from declining productivity to increasing productivity) while the latter does not. The reason for this increasing pattern of TFP changes in the econometric model is probably due to the time indicator t that is used to reflect the technological change. Moreover, the estimated coefficients β_t and β_{tt} are assumed to be the same for each utility. As a result, the TFP change has the same increasing pattern for each company.

In order to avoid this problem, additive and/or multiplicative dummy variables might conceivably be included in the estimation equation, but this potential solution is unfortunately technically impossible with current computer resources.

Another solution might be the division of samples for separate estimation instead of estimating all the utilities at the same time. However, selection of criteria for dividing the samples poses a problem. Moreover, it would have the additional problem of inconsistent measurement of parameter estimates in terms of scale effect and technological change for each divided sample.

In order to compare the differences in productivity measurement among the three models, Table X summarizes average total factor productivity changes over various periods for each model. From 1975 to 1978, the econometric model and the Craig and Harris model indicate decreases in the TFP, -0.0244 for the former and -0.0806 for the latter. However, the superlative index model indicates an increase of 0.0156 in the TFP. The models show similar patterns of productivity changes from 1978 to 1981: -0.0079 for the econometric model, 0.0132 for the superlative index model, and -0.0974 for the Craig and Harris model. From 1981 to 1984, the econometric model indicates some increasing productivity of 0.008, but the superlative index model and the Craig and Harris model show declining productivities of -0.0137 and -0.0486, respectively.

For overall comparison, the average TFP change from 1975 to 1984 is calculated for each model. The translog econometric model and the superlative index model indicate neither growth nor decline in the TFP; the former is -0.0080 and the latter is 0.0050. The Craig and Harris model, on the other hand, shows a declining TFP change of -0.0756.

TABLE X

PRODUCTIVITY COMPARISON OF THE THREE MODELS
TOTAL FACTOR PRODUCTIVITY GROWTH

Years	Econometric	Superlative	Craig & Harris
1975	-0.0327	-0.0080	-0.0693
1978	-0.0162	-0.0069	-0.0304
1981	0.0005	0.0035	-0.0388
1984	0.0157	0.0162	0.0097
1975 - 1978	-0.0244	0.0156	-0.0806
1978 - 1981	-0.0079	0.0132	-0.0974
1981 - 1984	0.0080	-0.0137	-0.0486
1975 - 1984	-0.0080	0.0050	-0.0756

It is clear that the Craig and Harris model tends to underestimate the measure of TFP change compared with the other two models. By contrast, the econometric model produces consistently higher estimates of the TFP change than that of the superlative index model.

PRODUCTIVITY PERFORMANCE: SUPERLATIVE INDEX COMPARISONS

As concluded in the first section of this chapter, constant returns to scale is a reasonable and convenient assumption for the study of the production structure for the electric industry. For analyzing the total factor productivity of 95 electric utility companies from 1974 to 1984, the translog econometric model is technically infeasible due to either the resource limitation or the estimation problem involving too many parameters without sufficient degrees of freedom (see Chapter II). Finally, the problem of assuming perfect input substitution limits the value of the Craig and Harris model. Therefore, one conclusion of this study is that the superlative index model is the most appropriate model for analyzing the TFP for the electric industry, both because it is theoretically sound and because it is cost effective.

In the following section, productivity comparisons over time are computed using the formula of the bilateral superlative index (equations (32) and (33)). However, for multilateral comparisons of productivity difference among regions, types of generation, and output levels, the indexes are calculated from equations (42) and (43) because of the advantage of the transitivity property in the formula.

The relative productivity differences are reported in this study by taking the exponential of the logarithmic differences between entities to be compared (both bilateral and multilateral superlative indexes). The bilateral indexes reported show productivity levels relative to the 1974 level, while the multilateral indexes show productivity levels relative to a base entity for each category.[*] Selection of the base is disscused in each sub-section.

[*] Taking the exponential by Φ_t = exp(TFP_t), then indexes are constructed by $\theta_{t+1} = \theta_t * \Phi_t$ where θ_{1974} = 1.000.

This section is further divided into four sub-sections. The first sub-section describes the results regarding the productivity of the industry as a whole (industry summary). Productivity comparisons among different regions and among different types of generation are discussed in the next two sub-sections. Finally, the last sub-section describes the comparisons of the productivity differences based on the different sizes of companies (or different output levels).

Industry Summary

This sub-section describes the total and partial (labor, capital, and fuel) productivity of the industry as a whole by using the bilateral superlative index model.

Table XI shows the results of productivity change over time by setting the index of 1974 to be 1.0. Figure 11 graphically shows the total and partial factor productivity over time from 1974 to 1984.

After the oil embargo of 1973-74, total factor productivity improved in 1975 and 1976; however, the TFP did not indicate significant change between 1978 and 1981. In 1982, the TFP declined sharply by four percent, partially due to the declining productivity in capital and labor. Another reason for this sharp decline was reduced electricity generation in the recession year of 1982. Total electricity generation dropped from 1371 billion KWH in 1981 to 1318 billion KWH in 1982. In the next two years, 1983 and 1984, the TFP increased slightly.

It seems that the capital productivity is the most influential factor in determining TFP, followed by labor productivity as shown in Figure 11. Also, it is interesting to note that the fuel productivity stayed relatively stable for the study period. The use of fuel is generally quite responsive to the quantity of electricity generated.

Although there were some fluctuations in the total and partial factor productivities, generally there were no overall productivity improvements for the electric utility industry in recent years.

Since it is believed that productivity performance of individual electric utilities may be drastically different, the following three sub-sections report results of examinations based on the location of service territories, types of electricity generation, and output levels.

Different Regions

This sub-section describes the results based on the total and partial (labor, capital, and fuel) factor productivities of utilities in each region using the bilateral superlative index model and the multilateral superlative index model. Regional classifications of 95 electric companies are given in Appendix D.

There are six regions under comparison - Great Lakes,

TABLE XI

PRODUCTIVITY INDEX COMPARISON OVER TIME
INDUSTRY SUMMARY
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0127	1.0111	1.0025	1.0265
1976	1.0332	1.0305	1.0202	1.0861
1977	1.0379	1.0384	1.0176	1.0967
1978	1.0445	1.0377	1.0226	1.1085
1979	1.0398	1.0316	1.0212	1.0954
1980	1.0442	1.0289	1.0208	1.0968
1981	1.0471	1.0243	1.0234	1.0976
1982	1.0197	1.0094	1.0220	1.0520
1983	1.0186	1.0150	1.0181	1.0526
1984	1.0300	1.0226	1.0267	1.0814

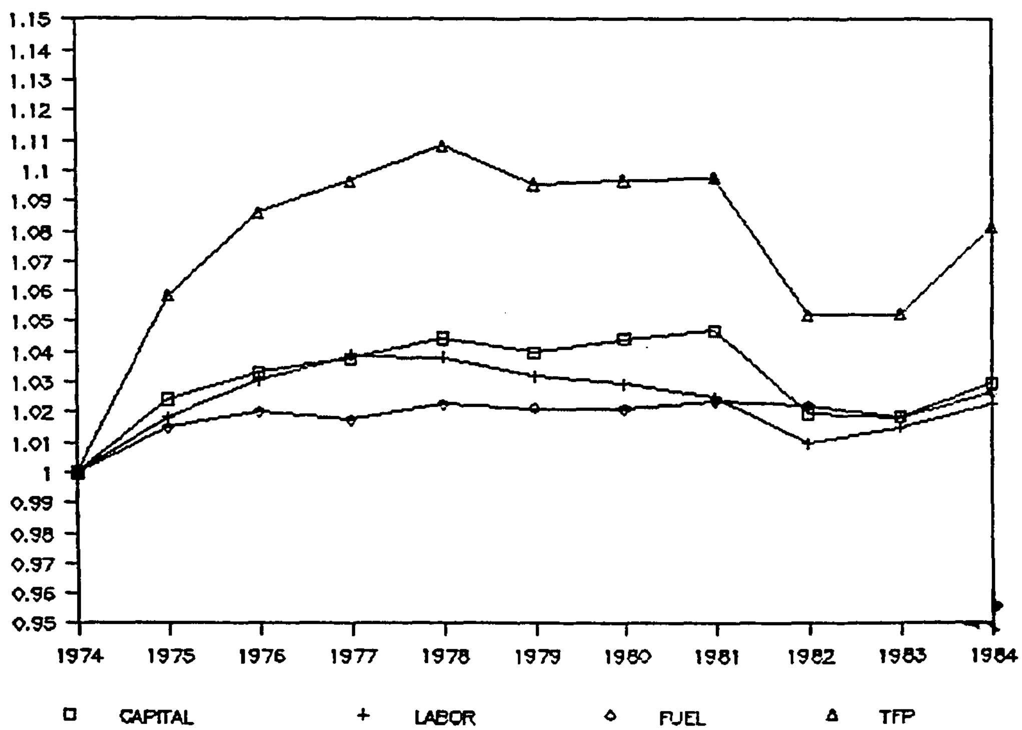

Figure 11. Graphic presentation of Table XI.

northeastern, north central, southeastern, south central, and western. Each region represents 28, 29, 4, 16, 15, and 8 percent of total electricity generation, respectively. The northwest and southwest regions are combined into the western region because of the lack of observations for each region alone. If an electric company serves more than one terriory, the major territory is chosen as the region of the company. The database constructed from Appendix A according to the above regional characteristics is given in Appendix E.

Using the bilateral index model (see equations (32) and (33) of Chapter II), productivity comparisons over time for each region are shown in Tables XII through XVII by setting the index of 1974 to be 1.0. Figures 12 through 17 graphically show the total and partial factor productivity over time for each region from 1974 to 1984. Note that a comparison of interregional productivity for a given year is not appropriate using the bilateral index. Instead, the multilateral index should be used.

Multilateral comparisons of productivity differences are calculated for the six regions using equations (42) and (43) of Chapter II. The results are shown in Tables XVIII through XXI, where the Great Lakes region in 1974 is set as the base for comparison. These indexes are plotted in Figures 18 through 21 to show the productivity among regions across various years.

Bilateral Comparisons of Regional Productivity. Table XII and its corresponding Figure 12 show that the TFP increased by 7 percent in the Great Lakes region from 1974 to 1978, and then decreased by 10 percent between 1978 and 1982. In 1983 and 1984, the TFP improved again by a few percent. The pattern of the TFP change is the same as that of capital and labor productivity. Fuel productivity was fairly stable for the entire period.

Table XIII and Figure 13 show that the total factor productivity in the northeastern increased steadily by 6 percent between 1974 and 1978 and then declined about 3 percent from 1978 to 1982. In 1983 and 1984, the TFP slightly recovered again.

From 1974 to 1977, the total factor productivity increased rapidly by almost 6 percent per year in the north central region, but it was gradually declining toward the 1980's. In this region, the TFP followed the same patterns of fluctuations in the capital productivity and labor productivity (see Table XIV and Figure 14).

In the south central region, the TFP increased steadily by 10 percent between 1974 and 1978 as shown in Table XV and Figure 15; however, it declined rapidly from 1978 to 1984 due to the declining capital productivity. This decline accounts for about 15 percent in 6 years. For the study period, labor and fuel productivity remained stable with a slight increase of 2 percent within 11 years. Therefore,

TABLE XII

PRODUCTIVITY INDEX COMPARISON OVER TIME
GREAT LAKES
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0066	1.0105	0.9997	1.0168
1976	1.0157	1.0277	1.0017	1.0456
1977	1.0027	1.0296	0.9974	1.0298
1978	1.0187	1.0340	1.0190	1.0733
1979	1.0197	1.0326	1.0209	1.0748
1980	1.0017	1.0175	1.0148	1.0343
1981	1.0004	1.0148	1.0163	1.0318
1982	0.9585	0.9963	1.0172	0.9713
1983	0.9793	1.0117	1.0207	1.0112
1984	1.0103	1.0210	1.0256	1.0579

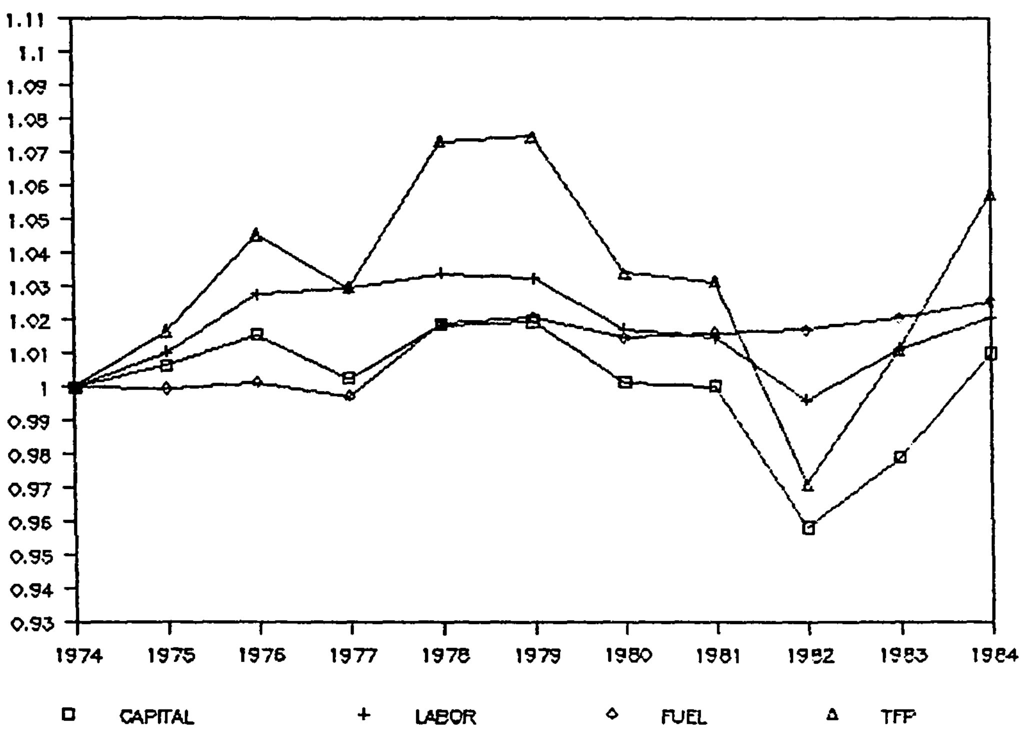

Figure 12. Graphic presentation of Table XII.

TABLE XIII

PRODUCTIVITY INDEX COMPARISON OVER TIME
NORTHEASTERN
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0135	1.0088	1.0163	1.0392
1976	1.0227	1.0167	1.0180	1.0586
1977	1.0279	1.0261	1.0140	1.0695
1978	1.0337	1.0247	1.0136	1.0736
1979	1.0304	1.0158	1.0136	1.0609
1980	1.0355	1.0088	1.0044	1.0492
1981	1.0440	1.0060	1.0124	1.0632
1982	1.0289	0.9976	1.0134	1.0402
1983	1.0272	1.0064	1.0150	1.0494
1984	1.0316	1.0178	1.0162	1.0669

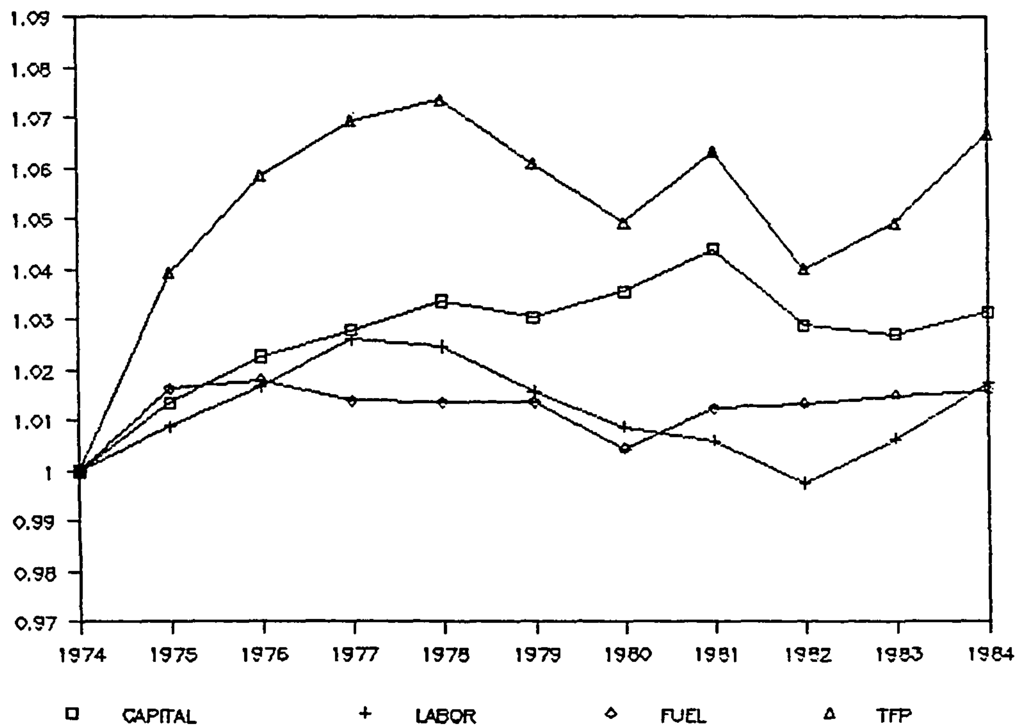

Figure 13. Graphic presentation of Table XIII.

TABLE XIV

PRODUCTIVITY INDEX COMPARISON OVER TIME
NORTH CENTRAL
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0279	1.0221	0.9795	1.0291
1976	1.0606	1.0522	0.9836	1.0977
1977	1.0918	1.0793	0.9865	1.1625
1978	1.0807	1.0817	0.9861	1.1528
1979	1.0593	1.0747	0.9914	1.1287
1980	1.0730	1.0762	0.9917	1.1452
1981	1.0926	1.0785	0.9926	1.1697
1982	1.0595	1.0547	0.9919	1.1084
1983	1.0654	1.0730	0.9940	1.1364
1984	1.0395	1.0600	0.9955	1.0970

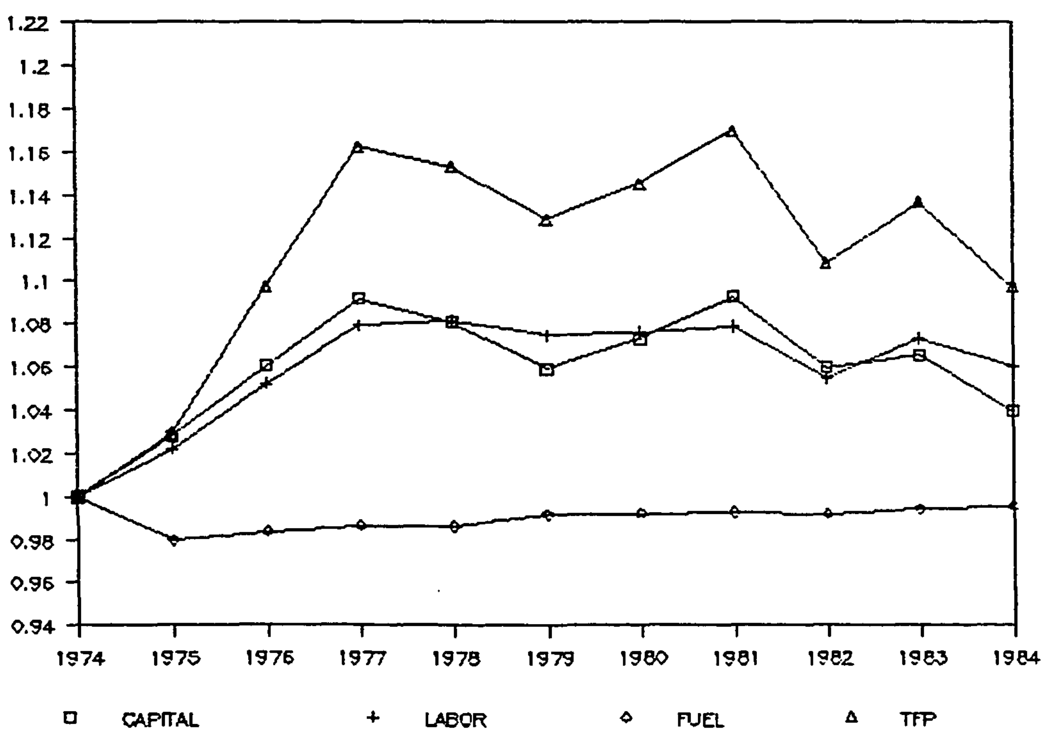

Figure 14. Graphic presentation of Table XIV.

TABLE XV

PRODUCTIVITY INDEX COMPARISON OVER TIME
SOUTH CENTRAL
(BILATERAL INDEX 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0216	1.0178	1.0284	1.0693
1976	1.0262	1.0347	1.0297	1.0933
1977	1.0240	1.0484	1.0268	1.1024
1978	1.0283	1.0540	1.0229	1.1086
1979	1.0076	1.0434	1.0204	1.0727
1980	1.0105	1.0477	1.0262	1.0865
1981	1.0087	1.0425	1.0233	1.0760
1982	0.9732	1.0267	1.0181	1.0173
1983	0.9303	1.0220	1.0178	0.9677
1984	0.9152	1.0223	1.0184	0.9528

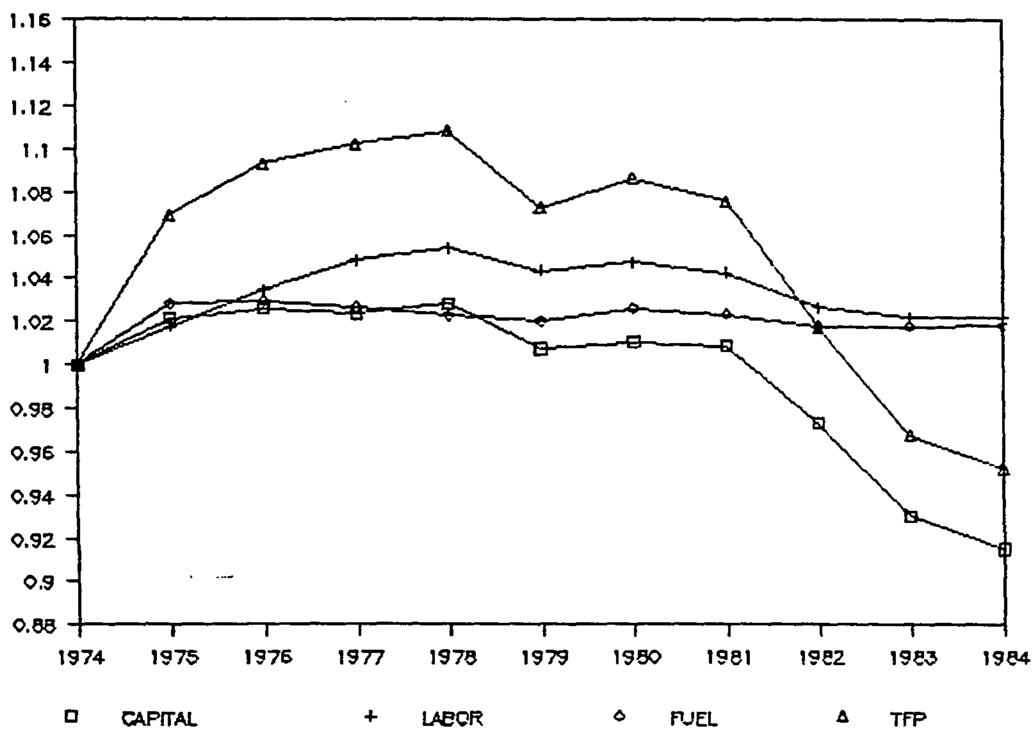

Figure 15. Graphic presentation of Table XV.

TABLE XVI

PRODUCTIVITY INDEX COMPARISON COMPARISON OVER TIME
SOUTHEASTERN
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0008	1.0051	0.9727	0.9784
1976	1.0172	1.0117	1.0005	1.0296
1977	1.0270	1.0039	0.9967	1.0277
1978	1.0302	0.9897	0.9941	1.0136
1979	1.0371	0.9850	1.0041	1.0257
1980	1.0627	0.9911	1.0039	1.0574
1981	1.0736	0.9838	1.0028	1.0590
1982	1.0608	0.9709	1.0041	1.0341
1983	1.0769	0.9740	1.0027	1.0516
1984	1.0917	0.9835	1.0054	1.0795

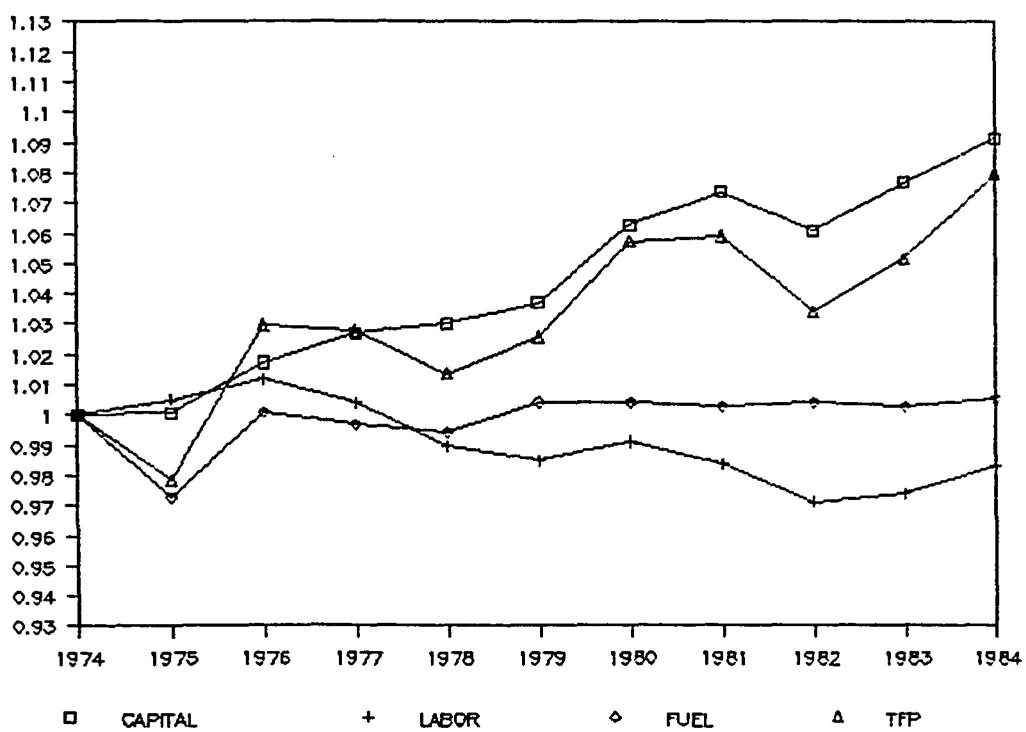

Figure 16. Graphic presentation of Table XVI.

TABLE XVII

PRODUCTIVITY INDEX COMPARISON OVER TIME
WESTERN
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0108	1.0073	0.9859	1.0039
1976	0.9841	1.0085	0.9845	0.9771
1977	1.0119	1.0324	0.9912	1.0354
1978	0.9935	1.0221	0.9854	1.0007
1979	1.0103	1.0374	0.9905	1.0382
1980	0.9866	1.0176	0.9791	0.9829
1981	0.9676	1.0042	0.9839	0.9560
1982	0.9380	0.9872	0.9629	0.8917
1983	0.9190	0.9756	0.9635	0.8639
1984	0.9518	0.9841	0.9723	0.9107

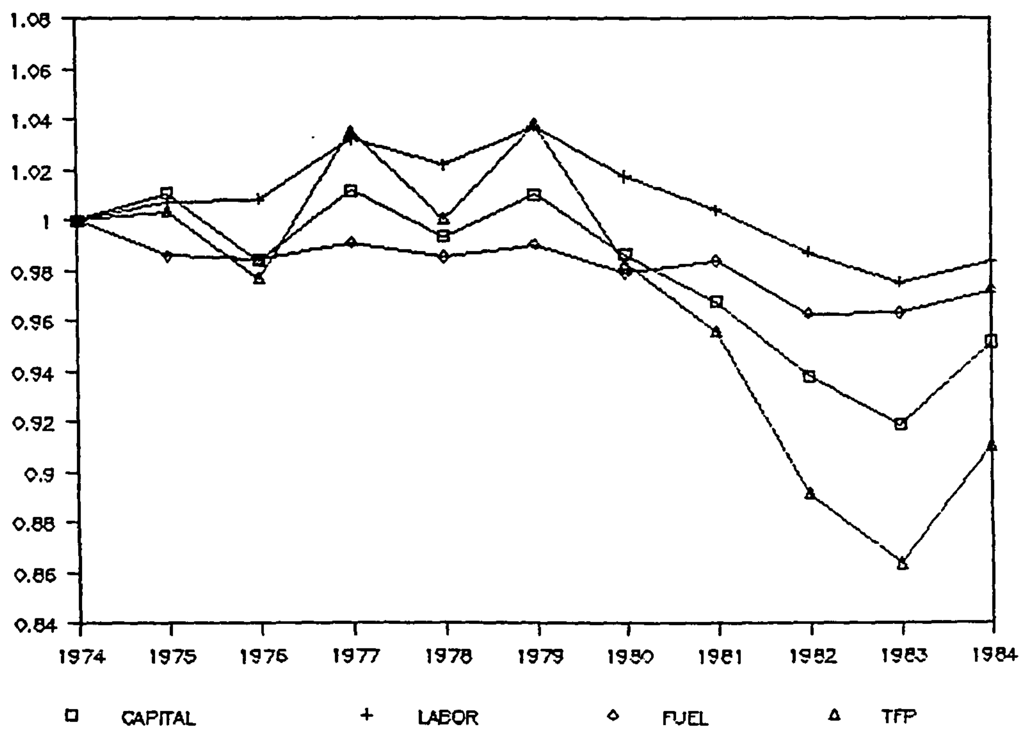

Figure 17. Graphic presentation of Table XVII.

the declining capital productivity was closely related to the decline of the total factor productivity from 1978 to 1984 in this region.

Although there were some fluctuations in the total factor productivity in the southeastern region, the TFP increased by 8 percent for the study period (see Table XVI and Figure 16). The fuel productivity stayed relatively stable between 1974 and 1984, however, the labor productivity gradually decreased by 2 percent for the same period. On the other hand, capital productivity continuously increased by 9 percent from 1974 to 1984. It was the growth in the capital productivity that attributed to the TFP growth in this region.

In the western region, the total factor productivity declined about 9 percent between 1974 and 1984 as shown in Table XVII and Figure 17. It seems that the TFP was again strongly associated with the change in the capital productivity followed by the labor productivity in this region. The fuel productivity remained stable.

In general, the total factor productivity improved from 1974 to 1978 in all but the western region. From 1978 to 1984, the total factor productivity declined for all except the southeastern region. The southeastern region was the only region which had continuous improvement in the total factor productivity from 1974 to 1984, with the strongest improvement in capital productivity. For the recession year of 1982, productivity declined for all the regions.

Capital productivity is the most influential component in determining the direction of total factor productivity. For all regions, labor productivity in general had a pattern similar to the TFP. Fuel productivity stayed relatively stable with a small increase between 1974 and 1984, except for the western region where fuel productivity declined along with other factor productivities.

In summary, for the study period from 1974 to 1984, the Great Lakes, northeastern, north central, and southeastern regions increased in total factor productivity by 6, 7, 10, and 8 percent, respectively. On the other hand, total factor productivity declined by 5 percent in the south central region, and by 9 percent in the western region for the same period.

Multilateral Comparisons of Regional Productivity. This section presents the multilateral comparisons of productivities among six regions. Due to the transitivity of the multilateral index, productivity comparisons are possible for different regions in different years.

During the 1970's, the total factor productivity of the south central region outperformed other regions by 20 to 50 percent as indicated in Table XVIII and its corresponding Figure 18. However these productivity differences were narrowed rapidly in the 1980's by the declining pattern of the TFP in the south central region and the increasing trend of the TFP in most of the other regions. By 1984, the TFP of the southeastern region surpassed that of the south central region by a margin of 0.5 percent. The difference between these two regions was due to the drastic changes in capital productivity: the south central region declined approximately 14 percent from 1974 to 1984, but the southeastern region increased 9 percent for the same period (see Table XX and Figure 20 for details).

For the study period, the northeastern region had the lowest. Although the western region was the third best in its total factor productivity in 1974, it dropped to the lowest in 1983 and was fifth in 1984. The positions of relative differences in total factor productivity in the Great Lakes and north central regions stayed relatively stable between 1974 and 1984.

By looking at Figures 19 and 20 (also corresponding Tables XIX and XX), patterns of regional differences in labor and capital productivity are similar to that of total factor productivity. Finally, the multilateral fuel productivity indexes demonstrate only small differences among regions as shown in Table XXI and Figure 21.

TABLE XVIII

TOTAL FACTOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, GREAT LAKES 1974 = 1.0000)

	GL	NE	NC	W	SC	SE
1974	1.0000	0.8830	0.9015	1.0579	1.2977	1.0989
1975	1.0164	0.9143	0.9198	1.0637	1.3731	1.0754
1976	1.0445	0.9282	0.9775	1.0341	1.3886	1.1318
1977	1.0287	0.9386	1.0313	1.0983	1.3955	1.1287
1978	1.0723	0.9410	1.0230	1.0602	1.4019	1.1120
1979	1.0737	0.9326	1.0034	1.1007	1.3480	1.1245
1980	1.0334	0.9262	1.0177	1.0408	1.3639	1.1595
1981	1.0304	0.9390	1.0384	1.0096	1.3469	1.1602
1982	0.9705	0.9128	0.9874	0.9371	1.2601	1.1328
1983	1.0082	0.9187	1.0115	0.9033	1.1979	1.1526
1984	1.0528	0.9324	0.9790	0.9497	1.1803	1.1841

GL: Great Lakes NE: Northeastern NC: North central
W: Western SC: South Central SE: Southeastern

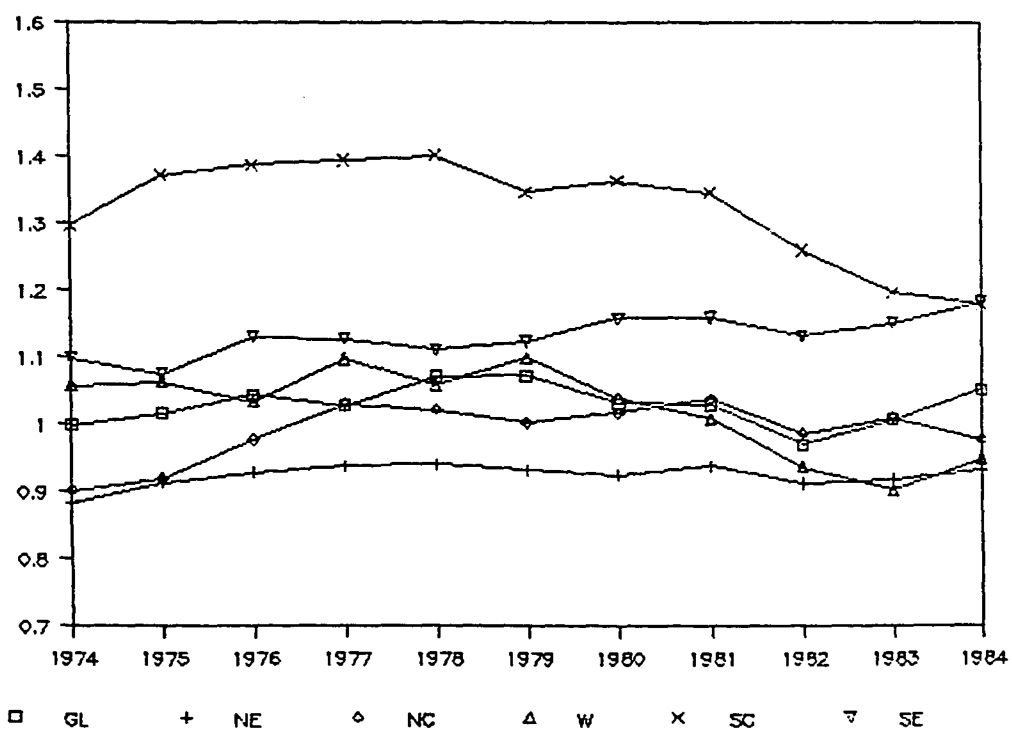

Figure 18. Graphic presentation of Table XVIII.

TABLE XIX

LABOR FACTOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, GREAT LAKES 1974 = 1.0000)

	GL	NE	NC	W	SC	SE
1974	1.0000	0.9460	0.9354	1.0100	1.0809	1.0474
1975	1.0107	0.9538	0.9555	1.0174	1.0985	1.0523
1976	1.0274	0.9591	0.9810	1.0188	1.1143	1.0607
1977	1.0293	0.9678	1.0035	1.0428	1.1296	1.0519
1978	1.0336	0.9656	1.0062	1.0328	1.1357	1.0360
1979	1.0322	0.9584	1.0003	1.0477	1.1212	1.0307
1980	1.0172	0.9537	1.0018	1.0273	1.1245	1.0376
1981	1.0146	0.9519	1.0036	1.0134	1.1152	1.0297
1982	0.9959	0.9417	0.9833	0.9950	1.0934	1.0159
1983	1.0111	0.9492	0.9997	0.9826	1.0877	1.0191
1984	1.0199	0.9593	0.9883	0.9899	1.0884	1.0289

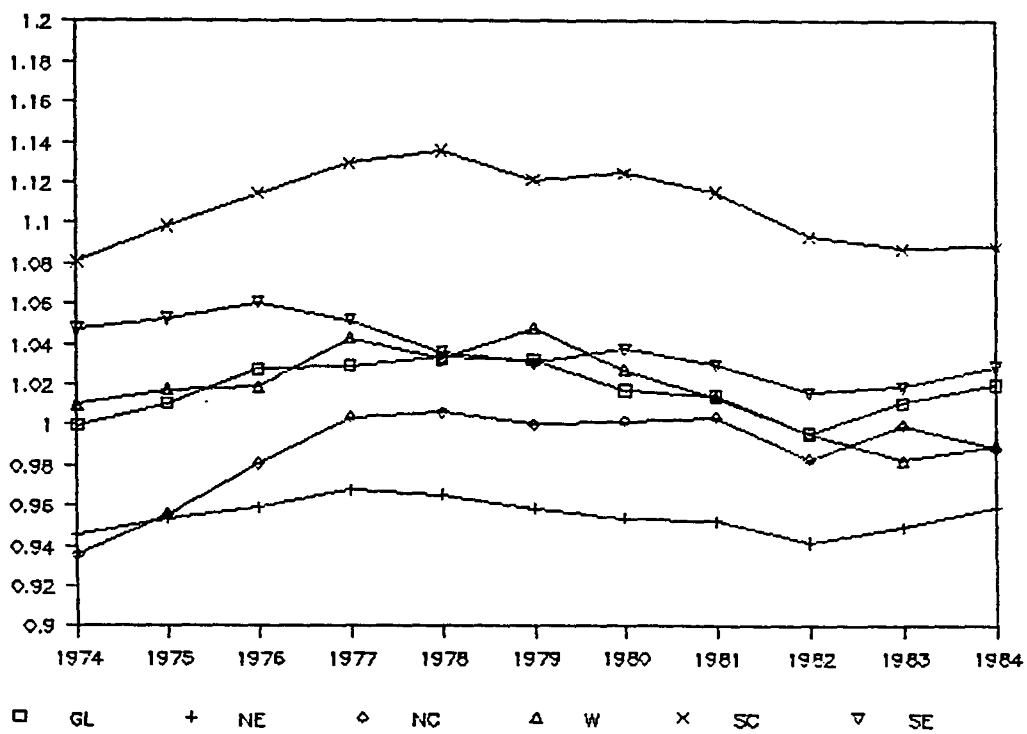

Figure 19. Graphic presentation of Table XIX.

TABLE XX

CAPITAL FACTOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX GREAT LAKES 1974 = 1.0000)

	GL	NE	NC	W	SC	SE
1974	1.0000	0.9246	0.9450	1.0089	1.1938	1.0153
1975	1.0066	0.9346	0.9700	1.0205	1.2089	1.0157
1976	1.0153	0.9421	0.9998	0.9922	1.2021	1.0318
1977	1.0027	0.9479	1.0283	1.0223	1.1940	1.0413
1978	1.0189	0.9530	1.0182	1.0023	1.1966	1.0445
1979	1.0198	0.9513	0.9985	1.0204	1.1679	1.0512
1980	1.0018	0.9581	1.0107	0.9949	1.1724	1.0766
1981	1.0000	0.9656	1.0284	0.9737	1.1702	1.0867
1982	0.9586	0.9483	0.9987	0.9397	1.1213	1.0749
1983	0.9772	0.9453	1.0036	0.9156	1.0725	1.0924
1984	1.0064	0.9483	0.9806	0.9453	1.0558	1.1088

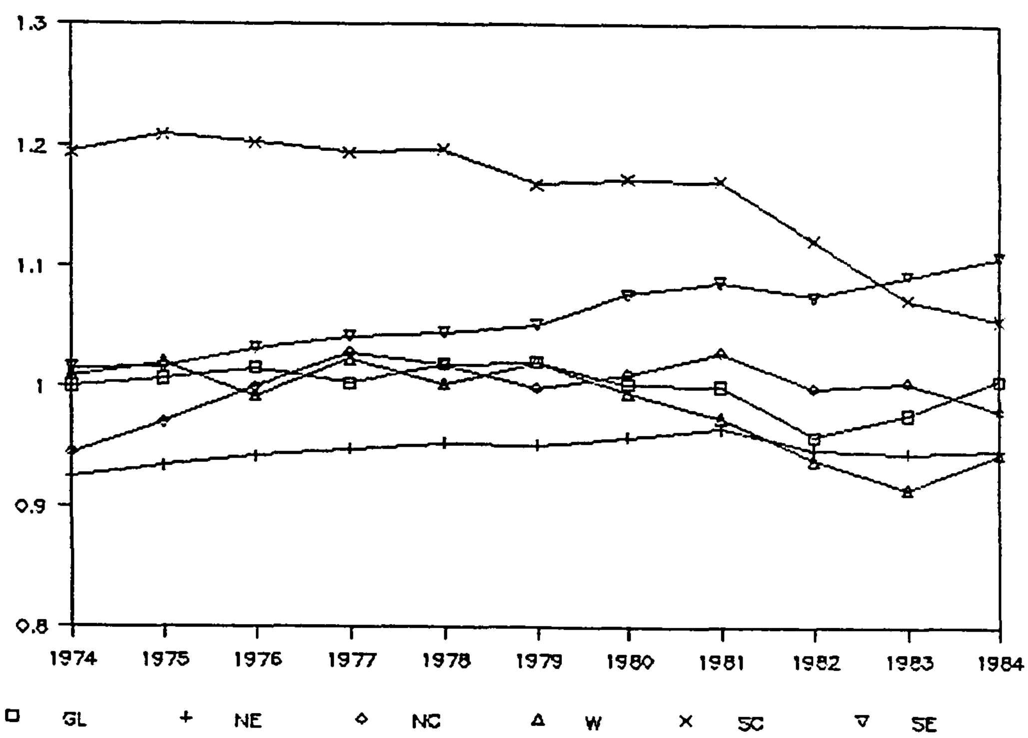

Figure 20. Graphic presentation of Table XX.

TABLE XXI

FUEL FACTOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, GREAT LAKES 1974 = 1.0000)

	GL	NE	NC	W	SC	SE
1974	1.0000	1.0095	1.0199	1.0382	1.0057	1.0334
1975	0.9991	1.0257	0.9924	1.0245	1.0340	1.0061
1976	1.0013	1.0272	0.9967	1.0230	1.0366	1.0341
1977	0.9967	1.0231	0.9994	1.0302	1.0347	1.0305
1978	1.0182	1.0227	0.9985	1.0243	1.0316	1.0277
1979	1.0200	1.0229	1.0046	1.0296	1.0294	1.0379
1980	1.0141	1.0137	1.0051	1.0184	1.0346	1.0380
1981	1.0155	1.0215	1.0061	1.0231	1.0321	1.0368
1982	1.0166	1.0222	1.0056	1.0022	1.0277	1.0373
1983	1.0204	1.0239	1.0081	1.0041	1.0269	1.0354
1984	1.0257	1.0250	1.0101	1.0149	1.0272	1.0379

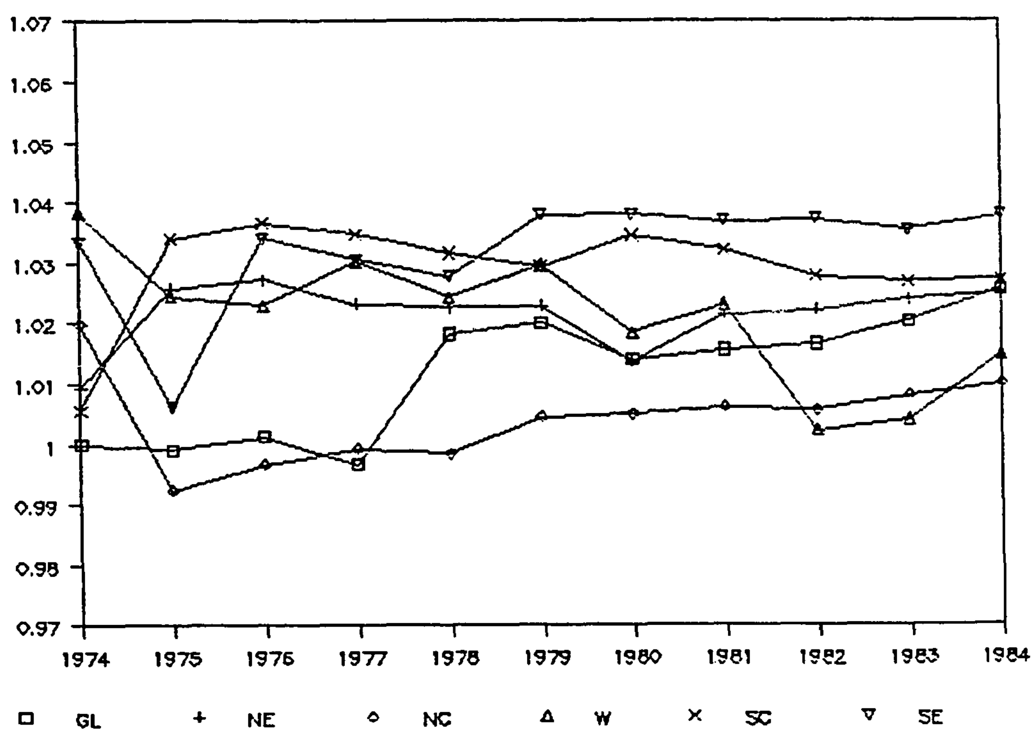

Figure 21. Graphic presentation of Table XXI.

<u>Types of Generation</u>

This sub-section describes the results based on the total and partial (labor, capital, and fuel) factor productivities of each type of generation using the bilateral and multilateral superlative index models.

Five sources of electric generation are considered: solid, gas, nuclear, liquid, and hydro. For the data used in this study, each source contributes 56.9, 15.1, 12.5, 12.0, and 3.2 percent of total electricity generation between 1974 and 1984, respectively. It is obvious that coal is a major source of generation, while hydro provides a small amount of electricity. For the study period of 11 years, generation by solid and nuclear sources increased significantly in generation shares. On the other hand, generation by liquid and gas drastically dropped for the same period. Generation by hydro was relatively constant for the study period.

Many electric companies rely on more than a single source. In order to categorize them into generation types, the dominant source of generation (i.e., that contributes more than 70 percent of total generation) is represented as a generation type for a company. If the dominant source of generation is less than 70 percent, the type of generation is labeled as either "mixed with nuclear" or "mixed without nuclear" to separate the effect of nuclear power. There are only two companies which are categorized as hydro generation. Therefore, the hydro generation is not included in this analysis.

Five types of generation are reported in this section: gas, liquid, mixed without nuclear, mixed with nuclear, and solid. Based on the above classification criteria, each type of generation represents 13, 2, 11, 31, and 43 percent of total electricity generation, respectively. The database constructed from Appendix A according to the above definition of generation types is given in Appendix F.

Using the bilateral index model (see equations (32) and (33)), productivity comparisons over time for each type of generation are shown in Tables XXII through XXVI; the base year is 1974. Figures 22 through 26 plot the corresponding productivity indexes over time from 1974 to 1984. Recall that direct comparison across different types of generation for a given year is not an appropriate use of the bilateral index. The multilateral index should be used instead.

Multilateral comparisons of productivity differences among the five types of generation are calculated using equations (42) and (43) of Chapter II. The results are presented in Tables XXVII through XXX and graphed in Figures 27 through 30; mixed generation without nuclear in 1974 is chosen as the benchmark for comparison.

<u>Bilateral Productivity Comparisons Based on Types of Generation</u>. Table XXII and Figure 22 show that the total factor productivity for companies with gas generation

steadily increased by 4 percent between 1974 and 1978, with increasing productivity in labor during the same period. Then the TFP rapidly declined by about 16 percent from 1978 to 1984, mainly due to a 12 percent drop in capital productivity. Fuel productivity was fairly constant for the study period.

Table XXIII and the corresponding Figure 23 show that for the electric utilities using liquid source, the total factor productivity significantly increased 14 percent from 1974 to 1984. It is interesting to note that all the factors - labor, capital, and fuel - contribute to the increase of the total factor productivity. Between 1974 and 1984, each factor productivity increased by 4, 6, and 3 percent respectively.

For mixed generation without nuclear, total factor productivity jumped 26 percent for the four-year period from 1974 to 1978. However, it declined sharply in the 1980's by about 15 percent with the declining capital productivity. Labor productivity and fuel productivity were relatively stable for 1980s (see Table XXIV and Figure 24 for details).

Table XXV and Figure 25 show the productivity performance of electric utilities of mixed generation with nuclear power. From 1974 to 1978, there was a significant 11 percent increase in the TFP, but it declined drastically after the nuclear accident at Three Mile Island in 1979. The same trend of productivity decline in labor is also noted. However, both capital and fuel productivities were stable for the study period.

The total factor productivity for the companies with solid generation rapidly increased by 11 percent in three years as shown in Table XXVI and Figure 26. This increase was due to increasing productivity in labor, capital, and fuel. Between 1976 and 1982, however, the TFP decreased by 5 percent, with declining labor and capital productivity during the same period. For 1983 and 1984, some improvement was shown in the TFP as well as labor and capital productivity. Fuel productivity remained the same throughout the study period.

In general, the total factor productivity improved in the mid 1970's for all the types of generation and then declined between 1978 and 1984 except for companies using liquid as a main generating source. The latter was the only one showing productivity improvement in the study period. For each type of generation, capital productivity was the most influential factor for the direction of the total factor productivity except for the mixed generation with nuclear. Labor productivity in general had a similar pattern to that of the TFP. Finally, fuel productivity stayed relatively stable between 1974 and 1984.

In summary for the study period from 1974 to 1984, the total factor productivity for electric generation by liquid,

TABLE XXII

PRODUCTIVITY INDEX COMPARISON OVER TIME
GAS
(BILATERAL INDEX, 1974 = 1.000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	0.9997	1.0071	1.0004	1.0072
1976	1.0064	1.0235	1.0015	1.0316
1977	1.0013	1.0343	0.9987	1.0344
1978	1.0030	1.0381	0.9955	1.0366
1979	0.9793	1.0256	0.9913	0.9956
1980	0.9781	1.0275	0.9912	0.9963
1981	0.9744	1.0207	0.9930	0.9877
1982	0.9404	1.0042	0.9897	0.9346
1983	0.8990	0.9956	0.9887	0.8849
1984	0.8837	0.9953	0.9895	0.8703

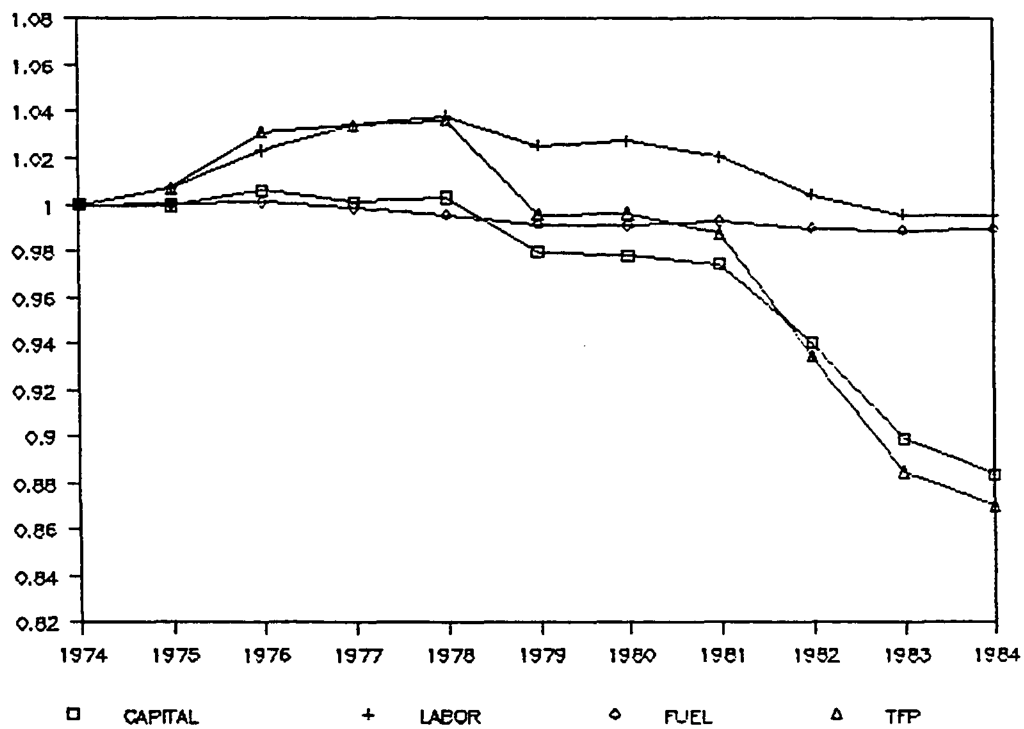

Figure 22. Graphic presentation of Table XXII.

TABLE XXIII

PRODUCTIVITY INDEX COMPARISON OVER TIME
LIQUID
(BILATERAL INDEX, 1974 = 1.000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0021	1.0032	1.0129	1.0182
1976	1.0224	1.0239	1.0228	1.0707
1977	1.0296	1.0331	1.0246	1.0899
1978	1.0352	1.0394	1.0248	1.1027
1979	1.0434	1.0435	1.0224	1.1132
1980	1.0476	1.0429	1.0180	1.1122
1981	1.0554	1.0452	1.0274	1.1335
1982	1.0382	1.0391	1.0325	1.1139
1983	1.0505	1.0653	1.0375	1.1611
1984	1.0416	1.0639	1.0342	1.1461

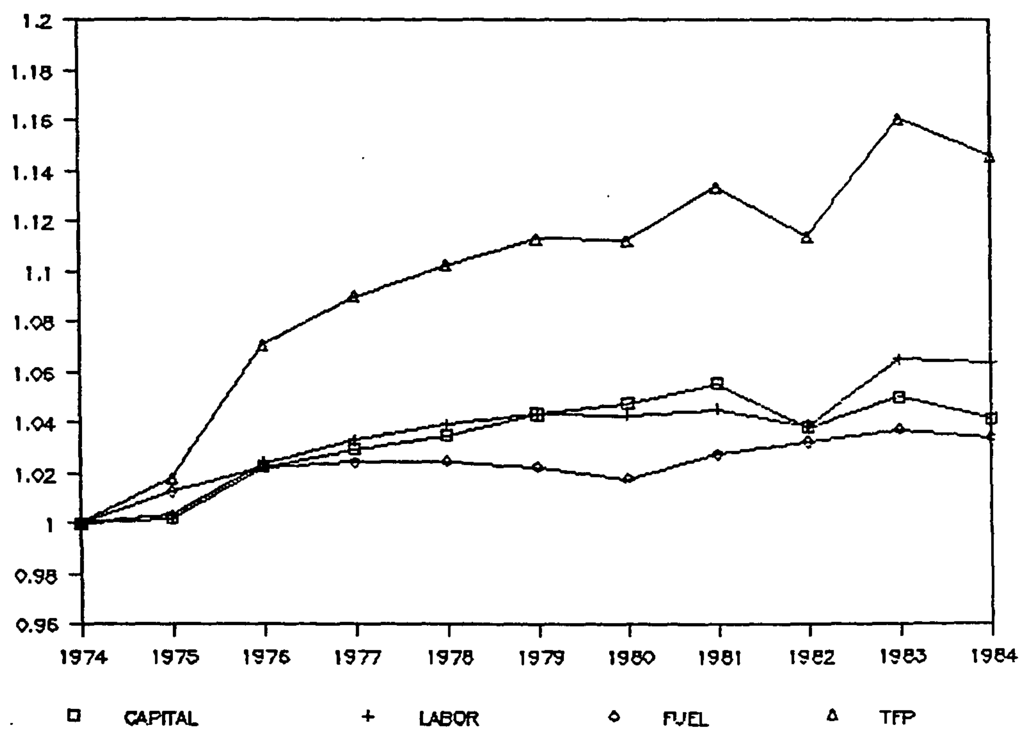

Figure 23. Graphic presentation of Table XXIII.

TABLE XXIV

PRODUCTIVITY INDEX COMPARISON OVER TIME
MIXED - NON NUCLEAR
(BILATERAL INDEX, 1974 = 1.000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0193	1.0164	1.0115	1.0479
1976	1.0037	1.0222	1.0134	1.0397
1977	1.0263	1.0493	1.0224	1.1009
1978	1.0669	1.0800	1.0945	1.2611
1979	1.0475	1.0717	1.0677	1.1985
1980	1.0556	1.0746	1.1145	1.2643
1981	1.0585	1.0747	1.1118	1.2648
1982	0.9970	1.0472	1.0982	1.1465
1983	0.9706	1.0472	1.1018	1.1199
1984	0.9713	1.0576	1.1036	1.1338

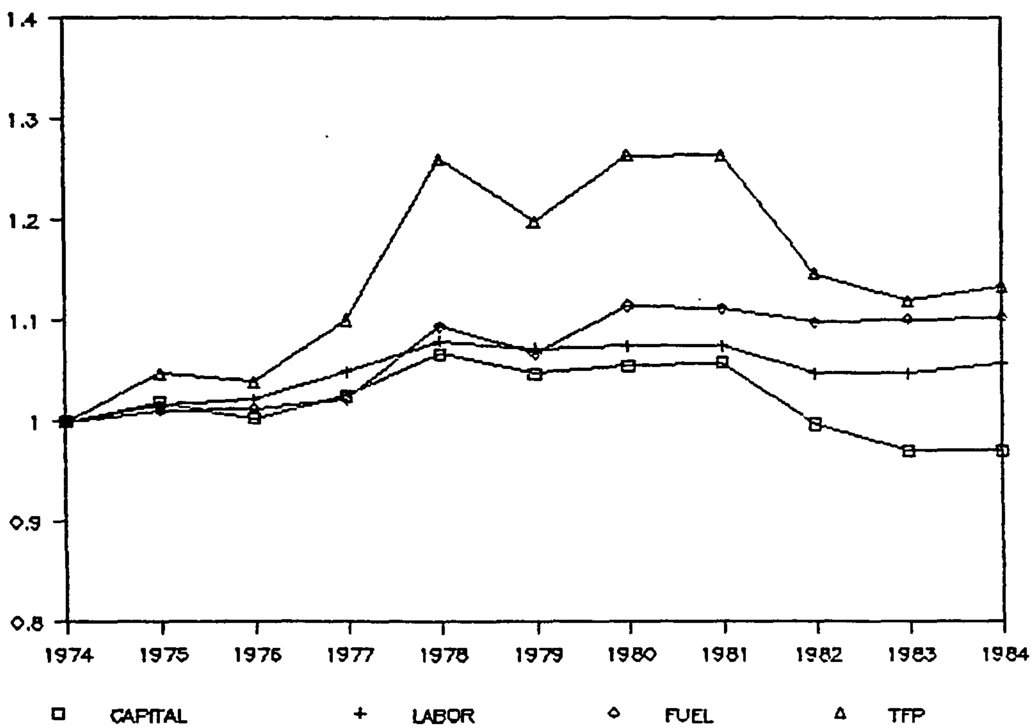

Figure 24. Graphic presentation of Table XXIV.

TABLE XXV

PRODUCTIVITY INDEX COMPARISON OVER TIME
MIXED - NUCLEAR
(BILATERAL INDEX, 1974 = 1.000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0197	1.0134	1.0121	1.0459
1976	1.0404	1.0303	1.0129	1.0858
1977	1.0507	1.0357	1.0090	1.0980
1978	1.0649	1.0388	1.0079	1.1149
1979	1.0452	1.0192	1.0082	1.0740
1980	1.0498	1.0155	1.0016	1.0678
1981	1.0537	1.0068	1.0015	1.0625
1982	1.0397	0.9929	1.0050	1.0375
1983	1.0408	0.9969	1.0054	1.0433
1984	1.0427	1.0015	1.0085	1.0531

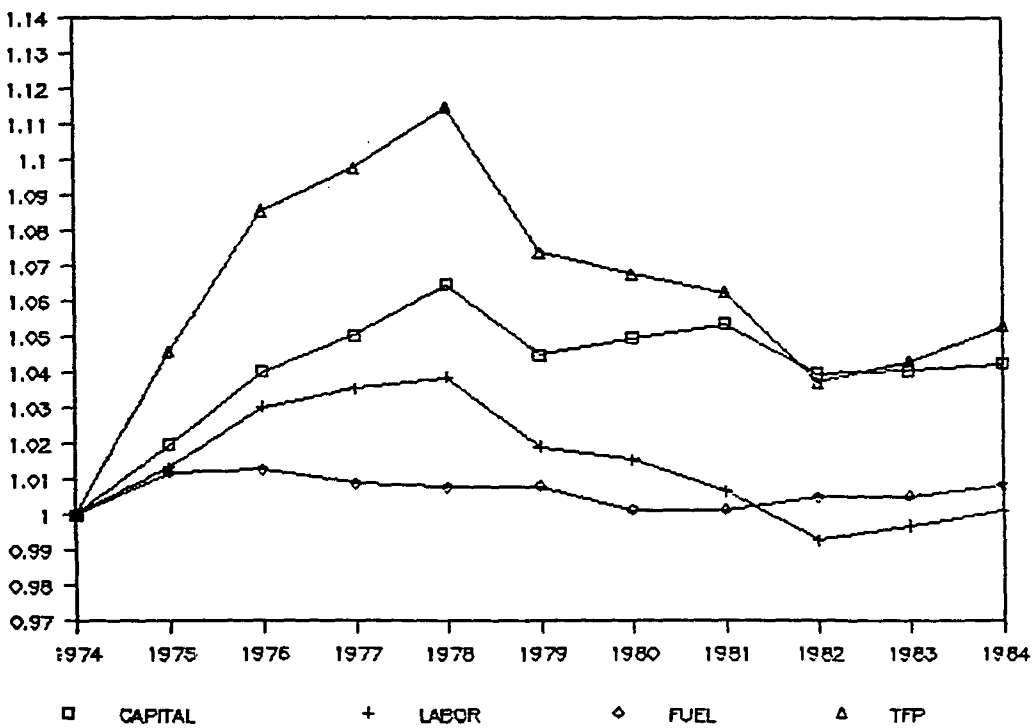

Figure 25. Graphic presentation of Table XXV.

TABLE XXVI

PRODUCTIVITY INDEX COMPARISON OVER TIME
SOLID
(BILATERAL INDEX, 1974 = 1.000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0332	1.0242	1.0222	1.0817
1976	1.0368	1.0353	1.0326	1.1084
1977	1.0348	1.0363	1.0298	1.1044
1978	1.0231	1.0203	1.0277	1.0729
1979	1.0386	1.0252	1.0306	1.0973
1980	1.0408	1.0182	1.0264	1.0878
1981	1.0439	1.0154	1.0315	1.0933
1982	1.0165	1.0041	1.0294	1.0508
1983	1.0365	1.0179	1.0198	1.0759
1984	1.0480	1.0293	1.0353	1.1168

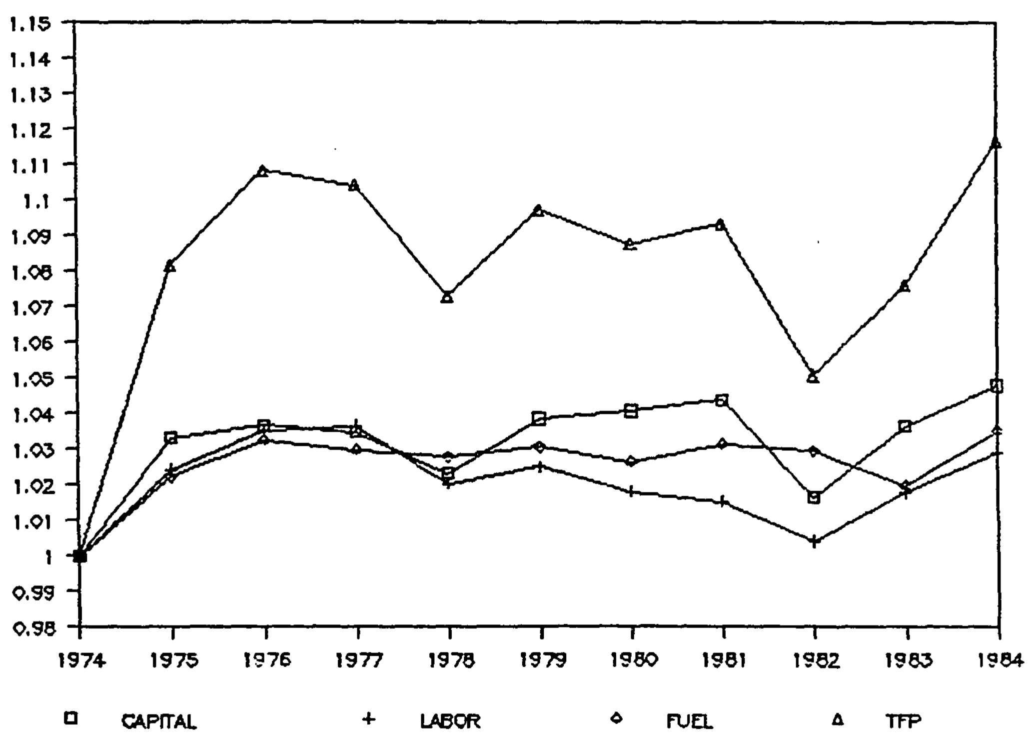

Figure 26. Graphic presentation of Table XXVI.

mixed without nuclear, mixed with nuclear, and solid increased by 15, 13, 5, 11 percent, respectively. Gas is only the type of generation which had a decline (13 percent) in the total factor productivity from 1974 to 1984.

Multilateral Productivity Comparison Based on Types of Generation. This section presents the multilateral comparisons for companies with different types of electric generation. Recall that the transitivity property of the multilateral index makes it possible to compare productivity for different types of generation in different years.

Although the total factor productivity of gas generation sharply declined between 1974 and 1984 as discussed in the previous section, it outperformed other types of generations for the study period. This is shown in Table XXVII and the corresponding figure 27. However, the productivity differences between gas generation and others was narrowed rapidly from 50 percent in 1974 to merely 4 percent in 1984 due to the relative declining capital productivity of gas generation.

As anticipated, generation by liquid was a less productive source for electric generation, especially during the 1970's. Toward the 1980's, the mixed type with nuclear generation became less productive along with the declining trend in labor productivity (see Table 28 and Figure 28). Figure 27 shows that the position of relative difference in the total factor productivity of mixed generation (without nuclear) fluctuated for the study period between 1974 and 1984. During the mid 1970's, this mixed generation was one of the least productive means of generation and then became the third best between 1978 and 1981. However, its position dropped again at the end of the study period.

Among these five types of generation, differences in capital productivity and labor productivity have similar patterns to that of total factor productivity. Finally as shown in Table XXX and Figure 30, the multilateral indexes of fuel productivity show no apparent differences among all the types of generation except for the non-nuclear mixed type during the early sample period of the 1970's.

Output Levels

This sub-section investigates whether or not there are any differences in productivity performance based on different output levels (or sizes of companies). The data in Appendix A were divided into the four output levels, with approximately the same number of observations for each output level.

The range of output for level 1 is between 102 and 4510 million KWH per year; for level 2 it is between 4537 and 9433. For level 3, the range is between 9613 and 17788, and it is between 17915 and 59681 million KWH for level 4. Each level accounts for 4, 12, 26, and 58 percent of total electricity generation in the industry, respectively. The

TABLE XXVII

TOTAL FACTOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, MIXED WITHOUT NUCLEAR 1974 = 1.0000)

	MIX	GAS	LIQUID	MIX-NUC	SOLID
1974	1.0000	1.7169	1.0090	1.0744	1.2271
1975	1.0489	1.7067	1.0315	1.1187	1.3251
1976	1.0401	1.7198	1.0832	1.1566	1.3582
1977	1.1020	1.7156	1.1044	1.1686	1.3529
1978	1.2622	1.7142	1.1158	1.1846	1.3150
1979	1.1991	1.6377	1.1348	1.1460	1.3445
1980	1.2632	1.6358	1.1453	1.1413	1.3327
1981	1.2636	1.6164	1.1766	1.1357	1.3400
1982	1.1396	1.5178	1.1419	1.1072	1.2906
1983	1.1078	1.4407	1.1916	1.1114	1.3179
1984	1.1279	1.4196	1.1741	1.1199	1.3690

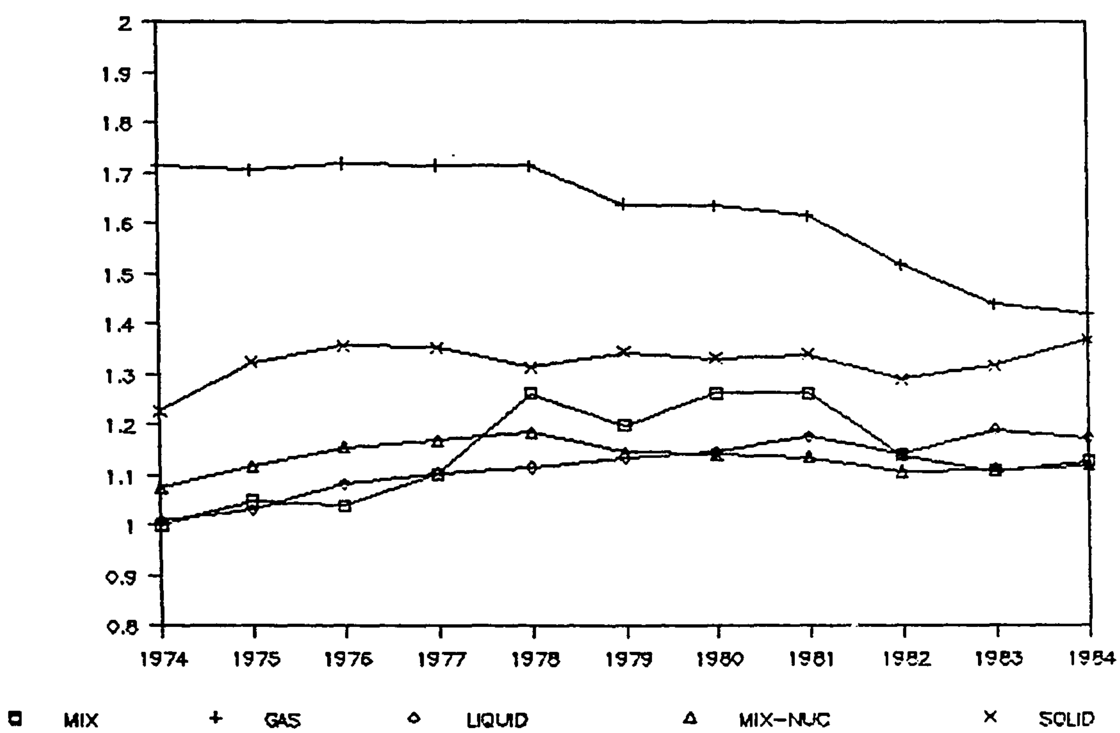

Figure 27. Graphic presentation of Table XXVII.

TABLE XXVIII

LABOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, MIXED WITHOUT NUCLEAR 1974 = 1.0000)

	MIX	GAS	LIQUID	MIX-NUC	SOLID
1974	1.0000	1.1824	0.9454	1.0118	1.0764
1975	1.0186	1.1854	0.9529	1.0237	1.1011
1976	1.0249	1.1995	0.9706	1.0384	1.1128
1977	1.0534	1.2117	0.9790	1.0435	1.1138
1978	1.0847	1.2152	0.9826	1.0460	1.0970
1979	1.0758	1.1976	0.9917	1.0286	1.1022
1980	1.0790	1.1970	0.9972	1.0262	1.0949
1981	1.0788	1.1848	1.0053	1.0181	1.0919
1982	1.0492	1.1619	0.9943	1.0030	1.0804
1983	1.0488	1.1512	1.0212	1.0064	1.0947
1984	1.0580	1.1511	1.0188	1.0098	1.1066

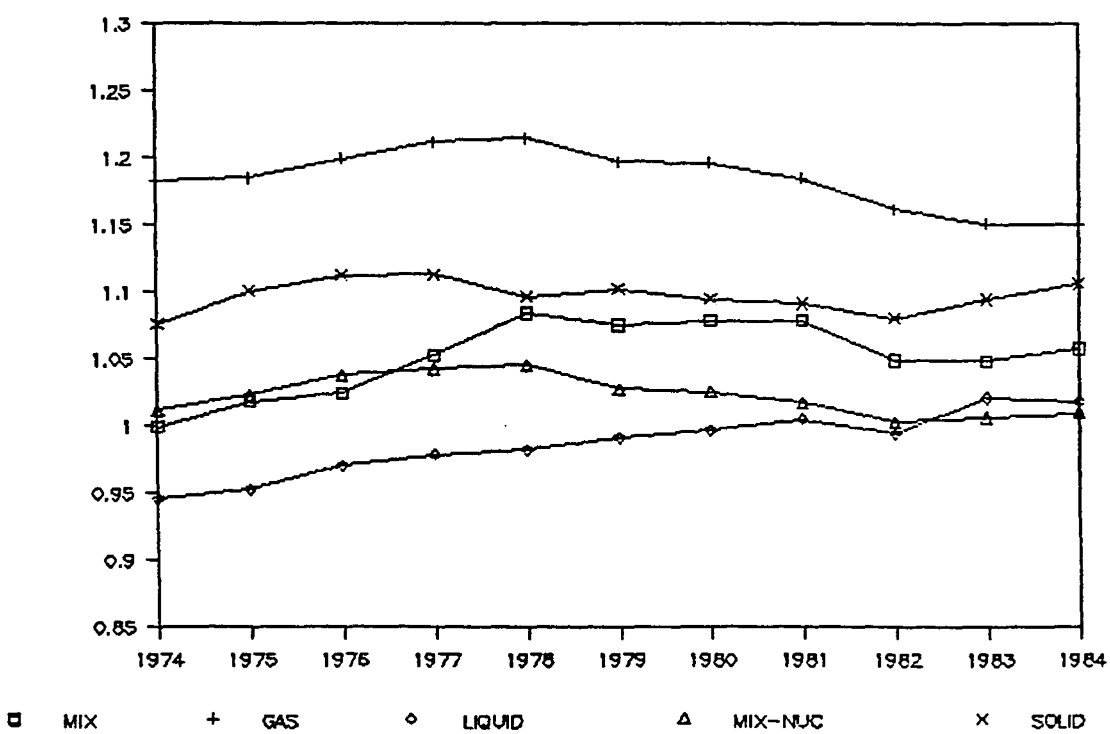

Figure 28. Graphic presentation of Table XXVIII.

TABLE XXIX

CAPITAL PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, MIXED WITHOUT NUCLEAR 1974 = 1.0000)

	MIX	GAS	LIQUID	MIX-NUC	SOLID
1974	1.0000	1.3098	0.9948	0.9832	1.0679
1975	1.0219	1.2965	0.9963	0.9985	1.1013
1976	1.0042	1.2875	1.0171	1.0168	1.1051
1977	1.0289	1.2738	1.0262	1.0269	1.1027
1978	1.0708	1.2724	1.0328	1.0398	1.0903
1979	1.0508	1.2382	1.0429	1.0225	1.1063
1980	1.0596	1.2373	1.0503	1.0281	1.1086
1981	1.0625	1.2333	1.0613	1.0313	1.1122
1982	0.9976	1.1844	1.0377	1.0162	1.0852
1983	0.9669	1.1364	1.0503	1.0160	1.1053
1984	0.9741	1.1193	1.0404	1.0166	1.1168

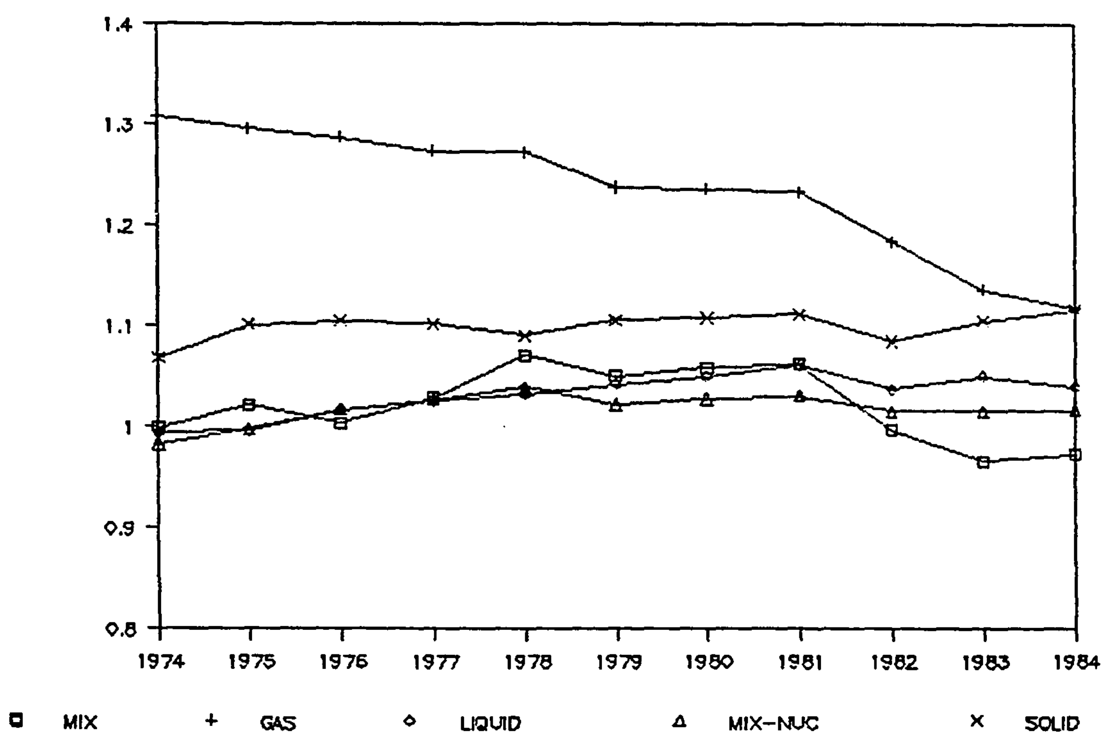

Figure 29. Graphic presentation of Table XXIX.

TABLE XXX

FUEL PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, MIXED WITHOUT NUCLEAR 1974 = 1.0000)

	MIX	GAS	LIQUID	MIX-NUC	SOLID
1974	1.0000	1.1086	1.0728	1.0801	1.0675
1975	1.0076	1.1105	1.0865	1.0944	1.0928
1976	1.0106	1.1136	1.0971	1.0954	1.1045
1977	1.0168	1.1115	1.0993	1.0906	1.1015
1978	1.0867	1.1086	1.0995	1.0892	1.0994
1979	1.0606	1.1044	1.0973	1.0896	1.1026
1980	1.1049	1.1045	1.0936	1.0817	1.0979
1981	1.1024	1.1062	1.1028	1.0817	1.1034
1982	1.0888	1.1030	1.1068	1.0863	1.1006
1983	1.0924	1.1013	1.1109	1.0869	1.0892
1984	1.0945	1.1018	1.1076	1.0909	1.1077

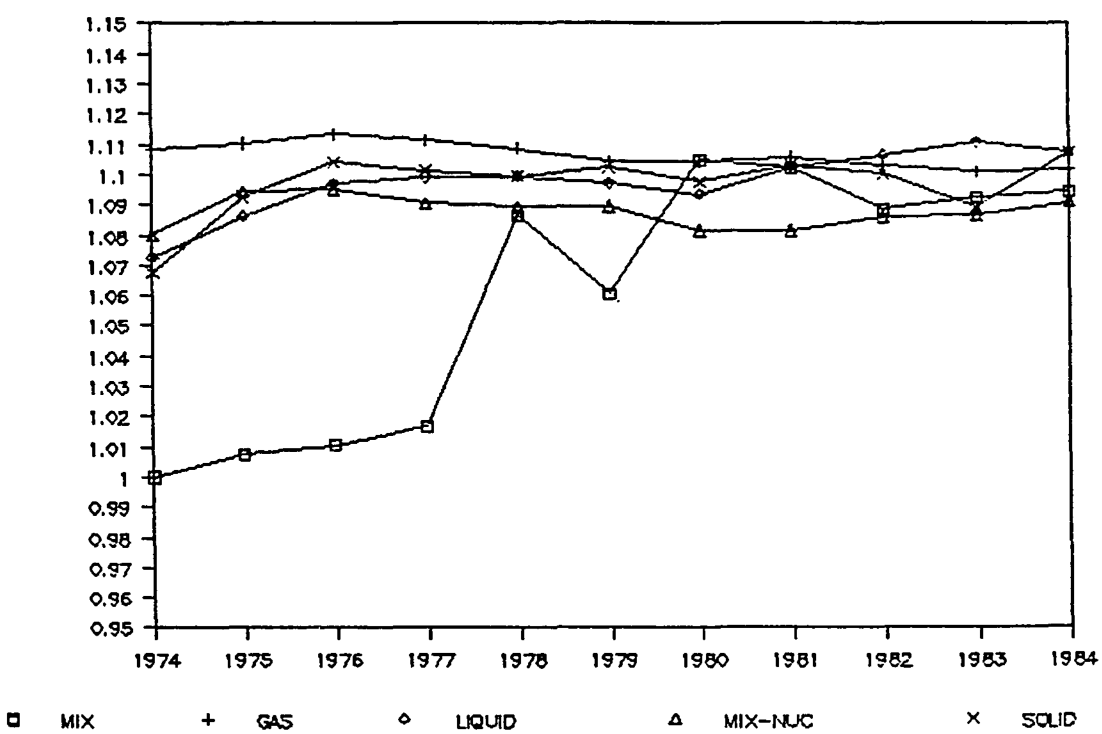

Figure 30. Graphic presentation of Table XXX.

database presented in Appendix G is constructed from Appendix A based on the above classification of different output levels.

Using the bilateral index (see equations (32) and (33)), productivity comparisons over time for each output level are shown in Tables XXXI through XXXIV; 1974 is the base year for comparisons. Figures 31 through 34 graphically show total and partial factor productivities over time for each level of output from 1974 to 1984. As explained in Chapter II, direct comparisons across different levels of output for a given year is not appropriate for the bilateral index. The multilateral index should be used in this case, as discussed below.

Multilateral comparisons of productivity differences among the four output levels are calculated using equations (42) and (43) of Chapter II. The results are presented in Tables XXXV through XXXVIII, where the output level 1 in 1974 is set as the benchmark for comparison. Figures 35 through 38 graphically plot the corresponding multilateral productivity indexes between 1974 and 1984.

Bilateral Productivity Comparisons Based on Different Output Levels. As shown in Table XXXI and Figure 31, the total factor productivity for companies in output level 1 (102-4510 million KWH) dropped gradually (by 4 percent) from 1974 to 1978 because of declining capital productivity. This was followed by a significant total factor productivity improvement of 9 percent from 1978 to 1981 due to increasing productivity in all the factors. However, the total factor productivity decreased by about 3 percent between 1981 and 1984 due to declining capital productivity. For the low output level group, capital and labor productivities seemed to be equally influential in terms of the direction of the TFP, while fuel productivity was relatively stable for the study period.

Table XXXII and Figure 32 showed that the total factor productivity for the output level 2 (4537-9433 million KWH) increased about 6 percent between 1974 and 1977, with increasing labor productivity for the same period. TFP was stable for the rest of the study period except during the recession year of 1982 where it declined by 4 percent from 1981. Labor productivity has the most influence on TFP for this output level. The productivities of capital and fuel were relatively stable throughout the study period.

Table XXXIII and Figure 33 show that between 1974 and 1978 the total factor productivity for output level 3 (9631-17788 million KWH) increased by 14 percent, with increasing productivity for all the factors. The TFP was then stable for the following years until 1981 and declined by 3 percent between 1981 and 1984. It is interesting to note that all the factors influenced the direction of the TFP for this output level.

TABLE XXXI

PRODUCTIVITY INDEX COMPARISON OVER TIME
OUTPUT LEVEL 1
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	0.9991	0.9976	1.0050	1.0016
1976	0.9916	0.9974	0.9915	0.9806
1977	0.9924	1.0059	0.9914	0.9896
1978	0.9719	0.9998	0.9882	0.9603
1979	0.9978	1.0138	1.0150	1.0268
1980	1.0140	1.0217	1.0175	1.0542
1981	1.0259	1.0271	1.0216	1.0764
1982	0.9965	1.0093	1.0142	1.0201
1983	0.9843	1.0288	1.0168	1.0296
1984	0.9923	1.0380	1.0181	1.0487

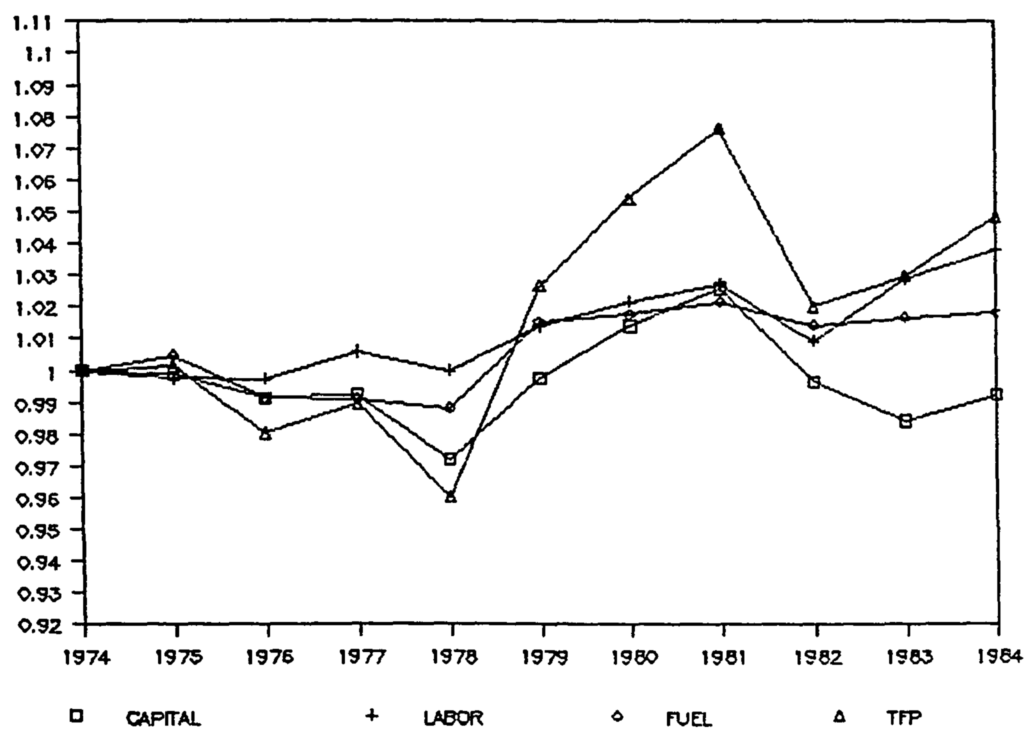

Figure 31. Graphic presentation of Table XXXI.

TABLE XXXII

PRODUCTIVITY INDEX COMPARISON OVER TIME
OUTPUT LEVEL 2
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0120	1.0177	1.0107	1.0410
1976	1.0098	1.0296	1.0098	1.0499
1977	1.0103	1.0395	1.0053	1.0558
1978	1.0100	1.0388	1.0059	1.0553
1979	0.9993	1.0311	1.0076	1.0381
1980	1.0143	1.0305	1.0076	1.0532
1981	1.0181	1.0223	1.0066	1.0477
1982	0.9861	1.0153	1.0034	1.0045
1983	0.9928	1.0316	1.0062	1.0306
1984	0.9948	1.0369	1.0121	1.0439

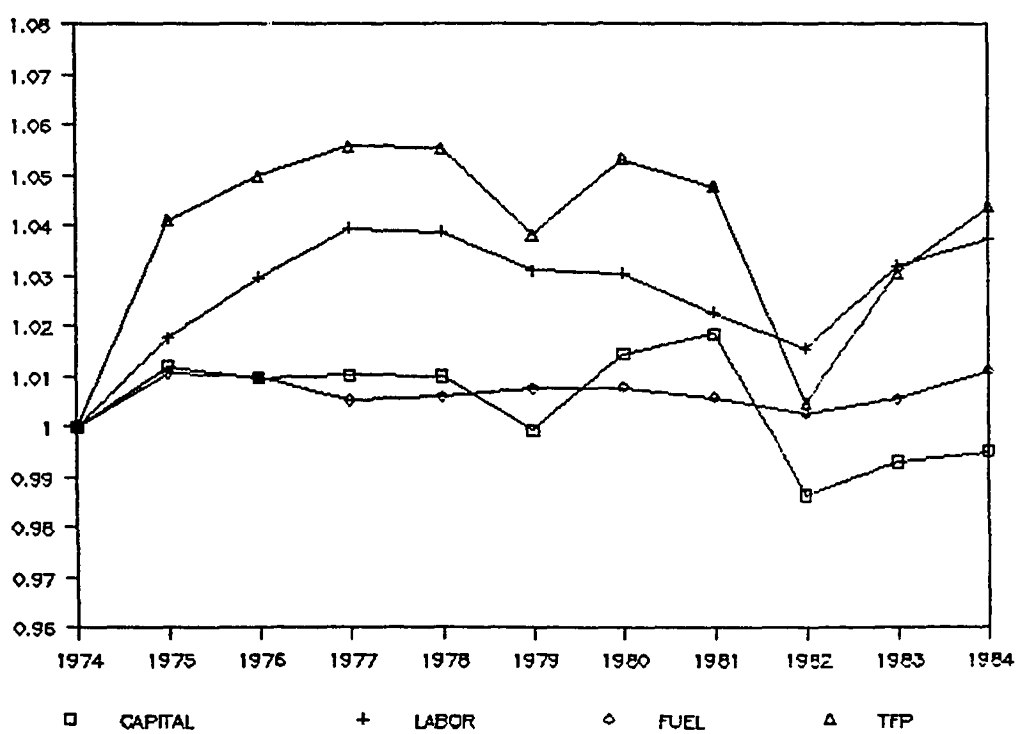

Figure 32. Graphic presentation of Table XXXII.

TABLE XXXIII

PRODUCTIVITY INDEX COMPARISONS OVER TIME
OUTPUT LEVEL 3
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0189	1.0149	1.0162	1.0508
1976	1.0305	1.0307	1.0189	1.0822
1977	1.0200	1.0317	1.0147	1.0678
1978	1.0499	1.0478	1.0410	1.1452
1979	1.0561	1.0479	1.0412	1.1523
1980	1.0538	1.0418	1.0403	1.1420
1981	1.0554	1.0373	1.0426	1.1413
1982	1.0296	1.0247	1.0403	1.0976
1983	1.0226	1.0274	1.0413	1.0941
1984	1.0224	1.0360	1.0472	1.1092

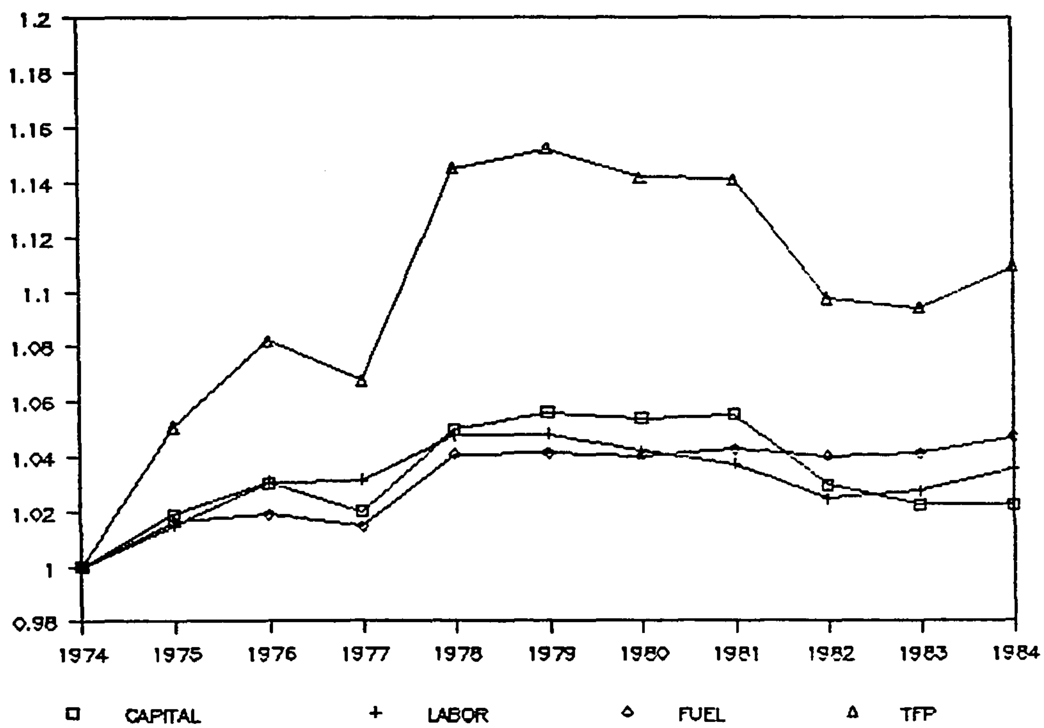

Figure 33. Graphic presentation of Table XXXIII.

TABLE XXXIV

PRODUCTIVITY INDEX COMPARISON OVER TIME
OUTPUT LEVEL 4
(BILATERAL INDEX, 1974 = 1.0000)

	FPK	FPL	FPF	TFP
1974	1.0000	1.0000	1.0000	1.0000
1975	1.0127	1.0097	0.9960	1.0185
1976	1.0425	1.0347	1.0255	1.1062
1977	1.0546	1.0426	1.0235	1.1254
1978	1.0556	1.0344	1.0208	1.1146
1979	1.0512	1.0278	1.0225	1.1047
1980	1.0530	1.0245	1.0195	1.0998
1981	1.0520	1.0176	1.0189	1.0908
1982	1.0252	1.0000	1.0187	1.0444
1983	1.0257	1.0029	1.0106	1.0395
1984	1.0291	1.0103	1.0215	1.0622

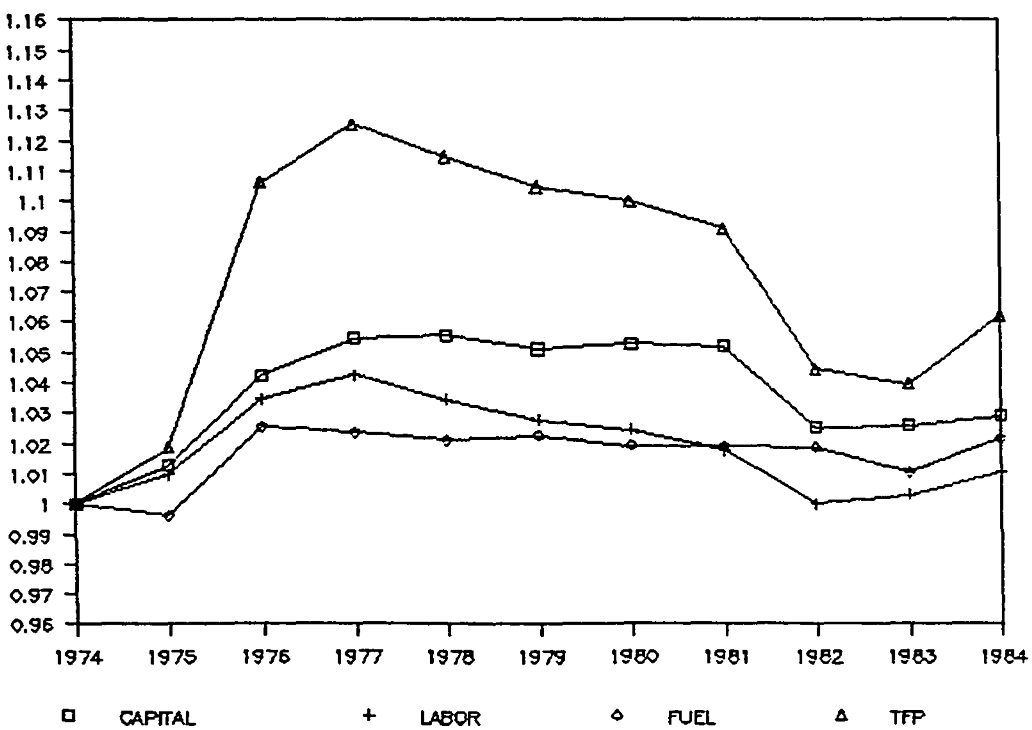

Figure 34. Graphic presentation of Table XXXIV.

The total factor productivity for output level 4 (17915-59681 million KWH) increased 13 percent from 1974 to 1977, with increasing productivity for both capital and labor. However, it declined by 6 percent for the rest of the study period between 1977 and 1984. This declining pattern of the total factor productivity was closely related to the decline of the labor productivity as shown in Table XXXIV and Figure 34. Capital productivity was relatively stable between 1977 and 1981, and fuel productivity remained the same for the entire period.

In summary, for the study period from 1974 to 1984 total factor productivity increased by about 5, 4, 11, 6 percent for the four levels of output, respectively. In particular, total factor productivity improved from 1974 to 1978; however, it declined between 1978 and 1984 for all output levels except the lowest. In the recession year of 1982, productivity declined for all output levels.

With regard to the partial factor productivity, capital productivity has a greater effect on the direction of the TFP of the higher output levels, while labor productivity has a greater influence on the lower output levels. Fuel productivity is generally stable for the study period except for the output level 3 where the fuel productivity increased by 5 percent between 1974 and 1984.

Multilateral Productivity Comparisons Based on Different Output Levels. This section presents the multilateral comparisons of productivities among the four output levels. Recall that productivity comparisons across different output levels over different years are possible because of the transitivity nature of the multilateral index.

Between 1974 and 1977, the total factor productivity of large companies (output level 4) slightly outperformed those of others as indicated in Table XXXV and Figure 35. From 1978 to 1984, the companies within the output level 3 (9631 - 17788 million KWH) were more productive than those at the output level 4 by a few percent.

Over the study period, small companies (output level 1) had the worst performance in terms of the total factor productivity. The productivity performance of the companies falling within the output level 2 (4537 - 9433 million KWH) was third best for the same period.

The differences of capital productivity and labor productivity have patterns similar to that of total factor productivity (see Tables XXXV and XXXVII, Figures 35 and 37) among different output levels. Also, Table XXXVIII and Figure 38 show that there are relatively small differences in the fuel productivity indexes among the four output levels, even though the fuel productivity index of the larger companies (output level 4) is slightly better between 1978 and 1982.

TABLE XXXV

TOTAL FACTOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, OUTPUT LEVEL 1 1974 = 1.0000)

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
1974	1.0000	1.1147	1.1221	1.1467
1975	1.0047	1.1599	1.1783	1.1673
1976	0.9833	1.1693	1.2142	1.2679
1977	0.9924	1.1756	1.1977	1.2892
1978	0.9630	1.1750	1.2838	1.2774
1979	1.0321	1.1559	1.2910	1.2650
1980	1.0620	1.1215	1.2781	1.2589
1981	1.0859	1.1671	1.2765	1.2483
1982	1.0271	1.1177	1.2288	1.1951
1983	1.0359	1.1457	1.2255	1.1896
1984	1.0544	1.1602	1.2438	1.2159

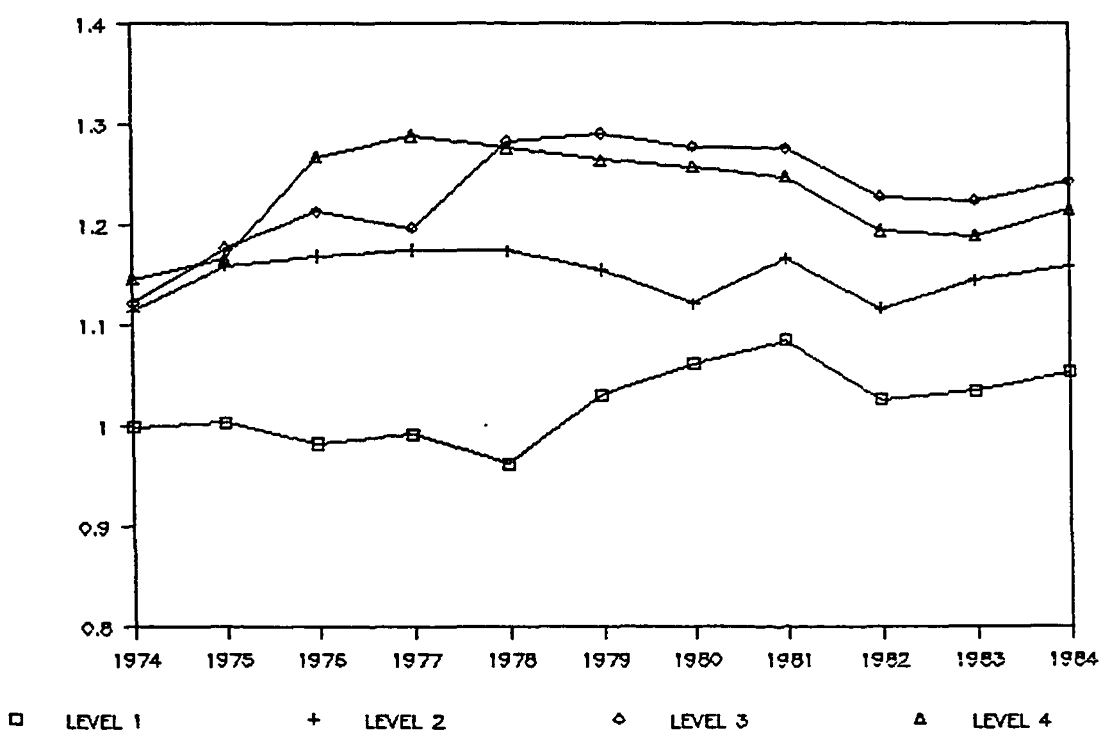

Figure 35. Graphic presentation of Table XXXV.

TABLE XXXVI

LABOR PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, OUTPUT LEVEL I 1974 = 1.0000)

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
1974	1.0000	1.0842	1.1164	1.1202
1975	1.0008	1.1027	1.1326	1.1307
1976	1.0012	1.1152	1.1507	1.1591
1977	1.0100	1.1255	1.1512	1.1674
1978	1.0044	1.1244	1.1698	1.1588
1979	1.0200	1.1162	1.1694	1.1509
1980	1.0294	1.1040	1.1615	1.1466
1981	1.0359	1.1066	1.1554	1.1384
1982	1.0170	1.0988	1.1418	1.1192
1983	1.0368	1.1169	1.1450	1.1226
1984	1.0463	1.1227	1.1558	1.1311

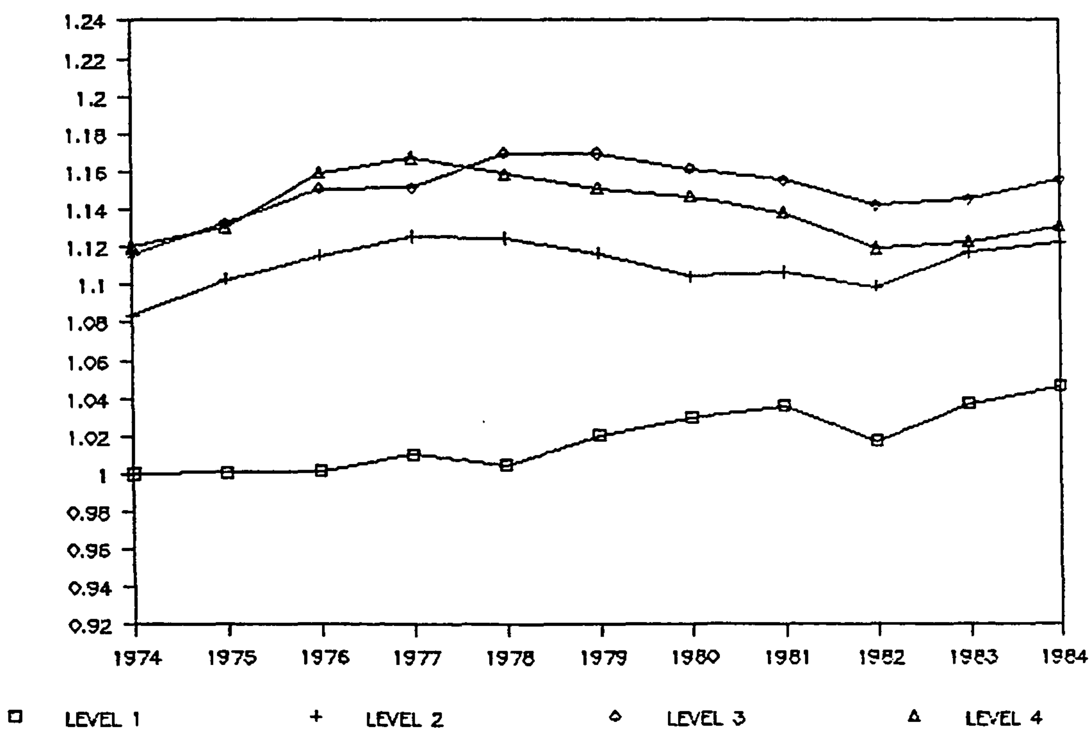

Figure 36. Graphic presentation of Table XXXVI.

TABLE XXXVII

CAPITAL PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, OUTPUT LEVEL 1 1974 = 1.0000)

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
1974	1.0000	1.0082	1.0092	1.0074
1975	0.9988	1.0201	1.0282	1.0202
1976	0.9910	1.0178	1.0400	1.0500
1977	0.9924	1.0185	1.0297	1.0615
1978	0.9711	1.0182	1.0590	1.0623
1979	0.9977	1.0073	1.0650	1.0573
1980	1.0149	1.0066	1.0622	1.0589
1981	1.0274	1.0274	1.0643	1.0582
1982	0.9967	0.9941	1.0397	1.0313
1983	0.9832	0.9998	1.0332	1.0321
1984	0.9903	1.0013	1.0329	1.0356

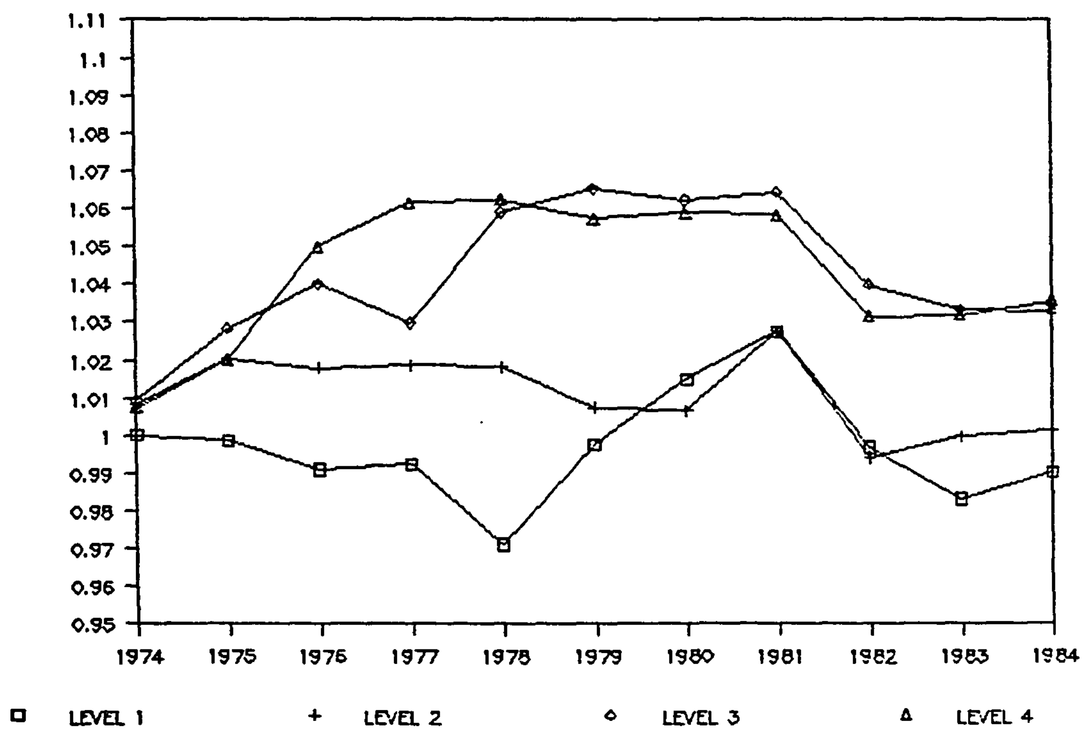

Figure 37. Graphic presentation of Table XXXVII.

TABLE XXXVIII

FUEL PRODUCTIVITY INDEX COMPARISON
(MULTILATERAL INDEX, OUTPUT LEVEL 1 1974 = 1.0000)

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
1974	1.0000	1.0199	0.9960	1.0161
1975	1.0051	1.0312	1.0118	1.0120
1976	0.9910	1.0302	1.0146	1.0418
1977	0.9901	1.0256	1.0104	1.0404
1978	0.9873	1.0263	1.0363	1.0376
1979	1.0142	1.0280	1.0366	1.0396
1980	1.0165	1.0091	1.0359	1.0369
1981	1.0203	1.0265	1.0381	1.0362
1982	1.0133	1.0232	1.0352	1.0354
1983	1.0162	1.0261	1.0359	1.0267
1984	1.0176	1.0321	1.0418	1.0380

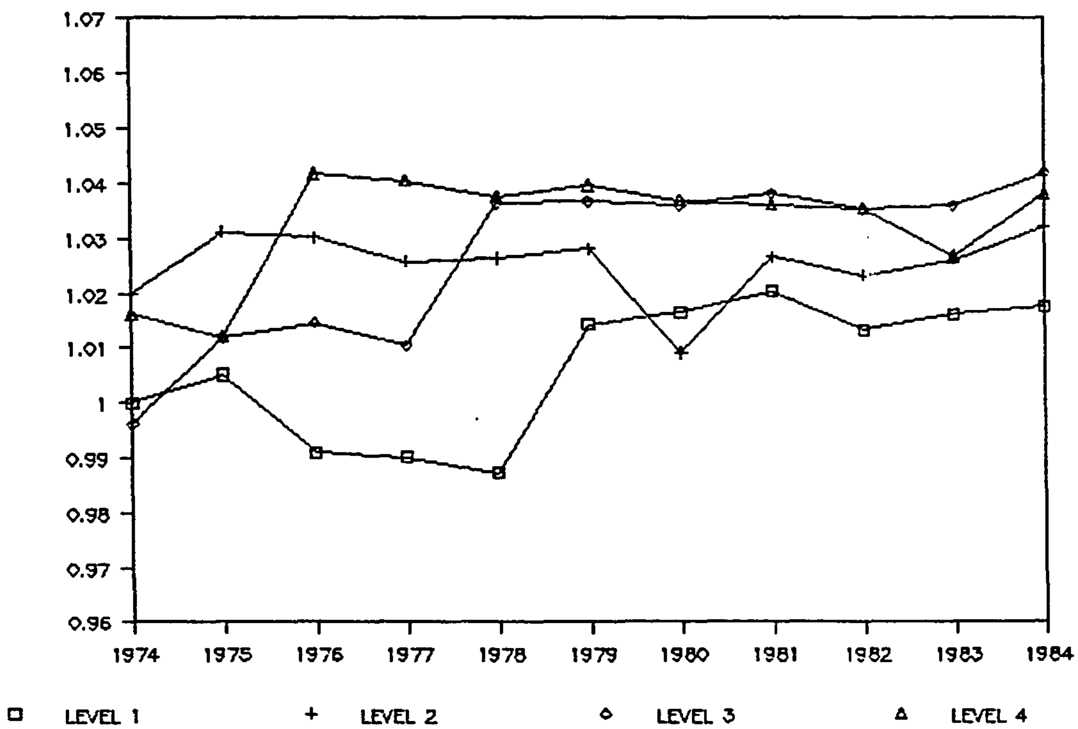

Figure 38. Graphic presentation of Table XXXVIII.

In summary, all measures of factor productivity (total and partial) show that the larger companies lagged behind medium sized companies (output level 3) in recent years. For electricity generation, the largest is not necessarily the most productive. Smaller sized companies (output levels 1 and 2) tended to be less productive. Therefore, companies of medium size maintain the best operation in terms of this productivity analysis.

CHAPTER V

CONCLUSION

This study employed three different models to measure and compare the total factor productivity of 95 electric utility companies from 1974 to 1984: the translog econometric model, the superlative index model, and the Craig and Harris model. Comparisons of these three models showed that the translog econometric model and the superative index model indicated increasing productivity, while the Craig and Harris model showed declining productivity for the study period. The contradictory result of the Craig and Harris model casts doubt on its usefulness.

Each model demonstrates advantages and disadvantages. The advantage of the translog econometric model is that interpretation of the econometric estimations provides useful information not only about productivity changes, but also about other characteristics of the underlying production structure. In particular, the electric industry is found to operate under constant returns to scale for the study period. However, a disadvantage is that the translog econometric model may be technically infeasible for data-intensive studies. The index number calculations of the

Craig and Harris model are easy and straightforward; however, the necessity of the model to assume perfect substitution limits its validity. Finally, based on the solid foundation of production theory, the superlative index model provides a simple and legitimate productivity computation, and it is selected for further analysis of productivity performances for the electric industry. Both bilateral and multilateral comparisons are presented using the superlative index model.

The bilateral superlative index is a useful tool for measurement and comparison of productivity performances over time. After the oil embargo of 1973-74, the electric industry indicated some improvement in the total factor productivity until 1976. However, recent years have shown no overall productivity improvement. Productivity increased for companies located in the Great Lakes, northeastern, north central, and southeastern regions between 1974 and 1984. On the other hand, companies in south central and western regions indicated decreasing productivity for the same period. In terms of types of generation, productivity improvements occurred over time from 1974 to 1984 for companies with liquid, mixed generation with nuclear, mixed generation without nuclear, and solid generation. However, companies with gas generation showed a drastic decline in productivity for the same period. No decrease in productivity was observed for the study period from 1974 to 1984 with respect to companies with different output levels.

Based on multilateral comparisons of the superlative indexes, clear differences existed in the TFP among company classifications according to region, type of generation, and output level. The following lists the major findings:

1. Until 1983, companies in the south central region outperformed those in other regions. However, the total factor productivity of companies in the southeastern region surpassed those in the south central region for the year 1984.
2. From 1974 to 1978, total factor productivity significantly increased for those companies of mixed generation with nuclear power, but their TFP declined drastically after the nuclear accident at Three Mile Island in 1979.
3. The larger companies lagged behind those of medium sized electric generation in terms of productivity performance. This finding indicates that companies with larger electricity generation in recent years are not necessarily more productive than companies with medium sized generation. Medium sized companies showed the best productivity performance, while companies with lower output generation tended to be least productive.

This study assumed that the industry operates under the condition of constant returns to scale and performed the productivity comparisons for four aggregate data sets: industry as a whole, six regions, five types of generation, and four different output levels. In the future, this study might be extended to measure and compare productivity performance at the firm level. However, the assumption of constant returns to scale may not be appropriate for this purpose. The scale economies of each firm must be econometrically estimated so that bias from the scale effect can be minimized in measuring productivity performance at the the firm level.

If data are available, a similar study might be conducted at the plant level within a company. Productivity comparisons at such a level may have significant policy implications in terms of resource allocation and comparative advantage.

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APPENDIX A

RAW DATA: 95 COMPANIES

APPENDIX A

RAW DATA: 95 COMPANIES, 1974-84

NOTATIONS

CO : Company Code
PK : Price of capital (cost of capital)
PL : Price of labor (annual wages including pension and retirement)
PF : Price of fuel (dollar per million BTU)
XK : Quantity of capital (capital stock in 1974 dollars)
XL : Quantity of labor (no of employees, 000s)
XF : Quantity of fuel (Trillion BTU)
Q : Output (million KWH)
TC : Total cost (PkXk + PlXl + PfXf million dollars)
Sk : Factor share of capital (PkXk / TC)
Sl : Factor share of labor (PlXl / TC)
Sf : Factor share of fuel (PfXf / TC)

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
1	1974	0.093	14.098	0.617	2069	7.988	252.88	24320	461	0.4173	0.2443	0.3384
1	1975	0.102	15.569	0.578	2441	7.845	377.35	25898	589	0.4225	0.2073	0.3702
1	1976	0.095	17.460	0.852	2816	8.049	242.78	23762	615	0.4351	0.2286	0.3363
1	1977	0.108	19.273	0.985	3216	8.388	254.23	24770	759	0.4574	0.2129	0.3297
1	1978	0.103	20.320	1.009	3565	9.503	292.50	27727	855	0.4293	0.2258	0.3450
1	1979	0.110	22.534	1.241	3822	9.012	294.50	28301	989	0.4252	0.2053	0.3695
1	1980	0.122	24.468	1.335	4062	9.366	329.13	31667	1164	0.4258	0.1969	0.3773
1	1981	0.126	28.852	1.604	4286	9.585	314.71	30086	1321	0.4087	0.2093	0.3821
1	1982	0.146	31.840	1.425	4505	9.755	379.73	35526	1510	0.4357	0.2057	0.3585
1	1983	0.155	35.090	0.907	4749	9.812	598.31	37244	1623	0.4535	0.2121	0.3344
1	1984	0.151	37.267	1.570	5120	10.103	425.05	40937	1817	0.4255	0.2072	0.3673
4	1974	0.119	14.806	0.993	1223	4.146	234.76	24791	440	0.3308	0.1395	0.5297
4	1975	0.128	13.788	1.035	1286	3.912	200.48	21236	426	0.3863	0.1266	0.4871
4	1976	0.128	15.730	1.007	1345	4.050	213.32	22493	451	0.3821	0.1413	0.4766
4	1977	0.106	17.746	1.172	1519	4.141	203.16	21570	473	0.3406	0.1555	0.5039
4	1978	0.109	21.692	1.350	1823	5.669	205.19	21708	599	0.3319	0.2054	0.4627
4	1979	0.108	25.150	1.457	2071	6.394	225.05	24042	712	0.3140	0.2258	0.4602
4	1980	0.123	26.703	1.578	2227	6.714	246.47	27103	842	0.3253	0.2129	0.4618
4	1981	0.147	28.507	1.808	2291	6.603	275.83	28926	1024	0.3290	0.1839	0.4872
4	1982	0.137	32.977	1.950	2301	6.683	233.09	24408	990	0.3184	0.2226	0.4590
4	1983	0.142	33.247	1.921	2295	6.105	227.43	23691	966	0.3375	0.2102	0.4524
4	1984	0.167	34.934	1.935	2269	5.379	252.86	26774	1056	0.3589	0.1779	0.4632
6	1974	0.107	18.002	1.513	519	1.827	48.36	4466	162	0.3436	0.2036	0.4528
6	1975	0.116	19.388	1.451	546	1.759	49.38	4715	169	0.3745	0.2017	0.4238
6	1976	0.118	21.717	1.362	565	1.726	50.83	4919	173	0.3846	0.2161	0.3992
6	1977	0.109	23.976	1.512	592	1.724	54.72	5169	189	0.3423	0.2191	0.4386
6	1978	0.115	26.229	1.430	621	1.758	59.26	5626	202	0.3529	0.2281	0.4190
6	1979	0.120	27.601	1.750	665	1.864	57.41	5397	232	0.3445	0.2220	0.4336

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
6	1980	0.123	30.495	2.230	734	1.940	59.14	5533	281	0.3209	0.2103	0.4688
6	1981	0.129	32.808	2.495	811	2.014	53.02	5029	303	0.3454	0.2181	0.4365
6	1982	0.118	35.802	2.126	906	2.030	58.16	5466	303	0.3525	0.2397	0.4078
6	1983	0.152	39.665	2.142	951	1.994	65.13	5517	363	0.3980	0.2178	0.3842
6	1984	0.145	45.465	2.595	1025	2.001	57.23	5553	388	0.3830	0.2344	0.3827
7	1974	0.099	15.893	1.471	1640	7.982	153.86	13748	516	0.3150	0.2460	0.4390
7	1975	0.107	18.140	1.221	1716	7.810	138.42	13167	494	0.3715	0.2866	0.3419
7	1976	0.112	20.038	1.026	1802	7.934	167.25	15972	532	0.3790	0.2986	0.3224
7	1977	0.110	21.953	1.001	1905	8.159	211.78	19955	601	0.3489	0.2983	0.3529
7	1978	0.122	22.765	1.108	1982	8.361	210.67	19841	666	0.3633	0.2860	0.3507
7	1979	0.121	26.209	1.273	2049	8.447	210.18	19119	737	0.3364	0.3004	0.3632
7	1980	0.124	29.434	1.280	2161	8.554	212.71	19485	792	0.3383	0.3179	0.3438
7	1981	0.127	32.312	1.414	2308	8.816	201.86	18582	863	0.3395	0.3299	0.3306
7	1982	0.133	34.281	1.369	2514	9.061	185.06	17187	898	0.3722	0.3457	0.2821
7	1983	0.160	36.767	1.223	2673	9.139	205.47	19027	1015	0.4213	0.3310	0.2476
7	1984	0.147	41.209	1.339	2825	9.161	223.92	20986	1093	0.3801	0.3455	0.2744
12	1974	0.112	18.036	1.785	31	0.250	7.09	377	21	0.1697	0.2181	0.6122
12	1975	0.139	20.220	2.081	32	0.246	5.33	244	21	0.2180	0.2421	0.5399
12	1976	0.138	22.640	1.926	33	0.243	3.15	253	16	0.2853	0.3398	0.3748
12	1977	0.140	24.607	2.056	33	0.239	2.95	244	17	0.2807	0.3541	0.3652
12	1978	0.136	26.178	2.074	33	0.236	2.73	216	16	0.2774	0.3771	0.3455
12	1979	0.131	31.801	2.973	34	0.225	3.80	295	23	0.1957	0.3119	0.4924
12	1980	0.135	37.517	4.510	35	0.220	2.98	233	26	0.1801	0.3119	0.5079
12	1981	0.111	40.410	5.137	38	0.222	2.35	191	25	0.1658	0.3556	0.4786
12	1982	0.133	46.770	4.898	38	0.213	2.09	162	25	0.2022	0.3935	0.4043
12	1983	0.200	49.504	4.414	39	0.213	2.36	194	29	0.2704	0.3670	0.3626
12	1984	0.207	54.421	4.775	41	0.208	2.68	209	33	0.2622	0.3463	0.3915
14	1974	0.092	13.262	0.930	1941	4.580	253.65	24542	475	0.3758	0.1278	0.4964
14	1975	0.106	14.780	0.910	2193	4.741	255.71	24942	535	0.4342	0.1309	0.4349
14	1976	0.118	16.055	0.826	2333	4.866	280.47	27255	585	0.4704	0.1335	0.3961
14	1977	0.115	17.457	0.898	2497	5.141	300.78	28627	647	0.4437	0.1387	0.4176
14	1978	0.124	19.694	0.882	2802	5.470	310.93	29488	729	0.4763	0.1477	0.3760
14	1979	0.118	21.402	0.974	3321	5.982	312.78	30303	824	0.4753	0.1553	0.3695
14	1980	0.114	23.688	1.223	3863	6.367	336.33	32154	1003	0.4393	0.1504	0.4103
14	1981	0.127	27.223	1.320	4137	6.795	348.06	32567	1170	0.4490	0.1581	0.3928
14	1982	0.133	30.924	1.515	4232	7.782	312.17	30713	1277	0.4409	0.1885	0.3706
14	1983	0.132	32.607	1.523	4456	8.730	340.15	32424	1391	0.4229	0.2047	0.3724
14	1984	0.140	36.852	1.657	5151	9.128	340.54	32561	1622	0.4447	0.2074	0.3479
15	1974	0.120	12.738	0.536	1651	7.586	352.96	34167	484	0.4094	0.1997	0.3909
15	1975	0.117	14.293	0.839	1821	7.335	349.66	34087	611	0.3484	0.1715	0.4801
15	1976	0.113	15.931	1.179	2032	7.177	379.75	37163	792	0.2900	0.1444	0.5656
15	1977	0.122	17.137	1.419	2388	7.250	419.21	41272	1011	0.2883	0.1229	0.5888
15	1978	0.124	18.394	1.531	2802	7.577	455.72	44714	1185	0.2932	0.1176	0.5891
15	1979	0.120	19.557	1.644	3313	8.181	460.82	45293	1315	0.3023	0.1217	0.5761
15	1980	0.125	21.022	1.834	3753	8.345	511.97	49855	1583	0.2963	0.1108	0.5929
15	1981	0.148	23.042	2.083	3907	8.595	522.36	51018	1865	0.3101	0.1062	0.5837
15	1982	0.143	27.301	2.508	4297	8.882	503.65	48718	2120	0.2898	0.1144	0.5958
15	1983	0.146	30.056	2.686	4872	9.132	494.08	47555	2313	0.3075	0.1187	0.5738
15	1984	0.147	32.141	2.767	5623	9.295	502.58	48385	2516	0.3285	0.1187	0.5527
16	1974	0.103	17.476	1.486	276	1.443	33.83	3354	104	0.2737	0.2426	0.4837
16	1975	0.111	19.148	1.631	286	1.408	33.81	3372	114	0.2790	0.2368	0.4842

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
16	1976	0.120	14.155	1.632	298	1.352	33.94	3422	110	0.3240	0.1736	0.5024
16	1977	0.120	23.822	2.052	315	1.312	36.55	3659	144	0.2623	0.2170	0.5207
16	1978	0.111	25.808	1.929	364	1.305	34.22	3421	140	0.2883	0.2405	0.4712
16	1979	0.128	27.690	2.506	387	1.298	37.17	3699	179	0.2772	0.2013	0.5215
16	1980	0.128	29.902	3.579	408	1.314	35.32	3460	218	0.2397	0.1803	0.5800
16	1981	0.137	32.927	4.602	440	1.345	39.27	3880	285	0.2114	0.1552	0.6334
16	1982	0.137	36.725	4.312	484	1.346	38.12	3743	280	0.2366	0.1765	0.5869
16	1983	0.142	40.262	4.259	539	1.327	44.83	4449	321	0.2385	0.1665	0.5950
16	1984	0.140	43.680	4.652	636	1.325	44.25	4360	353	0.2525	0.1640	0.5835
17	1974	0.109	16.425	0.508	522	2.140	75.16	7086	130	0.4367	0.2700	0.2933
17	1975	0.111	19.198	0.866	622	2.106	79.06	7541	178	0.3880	0.2273	0.3847
17	1976	0.107	20.294	1.030	707	2.142	82.12	7716	204	0.3714	0.2134	0.4152
17	1977	0.108	22.213	1.083	842	2.265	85.42	7749	234	0.3891	0.2152	0.3957
17	1978	0.117	23.694	1.426	950	2.484	105.57	9909	321	0.3468	0.1836	0.4695
17	1979	0.118	42.881	1.325	1073	2.527	108.34	10186	379	0.3346	0.2863	0.3791
17	1980	0.120	27.081	1.393	1137	2.739	114.51	10165	370	0.3686	0.2004	0.4310
17	1981	0.130	29.508	1.541	1185	2.868	107.76	9729	405	0.3807	0.2090	0.4103
17	1982	0.134	34.035	1.607	1233	2.862	114.36	9602	446	0.3700	0.2182	0.4118
17	1983	0.155	36.272	1.659	1226	2.868	119.13	10488	492	0.3864	0.2116	0.4020
17	1984	0.141	39.442	1.741	1243	2.871	115.31	10974	489	0.3582	0.2314	0.4104
19	1974	0.106	13.919	0.824	308	1.933	39.39	3505	92	0.3545	0.2926	0.3529
19	1975	0.109	14.555	0.907	339	1.958	29.82	2719	93	0.3997	0.3079	0.2923
19	1976	0.117	15.799	0.640	393	1.961	26.58	2409	94	0.4891	0.3297	0.1811
19	1977	0.117	17.615	0.656	459	1.964	23.77	2154	104	0.5169	0.3330	0.1501
19	1978	0.126	19.437	0.759	512	1.983	25.67	2284	123	0.5265	0.3145	0.1590
19	1979	0.129	21.178	1.112	550	2.002	26.70	2262	143	0.4961	0.2964	0.2075
19	1980	0.117	23.228	2.356	620	2.018	27.95	2469	185	0.3914	0.2531	0.3555
19	1981	0.119	26.375	2.772	682	2.015	31.78	2879	222	0.3649	0.2390	0.3961
19	1982	0.142	28.895	2.317	753	2.063	30.51	2760	237	0.4507	0.2513	0.2980
19	1983	0.147	30.501	2.370	847	2.112	31.89	2913	264	0.4706	0.2436	0.2858
19	1984	0.135	33.774	2.428	915	2.094	32.64	2971	273	0.4517	0.2586	0.2898
20	1974	0.122	12.893	0.853	560	2.535	104.38	9927	190	0.3594	0.1720	0.4686
20	1975	0.124	15.427	1.432	608	2.409	92.10	8872	244	0.3084	0.1521	0.5395
20	1976	0.126	17.096	1.832	671	2.238	99.18	9544	305	0.2776	0.1256	0.5968
20	1977	0.122	18.716	1.954	883	2.168	118.35	11413	380	0.2839	0.1069	0.6092
20	1978	0.126	19.741	1.989	998	2.174	136.74	12772	441	0.2855	0.0974	0.6171
20	1979	0.127	21.363	2.192	1170	2.301	132.44	12904	488	0.3045	0.1007	0.5948
20	1980	0.143	22.411	2.539	1352	2.399	140.65	13572	604	0.3199	0.0890	0.5911
20	1981	0.140	24.843	3.049	1494	2.465	155.17	15204	743	0.2813	0.0824	0.6364
20	1982	0.141	27.649	3.528	1673	2.581	154.02	14986	851	0.2773	0.0839	0.6388
20	1983	0.142	30.267	3.459	1899	2.622	152.92	14909	878	0.3072	0.0904	0.6024
20	1984	0.134	33.030	3.313	2248	2.684	166.23	16105	941	0.3202	0.0942	0.5855
21	1974	0.089	14.220	0.062	85	0.624	3.63	196	17	0.4533	0.5332	0.0135
21	1975	0.111	15.178	0.046	88	0.608	3.68	184	19	0.5103	0.4809	0.0088
21	1976	0.118	17.245	0.022	94	0.605	4.76	218	22	0.5136	0.4816	0.0048
21	1977	0.116	18.975	0.018	101	0.612	4.75	170	23	0.5014	0.4949	0.0037
21	1978	0.130	21.503	0.041	114	0.571	3.00	159	27	0.5435	0.4520	0.0045
21	1979	0.127	21.867	0.097	125	0.581	3.01	180	29	0.5497	0.4402	0.0101
21	1980	0.117	24.364	0.527	139	0.576	1.86	161	31	0.5202	0.4485	0.0313
21	1981	0.140	26.597	0.636	149	0.580	2.40	220	38	0.5520	0.4077	0.0403
21	1982	0.143	29.398	0.580	181	0.590	2.01	180	44	0.5831	0.3906	0.0263

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
21	1983	0.132	31.762	0.544	220	0.587	2.37	215	49	0.5930	0.3806	0.0263
21	1984	0.146	33.610	0.897	253	0.597	3.21	246	60	0.6167	0.3351	0.0481
22	1974	0.098	18.326	0.597	416	1.590	46.94	4550	98	0.4163	0.2975	0.2861
22	1975	0.101	20.649	0.880	481	1.591	43.87	4216	120	0.4045	0.2738	0.3217
22	1976	0.113	22.786	1.043	539	1.612	48.75	4549	148	0.4103	0.2474	0.3423
22	1977	0.113	24.811	1.306	551	1.595	54.80	5024	173	0.3592	0.2282	0.4126
22	1978	0.124	27.332	1.499	573	1.582	51.55	4883	191	0.3707	0.2258	0.4035
22	1979	0.133	29.232	1.699	590	1.623	49.74	4784	210	0.3729	0.2255	0.4017
22	1980	0.122	32.097	1.817	622	1.632	51.95	5019	223	0.3408	0.2353	0.4239
22	1981	0.131	34.941	2.097	637	1.665	50.81	4831	248	0.3364	0.2344	0.4292
22	1982	0.137	38.130	2.260	662	1.695	51.02	4881	271	0.3353	0.2388	0.4259
22	1983	0.145	39.222	2.174	613	1.671	51.75	4945	267	0.3331	0.2455	0.4214
22	1984	0.146	41.718	2.215	621	1.659	50.92	4863	273	0.3325	0.2538	0.4136
23	1974	0.109	14.706	0.742	902	4.572	121.40	11886	256	0.3846	0.2630	0.3524
23	1975	0.114	15.398	0.927	1002	4.545	125.23	12352	300	0.3803	0.2331	0.3866
23	1976	0.111	17.360	1.009	1088	4.399	135.76	13247	334	0.3614	0.2286	0.4100
23	1977	0.128	19.502	1.116	1184	4.376	145.10	13848	399	0.3800	0.2139	0.4060
23	1978	0.120	20.810	1.311	1334	4.518	148.19	14196	448	0.3571	0.2097	0.4332
23	1979	0.120	22.846	1.397	1542	4.689	154.82	14879	508	0.3640	0.2107	0.4253
23	1980	0.115	24.925	1.545	1765	4.981	151.97	14664	562	0.3612	0.2209	0.4179
23	1981	0.124	26.674	1.643	1953	5.100	162.20	15583	645	0.3756	0.2110	0.4134
23	1982	0.136	29.276	1.753	2119	5.197	151.78	14986	706	0.4079	0.2154	0.3767
23	1983	0.144	32.048	1.841	2249	5.175	159.73	16185	784	0.4132	0.2116	0.3751
23	1984	0.142	34.809	1.895	2020	4.802	162.23	16612	761	0.3767	0.2195	0.4038
25	1974	0.126	18.289	1.023	1158	4.918	192.31	18236	433	0.3372	0.2079	0.4548
25	1975	0.113	19.403	1.110	1305	4.973	171.52	16416	434	0.3395	0.2221	0.4384
25	1976	0.116	21.342	1.055	1543	4.908	174.94	16992	468	0.3821	0.2237	0.3942
25	1977	0.128	23.931	1.175	1786	4.812	188.47	18353	565	0.4044	0.2038	0.3918
25	1978	0.118	25.729	1.318	2028	4.844	179.63	17091	601	0.3984	0.2074	0.3942
25	1979	0.122	26.590	1.425	2299	4.913	184.06	17307	673	0.4164	0.1940	0.3896
25	1980	0.118	29.710	1.569	2630	4.996	164.36	15569	717	0.4331	0.2071	0.3598
25	1981	0.136	32.458	1.750	2961	5.098	185.00	17479	892	0.4515	0.1855	0.3630
25	1982	0.143	35.220	1.748	3301	5.313	180.45	17226	975	0.4843	0.1920	0.3236
25	1983	0.151	37.325	1.691	3701	5.351	180.97	17317	1065	0.5249	0.1876	0.2875
25	1984	0.151	40.477	1.659	4258	5.507	176.23	16961	1158	0.5552	0.1925	0.2524
26	1974	0.105	17.590	0.670	707	2.859	89.82	8204	185	0.4018	0.2723	0.3259
26	1975	0.116	20.281	0.920	834	2.774	85.83	7978	232	0.4169	0.2425	0.3405
26	1976	0.118	21.877	0.951	988	2.902	89.53	8374	265	0.4396	0.2394	0.3210
26	1977	0.117	25.421	0.980	1113	2.973	104.27	9670	308	0.4229	0.2454	0.3317
26	1978	0.106	28.694	1.206	1199	2.987	101.64	9427	335	0.3789	0.2555	0.3655
26	1979	0.125	31.185	1.217	1272	2.894	112.64	10495	386	0.4116	0.2336	0.3547
26	1980	0.126	33.952	1.311	1293	3.098	115.11	10540	419	0.3888	0.2510	0.3602
26	1981	0.143	38.294	1.448	1355	3.020	122.42	11342	487	0.3981	0.2377	0.3642
26	1982	0.134	40.064	1.542	1432	2.856	112.85	10547	480	0.3995	0.2382	0.3623
26	1983	0.159	38.567	1.670	1515	2.648	100.43	9321	511	0.4715	0.2000	0.3285
26	1984	0.144	40.290	1.728	1637	2.633	107.01	10181	527	0.4475	0.2014	0.3510
27	1974	0.109	21.631	0.557	4559	15.038	655.70	58985	1187	0.4185	0.2739	0.3076
27	1975	0.112	24.076	0.633	5043	14.853	650.71	58823	1334	0.4234	0.2680	0.3086
27	1976	0.113	26.154	0.720	5777	14.982	679.42	61251	1534	0.4257	0.2555	0.3188
27	1977	0.110	27.865	0.835	6606	15.311	709.48	63637	1746	0.4162	0.2444	0.3394
27	1978	0.115	30.486	1.000	7678	15.676	753.96	67451	2115	0.4176	0.2260	0.3564

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
27	1979	0.105	32.660	1.387	8711	16.326	694.26	62669	2411	0.3794	0.2212	0.3994
27	1980	0.118	35.492	1.685	9626	16.444	692.88	63303	2887	0.3935	0.2022	0.4044
27	1981	0.124	38.265	1.825	10654	16.780	684.91	60257	3213	0.4111	0.1998	0.3890
27	1982	0.133	44.559	1.964	11783	17.123	646.63	57900	3600	0.4353	0.2119	0.3528
27	1983	0.146	48.217	2.067	12928	17.509	664.01	59939	4104	0.4599	0.2057	0.3344
27	1984	0.148	55.618	1.911	14440	18.100	669.77	60421	4424	0.4831	0.2276	0.2893
28	1974	0.100	16.877	2.139	113	1.125	3.50	243	38	0.2998	0.5022	0.1980
28	1975	0.102	18.239	2.022	122	1.102	1.79	116	36	0.3432	0.5566	0.1002
28	1976	0.130	19.982	1.702	128	1.115	2.37	161	43	0.3867	0.5193	0.0940
28	1977	0.134	22.042	2.060	136	1.097	1.45	93	45	0.4014	0.5328	0.0658
28	1978	0.118	24.368	2.080	145	1.094	1.25	81	46	0.3690	0.5749	0.0561
28	1979	0.119	26.520	2.883	154	1.121	2.09	150	54	0.3395	0.5492	0.1113
28	1980	0.133	29.621	4.196	168	1.140	1.96	143	64	0.3476	0.5246	0.1278
28	1981	0.123	29.901	4.794	150	1.036	1.84	132	58	0.3167	0.5319	0.1515
28	1982	0.152	32.721	4.595	158	1.041	1.68	120	66	0.3656	0.5172	0.1172
28	1983	0.167	36.347	4.345	169	1.046	1.73	132	74	0.3821	0.5159	0.1020
28	1984	0.171	41.107	4.828	182	1.050	1.92	148	84	0.3723	0.5167	0.1110
31	1974	0.092	19.342	1.840	4878	24.436	364.41	30802	1592	0.2819	0.2969	0.4212
31	1975	0.106	20.946	1.820	4691	25.025	350.10	31179	1658	0.2998	0.3160	0.3841
31	1976	0.111	25.311	1.930	4802	24.605	308.30	27764	1751	0.3044	0.3557	0.3398
31	1977	0.114	27.752	1.950	4897	23.938	315.15	28075	1837	0.3039	0.3616	0.3345
31	1978	0.110	30.154	1.910	5002	23.710	291.59	25774	1822	0.3020	0.3924	0.3057
31	1979	0.112	32.512	2.480	5094	23.292	266.36	22942	1988	0.2869	0.3809	0.3322
31	1980	0.114	35.784	3.370	5174	23.156	286.41	24584	2384	0.2475	0.3476	0.4049
31	1981	0.132	39.810	4.500	5309	23.016	270.10	23472	2832	0.2474	0.3235	0.4291
31	1982	0.136	42.905	4.071	5457	22.696	259.20	22682	2771	0.2678	0.3514	0.3808
31	1983	0.146	43.827	3.771	5551	22.414	275.17	24477	2831	0.2863	0.3471	0.3666
31	1984	0.149	50.747	4.207	5769	21.744	239.67	21189	2971	0.2893	0.3714	0.3393
32	1974	0.087	17.575	0.888	1940	11.386	193.87	18480	541	0.3120	0.3699	0.3182
32	1975	0.107	19.585	1.095	2065	10.691	228.10	20961	680	0.3249	0.3079	0.3673
32	1976	0.114	21.312	1.197	2308	10.586	222.86	20773	755	0.3483	0.2987	0.3530
32	1977	0.107	23.026	1.102	2682	10.683	238.76	22096	796	0.3605	0.3091	0.3304
32	1978	0.107	24.860	1.511	3184	11.366	245.82	22428	995	0.3426	0.2841	0.3733
32	1979	0.112	26.571	1.599	3802	11.891	241.95	22335	1129	0.3773	0.2800	0.3427
32	1980	0.112	28.902	1.942	4220	12.251	215.98	20197	1246	0.3793	0.2841	0.3366
32	1981	0.129	31.425	2.005	4722	12.348	238.61	22958	1476	0.4128	0.2630	0.3242
32	1982	0.120	33.353	1.838	5385	12.618	187.79	18193	1412	0.4576	0.2980	0.2444
32	1983	0.121	37.521	1.771	5919	12.779	207.67	20779	1564	0.4581	0.3067	0.2353
32	1984	0.125	40.793	1.976	6659	11.916	184.45	18749	1683	0.4946	0.2888	0.2166
35	1974	0.108	18.912	1.704	639	2.363	86.76	8199	261	0.2637	0.1709	0.5654
35	1975	0.110	20.897	1.533	658	2.355	79.44	7418	243	0.2974	0.2022	0.5004
35	1976	0.110	23.028	1.462	714	2.416	84.04	7911	257	0.3056	0.2164	0.4780
35	1977	0.113	25.443	1.671	824	2.427	80.45	7567	289	0.3218	0.2135	0.4648
35	1978	0.117	27.331	1.622	929	2.461	93.74	8796	328	0.3315	0.2051	0.4635
35	1979	0.117	29.117	2.134	1010	2.483	93.67	8773	390	0.3027	0.1852	0.5121
35	1980	0.118	30.777	2.650	1077	2.554	89.11	8351	442	0.2876	0.1779	0.5345
35	1981	0.132	31.454	2.806	1104	2.645	101.48	9600	514	0.2838	0.1620	0.5543
35	1982	0.143	32.386	2.393	1161	2.748	100.28	9112	495	0.3354	0.1798	0.4848
35	1983	0.147	37.822	2.439	1166	2.516	112.75	10603	542	0.3165	0.1757	0.5078
35	1984	0.152	38.805	2.485	1196	2.522	114.13	10770	563	0.3228	0.1737	0.5034
36	1974	0.096	19.897	0.893	3090	10.171	402.46	36698	858	0.3456	0.2357	0.4187

CO	YEAR	PK	PL	PP	XK	XL	XP	Q	TC	Sk	Sl	Sf
36	1975	0.101	22.639	1.101	3192	9.643	388.76	35635	969	0.3329	0.2254	0.4417
36	1976	0.107	25.414	1.208	3381	9.591	370.68	33897	1053	0.3435	0.2314	0.4251
36	1977	0.111	26.956	1.302	3535	9.721	376.90	34583	1145	0.3426	0.2288	0.4286
36	1978	0.108	28.737	1.490	4062	10.729	364.54	33939	1290	0.3401	0.2390	0.4209
36	1979	0.114	33.022	1.634	4522	10.809	381.88	35728	1496	0.3445	0.2385	0.4170
36	1980	0.116	36.536	1.782	4957	10.848	348.83	33350	1593	0.3609	0.2488	0.3903
36	1981	0.130	40.522	1.905	5773	10.897	332.42	32068	1825	0.4112	0.2419	0.3469
36	1982	0.123	43.983	1.939	6750	11.206	336.30	32540	1975	0.4203	0.2495	0.3301
36	1983	0.132	47.961	1.902	7246	11.145	324.25	31531	2108	0.4538	0.2536	0.2926
36	1984	0.136	52.027	1.937	8130	11.117	332.66	32497	2328	0.4749	0.2484	0.2767
38	1974	0.101	13.441	0.776	2992	13.086	429.47	45107	811	0.3725	0.2168	0.4107
38	1975	0.110	14.837	0.746	3284	11.840	452.58	46297	875	0.4129	0.2008	0.3862
38	1976	0.121	16.731	0.816	3566	12.514	489.52	50921	1040	0.4148	0.2012	0.3840
38	1977	0.118	18.407	0.968	3980	14.573	510.49	52409	1232	0.3812	0.2177	0.4010
38	1978	0.123	20.052	1.051	4274	16.844	517.14	52938	1407	0.3737	0.2401	0.3862
38	1979	0.120	20.166	1.109	4873	19.245	532.08	54613	1563	0.3742	0.2483	0.3775
38	1980	0.124	23.164	1.226	5546	19.518	555.06	57373	1820	0.3778	0.2484	0.3738
38	1981	0.133	30.027	1.426	5603	19.954	553.27	57513	2133	0.3493	0.2809	0.3698
38	1982	0.134	33.051	1.452	5915	20.510	537.77	55650	2252	0.3520	0.3011	0.3469
38	1983	0.149	36.113	1.264	5717	20.861	559.51	57334	2313	0.3683	0.3257	0.3059
38	1984	0.160	37.898	1.187	5695	20.830	595.56	60428	2408	0.3784	0.3279	0.2937
39	1974	0.096	16.718	0.750	1301	4.227	141.03	12796	301	0.4144	0.2345	0.3510
39	1975	0.106	18.627	1.043	1431	4.439	123.00	12011	363	0.4183	0.2280	0.3537
39	1976	0.099	20.873	1.029	1554	4.440	133.57	12497	384	0.4007	0.2414	0.3579
39	1977	0.103	21.655	1.009	1679	4.557	147.77	13832	421	0.4110	0.2346	0.3544
39	1978	0.098	23.215	1.253	1832	4.436	131.57	12273	447	0.4013	0.2302	0.3685
39	1979	0.103	26.435	1.317	1973	4.377	148.61	13907	515	0.3949	0.2248	0.3803
39	1980	0.110	28.425	1.497	2157	4.418	142.03	13451	576	0.4123	0.2182	0.3695
39	1981	0.119	29.597	1.597	2311	4.539	148.90	13933	647	0.4250	0.2076	0.3675
39	1982	0.122	33.045	1.679	2496	4.727	131.81	12385	682	0.4464	0.2290	0.3246
39	1983	0.128	33.999	1.670	2708	4.942	127.75	11939	728	0.4761	0.2308	0.2931
39	1984	0.125	40.602	1.686	3155	4.711	139.43	13024	821	0.4805	0.2330	0.2864
43	1974	0.104	12.195	0.737	183	0.724	36.71	3370	55	0.3462	0.1609	0.4929
43	1975	0.116	12.888	1.180	201	0.760	37.80	3433	78	0.2996	0.1261	0.5743
43	1976	0.125	15.306	1.460	217	0.798	37.92	3501	95	0.2866	0.1290	0.5845
43	1977	0.107	16.497	1.660	273	0.827	36.95	3476	104	0.2802	0.1310	0.5889
43	1978	0.108	17.742	1.700	365	0.851	39.44	3674	122	0.3241	0.1242	0.5517
43	1979	0.105	19.178	1.970	486	0.903	40.27	3771	148	0.3454	0.1173	0.5373
43	1980	0.128	20.311	2.599	643	0.979	36.91	3977	198	0.4154	0.1004	0.4842
43	1981	0.147	22.660	3.316	806	1.016	32.62	3816	250	0.4745	0.0922	0.4333
43	1982	0.133	25.566	3.110	1007	1.083	31.93	2965	261	0.5132	0.1061	0.3807
43	1983	0.140	33.053	3.021	1230	1.107	27.10	2533	291	0.5925	0.1259	0.2816
43	1984	0.142	31.796	3.008	1444	1.084	29.06	2705	327	0.6273	0.1054	0.2673
44	1974	0.120	15.461	0.370	94	0.532	20.02	1720	27	0.4191	0.3057	0.2753
44	1975	0.124	17.014	0.494	96	0.518	21.13	1846	31	0.3809	0.2834	0.3357
44	1976	0.114	19.031	0.591	102	0.508	21.55	1893	34	0.3426	0.2837	0.3736
44	1977	0.113	20.879	0.668	123	0.511	20.24	1779	38	0.3652	0.2799	0.3549
44	1978	0.105	22.452	0.860	160	0.529	22.47	1936	48	0.3500	0.2475	0.4026
44	1979	0.116	23.928	0.960	186	0.545	22.39	1958	56	0.3847	0.2324	0.3829
44	1980	0.123	26.524	1.114	194	0.562	26.06	2380	68	0.3516	0.2199	0.4285
44	1981	0.124	28.076	1.213	200	0.586	23.03	2143	69	0.3588	0.2376	0.4036

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
44	1982	0.144	30.811	1.238	202	0.592	23.91	2183	77	0.3780	0.2372	0.3848
44	1983	0.154	33.109	1.240	207	0.597	25.12	2307	83	0.3854	0.2386	0.3760
44	1984	0.163	36.334	1.290	220	0.605	26.99	2470	93	0.3868	0.2374	0.3759
45	1974	0.101	15.562	1.706	22	0.217	1.69	116	9	0.2638	0.3971	0.3391
45	1975	0.116	17.535	1.957	24	0.194	0.82	67	8	0.3579	0.4363	0.2059
45	1976	0.108	17.922	1.936	25	0.191	0.99	93	8	0.3341	0.4269	0.2390
45	1977	0.121	20.087	2.254	27	0.182	0.92	91	9	0.3594	0.4087	0.2319
45	1978	0.142	20.831	2.146	26	0.185	1.00	100	10	0.3819	0.3970	0.2210
45	1979	0.148	26.150	3.210	27	0.161	1.06	104	12	0.3455	0.3619	0.2925
45	1980	0.117	27.633	4.875	28	0.164	1.01	101	13	0.2585	0.3554	0.3861
45	1981	0.138	28.579	5.729	40	0.166	1.09	112	17	0.3351	0.2871	0.3779
45	1982	0.103	31.317	4.770	49	0.167	0.99	103	15	0.3355	0.3492	0.3153
45	1983	0.126	42.215	4.581	58	0.136	1.13	117	18	0.4029	0.3140	0.2831
45	1984	0.128	41.286	5.191	61	0.146	1.19	126	20	0.3902	0.3012	0.3086
46	1974	0.093	16.656	1.511	1301	3.478	132.59	12784	379	0.3190	0.1528	0.5283
46	1975	0.112	17.145	1.681	1369	3.480	139.88	13956	448	0.3422	0.1331	0.5247
46	1976	0.106	18.712	1.670	1454	3.712	149.01	14701	472	0.3263	0.1470	0.5267
46	1977	0.136	20.133	1.509	1491	3.835	172.70	16575	541	0.3750	0.1428	0.4821
46	1978	0.134	21.664	1.682	1523	4.091	168.18	16046	576	0.3546	0.1540	0.4914
46	1979	0.123	22.630	2.014	1630	4.333	178.54	17002	658	0.3046	0.1490	0.5464
46	1980	0.111	25.601	2.519	1850	4.540	183.62	17586	784	0.2619	0.1482	0.5899
46	1981	0.130	27.136	3.123	2100	4.916	190.00	18345	1000	0.2730	0.1334	0.5936
46	1982	0.126	29.553	2.780	2390	5.243	177.74	17130	950	0.3169	0.1630	0.5200
46	1983	0.146	31.122	2.851	2544	5.444	192.00	19046	1088	0.3413	0.1557	0.5030
46	1984	0.149	34.799	2.398	2738	5.433	192.23	19084	1058	0.3855	0.1787	0.4357
50	1974	0.097	14.918	0.796	3151	8.971	366.98	33873	732	0.4178	0.1829	0.3993
50	1975	0.118	15.919	0.979	3231	9.040	366.97	34405	885	0.4310	0.1627	0.4063
50	1976	0.119	18.204	1.028	3411	9.474	423.51	40716	1014	0.4005	0.1701	0.4294
50	1977	0.118	18.777	1.177	3501	10.929	451.40	43458	1150	0.3593	0.1785	0.4622
50	1978	0.125	19.724	1.274	3822	11.792	433.12	41920	1262	0.3785	0.1843	0.4372
50	1979	0.129	21.506	1.347	4244	12.256	443.99	44157	1409	0.3885	0.1870	0.4244
50	1980	0.138	23.727	1.421	4370	12.772	504.01	49399	1622	0.3717	0.1868	0.4415
50	1981	0.126	29.447	1.599	4865	13.221	507.50	49981	1814	0.3379	0.2146	0.4474
50	1982	0.135	32.434	1.728	5521	13.720	479.51	46676	2019	0.3692	0.2204	0.4104
50	1983	0.147	35.288	1.728	6300	14.285	511.77	50664	2315	0.4001	0.2178	0.3821
50	1984	0.155	40.028	1.810	7297	14.560	561.72	56154	2731	0.4142	0.2134	0.3724
53	1974	0.091	12.703	0.767	331	1.031	72.09	6478	99	0.3058	0.1330	0.5613
53	1975	0.127	14.661	1.091	353	0.980	62.93	5633	128	0.3504	0.1124	0.5371
53	1976	0.109	16.690	1.100	423	0.988	73.99	6755	144	0.3200	0.1146	0.5654
53	1977	0.107	17.649	1.249	483	1.083	65.50	5907	153	0.3387	0.1253	0.5360
53	1978	0.116	18.765	1.450	516	1.159	70.90	6170	184	0.3245	0.1179	0.5576
53	1979	0.115	20.815	1.569	564	1.254	72.85	6632	205	0.3162	0.1271	0.5567
53	1980	0.112	22.715	1.821	634	1.326	67.13	6150	223	0.3179	0.1348	0.5473
53	1981	0.135	26.988	2.010	648	1.404	83.81	7557	294	0.2978	0.1289	0.5733
53	1982	0.147	29.092	2.281	668	1.429	80.14	7348	323	0.3044	0.1289	0.5667
53	1983	0.155	33.357	2.402	685	1.454	82.70	7712	353	0.3006	0.1373	0.5622
53	1984	0.154	33.959	2.483	820	1.477	87.92	8264	395	0.3198	0.1271	0.5531
54	1974	0.114	12.696	0.616	1170	3.136	220.03	20950	309	0.4321	0.1289	0.4390
54	1975	0.118	12.759	0.559	1289	3.046	220.01	20741	314	0.4847	0.1238	0.3915
54	1976	0.116	17.466	0.734	1434	2.931	246.17	23135	398	0.4176	0.1285	0.4539
54	1977	0.119	19.279	0.948	1556	3.086	268.71	25165	499	0.3708	0.1191	0.5101

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
54	1978	0.115	21.113	1.071	1750	3.474	293.28	27222	589	0.3417	0.1246	0.5337
54	1979	0.111	22.910	1.192	2075	3.978	265.11	24349	638	0.3613	0.1429	0.4958
54	1980	0.118	28.507	1.297	2613	3.916	290.62	26761	797	0.3869	0.1401	0.4730
54	1981	0.135	30.676	1.603	2965	4.401	300.17	27410	1016	0.3939	0.1328	0.4733
54	1982	0.135	33.716	1.678	3501	4.769	269.40	24965	1085	0.4355	0.1481	0.4164
54	1983	0.142	37.763	1.599	4024	4.886	273.77	25353	1194	0.4786	0.1546	0.3668
54	1984	0.144	42.024	1.576	4509	5.038	269.49	25731	1286	0.5050	0.1647	0.3303
55	1974	0.106	20.292	0.837	473	1.909	55.45	5137	135	0.3706	0.2863	0.3431
55	1975	0.112	23.187	1.554	497	1.834	56.21	5309	186	0.3001	0.2292	0.4708
55	1976	0.117	25.583	1.584	521	1.783	60.42	5633	202	0.3015	0.2255	0.4730
55	1977	0.117	28.188	1.884	539	1.748	62.25	5855	230	0.2748	0.2145	0.5107
55	1978	0.115	30.935	2.214	562	1.811	64.14	6023	263	0.2461	0.2133	0.5406
55	1979	0.118	34.334	2.557	605	1.823	65.34	6175	301	0.2370	0.2079	0.5550
55	1980	0.115	36.641	3.759	672	1.839	67.03	6257	397	0.1949	0.1699	0.6352
55	1981	0.132	39.914	6.580	696	1.809	66.75	6328	603	0.1524	0.1197	0.7280
55	1982	0.124	48.769	6.602	707	1.788	65.03	6212	604	0.1451	0.1443	0.7106
55	1983	0.142	48.009	5.440	719	1.656	66.19	6358	542	0.1884	0.1468	0.6648
55	1984	0.148	58.205	5.518	743	1.670	67.56	6455	580	0.1895	0.1676	0.6428
58	1974	0.108	10.236	0.370	1554	7.553	376.55	38190	384	0.4365	0.2011	0.3624
58	1975	0.107	11.697	0.598	1825	7.420	401.25	40276	522	0.3741	0.1663	0.4596
58	1976	0.120	12.437	0.817	2066	7.094	432.87	43353	690	0.3594	0.1279	0.5127
58	1977	0.119	17.875	1.055	2437	6.540	490.87	48535	925	0.3135	0.1264	0.5601
58	1978	0.113	18.820	1.262	2804	6.975	540.62	53102	1131	0.2803	0.1161	0.6036
58	1979	0.120	22.584	1.711	3226	7.736	560.30	54678	1520	0.2546	0.1149	0.6305
58	1980	0.125	23.857	2.058	3777	8.489	586.14	57228	1881	0.2510	0.1077	0.6414
58	1981	0.132	26.840	2.712	4330	9.176	582.05	57165	2397	0.2385	0.1028	0.6587
58	1982	0.106	29.609	3.371	4628	10.676	556.76	54470	2684	0.1828	0.1178	0.6994
58	1983	0.139	32.888	3.212	5394	10.955	521.35	50989	2784	0.2693	0.1294	0.6013
58	1984	0.139	36.606	3.142	6327	11.173	535.19	52136	2970	0.2961	0.1377	0.5662
59	1974	0.090	13.938	0.026	661	1.330	101.93	9749	81	0.7375	0.2297	0.0328
59	1975	0.104	15.098	0.049	695	1.400	116.19	10969	99	0.7290	0.2133	0.0577
59	1976	0.095	17.666	0.060	734	1.443	120.20	11272	102	0.6809	0.2490	0.0702
59	1977	0.092	18.290	0.135	831	1.512	90.75	8677	116	0.6571	0.2376	0.1053
59	1978	0.095	21.040	0.094	929	1.564	114.52	10891	132	0.6690	0.2494	0.0816
59	1979	0.092	21.057	0.143	1043	1.615	109.72	10785	146	0.6587	0.2334	0.1080
59	1980	0.108	26.977	0.177	1140	1.621	142.45	11789	192	0.6412	0.2277	0.1311
59	1981	0.110	29.870	0.301	1236	1.653	128.66	11598	224	0.6069	0.2204	0.1727
59	1982	0.138	33.930	0.272	1284	1.705	166.95	14678	280	0.6317	0.2063	0.1620
59	1983	0.137	35.840	0.262	1341	1.749	169.58	14641	291	0.6318	0.2155	0.1527
59	1984	0.147	41.862	0.329	1420	1.780	172.25	16197	340	0.6140	0.2191	0.1668
60	1974	0.110	16.212	0.489	888	3.436	128.94	12658	216	0.4512	0.2574	0.2914
60	1975	0.126	18.341	0.649	959	3.376	139.55	13896	273	0.4419	0.2266	0.3315
60	1976	0.112	20.107	0.782	1145	3.436	158.21	15744	321	0.3996	0.2152	0.3852
60	1977	0.113	21.189	1.003	1373	3.625	148.19	14605	381	0.4077	0.2018	0.3905
60	1978	0.115	23.940	1.267	1522	3.774	163.52	15808	473	0.3703	0.1912	0.4385
60	1979	0.115	25.490	1.305	1739	3.877	173.11	16895	525	0.3812	0.1884	0.4305
60	1980	0.119	27.986	1.431	1963	3.925	168.13	16369	584	0.4000	0.1881	0.4119
60	1981	0.124	29.744	1.518	2237	4.012	161.81	15746	642	0.4319	0.1858	0.3823
60	1982	0.123	33.553	1.616	2539	4.042	148.59	14442	688	0.4538	0.1971	0.3491
60	1983	0.136	36.027	1.609	2790	3.987	161.16	15829	782	0.4850	0.1836	0.3314
60	1984	0.135	34.880	1.633	3320	4.236	157.32	15574	853	0.5256	0.1732	0.3012

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
61	1974	0.093	15.114	0.691	1369	2.793	85.55	8901	229	0.5567	0.1847	0.2586
61	1975	0.099	15.536	0.654	1477	2.731	82.01	9493	242	0.6036	0.1751	0.2213
61	1976	0.110	15.845	0.463	1579	3.092	148.48	14582	291	0.5959	0.1681	0.2360
61	1977	0.126	19.453	0.588	1736	2.722	126.00	12171	346	0.6326	0.1532	0.2143
61	1978	0.137	23.590	0.711	1944	2.968	176.15	16715	462	0.5770	0.1517	0.2713
61	1979	0.128	22.822	0.760	2171	3.354	191.47	18135	500	0.5559	0.1531	0.2910
61	1980	0.122	26.421	0.825	2547	3.904	207.93	19957	585	0.5309	0.1762	0.2929
61	1981	0.126	28.110	0.858	2745	3.937	204.72	19638	632	0.5471	0.1750	0.2779
61	1982	0.136	33.416	0.796	2855	3.795	179.23	17013	658	0.5902	0.1928	0.2170
61	1983	0.140	33.870	0.849	2899	3.344	188.12	18040	679	0.5979	0.1668	0.2353
61	1984	0.142	36.505	0.968	2924	3.627	201.93	20052	743	0.5587	0.1782	0.2631
62	1974	0.102	15.691	0.428	524	2.154	86.38	8364	124	0.4304	0.2721	0.2976
62	1975	0.109	17.382	0.620	635	2.081	88.42	8550	160	0.4321	0.2258	0.3421
62	1976	0.115	19.031	0.680	737	2.065	92.77	8980	187	0.4529	0.2099	0.3372
62	1977	0.127	20.384	0.788	810	2.089	90.52	8718	217	0.4746	0.1965	0.3289
62	1978	0.122	22.564	1.081	842	2.090	102.48	9802	261	0.3941	0.1810	0.4250
62	1979	0.142	25.424	1.036	867	2.114	109.24	10507	290	0.4246	0.1852	0.3902
62	1980	0.150	27.495	1.035	924	2.176	118.32	11464	321	0.4319	0.1864	0.3817
62	1981	0.132	30.796	1.125	976	2.182	111.36	10684	321	0.4009	0.2092	0.3900
62	1982	0.145	34.645	1.270	1030	2.188	108.54	10371	363	0.4114	0.2088	0.3798
62	1983	0.145	37.953	1.319	1132	2.181	119.33	11349	404	0.4060	0.2048	0.3893
62	1984	0.144	43.732	1.371	1255	2.211	114.33	10927	434	0.4163	0.2227	0.3610
64	1974	0.096	14.364	0.499	362	1.638	33.51	2801	75	0.4637	0.3135	0.2228
64	1975	0.118	16.598	0.577	361	1.596	37.65	3180	91	0.4690	0.2917	0.2393
64	1976	0.128	18.425	0.659	368	1.588	40.35	3440	103	0.4574	0.2843	0.2583
64	1977	0.124	19.820	0.744	391	1.631	44.64	3787	114	0.4251	0.2836	0.2913
64	1978	0.127	21.715	1.142	432	1.652	34.52	2611	130	0.4213	0.2757	0.3030
64	1979	0.121	23.144	1.137	462	1.685	31.46	3332	131	0.4278	0.2985	0.2738
64	1980	0.129	25.787	1.094	504	1.716	38.10	3301	151	0.4306	0.2932	0.2762
64	1981	0.128	29.122	1.351	543	1.687	34.47	2987	165	0.4208	0.2974	0.2819
64	1982	0.146	32.281	1.427	537	1.672	36.57	3175	184	0.4246	0.2926	0.2829
64	1983	0.143	34.990	1.581	551	1.653	37.09	3214	195	0.4037	0.2961	0.3001
64	1984	0.152	38.172	1.580	564	1.501	34.28	2957	197	0.4346	0.2907	0.2747
65	1974	0.108	14.980	0.517	267	1.417	27.90	2233	64	0.4471	0.3292	0.2237
65	1975	0.123	16.885	0.674	302	1.417	26.47	2032	79	0.4706	0.3032	0.2262
65	1976	0.122	18.171	0.828	357	1.454	29.78	2360	95	0.4602	0.2793	0.2605
65	1977	0.112	19.730	0.912	421	1.454	23.71	2065	97	0.4838	0.2944	0.2218
65	1978	0.125	21.781	1.009	482	1.511	23.98	2083	117	0.5135	0.2804	0.2061
65	1979	0.131	23.996	1.075	533	1.545	31.06	2784	140	0.4978	0.2643	0.2379
65	1980	0.129	26.413	1.183	584	1.574	35.58	3169	159	0.4739	0.2615	0.2646
65	1981	0.132	29.727	1.157	651	1.571	37.05	3332	175	0.4895	0.2662	0.2444
65	1982	0.141	32.065	1.288	681	1.534	32.32	2858	187	0.5139	0.2633	0.2229
65	1983	0.153	32.394	1.551	711	1.218	35.59	3033	203	0.5348	0.1939	0.2713
65	1984	0.161	35.756	1.497	714	1.258	34.59	3103	212	0.5429	0.2125	0.2446
67	1974	0.134	13.799	0.540	105	0.557	12.04	1057	28	0.4971	0.2724	0.2305
67	1975	0.122	15.394	0.693	118	0.552	12.17	1112	31	0.4594	0.2713	0.2693
67	1976	0.108	16.688	0.797	122	0.546	19.57	1870	38	0.3483	0.2404	0.4113
67	1977	0.132	17.554	0.872	135	0.544	17.78	1667	43	0.4162	0.2226	0.3612
67	1978	0.121	19.174	1.181	166	0.554	17.79	1629	52	0.3884	0.2054	0.4063
67	1979	0.118	20.935	1.251	206	0.569	18.07	1725	59	0.4134	0.2025	0.3842
67	1980	0.121	23.485	1.406	231	0.590	16.53	1620	65	0.4299	0.2130	0.3572

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
67	1981	0.135	27.099	1.497	241	0.593	19.45	1891	78	0.4186	0.2068	0.3747
67	1982	0.160	29.672	1.551	242	0.568	21.89	2044	89	0.4322	0.1883	0.3795
67	1983	0.160	31.433	1.618	239	0.550	23.13	2224	93	0.4115	0.1860	0.4026
67	1984	0.169	33.614	1.645	239	0.541	24.96	2501	100	0.4056	0.1825	0.4120
68	1974	0.111	15.326	0.456	259	1.388	41.00	3485	69	0.4186	0.3095	0.2720
68	1975	0.116	16.581	0.609	298	1.418	38.40	3212	81	0.4245	0.2886	0.2869
68	1976	0.128	18.148	0.589	342	1.426	46.48	4041	97	0.4514	0.2667	0.2819
68	1977	0.124	19.982	0.654	393	1.437	44.85	3893	107	0.4565	0.2689	0.2746
68	1978	0.123	21.320	0.805	442	1.463	50.29	4279	126	0.4315	0.2474	0.3211
68	1979	0.133	23.117	0.919	504	1.490	55.11	4898	152	0.4406	0.2265	0.3329
68	1980	0.125	25.066	0.947	593	1.558	48.54	4355	159	0.4656	0.2455	0.2889
68	1981	0.137	27.666	0.836	704	1.601	59.74	5378	191	0.5059	0.2322	0.2619
68	1982	0.146	30.339	1.038	778	1.649	55.21	4952	221	0.5142	0.2264	0.2594
68	1983	0.152	33.092	1.107	822	1.621	59.58	5310	245	0.5109	0.2193	0.2698
68	1984	0.163	35.310	1.106	836	1.591	57.35	5277	256	0.5325	0.2195	0.2480
70	1974	0.107	17.973	1.112	1186	3.718	118.54	10346	326	0.3899	0.2053	0.4049
70	1975	0.103	19.853	0.879	1279	3.430	93.58	8555	282	0.4671	0.2414	0.2915
70	1976	0.112	22.508	0.841	1364	3.410	95.28	8854	310	0.4933	0.2478	0.2588
70	1977	0.120	24.271	1.049	1467	3.470	92.63	8541	357	0.4926	0.2356	0.2719
70	1978	0.117	26.745	1.017	1626	3.655	96.24	8995	386	0.4931	0.2534	0.2536
70	1979	0.113	28.133	1.180	1750	3.684	93.39	8724	412	0.4804	0.2518	0.2677
70	1980	0.108	32.472	2.154	1393	3.588	66.26	5963	410	0.3672	0.2844	0.3484
70	1981	0.107	32.188	2.196	1467	3.681	66.61	6100	422	0.3722	0.2810	0.3468
70	1982	0.106	34.827	2.361	1534	3.118	64.68	5715	424	0.3836	0.2562	0.3602
70	1983	0.120	38.689	3.064	1611	3.258	50.27	4396	473	0.4084	0.2662	0.3253
70	1984	0.125	42.696	3.343	1792	3.352	50.96	4494	538	0.4168	0.2663	0.3169
71	1974	0.101	19.365	0.797	600	2.461	41.31	7238	141	0.4293	0.3375	0.2332
71	1975	0.110	22.619	0.524	664	2.491	83.53	7204	173	0.4219	0.3255	0.2526
71	1976	0.106	24.397	0.620	762	2.530	86.87	7667	196	0.4116	0.3143	0.2741
71	1977	0.106	27.183	0.767	894	2.560	94.73	8229	237	0.3998	0.2937	0.3066
71	1978	0.110	24.666	0.915	1045	2.686	96.70	8581	270	0.4264	0.2457	0.3280
71	1979	0.099	31.097	1.134	1234	2.541	87.63	7533	301	0.4065	0.2629	0.3307
71	1980	0.131	32.050	1.125	1359	2.637	106.71	9564	383	0.4653	0.2209	0.3138
71	1981	0.135	34.275	1.271	1437	2.694	119.65	10762	438	0.4425	0.2106	0.3469
71	1982	0.127	37.786	1.420	1598	2.720	101.79	9138	450	0.4507	0.2283	0.3210
71	1983	0.142	38.425	1.556	1856	2.708	99.96	9191	523	0.5038	0.1989	0.2973
71	1984	0.141	40.876	1.548	2236	2.633	109.26	10157	592	0.5325	0.1818	0.2857
72	1974	0.103	14.191	0.333	376	1.285	67.06	5946	79	0.4881	0.2301	0.2818
72	1975	0.107	15.430	0.585	449	1.287	67.13	6164	107	0.4486	0.1853	0.3662
72	1976	0.106	16.831	0.672	549	1.311	63.48	5879	123	0.4735	0.1794	0.3471
72	1977	0.105	18.280	0.993	636	1.337	74.35	6732	165	0.4046	0.1481	0.4474
72	1978	0.103	19.599	1.092	748	1.370	87.85	8130	200	0.3854	0.1344	0.4803
72	1979	0.104	21.425	1.227	900	1.421	83.07	7554	226	0.4143	0.1347	0.4509
72	1980	0.125	22.921	1.330	1066	1.514	86.63	7958	283	0.4706	0.1226	0.4069
72	1981	0.117	25.217	1.529	1210	1.660	83.55	7490	311	0.4549	0.1345	0.4106
72	1982	0.132	27.016	1.679	1411	1.828	76.26	6894	364	0.5120	0.1358	0.3522
72	1983	0.130	30.052	1.865	1646	1.928	74.71	6806	411	0.5204	0.1409	0.3388
72	1984	0.128	35.097	1.885	1999	2.182	80.30	7195	484	0.5288	0.1583	0.3129
74	1974	0.109	13.955	0.961	233	0.626	58.93	6290	91	0.2800	0.0962	0.6238
74	1975	0.107	14.485	0.865	239	0.610	47.57	5020	76	0.3383	0.1170	0.5447
74	1976	0.123	14.922	0.828	263	0.644	61.13	6432	93	0.3497	0.1038	0.5465

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
74	1977	0.120	17.455	0.966	279	0.659	62.24	6547	105	0.3181	0.1095	0.5724
74	1978	0.127	18.330	1.156	309	0.715	54.72	5579	116	0.3393	0.1134	0.5474
74	1979	0.112	22.010	1.279	344	0.735	47.59	4822	116	0.3336	0.1399	0.5265
74	1980	0.130	22.414	1.290	370	0.828	59.47	6154	143	0.3358	0.1294	0.5348
74	1981	0.120	25.069	1.478	397	0.857	56.70	5897	153	0.3113	0.1405	0.5482
74	1982	0.136	27.850	1.654	451	0.851	52.15	5501	171	0.3580	0.1384	0.5036
74	1983	0.145	28.638	1.633	500	0.823	51.45	5414	180	0.4025	0.1309	0.4666
74	1984	0.161	33.421	1.621	482	0.869	58.61	6008	202	0.3848	0.1440	0.4711
75	1974	0.099	12.573	0.655	482	1.748	70.29	6621	116	0.4122	0.1899	0.3979
75	1975	0.117	15.205	0.808	545	1.645	71.94	6843	147	0.4341	0.1703	0.3956
75	1976	0.117	16.651	0.736	608	1.659	84.64	7819	161	0.4417	0.1716	0.3867
75	1977	0.112	18.610	1.013	652	1.654	92.22	8470	197	0.3703	0.1561	0.4736
75	1978	0.112	20.005	1.249	711	1.723	95.18	8672	233	0.3419	0.1479	0.5102
75	1979	0.115	21.645	1.205	821	1.765	88.46	8110	239	0.3945	0.1597	0.4458
75	1980	0.101	22.501	1.384	964	1.944	95.75	8876	274	0.3557	0.1599	0.4844
75	1981	0.125	25.120	1.582	1042	2.003	94.77	8797	331	0.3942	0.1522	0.4536
75	1982	0.146	28.695	1.706	1105	1.900	96.04	8863	380	0.4248	0.1436	0.4316
75	1983	0.145	29.860	1.755	1174	1.936	106.60	9898	415	0.4102	0.1393	0.4506
75	1984	0.151	34.369	1.785	1216	1.962	106.40	9814	441	0.4165	0.1529	0.4306
79	1974	0.115	14.826	0.415	887	2.096	185.17	17905	210	0.4860	0.1480	0.3660
79	1975	0.115	17.035	0.440	960	2.113	193.05	18932	231	0.4769	0.1556	0.3675
79	1976	0.110	18.577	0.626	1064	2.103	215.99	21541	291	0.4016	0.1341	0.4643
79	1977	0.113	19.683	0.685	1217	2.129	206.18	20204	321	0.4288	0.1307	0.4406
79	1978	0.110	21.794	0.777	1475	2.184	216.44	21251	378	0.4291	0.1259	0.4450
79	1979	0.106	23.489	0.972	1715	2.281	195.71	18429	426	0.4271	0.1259	0.4471
79	1980	0.125	25.931	1.680	1926	2.345	176.68	16440	598	0.4023	0.1016	0.4961
79	1981	0.131	31.412	2.160	2202	2.425	165.18	15471	721	0.3999	0.1056	0.4945
79	1982	0.131	32.970	2.470	2663	2.647	156.97	14540	824	0.4234	0.1059	0.4706
79	1983	0.122	37.261	2.510	3166	2.737	139.28	12922	838	0.4610	0.1217	0.4173
79	1984	0.132	40.714	2.572	3618	2.898	150.17	14100	982	0.4864	0.1202	0.3934
80	1974	0.110	13.315	0.397	366	3.101	66.43	6585	108	0.3727	0.3828	0.2445
80	1975	0.117	14.025	0.541	438	3.037	70.38	7025	132	0.3883	0.3230	0.2887
80	1976	0.107	15.619	0.593	508	3.170	81.36	8090	152	0.3573	0.3255	0.3172
80	1977	0.111	17.408	0.710	593	3.374	85.79	8422	185	0.3548	0.3168	0.3284
80	1978	0.105	18.820	1.193	651	3.499	82.35	7943	232	0.2941	0.2833	0.4226
80	1979	0.106	19.506	1.055	720	3.488	83.84	8088	233	0.3278	0.2923	0.3799
80	1980	0.113	20.988	1.164	811	3.581	82.49	7960	263	0.3486	0.2860	0.3654
80	1981	0.113	24.347	1.266	922	3.626	80.45	7743	294	0.3540	0.2999	0.3461
80	1982	0.108	28.321	1.362	1075	3.789	80.95	7525	334	0.3479	0.3216	0.3305
80	1983	0.134	30.750	1.362	1115	3.592	85.84	8195	377	0.3966	0.2932	0.3103
80	1984	0.145	32.354	1.400	1157	3.522	86.57	8219	403	0.4164	0.2828	0.3008
81	1974	0.081	13.710	0.647	135	0.513	10.95	1063	25	0.4368	0.2806	0.2826
81	1975	0.076	15.471	0.548	147	0.493	17.26	1518	28	0.3955	0.2700	0.3345
81	1976	0.086	16.207	0.666	159	0.494	19.24	1715	35	0.3970	0.2320	0.3710
81	1977	0.132	17.978	0.767	176	0.494	19.48	1731	47	0.4932	0.1890	0.3178
81	1978	0.138	17.663	0.943	179	0.543	24.42	2149	57	0.4306	0.1674	0.4021
81	1979	0.138	19.059	1.168	177	0.571	27.17	2345	67	0.3642	0.1623	0.4735
81	1980	0.150	22.408	1.266	176	0.573	25.33	2244	71	0.3696	0.1802	0.4502
81	1981	0.142	24.991	1.337	173	0.618	22.04	1967	70	0.3540	0.2221	0.4239
81	1982	0.153	27.265	1.548	171	0.653	22.47	1955	79	0.3317	0.2263	0.4420
81	1983	0.189	30.200	1.582	166	0.657	24.18	2089	90	0.3511	0.2216	0.4273

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
81	1984	0.192	31.435	1.605	175	0.703	23.17	2090	93	0.3621	0.2378	0.4002
85	1974	0.101	17.282	0.991	875	2.870	78.35	7151	216	0.4098	0.2301	0.3602
85	1975	0.105	19.280	0.937	920	2.581	85.79	8153	227	0.4260	0.2195	0.3545
85	1976	0.111	21.702	0.900	971	2.600	76.71	7294	233	0.4621	0.2419	0.2960
85	1977	0.117	23.494	0.878	1028	2.651	86.84	8144	259	0.4649	0.2407	0.2945
85	1978	0.116	26.327	0.967	1080	2.738	86.73	8064	281	0.4456	0.2563	0.2981
85	1979	0.100	29.206	1.219	1077	2.733	57.92	5434	258	0.4171	0.3092	0.2736
85	1980	0.079	30.302	1.565	1064	2.822	57.13	5387	259	0.3244	0.3302	0.3454
85	1981	0.070	33.172	1.825	1112	2.821	51.75	4838	266	0.2928	0.3520	0.3552
85	1982	0.106	36.382	1.856	1105	1.886	42.66	3993	265	0.4422	0.2590	0.2988
85	1983	0.116	38.728	1.788	1074	1.995	52.04	5007	295	0.4225	0.2620	0.3155
85	1984	0.133	41.099	1.895	1101	2.093	47.11	4496	322	0.4551	0.2674	0.2775
89	1974	0.102	13.978	0.895	364	0.957	71.91	6657	115	0.3232	0.1165	0.5603
89	1975	0.102	15.451	0.979	409	0.936	58.91	5618	114	0.3662	0.1270	0.5068
89	1976	0.121	17.506	1.209	442	0.953	66.41	6062	150	0.3554	0.1109	0.5337
89	1977	0.120	19.308	1.328	476	1.006	66.82	5965	165	0.3457	0.1175	0.5368
89	1978	0.114	19.834	1.494	492	1.070	71.72	6464	184	0.3040	0.1151	0.5809
89	1979	0.107	21.357	1.618	491	1.135	65.42	5753	183	0.2877	0.1327	0.5796
89	1980	0.128	22.684	1.854	491	1.241	72.17	6740	225	0.2795	0.1252	0.5952
89	1981	0.154	27.202	2.111	527	1.359	63.09	5777	251	0.3230	0.1471	0.5299
89	1982	0.139	31.009	2.283	550	1.422	65.56	6199	270	0.2830	0.1632	0.5539
89	1983	0.155	40.028	2.406	597	1.586	63.96	6097	310	0.2986	0.2049	0.4965
89	1984	0.153	33.391	2.402	616	1.633	67.14	6467	310	0.3041	0.1758	0.5201
91	1974	0.117	14.959	0.606	426	1.447	85.45	8322	123	0.4044	0.1756	0.4200
91	1975	0.125	16.555	0.956	463	1.401	95.25	9330	172	0.3360	0.1348	0.5292
91	1976	0.137	19.015	0.991	503	1.382	104.33	10380	199	0.3471	0.1323	0.5206
91	1977	0.117	20.404	1.022	566	1.377	106.52	10312	203	0.3258	0.1383	0.5360
91	1978	0.113	22.419	1.200	640	1.409	87.41	8419	209	0.3463	0.1514	0.5024
91	1979	0.111	24.926	1.198	671	1.449	101.27	9802	232	0.3210	0.1558	0.5233
91	1980	0.124	27.980	1.286	708	1.481	98.88	9594	256	0.3423	0.1616	0.4961
91	1981	0.137	29.226	1.473	725	1.530	98.96	9664	290	0.3425	0.1543	0.5031
91	1982	0.165	32.393	1.667	736	1.558	108.72	10613	353	0.3439	0.1429	0.5132
91	1983	0.165	35.039	1.612	749	1.581	110.08	10774	356	0.3467	0.1554	0.4979
91	1984	0.156	38.434	1.566	779	1.581	113.76	11035	360	0.3372	0.1686	0.4942
94	1974	0.110	17.220	1.782	188	1.385	14.79	1183	71	0.2915	0.3366	0.3720
94	1975	0.119	14.435	1.845	189	1.251	9.41	782	58	0.3878	0.3121	0.3001
94	1976	0.101	20.846	1.993	190	1.182	5.95	500	56	0.3449	0.4422	0.2128
94	1977	0.113	22.689	2.092	192	1.124	7.08	558	62	0.3498	0.4113	0.2389
94	1978	0.129	25.343	2.021	194	1.082	7.11	553	67	0.3749	0.4101	0.2150
94	1979	0.160	25.967	2.581	196	1.068	7.49	583	78	0.3999	0.3536	0.2465
94	1980	0.133	26.531	3.752	198	1.037	11.98	949	99	0.2669	0.2783	0.4548
94	1981	0.151	27.969	4.563	202	1.028	10.37	812	107	0.2862	0.2698	0.4440
94	1982	0.175	30.521	4.499	206	1.005	5.75	432	93	0.3894	0.3312	0.2794
94	1983	0.184	34.476	4.164	213	0.971	7.54	575	104	0.3766	0.3217	0.3017
94	1984	0.162	38.807	4.359	222	0.933	7.84	591	106	0.3384	0.3403	0.3212
97	1974	0.095	20.143	1.482	745	0.734	114.69	11615	256	0.2771	0.0579	0.6651
97	1975	0.106	18.469	1.651	778	0.739	127.22	12687	306	0.2694	0.0446	0.6860
97	1976	0.128	22.654	1.533	813	0.758	127.53	12854	317	0.3286	0.0542	0.6172
97	1977	0.124	24.855	1.860	854	0.738	126.27	12749	359	0.2948	0.0511	0.6541
97	1978	0.116	27.716	1.690	906	0.761	138.03	14112	359	0.2925	0.0587	0.6488
97	1979	0.118	29.587	2.230	933	0.765	129.53	13026	422	0.2611	0.0537	0.6852

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
97	1980	0.121	30.216	2.936	1051	0.762	130.16	13015	532	0.2389	0.0433	0.7178
97	1981	0.119	31.745	3.883	1188	0.781	126.28	12756	657	0.2153	0.0378	0.7469
97	1982	0.146	34.703	2.979	1349	0.816	135.68	13630	629	0.3129	0.0450	0.6421
97	1983	0.155	38.928	2.823	1540	0.836	133.61	13255	648	0.3682	0.0502	0.5816
97	1984	0.159	42.235	2.818	1746	0.824	144.33	14540	719	0.3860	0.0484	0.5656
98	1974	0.095	14.027	0.869	190	2.914	37.06	3189	91	0.1982	0.4485	0.3534
98	1975	0.100	14.943	1.374	193	2.821	28.36	2412	100	0.1920	0.4199	0.3881
98	1976	0.130	16.913	1.560	191	2.783	28.25	2440	116	0.2145	0.4057	0.3798
98	1977	0.135	18.200	1.763	191	2.830	41.41	3587	150	0.1718	0.3426	0.4855
98	1978	0.133	20.374	1.737	192	2.892	41.77	3663	157	0.1625	0.3754	0.4621
98	1979	0.135	21.760	2.337	196	2.925	47.51	4093	201	0.1317	0.3164	0.5519
98	1980	0.119	23.629	2.747	200	2.921	50.64	4186	232	0.1024	0.2977	0.5999
98	1981	0.138	26.533	3.545	201	2.884	50.84	4168	284	0.0974	0.2690	0.6336
98	1982	0.137	29.209	3.847	202	2.839	43.90	3650	280	0.0992	0.2966	0.6041
98	1983	0.123	34.992	3.623	203	1.535	25.39	2155	171	0.1464	0.3147	0.5389
98	1984	0.191	41.321	3.367	204	1.527	32.39	2820	211	0.1848	0.2988	0.5164
99	1974	0.114	17.663	0.814	759	4.239	80.28	7344	227	0.3816	0.3302	0.2882
99	1975	0.106	19.931	0.948	885	4.146	75.15	6871	248	0.3789	0.3336	0.2875
99	1976	0.109	22.714	0.967	1044	4.174	78.31	7046	284	0.4002	0.3335	0.2663
99	1977	0.108	24.659	1.036	1187	4.218	84.79	7606	320	0.4006	0.3250	0.2744
99	1978	0.116	26.164	1.205	1275	4.240	102.07	9350	382	0.3873	0.2906	0.3221
99	1979	0.122	28.711	1.282	1397	4.226	112.08	10430	435	0.3913	0.2787	0.3300
99	1980	0.122	29.959	1.336	1518	4.332	112.82	10449	466	0.3976	0.2787	0.3237
99	1981	0.126	32.997	1.540	1749	4.313	116.68	10762	542	0.4064	0.2624	0.3312
99	1982	0.134	35.817	1.636	2253	4.396	118.33	10945	653	0.4624	0.2411	0.2965
99	1983	0.128	38.071	1.579	2593	4.397	115.71	10854	682	0.4867	0.2455	0.2679
99	1984	0.144	38.945	1.680	3003	4.382	129.18	12096	820	0.5272	0.2081	0.2647
101	1974	0.099	18.886	0.805	1950	10.080	200.35	19300	545	0.3544	0.3495	0.2961
101	1975	0.112	21.247	1.027	2020	9.067	205.13	19895	630	0.3593	0.3060	0.3347
101	1976	0.108	24.100	1.020	2133	8.897	224.36	21686	674	0.3421	0.3183	0.3396
101	1977	0.109	26.316	1.310	2315	9.108	232.06	22600	796	0.3170	0.3011	0.3818
101	1978	0.113	27.911	1.288	2469	9.260	242.94	23647	850	0.3281	0.3039	0.3680
101	1979	0.114	30.877	1.617	2716	9.452	236.96	22456	985	0.3145	0.2964	0.3891
101	1980	0.116	32.602	1.978	2940	9.627	234.24	22070	1118	0.3050	0.2807	0.4143
101	1981	0.127	36.059	2.473	3240	9.685	229.77	21745	1329	0.3096	0.2628	0.4275
101	1982	0.136	39.278	2.476	3641	9.951	203.23	19497	1389	0.3565	0.2814	0.3622
101	1983	0.138	42.622	2.232	4149	10.335	212.44	20354	1487	0.3850	0.2962	0.3188
101	1984	0.138	46.840	2.201	4802	10.476	221.90	21158	1642	0.4036	0.2989	0.2975
102	1974	0.087	17.455	1.473	1984	7.950	187.84	17409	588	0.2935	0.2360	0.4705
102	1975	0.089	19.808	1.415	2190	7.554	160.45	15052	572	0.3410	0.2617	0.3973
102	1976	0.101	22.280	0.982	2322	7.311	182.26	16992	576	0.4070	0.2826	0.3104
102	1977	0.106	22.868	1.047	2398	7.443	185.74	17565	619	0.4108	0.2750	0.3142
102	1978	0.106	26.362	1.028	2483	7.311	186.65	17521	648	0.4063	0.2975	0.2963
102	1979	0.109	29.389	1.441	2545	7.227	179.87	16772	749	0.3704	0.2836	0.3461
102	1980	0.108	32.689	2.388	2687	7.486	199.15	18629	1011	0.2872	0.2421	0.4707
102	1981	0.118	33.425	2.576	2940	8.150	186.85	17198	1101	0.3151	0.2475	0.4374
102	1982	0.126	36.692	2.177	3256	8.579	190.47	17434	1140	0.3600	0.2762	0.3638
102	1983	0.133	39.325	2.426	3759	8.957	177.34	16650	1282	0.3898	0.2747	0.3355
102	1984	0.135	43.400	2.475	4346	9.100	225.43	20893	1540	0.3811	0.2565	0.3624
103	1974	0.103	15.750	0.535	788	5.628	83.50	7884	215	0.3785	0.4132	0.2082
103	1975	0.105	18.706	0.780	910	5.532	89.30	8558	269	0.3556	0.3851	0.2593

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
103	1976	0.111	18.846	0.802	1024	5.638	89.63	8660	292	0.3895	0.3641	0.2464
103	1977	0.106	21.445	1.088	1182	5.723	102.29	9539	359	0.3487	0.3415	0.3098
103	1978	0.102	23.897	1.423	1326	5.893	100.41	9359	419	0.3229	0.3361	0.3410
103	1979	0.105	26.662	1.611	1458	6.073	100.57	9114	477	0.3210	0.3394	0.3397
103	1980	0.105	27.805	1.908	1598	6.321	113.54	10097	560	0.2996	0.3137	0.3867
103	1981	0.113	32.963	2.272	1674	6.516	109.78	9816	653	0.2895	0.3287	0.3817
103	1982	0.111	38.993	2.528	2074	6.862	99.70	8860	750	0.3070	0.3569	0.3361
103	1983	0.133	43.425	2.533	2199	6.311	111.90	10036	850	0.3441	0.3225	0.3335
103	1984	0.143	48.076	2.467	2359	5.913	103.33	9390	877	0.3848	0.3243	0.2908
104	1974	0.076	17.207	0.435	1703	6.736	181.80	16339	324	0.3989	0.3573	0.2438
104	1975	0.085	20.023	0.456	1827	6.722	215.52	19421	388	0.4001	0.3468	0.2531
104	1976	0.086	21.792	0.521	1900	6.901	245.17	22167	441	0.3701	0.3407	0.2892
104	1977	0.086	23.768	0.529	1946	7.115	293.58	27199	492	0.3402	0.3438	0.3160
104	1978	0.093	26.917	0.581	2038	7.076	290.41	26811	549	0.3454	0.3470	0.3076
104	1979	0.094	28.824	0.653	2104	6.966	274.38	25305	578	0.3424	0.3475	0.3101
104	1980	0.089	32.448	0.764	2173	7.170	267.13	24533	630	0.3069	0.3692	0.3239
104	1981	0.093	36.382	0.802	2284	7.385	259.14	23916	689	0.3083	0.3900	0.3017
104	1982	0.109	40.130	0.870	2409	7.692	250.45	23030	789	0.3327	0.3911	0.2762
104	1983	0.113	43.241	0.933	2429	7.560	267.69	24769	851	0.3224	0.3840	0.2935
104	1984	0.111	47.603	1.059	2647	7.918	235.73	21689	920	0.3192	0.4095	0.2712
107	1974	0.100	17.149	0.933	1609	6.236	206.93	19655	461	0.3491	0.2320	0.4189
107	1975	0.106	18.553	1.092	1840	6.149	200.34	18369	528	0.3695	0.2161	0.4144
107	1976	0.110	20.014	0.976	2101	6.229	215.99	20281	567	0.4079	0.2200	0.3720
107	1977	0.111	21.972	0.979	2392	6.450	217.02	19972	620	0.4285	0.2287	0.3428
107	1978	0.101	23.762	1.188	2705	6.712	231.07	20967	707	0.3863	0.2255	0.3881
107	1979	0.113	24.746	1.281	2998	7.089	243.32	22208	826	0.4102	0.2124	0.3773
107	1980	0.110	27.360	1.531	3422	7.453	241.74	22595	950	0.3960	0.2145	0.3895
107	1981	0.133	30.322	1.677	3836	7.609	269.33	24916	1193	0.4278	0.1935	0.3788
107	1982	0.129	33.211	1.685	4366	7.844	249.33	23046	1244	0.4528	0.2094	0.3377
107	1983	0.136	35.533	1.536	4940	7.791	256.89	23998	1343	0.5002	0.2061	0.2937
107	1984	0.140	48.993	1.548	5746	7.681	275.02	26072	1607	0.5007	0.2342	0.2650
108	1974	0.108	14.694	0.738	2029	4.421	354.95	38298	546	0.4013	0.1190	0.4797
108	1975	0.124	15.367	0.981	2133	4.130	400.75	41132	721	0.3667	0.0880	0.5453
108	1976	0.136	16.355	0.946	2250	4.061	454.63	46786	802	0.3813	0.0828	0.5360
108	1977	0.125	17.693	1.048	2393	4.054	459.07	47144	852	0.3511	0.0842	0.5647
108	1978	0.119	22.109	1.328	2493	7.189	461.45	46897	1068	0.2777	0.1488	0.5735
108	1979	0.130	24.794	1.278	2577	8.026	513.48	51951	1190	0.2815	0.1672	0.5513
108	1980	0.135	30.164	1.384	2715	8.411	470.78	47445	1272	0.2881	0.1995	0.5124
108	1981	0.143	31.711	1.567	2806	8.146	456.24	46391	1374	0.2919	0.1879	0.5201
108	1982	0.142	35.258	1.706	2806	8.472	403.30	40796	1385	0.2876	0.2156	0.4968
108	1983	0.144	37.100	1.777	2755	8.139	426.21	43516	1456	0.2724	0.2074	0.5202
108	1984	0.156	42.996	1.763	2789	8.478	429.64	43868	1557	0.2794	0.2341	0.4865
109	1974	0.115	12.877	0.363	756	3.088	164.01	15686	186	0.4669	0.2135	0.3196
109	1975	0.114	14.601	0.565	879	3.119	164.35	15788	239	0.4198	0.1909	0.3893
109	1976	0.108	16.235	1.009	1044	3.131	172.88	16646	338	0.3336	0.1503	0.5160
109	1977	0.106	18.415	1.231	1230	3.201	182.15	17440	413	0.3153	0.1426	0.5421
109	1978	0.111	20.009	1.339	1374	3.267	213.17	20099	503	0.3030	0.1298	0.5671
109	1979	0.102	22.579	1.400	1471	3.454	225.33	21186	543	0.2761	0.1435	0.5804
109	1980	0.116	25.542	1.524	1534	3.555	240.69	22634	636	0.2801	0.1429	0.5770
109	1981	0.132	29.258	1.655	1589	3.621	241.40	22659	715	0.2932	0.1481	0.5587
109	1982	0.140	32.858	1.800	1751	3.781	235.68	22289	794	0.3088	0.1566	0.5346

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
109	1983	0.142	34.173	2.000	1869	3.999	239.35	22669	881	0.3014	0.1552	0.5434
109	1984	0.142	37.663	2.215	1976	4.094	236.16	21887	958	0.2930	0.1610	0.5461
110	1974	0.098	18.750	1.868	349	1.670	40.06	3769	140	0.2439	0.2230	0.5330
110	1975	0.115	21.303	1.908	360	1.640	38.17	3650	149	0.2776	0.2342	0.4882
110	1976	0.121	23.680	1.868	367	1.650	34.53	3377	148	0.3003	0.2640	0.4358
110	1977	0.114	25.143	2.134	370	1.694	33.76	3272	157	0.2690	0.2716	0.4594
110	1978	0.125	27.425	2.057	376	1.674	29.29	2840	153	0.3070	0.2997	0.3933
110	1979	0.123	30.086	4.103	383	1.668	18.50	2792	173	0.2719	0.2898	0.4383
110	1980	0.128	32.647	3.250	397	1.689	33.65	3173	215	0.2361	0.2561	0.5079
110	1981	0.132	35.420	4.043	420	1.711	31.82	2943	245	0.2265	0.2477	0.5258
110	1982	0.143	38.399	4.397	384	1.719	29.61	2729	251	0.2189	0.2628	0.5183
110	1983	0.149	42.592	4.089	384	1.640	29.22	2716	247	0.2321	0.2833	0.4846
110	1984	0.150	46.319	4.122	409	1.631	30.14	2855	261	0.2349	0.2893	0.4758
111	1974	0.106	15.649	0.451	174	0.904	16.09	1213	40	0.4634	0.3546	0.1819
111	1975	0.105	18.501	0.539	192	0.870	20.61	1683	47	0.4254	0.3400	0.2346
111	1976	0.120	19.869	0.598	202	0.841	24.29	2007	55	0.4368	0.3014	0.2619
111	1977	0.121	21.450	0.624	219	0.862	24.70	2015	60	0.4382	0.3063	0.2555
111	1978	0.116	21.222	0.687	264	0.886	25.64	2118	67	0.4564	0.2806	0.2630
111	1979	0.116	23.085	0.785	320	0.918	23.19	1940	76	0.4847	0.2772	0.2381
111	1980	0.111	25.661	0.910	379	0.937	24.87	2139	89	0.4741	0.2710	0.2550
111	1981	0.117	29.348	1.026	403	0.914	28.20	2374	103	0.4584	0.2605	0.2811
111	1982	0.141	34.910	1.144	407	0.898	29.02	2447	122	0.4707	0.2570	0.2722
111	1983	0.145	43.028	1.139	412	0.895	24.96	2108	127	0.4718	0.3039	0.2244
111	1984	0.150	41.611	1.162	415	0.907	25.34	2179	129	0.4809	0.2916	0.2275
114	1974	0.104	17.848	0.653	912	4.042	115.10	10232	242	0.3917	0.2979	0.3104
114	1975	0.111	19.744	0.788	1002	3.676	117.67	10655	277	0.4022	0.2625	0.3353
114	1976	0.110	21.744	0.838	1098	3.752	113.06	10253	297	0.4066	0.2746	0.3188
114	1977	0.111	24.642	0.872	1177	3.891	109.34	9992	322	0.4060	0.2979	0.2961
114	1978	0.114	26.048	1.074	1220	4.211	132.83	12212	391	0.3554	0.2802	0.3644
114	1979	0.123	27.080	1.174	1229	4.149	140.32	12935	428	0.3530	0.2624	0.3847
114	1980	0.111	29.931	1.336	1243	4.100	126.04	11513	429	0.3215	0.2860	0.3925
114	1981	0.115	32.401	1.579	1294	4.087	123.79	11471	477	0.3122	0.2778	0.4100
114	1982	0.135	35.590	1.609	1314	4.115	121.31	11284	519	0.3418	0.2821	0.3760
114	1983	0.134	38.096	1.480	1313	4.159	120.95	11291	513	0.3428	0.3086	0.3486
114	1984	0.147	41.128	1.643	1347	4.240	116.41	11005	564	0.3514	0.3094	0.3393
115	1974	0.111	16.260	0.828	1739	7.133	262.77	25205	527	0.3666	0.2202	0.4132
115	1975	0.111	19.066	0.996	2026	6.792	270.61	27476	624	0.3604	0.2076	0.4320
115	1976	0.109	20.966	1.113	2355	6.700	290.44	28547	720	0.3563	0.1950	0.4487
115	1977	0.119	22.956	1.293	2647	6.847	338.72	33423	910	0.3461	0.1727	0.4811
115	1978	0.114	24.849	1.405	2935	7.040	321.35	31400	961	0.3482	0.1820	0.4697
115	1979	0.117	26.290	1.567	3354	7.490	339.52	33099	1121	0.3499	0.1756	0.4745
115	1980	0.109	29.497	1.928	3824	7.640	328.05	32854	1275	0.3270	0.1768	0.4962
115	1981	0.124	32.316	2.225	4362	7.888	305.77	30200	1476	0.3664	0.1727	0.4608
115	1982	0.127	36.528	2.117	5031	8.155	297.88	29581	1568	0.4076	0.1900	0.4023
115	1983	0.129	40.409	2.037	5573	8.205	375.94	37720	1816	0.3958	0.1825	0.4216
115	1984	0.125	42.170	1.901	6045	8.313	383.29	37890	1835	0.4118	0.1910	0.3971
116	1974	0.105	16.444	0.895	246	0.833	28.52	2620	65	0.3971	0.2106	0.3924
116	1975	0.106	17.837	1.165	283	0.910	27.23	2372	78	0.3850	0.2081	0.4068
116	1976	0.104	18.748	1.006	335	1.057	30.17	2715	85	0.4100	0.2331	0.3569
116	1977	0.104	20.772	0.915	372	1.197	38.55	3480	99	0.3911	0.2517	0.3572
116	1978	0.103	22.943	1.065	414	1.307	37.36	3313	112	0.3793	0.2667	0.3539

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
116	1979	0.116	22.843	1.200	443	1.500	36.58	3188	130	0.3970	0.2644	0.3386
116	1980	0.112	25.765	1.421	485	1.682	35.43	3106	148	0.3670	0.2928	0.3402
116	1981	0.119	29.083	1.300	521	1.779	42.16	3828	168	0.3676	0.3071	0.3253
116	1982	0.125	32.750	1.535	574	1.835	39.01	3539	192	0.3740	0.3135	0.3124
116	1983	0.129	34.124	1.377	628	1.868	39.53	3559	199	0.4067	0.3200	0.2732
116	1984	0.142	40.079	1.363	712	1.845	44.55	4059	236	0.4290	0.3136	0.2575
117	1974	0.098	19.087	1.295	3009	10.234	229.80	21532	788	0.3743	0.2479	0.3777
117	1975	0.105	21.517	1.089	3258	9.924	214.49	20389	789	0.4335	0.2706	0.2959
117	1976	0.107	24.145	1.122	3448	9.649	222.91	21179	852	0.4330	0.2735	0.2935
117	1977	0.108	26.854	1.255	3716	9.672	205.80	18909	919	0.4366	0.2825	0.2809
117	1978	0.111	28.998	1.196	3975	9.630	251.18	23333	1021	0.4322	0.2736	0.2942
117	1979	0.108	32.190	1.391	4235	9.544	227.44	20993	1081	0.4231	0.2842	0.2927
117	1980	0.119	35.294	1.786	4625	9.721	218.36	20249	1283	0.4289	0.2673	0.3038
117	1981	0.124	38.265	1.949	5205	9.868	208.52	19075	1429	0.4515	0.2642	0.2843
117	1982	0.130	42.224	1.451	5902	10.156	230.31	21099	1530	0.5014	0.2803	0.2183
117	1983	0.129	45.434	2.039	6637	10.464	198.43	18206	1736	0.4931	0.2738	0.2330
117	1984	0.135	51.214	2.018	7592	10.637	218.99	20057	2011	0.5095	0.2708	0.2197
119	1974	0.100	16.558	0.636	394	1.542	58.74	5999	102	0.3853	0.2496	0.3652
119	1975	0.123	17.998	0.954	414	1.502	76.92	7744	151	0.3364	0.1786	0.4850
119	1976	0.123	20.176	0.971	463	1.483	81.77	9346	166	0.3424	0.1800	0.4777
119	1977	0.100	22.326	0.996	538	1.385	89.79	8837	174	0.3091	0.1775	0.5133
119	1978	0.090	23.528	1.205	609	1.394	76.00	7544	179	0.3060	0.1830	0.5110
119	1979	0.101	24.869	1.205	647	1.443	82.21	8275	200	0.3262	0.1792	0.4947
119	1980	0.126	27.422	1.304	680	1.463	91.27	9046	245	0.3500	0.1639	0.4861
119	1981	0.131	29.564	1.482	697	1.469	96.29	9545	277	0.3290	0.1566	0.5144
119	1982	0.148	33.038	1.667	709	1.428	97.26	9734	314	0.3339	0.1501	0.5159
119	1983	0.156	35.804	1.627	713	1.386	104.24	10289	330	0.3365	0.1502	0.5133
119	1984	0.158	39.738	1.570	754	1.346	105.08	10398	338	0.3529	0.1584	0.4887
120	1974	0.100	15.367	1.418	1497	4.534	193.29	18922	493	0.3034	0.1412	0.5554
120	1975	0.100	17.094	1.472	1593	4.431	163.60	16139	476	0.3347	0.1592	0.5062
120	1976	0.103	19.423	1.357	1657	4.488	189.35	18562	515	0.3315	0.1693	0.4992
120	1977	0.121	21.086	1.571	1693	4.623	182.77	17805	590	0.3475	0.1653	0.4871
120	1978	0.118	22.497	1.667	1807	4.805	197.58	19319	651	0.3276	0.1661	0.5063
120	1979	0.118	24.578	1.860	1906	5.038	189.80	18506	702	0.3205	0.1765	0.5030
120	1980	0.130	27.129	2.023	1935	5.216	188.35	18080	774	0.3250	0.1828	0.4922
120	1981	0.132	29.755	2.258	2084	5.343	159.44	15595	794	0.3464	0.2002	0.4534
120	1982	0.133	33.779	2.281	2206	5.349	166.94	16463	855	0.3431	0.2114	0.4455
120	1983	0.149	38.851	2.209	2279	5.321	179.75	17750	943	0.3600	0.2191	0.4209
120	1984	0.160	43.718	2.244	2409	5.314	187.51	18537	1039	0.3712	0.2237	0.4052
121	1974	0.097	16.203	0.461	872	5.658	127.21	11315	235	0.3602	0.3902	0.2496
121	1975	0.108	18.434	0.613	946	5.592	134.19	11619	288	0.3553	0.3585	0.2862
121	1976	0.112	20.525	0.653	1010	5.666	142.75	12667	323	0.3507	0.3605	0.2889
121	1977	0.103	22.423	0.728	1089	5.931	153.40	13747	357	0.3143	0.3728	0.3130
121	1978	0.102	24.564	0.822	1214	6.088	151.30	13514	398	0.3113	0.3760	0.3127
121	1979	0.100	26.583	1.087	1384	6.286	160.96	14551	480	0.2879	0.3478	0.3643
121	1980	0.118	29.265	1.279	1549	6.231	143.10	12776	548	0.3335	0.3326	0.3338
121	1981	0.126	32.509	1.217	1662	6.313	138.92	12768	584	0.3587	0.3516	0.2896
121	1982	0.142	35.253	1.213	1648	6.765	148.71	13483	653	0.3584	0.3653	0.2763
121	1983	0.138	38.999	1.214	1671	6.845	141.63	13028	670	0.3445	0.3987	0.2568
121	1984	0.156	41.722	1.302	1771	6.899	134.82	12360	740	0.3735	0.3892	0.2373
122	1974	0.115	13.965	0.379	1021	3.404	150.62	14580	222	0.5289	0.2141	0.2571

CO	YEAR	PK	PL	PP	XK	XL	XP	Q	TC	Sk	Sl	SE
122	1975	0.115	15.013	0.510	1134	3.503	162.79	16002	266	0.4901	0.1976	0.3123
122	1976	0.132	16.591	0.644	1299	3.634	190.62	18698	354	0.4837	0.1701	0.3462
122	1977	0.126	18.239	0.790	1519	3.814	206.31	20012	424	0.4514	0.1641	0.3845
122	1978	0.117	20.130	1.045	1763	3.942	201.66	19276	496	0.4156	0.1598	0.4246
122	1979	0.133	21.662	1.056	2062	4.207	242.93	23690	622	0.4409	0.1465	0.4125
122	1980	0.123	24.776	1.149	2480	4.658	246.61	23938	704	0.4335	0.1640	0.4025
122	1981	0.126	26.988	1.271	2877	4.981	234.04	22809	794	0.4563	0.1692	0.3745
122	1982	0.143	29.739	1.427	3349	5.328	224.67	21841	958	0.4999	0.1654	0.3347
122	1983	0.171	31.225	1.380	1761	5.255	249.54	24309	810	0.3720	0.2026	0.4254
122	1984	0.129	39.126	1.396	1739	4.048	289.77	28357	787	0.2850	0.2012	0.5139
123	1974	0.107	15.751	1.047	380	1.525	41.21	3692	108	0.3770	0.2228	0.4002
123	1975	0.119	17.454	1.343	402	1.527	43.56	4005	133	0.3599	0.2003	0.4398
123	1976	0.117	19.302	1.375	456	1.521	43.28	3925	142	0.3754	0.2064	0.4182
123	1977	0.105	20.998	1.500	553	1.521	46.99	4366	160	0.3620	0.1990	0.4391
123	1978	0.117	21.543	1.592	708	1.661	45.78	4142	191	0.4324	0.1869	0.3806
123	1979	0.107	22.968	1.890	861	1.796	58.93	5457	245	0.3765	0.1685	0.4550
123	1980	0.118	25.864	2.486	1059	1.877	58.51	5348	319	0.3917	0.1522	0.4561
123	1981	0.133	28.271	3.163	1106	2.046	52.11	4751	370	0.3978	0.1564	0.4457
123	1982	0.117	31.942	2.620	1366	2.295	44.91	4125	351	0.4556	0.2090	0.3354
123	1983	0.142	34.815	2.636	1758	2.419	48.00	4469	460	0.5423	0.1829	0.2748
123	1984	0.114	42.024	2.866	2099	2.188	58.34	5619	498	0.4801	0.1845	0.3354
124	1974	0.104	13.590	0.397	240	1.216	36.76	3341	56	0.4448	0.2949	0.2604
124	1975	0.108	17.685	0.512	304	1.326	40.33	3729	77	0.4267	0.3050	0.2683
124	1976	0.095	16.727	0.618	423	1.476	39.44	3556	89	0.4505	0.2764	0.2731
124	1977	0.098	17.141	0.928	555	1.751	49.42	4489	130	0.4177	0.2304	0.3519
124	1978	0.099	18.759	1.051	736	2.054	42.48	3846	156	0.4669	0.2470	0.2861
124	1979	0.102	20.377	1.207	1021	2.294	48.06	4471	209	0.4986	0.2238	0.2776
124	1980	0.107	25.956	1.096	1271	2.498	55.04	5213	261	0.5208	0.2483	0.2310
124	1981	0.117	31.816	1.195	1516	2.787	58.08	5171	335	0.5289	0.2643	0.2068
124	1982	0.113	31.449	1.150	1773	2.973	73.62	6517	379	0.5294	0.2470	0.2236
124	1983	0.134	35.002	0.971	1808	2.783	91.15	7861	428	0.5658	0.2275	0.2067
124	1984	0.131	35.904	1.118	2055	2.750	76.83	6989	454	0.5932	0.2175	0.1893
126	1974	0.099	20.453	1.462	3049	14.447	280.98	26194	1008	0.2994	0.2931	0.4075
126	1975	0.104	22.389	1.436	3204	13.581	241.39	22868	984	0.3387	0.3090	0.3523
126	1976	0.112	24.730	1.418	3403	13.347	256.52	24275	1075	0.3545	0.3070	0.3385
126	1977	0.113	26.918	1.627	3661	13.456	272.57	25590	1219	0.3392	0.2970	0.3637
126	1978	0.115	29.095	1.491	3674	13.226	286.40	27077	1234	0.3423	0.3118	0.3460
126	1979	0.111	31.449	1.892	4007	13.217	262.70	24888	1358	0.3276	0.3062	0.3662
126	1980	0.119	35.300	2.258	4377	12.807	303.27	28387	1658	0.3142	0.2727	0.4131
126	1981	0.132	39.428	2.486	4593	12.641	282.80	26419	1808	0.3353	0.2757	0.3889
126	1982	0.122	43.331	2.195	5157	12.938	290.75	27203	1828	0.3442	0.3067	0.3491
126	1983	0.125	47.955	2.594	5778	13.274	265.61	24709	2048	0.3527	0.3108	0.3365
126	1984	0.131	50.770	2.700	6545	13.527	271.44	25512	2277	0.3765	0.3016	0.3218
128	1974	0.099	19.626	0.584	365	2.754	46.33	4288	117	0.3082	0.4610	0.2308
128	1975	0.103	23.049	0.627	420	2.653	54.40	5026	139	0.3123	0.4413	0.2463
128	1976	0.109	25.961	0.740	472	2.671	48.74	4381	157	0.3279	0.4421	0.2300
128	1977	0.103	28.179	0.732	543	2.651	64.25	5514	178	0.3147	0.4206	0.2647
128	1978	0.109	30.571	0.783	616	2.642	59.04	5425	194	0.3458	0.4161	0.2381
128	1979	0.108	32.892	0.904	687	2.668	55.04	5130	212	0.3504	0.4145	0.2351
128	1980	0.110	35.902	1.180	747	2.703	60.45	5572	251	0.3281	0.3873	0.2846
128	1981	0.132	38.518	1.269	829	2.790	62.21	5723	296	0.3698	0.3633	0.2669

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
128	1982	0.138	40.291	1.530	898	2.818	53.62	4937	319	0.3879	0.3554	0.2567
128	1983	0.139	42.648	1.377	1033	2.739	60.63	5662	344	0.4176	0.3397	0.2427
128	1984	0.148	48.502	1.219	1206	2.646	60.04	5640	380	0.4697	0.3377	0.1926
132	1974	0.119	14.327	1.369	156	0.452	21.55	1921	55	0.3406	0.1187	0.5407
132	1975	0.115	14.012	1.380	167	0.431	22.65	2034	57	0.3402	0.1068	0.5530
132	1976	0.111	16.484	1.690	175	0.428	22.91	2153	65	0.2975	0.1083	0.5942
132	1977	0.129	18.770	2.018	191	0.444	24.68	2268	83	0.2977	0.1007	0.6016
132	1978	0.136	20.490	1.899	225	0.457	24.99	2263	87	0.3502	0.1071	0.5427
132	1979	0.122	22.315	2.320	233	0.496	22.21	2040	91	0.3120	0.1217	0.5663
132	1980	0.143	23.341	2.147	234	0.522	19.07	1762	87	0.3870	0.1406	0.4724
132	1981	0.146	26.023	2.269	269	0.572	19.95	1788	99	0.3952	0.1497	0.4551
132	1982	0.136	29.474	2.170	290	0.585	20.55	1898	101	0.3894	0.1703	0.4403
132	1983	0.175	30.350	2.011	293	0.615	21.97	2064	114	0.4490	0.1637	0.3874
132	1984	0.183	34.922	1.994	317	0.610	22.52	2145	124	0.4673	0.1714	0.3613
133	1974	0.099	14.511	0.948	678	2.686	110.72	10767	211	0.3179	0.1847	0.4974
133	1975	0.113	15.893	1.058	781	2.714	103.70	10294	241	0.3660	0.1789	0.4551
133	1976	0.109	17.610	1.064	945	2.787	109.87	10985	269	0.3830	0.1824	0.4346
133	1977	0.105	18.672	1.280	1102	2.882	121.42	12129	325	0.3559	0.1656	0.4785
133	1978	0.115	20.857	1.462	1219	3.009	126.09	12569	387	0.3619	0.1621	0.4761
133	1979	0.114	23.136	1.547	1323	3.193	120.15	12014	411	0.3672	0.1799	0.4528
133	1980	0.119	25.858	1.703	1432	3.327	120.67	11902	462	0.3688	0.1862	0.4450
133	1981	0.134	29.032	1.959	1559	3.511	119.76	11790	545	0.3829	0.1869	0.4302
133	1982	0.130	34.512	1.944	1695	3.684	109.38	11108	560	0.3934	0.2270	0.3796
133	1983	0.134	31.880	1.990	1761	4.146	130.86	12546	629	0.3754	0.2103	0.4143
133	1984	0.146	38.698	1.704	1943	4.265	133.45	13060	676	0.4196	0.2441	0.3363
135	1974	0.113	20.319	1.125	3690	13.598	448.93	46985	1198	0.3479	0.2306	0.4215
135	1975	0.105	22.777	1.588	3969	13.452	484.18	47657	1492	0.2793	0.2053	0.5153
135	1976	0.109	25.243	1.700	4374	12.971	481.74	47221	1623	0.2937	0.2017	0.5046
135	1977	0.111	27.319	1.948	4786	13.182	571.38	56927	2004	0.2651	0.1797	0.5552
135	1978	0.108	30.021	1.995	5272	13.476	544.62	53071	2061	0.2763	0.1963	0.5274
135	1979	0.121	34.029	2.367	5881	13.318	605.92	59398	2599	0.2738	0.1744	0.5518
135	1980	0.115	39.670	3.108	6540	14.344	544.83	52595	3014	0.2495	0.1888	0.5617
135	1981	0.131	42.874	3.873	7473	14.863	520.86	50772	3633	0.2694	0.1754	0.5552
135	1982	0.137	49.749	3.470	8448	15.230	473.59	43398	3559	0.3252	0.2129	0.4619
135	1983	0.159	53.917	3.128	9136	16.123	438.21	40082	3692	0.3934	0.2354	0.3712
135	1984	0.167	61.499	2.897	9754	16.569	483.83	44596	4050	0.4022	0.2516	0.3461
138	1974	0.135	13.149	0.369	170	0.737	33.69	3116	45	0.5090	0.2151	0.2759
138	1975	0.132	14.246	0.499	172	0.702	33.17	3122	49	0.4601	0.2032	0.3367
138	1976	0.143	14.355	0.570	183	0.702	31.25	2893	54	0.4846	0.1862	0.3292
138	1977	0.120	16.946	0.733	231	0.725	35.98	3312	66	0.4179	0.1850	0.3971
138	1978	0.126	18.079	1.092	279	0.783	36.77	3353	90	0.3932	0.1581	0.4487
138	1979	0.129	19.453	1.059	301	0.825	40.13	3758	97	0.3986	0.1649	0.4366
138	1980	0.152	21.414	1.193	310	0.874	44.61	4187	119	0.3953	0.1573	0.4474
138	1981	0.144	22.860	1.293	322	0.897	45.10	4178	125	0.3702	0.1638	0.4660
138	1982	0.147	26.169	1.389	363	0.893	39.69	3573	132	0.4045	0.1773	0.4182
138	1983	0.149	28.696	1.489	428	0.889	44.30	4113	155	0.4109	0.1643	0.4248
138	1984	0.152	31.967	1.546	476	0.897	46.39	4366	173	0.4188	0.1660	0.4152
140	1974	0.132	12.269	0.355	395	1.749	87.45	8528	105	0.4981	0.2051	0.2968
140	1975	0.118	13.403	0.461	459	1.733	89.11	8617	118	0.4570	0.1961	0.3470
140	1976	0.117	14.559	0.690	551	1.744	89.11	8640	151	0.4259	0.1678	0.4062
140	1977	0.127	15.606	0.889	653	1.813	107.27	10366	207	0.4014	0.1370	0.4616

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
140	1978	0.124	17.527	1.068	733	1.817	119.10	11459	250	0.3639	0.1274	0.5087
140	1979	0.123	19.391	1.139	841	1.894	129.27	12437	287	0.3601	0.1278	0.5121
140	1980	0.126	20.292	1.260	995	1.940	142.16	13592	344	0.3646	0.1145	0.5209
140	1981	0.143	22.571	1.315	1116	1.973	156.42	14963	410	0.3893	0.1087	0.5020
140	1982	0.146	25.931	1.836	1326	2.049	150.68	14290	523	0.3700	0.1015	0.5285
140	1983	0.161	28.604	2.198	1523	2.100	146.82	13836	628	0.3904	0.0957	0.5139
140	1984	0.159	31.778	2.406	1759	2.130	140.83	13268	686	0.4076	0.0986	0.4938
142	1974	0.118	13.978	0.439	58	0.452	13.96	1144	19	0.3549	0.3275	0.3176
142	1975	0.119	16.005	0.647	67	0.462	8.82	659	21	0.3785	0.3508	0.2707
142	1976	0.116	17.792	0.897	79	0.462	9.16	728	26	0.3590	0.3207	0.3204
142	1977	0.123	19.697	1.137	92	0.465	10.71	883	33	0.3454	0.2810	0.3736
142	1978	0.121	21.351	1.219	113	0.473	12.87	1063	40	0.3473	0.2556	0.3971
142	1979	0.111	22.464	1.403	132	0.487	10.41	864	40	0.3638	0.2725	0.3637
142	1980	0.144	26.227	1.366	134	0.472	9.75	899	45	0.4280	0.2756	0.2964
142	1981	0.162	28.638	1.273	131	0.468	10.57	1027	48	0.4421	0.2784	0.2795
142	1982	0.152	31.031	1.404	133	0.466	9.03	859	47	0.4260	0.3059	0.2681
142	1983	0.170	31.829	1.416	128	0.454	9.71	913	50	0.4346	0.2897	0.2757
142	1984	0.171	33.660	1.404	132	0.451	10.19	979	52	0.4327	0.2920	0.2753
143	1974	0.102	16.482	0.776	609	2.085	92.41	8728	168	0.3693	0.2043	0.4264
143	1975	0.114	17.555	1.108	692	2.298	94.30	8874	224	0.3525	0.1803	0.4671
143	1976	0.122	19.253	1.320	728	2.340	100.12	9454	266	0.3339	0.1694	0.4967
143	1977	0.129	21.817	1.464	744	2.311	107.20	10338	303	0.3164	0.1662	0.5174
143	1978	0.140	23.625	1.648	755	2.365	113.10	10741	348	0.3039	0.1606	0.5355
143	1979	0.129	26.026	2.030	768	2.450	115.72	10988	398	0.2490	0.1603	0.5907
143	1980	0.148	28.248	2.309	801	2.511	124.40	12012	477	0.2486	0.1488	0.6026
143	1981	0.140	30.011	2.756	865	2.675	121.31	11715	536	0.2259	0.1499	0.6242
143	1982	0.118	32.858	2.535	1045	2.908	115.15	11281	511	0.2413	0.1871	0.5716
143	1983	0.140	35.406	2.505	1243	3.098	120.67	11730	586	0.2969	0.1872	0.5158
143	1984	0.143	40.229	2.384	1460	3.219	128.34	12426	644	0.3241	0.2010	0.4750
150	1974	0.102	14.107	0.722	440	1.472	50.07	4661	102	0.4407	0.2040	0.3552
150	1975	0.100	16.976	0.801	500	1.386	40.79	3850	106	0.4708	0.2215	0.3077
150	1976	0.112	19.315	0.930	622	1.265	46.92	4150	138	0.5057	0.1774	0.3169
150	1977	0.116	21.765	1.030	721	1.195	62.64	5859	174	0.4803	0.1493	0.3704
150	1978	0.115	24.074	1.160	849	1.226	66.14	5942	204	0.4789	0.1447	0.3763
150	1979	0.123	20.424	1.364	895	1.253	64.62	6141	224	0.4919	0.1143	0.3938
150	1980	0.123	28.318	1.297	1010	1.143	66.11	6424	242	0.5126	0.1335	0.3539
150	1981	0.131	31.425	1.422	1096	1.175	76.26	7007	289	0.4968	0.1278	0.3754
150	1982	0.115	34.871	1.350	1300	1.167	62.03	5555	274	0.5458	0.1486	0.3056
150	1983	0.127	39.186	1.231	1520	1.129	62.21	5563	314	0.6151	0.1410	0.2440
150	1984	0.147	42.041	1.367	1159	1.035	49.19	4530	281	0.6060	0.1548	0.2392
153	1974	0.109	16.689	1.952	382	1.516	46.17	4268	157	0.2650	0.1611	0.5739
153	1975	0.113	18.502	2.006	408	1.449	45.24	4289	164	0.2817	0.1638	0.5544
153	1976	0.110	20.291	1.920	427	1.422	51.28	4946	174	0.2697	0.1655	0.5647
153	1977	0.117	21.890	2.251	460	1.421	48.48	4718	194	0.2775	0.1603	0.5623
153	1978	0.108	24.227	2.097	515	1.424	53.38	5228	202	0.2754	0.1707	0.5539
153	1979	0.116	25.738	3.206	578	1.460	50.93	4922	268	0.2503	0.1403	0.6095
153	1980	0.118	27.935	4.792	623	1.481	49.32	4823	351	0.2093	0.1178	0.6729
153	1981	0.132	31.157	5.652	698	1.514	45.83	4552	398	0.2313	0.1184	0.6503
153	1982	0.137	34.851	4.705	845	1.517	45.91	4601	385	0.3010	0.1374	0.5615
153	1983	0.144	37.005	4.527	1021	1.569	53.44	5394	447	0.3290	0.1299	0.5411
153	1984	0.126	39.176	4.984	1133	1.559	50.90	5144	458	0.3120	0.1335	0.5545

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
155	1974	0.098	13.840	0.867	47	0.382	6.28	391	15	0.3017	0.3440	0.3543
155	1975	0.104	15.212	1.082	53	0.416	5.67	359	18	0.3070	0.3519	0.3411
155	1976	0.117	17.622	1.112	56	0.442	5.21	328	20	0.3246	0.3874	0.2880
155	1977	0.115	19.521	1.091	59	0.470	5.13	317	22	0.3140	0.4262	0.2599
155	1978	0.108	21.679	1.301	60	0.506	5.81	357	25	0.2585	0.4389	0.3026
155	1979	0.123	23.579	0.950	60	0.554	3.53	207	24	0.3115	0.5479	0.1406
155	1980	0.106	24.325	1.042	62	0.579	3.39	202	24	0.2706	0.5832	0.1462
155	1981	0.136	27.421	1.098	62	0.579	3.23	193	28	0.3032	0.5696	0.1272
155	1982	0.163	26.151	1.270	63	0.576	3.31	195	30	0.3487	0.5092	0.1421
155	1983	0.163	30.705	1.178	65	0.564	3.40	191	32	0.3321	0.5424	0.1255
155	1984	0.159	33.770	1.256	70	0.585	3.28	184	35	0.3164	0.5656	0.1180
156	1974	0.090	15.803	0.303	719	2.474	86.09	7930	130	0.4983	0.3009	0.2008
156	1975	0.099	17.369	0.401	841	2.653	95.58	8854	168	0.4966	0.2748	0.2286
156	1976	0.108	19.469	0.503	1064	2.821	82.10	7733	211	0.5442	0.2600	0.1957
156	1977	0.096	21.299	0.617	1342	3.172	116.62	10868	268	0.4800	0.2518	0.2682
156	1978	0.106	23.071	0.746	1555	3.522	136.11	13056	348	0.4742	0.2337	0.2921
156	1979	0.105	24.845	0.903	1761	3.851	157.14	14895	422	0.4377	0.2265	0.3358
156	1980	0.123	28.429	1.043	1855	4.013	164.93	15921	514	0.4437	0.2218	0.3345
156	1981	0.117	32.304	1.093	2180	4.255	155.23	14869	562	0.4538	0.2445	0.3017
156	1982	0.125	35.939	1.263	2424	4.481	167.16	14750	675	0.4487	0.2385	0.3127
156	1983	0.137	39.657	1.223	2545	4.575	163.57	15051	730	0.4775	0.2485	0.2740
156	1984	0.127	42.801	1.282	2602	4.760	173.99	16683	757	0.4364	0.2691	0.2946
157	1974	0.108	13.770	0.350	179	0.820	24.00	2241	39	0.4955	0.2893	0.2152
157	1975	0.121	14.931	0.440	185	0.740	21.57	1953	43	0.5215	0.2573	0.2212
157	1976	0.123	16.876	0.490	189	0.777	22.00	2093	47	0.4933	0.2782	0.2285
157	1977	0.116	18.190	0.603	203	0.791	21.27	1842	51	0.4636	0.2837	0.2527
157	1978	0.113	20.107	0.890	252	0.780	24.13	2083	66	0.4339	0.2390	0.3271
157	1979	0.129	21.808	1.024	268	0.811	22.69	1988	75	0.4577	0.2345	0.3079
157	1980	0.131	24.266	1.341	281	0.808	21.87	1974	86	0.4292	0.2287	0.3421
157	1981	0.142	25.749	1.490	301	0.817	25.86	2281	102	0.4176	0.2057	0.3768
157	1982	0.141	28.243	1.600	313	0.815	24.94	2280	107	0.4125	0.2149	0.3726
157	1983	0.173	29.740	1.650	324	0.824	28.48	2675	128	0.4393	0.1922	0.3685
157	1984	0.173	31.782	1.747	331	0.919	28.63	2679	137	0.4196	0.2139	0.3665
159	1974	0.094	12.305	1.114	3121	7.421	328.06	30175	750	0.3911	0.1217	0.4872
159	1975	0.105	13.541	1.164	3433	7.900	367.55	33746	895	0.4026	0.1195	0.4779
159	1976	0.106	15.242	1.202	3756	8.275	379.06	35836	980	0.4062	0.1287	0.4651
159	1977	0.108	16.730	1.379	4093	8.821	403.15	36954	1146	0.3859	0.1288	0.4853
159	1978	0.110	18.277	1.243	4478	9.382	439.78	39902	1211	0.4069	0.1416	0.4514
159	1979	0.107	20.291	1.783	4982	9.625	363.49	32835	1377	0.3873	0.1419	0.4708
159	1980	0.115	21.439	1.897	5351	10.580	349.82	31130	1506	0.4087	0.1506	0.4407
159	1981	0.119	23.955	1.579	5795	11.487	389.23	34822	1579	0.4367	0.1742	0.3891
159	1982	0.147	27.670	1.344	5588	12.663	393.84	35904	1701	0.4829	0.2060	0.3112
159	1983	0.139	31.665	1.156	5829	12.664	417.03	38515	1693	0.4785	0.2368	0.2847
159	1984	0.134	36.146	1.292	6332	12.983	419.83	39146	1860	0.4561	0.2523	0.2916
161	1974	0.110	16.055	0.752	738	2.037	130.52	12994	212	0.3830	0.1542	0.4628
161	1975	0.125	19.221	0.980	770	1.970	164.06	16478	295	0.3263	0.1284	0.5453
161	1976	0.120	21.047	0.947	822	1.910	172.54	17854	302	0.3264	0.1330	0.5406
161	1977	0.119	22.876	1.009	926	1.977	158.50	15895	315	0.3493	0.1434	0.5072
161	1978	0.119	23.579	1.283	1040	2.017	128.19	12718	336	0.3685	0.1416	0.4899
161	1979	0.129	25.343	1.191	1101	2.097	160.94	16270	387	0.3672	0.1374	0.4955
161	1980	0.124	30.215	1.285	1179	2.107	162.62	16301	419	0.3491	0.1520	0.4989

CO	YEAR	PK	PL	PF	XK	XL	XF	Q	TC	Sk	Sl	Sf
161	1981	0.145	28.927	1.468	1243	2.113	159.13	15925	475	0.3794	0.1287	0.4919
161	1982	0.140	32.170	1.656	1286	2.158	163.98	16475	521	0.3455	0.1333	0.5212
161	1983	0.143	34.732	1.588	1297	2.185	181.66	18107	550	0.3372	0.1380	0.5247
161	1984	0.147	38.655	1.552	1333	2.192	181.62	18070	563	0.3483	0.1506	0.5011
162	1974	0.141	10.069	0.410	167	1.053	38.66	3631	50	0.4710	0.2120	0.3170
162	1975	0.143	11.147	0.866	179	1.068	43.51	4182	75	0.3408	0.1583	0.5009
162	1976	0.144	12.237	1.210	191	1.077	46.77	4460	97	0.2827	0.1355	0.5818
162	1977	0.148	12.859	1.430	198	1.073	50.87	4860	116	0.2527	0.1191	0.6282
162	1978	0.139	15.653	1.550	201	1.066	46.89	4544	117	0.2380	0.1423	0.6197
162	1979	0.144	16.989	1.669	209	1.137	48.90	4709	131	0.2293	0.1475	0.6232
162	1980	0.149	19.461	1.869	226	1.153	55.55	5313	160	0.2106	0.1403	0.6492
162	1981	0.126	21.851	2.379	259	1.232	47.85	4563	173	0.1882	0.1553	0.6566
162	1982	0.139	24.587	3.161	307	1.286	48.38	4596	227	0.1879	0.1392	0.6729
162	1983	0.132	26.884	3.180	387	1.319	46.08	4309	233	0.2190	0.1522	0.6288
162	1984	0.152	31.200	3.008	485	1.284	47.35	4445	256	0.2878	0.1564	0.5558
165	1974	0.075	14.831	0.439	911	5.761	177.63	16440	232	0.2949	0.3686	0.3364
165	1975	0.079	17.109	0.638	923	5.750	174.40	16282	283	0.2580	0.3481	0.3939
165	1976	0.082	18.881	0.683	927	5.707	176.72	16791	304	0.2497	0.3539	0.3963
165	1977	0.134	20.346	0.707	979	5.725	181.52	17086	376	0.3490	0.3097	0.3413
165	1978	0.126	22.169	0.855	1128	5.778	183.67	16946	427	0.3327	0.2998	0.3674
165	1979	0.128	24.475	0.985	1316	5.936	183.72	16507	495	0.3405	0.2936	0.3658
165	1980	0.124	27.155	1.172	1499	6.068	186.49	16505	569	0.3266	0.2895	0.3839
165	1981	0.152	30.694	1.295	1538	6.087	194.89	17439	673	0.3473	0.2776	0.3750
165	1982	0.164	34.492	1.382	1561	6.166	186.72	16801	727	0.3523	0.2926	0.3551
165	1983	0.183	36.715	1.392	1584	6.157	201.98	16938	797	0.3636	0.2837	0.3527
165	1984	0.196	40.018	1.422	1621	6.098	200.69	18461	847	0.3750	0.2881	0.3369
166	1974	0.115	15.563	0.609	372	1.810	53.35	4960	103	0.4136	0.2723	0.3141
166	1975	0.121	17.106	0.674	392	1.837	58.90	5494	119	0.3998	0.2651	0.3351
166	1976	0.130	19.811	0.755	419	1.868	62.87	5928	139	0.3919	0.2664	0.3417
166	1977	0.134	21.658	0.836	446	1.961	67.73	6351	159	0.3759	0.2674	0.3566
166	1978	0.132	23.264	0.940	464	2.160	70.89	6581	178	0.3441	0.2821	0.3738
166	1979	0.147	24.272	1.093	479	2.336	79.43	7507	214	0.3294	0.2649	0.4057
166	1980	0.142	28.429	1.176	501	2.406	81.20	7679	235	0.3027	0.2909	0.4063
166	1981	0.141	31.488	1.269	541	2.423	72.06	6810	244	0.3127	0.3126	0.3748
166	1982	0.169	33.689	1.458	583	2.394	73.63	6908	287	0.3439	0.2815	0.3746
166	1983	0.174	35.718	1.523	625	2.367	80.69	7646	316	0.3440	0.2674	0.3886
166	1984	0.176	37.083	1.452	671	2.437	83.79	7914	330	0.3576	0.2738	0.3685
167	1974	0.115	15.384	0.683	344	1.929	54.22	4836	106	0.3722	0.2793	0.3485
167	1975	0.129	18.178	0.763	356	1.879	56.58	5150	123	0.3726	0.2772	0.3502
167	1976	0.145	21.315	0.792	361	1.831	64.98	5977	143	0.3664	0.2733	0.3603
167	1977	0.150	23.938	0.848	370	1.813	64.95	5968	154	0.3602	0.2819	0.3579
167	1978	0.154	25.460	0.917	381	1.848	69.40	6338	169	0.3466	0.2777	0.3757
167	1979	0.151	28.112	1.079	419	1.900	72.85	6710	195	0.3242	0.2734	0.4024
167	1980	0.137	29.446	1.193	495	1.974	71.11	6605	211	0.3217	0.2757	0.4025
167	1981	0.144	30.188	1.297	554	2.074	67.90	6250	230	0.3463	0.2717	0.3820
167	1982	0.170	31.973	1.591	556	2.191	71.88	6591	279	0.3388	0.2511	0.4100
167	1983	0.187	34.751	1.627	540	2.276	77.77	7136	307	0.3295	0.2579	0.4126
167	1984	0.196	36.596	1.603	537	2.380	78.99	7328	319	0.3301	0.2730	0.3969

APPENDIX B

INDUSTRY SUMMARY, 1974 - 84

APPENDIX B

INDUSTRY SUMMARY DATA: 1974-84

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1015	16.6222	0.8448	92289	363.632	11999	25548	1074038	0.3667	0.2366	0.3968
1975	0.1086	18.4316	0.9539	91546	355.832	12240	29103	1136483	0.3735	0.2254	0.4012
1976	0.1120	20.3253	1.0118	95332	359.214	12869	32598	1210915	0.3766	0.2240	0.3994
1977	0.1135	22.4043	1.1487	99204	365.432	13640	37563	1275509	0.3649	0.2180	0.4171
1978	0.1140	24.2493	1.2582	102043	383.705	14114	42258	1335424	0.3596	0.2202	0.4202
1979	0.1150	26.3870	1.4562	103945	396.630	14244	48177	1343207	0.3522	0.2172	0.4305
1980	0.1187	29.0098	1.7126	104481	408.392	14504	55907	1366588	0.3438	0.2119	0.4443
1981	0.1281	32.1253	1.9691	103999	418.656	14466	64578	1371038	0.3506	0.2083	0.4411
1982	0.1322	35.5681	1.9977	107613	430.808	13957	68846	1318464	0.3724	0.2226	0.4050
1983	0.1407	38.4587	1.9384	111299	433.460	14535	74143	1359687	0.3952	0.2248	0.3800
1984	0.1429	41.3473	1.9576	112188	434.786	14730	78434	1409363	0.4032	0.2292	0.3676

* All price indexes are the averages of 95 companies.

* All quantity indexes are the aggregate of 95 companies.

* See Appendix A for the notation and the unit of measurement of each variable.

APPENDIX C

COMPARISONS OF THREE MODELS

APPENDIX C

COMPARISONS OF THREE MODELS
TOTAL FACTOR PRODUCTIVITY GROWTH OVER TIME FO
(FRACTION CHANGE OF THREE-YEAR PERIOD)

MODELS: CRAIG - CRAIG & HARRIS MODEL
ECON - ECONOMETRIC MODEL
SUPER - SUPERLATIVE INDEX MODEL

CO	YEAR	CRAIG	ECON	SUPER
1	1975			
1	1978	0.0678	-0.024	0.0327
1	1981	-0.0588	-0.008	0.0859
1	1984	-0.0173	0.0065	0.1725
4	1975			
4	1978	-0.1827	-0.0227	-0.1118
4	1981	-0.1242	-0.0076	0.1282
4	1984	-0.2678	0.007	0.0555
6	1975			
6	1978	-0.2101	-0.0226	0.1184
6	1981	0.1409	-0.0061	-0.0968
6	1984	0.1059	0.0102	0.0383
7	1975			
7	1978	0.0444	-0.0231	0.2578
7	1981	-0.1393	-0.0082	-0.0285
7	1984	0.1023	0.0066	0.0582
12	1975			
12	1978	-0.1812	-0.022	0.2223
12	1981	-0.0902	-0.0017	-0.0071
12	1984	0.0211	0.0175	0.0675
14	1975			
14	1978	-0.1621	-0.0236	0.0379
14	1981	-0.0877	-0.0088	-0.0359
14	1984	-0.0339	0.0065	-0.0775
15	1975			
15	1978	-0.1560	-0.0228	0.0441
15	1981	-0.4614	-0.0073	0.0167
15	1984	-0.1244	0.0075	-0.1086
16	1975			
16	1978	0.1655	-0.0217	0.0094
16	1981	-0.5542	-0.0043	0.0619
16	1984	0.1327	0.0126	-0.0045
17	1975			
17	1978	-0.0397	-0.0235	0.0256
17	1981	0.0791	-0.0072	-0.0405
17	1984	-0.2596	0.008	0.1298

CO	YEAR	CRAIG	ECON	SUPER
19	1975			
19	1978	-0.0722	-0.0244	-0.2522
19	1981	-0.0818	-0.0064	0.1573
19	1984	0.0232	0.0116	-0.0465
20	1975			
20	1978	0.0285	-0.0217	0.0543
20	1981	0.0309	-0.0056	0.0441
20	1984	0.0242	0.0098	-0.0702
21	1975			
21	1978	-0.2830	-0.0399	-0.1544
21	1981	0.0351	-0.0151	0.3174
21	1984	-0.4868	0.0104	-0.1333
22	1975			
22	1978	-0.3483	-0.0236	0.0912
22	1981	0.1476	-0.0065	0.0385
22	1984	-0.1293	0.0098	0.0652
23	1975			
23	1978	-0.0425	-0.0231	0.0316
23	1981	-0.0161	-0.0073	-0.0137
23	1984	-0.0367	0.0079	0.1201
25	1975			
25	1978	-0.0366	-0.023	-0.0700
25	1981	-0.3487	-0.0076	-0.0479
25	1984	-0.0893	0.0074	-0.1377
26	1975			
26	1978	-0.0958	-0.0238	0.0152
26	1981	-0.1437	-0.008	0.1690
26	1984	0.0364	0.0076	-0.0468
27	1975			
27	1978	-0.1505	-0.0246	-0.0270
27	1981	-0.1017	-0.0087	-0.1183
27	1984	0.1080	0.0062	-0.0753
28	1975			
28	1978	-0.0821	-0.0214	-0.3262
28	1981	-0.1052	-0.0011	0.5570
28	1984	-0.1161	0.0185	0.0866
31	1975			
31	1978	0.1209	-0.0214	-0.0738
31	1981	-0.1434	-0.0057	0.0011
31	1984	-0.1169	0.01	-0.0190
32	1975			
32	1978	-0.4978	-0.0226	-0.0631
32	1981	-0.2070	-0.0071	-0.0385
32	1984	0.1478	0.008	-0.2115
35	1975			
35	1978	-0.1516	-0.0223	0.0294
35	1981	-0.2583	-0.0061	0.0616
35	1984	0.0180	0.0095	0.0817
36	1975			
36	1978	-0.2590	-0.0227	-0.0668
36	1981	-0.0390	-0.0076	-0.0584

CO	YEAR	CRAIG	ECON	SUPER
36	1984	0.3755	0.007	-0.0775
38	1975			
38	1978	0.0455	-0.0236	-0.0286
38	1981	-0.1506	-0.0087	0.0104
38	1984	0.0533	0.0052	0.0602
39	1975			
39	1978	-0.0165	-0.0229	-0.0307
39	1981	0.0611	-0.0073	0.0889
39	1984	0.0381	0.008	-0.1277
43	1975			
43	1978	0.1470	-0.022	-0.1008
43	1981	0.0026	-0.0047	-0.0994
43	1984	-0.1287	0.0119	-0.5496
44	1975			
44	1978	-0.1201	-0.0258	-0.1038
44	1981	-0.2053	-0.0075	0.0802
44	1984	0.1580	0.0089	0.0936
45	1975			
45	1978	-0.0326	-0.0218	0.4137
45	1981	0.0033	-0.0008	0.0647
45	1984	-0.0603	0.0197	0.0274
46	1975			
46	1978	0.0611	-0.0217	0.0478
46	1981	-0.0528	-0.0061	0.0230
46	1984	-0.1654	0.009	-0.0205
50	1975			
50	1978	-0.0986	-0.0229	0.0858
50	1981	-0.1699	-0.008	0.0907
50	1984	0.0534	0.0062	-0.0423
53	1975			
53	1978	-0.3268	-0.0227	-0.0617
53	1981	0.0316	-0.0064	0.0952
53	1984	-0.1779	0.0093	0.0296
54	1975			
54	1978	-0.0830	-0.0241	0.0703
54	1981	-0.0001	-0.0081	-0.1326
54	1984	-0.0319	0.0068	-0.1615
55	1975			
55	1978	0.0185	-0.0219	0.0775
55	1981	-0.0874	-0.004	0.0340
55	1984	-0.1037	0.0127	0.0375
58	1975			
58	1978	0.1545	-0.0233	0.0446
58	1981	-0.0787	-0.0072	-0.0475
58	1984	-0.2385	0.008	-0.1259
59	1975			
59	1978	-0.1761	-0.0336	-0.1104
59	1981	-0.1339	-0.0148	0.0207
59	1984	-0.1893	0.0022	0.2744
60	1975			
60	1978	0.2053	-0.0242	-0.0705

CO	YEAR	CRAIG	ECON	SUPER
60	1981	-0.2858	-0.0076	-0.0602
60	1984	0.0079	0.0076	-0.1290
61	1975			
61	1978	0.0507	-0.0251	0.3072
61	1981	-0.2673	-0.0099	0.0275
61	1984	-0.0900	0.0054	0.0864
62	1975			
62	1978	0.0540	-0.0245	0.0365
62	1981	0.0523	-0.0084	0.0897
62	1984	-0.1478	0.007	-0.0323
64	1975			
64	1978	0.1495	-0.0248	-0.1834
64	1981	-0.2026	-0.0072	0.1428
64	1984	0.0561	0.0092	0.0736
65	1975			
65	1978	0.1249	-0.0249	-0.1150
65	1981	-0.4407	-0.0078	0.3426
65	1984	0.1886	0.0086	0.0278
67	1975			
67	1978	0.0758	-0.0245	0.1834
67	1981	-0.3120	-0.0066	0.0559
67	1984	0.2026	0.0097	0.2639
68	1975			
68	1978	-0.3125	-0.0253	0.1041
68	1981	0.1807	-0.0091	0.0618
68	1984	-0.1671	0.0069	-0.0187
70	1975			
70	1978	-0.1169	-0.0241	-0.0026
70	1981	0.0725	-0.0069	-0.1215
70	1984	0.0634	0.011	-0.2115
71	1975			
71	1978	-0.1634	-0.0254	-0.0059
71	1981	-0.1591	-0.0085	0.1298
71	1984	0.0514	0.0074	-0.1674
72	1975			
72	1978	-0.1175	-0.0242	0.0152
72	1981	-0.3651	-0.0071	-0.1773
72	1984	-0.1108	0.009	-0.2396
74	1975			
74	1978	-0.0481	-0.0235	-0.0159
74	1981	-0.1918	-0.0071	0.0169
74	1984	-0.1151	0.0086	-0.0162
75	1975			
75	1978	-0.1809	-0.0235	0.0687
75	1981	-0.0192	-0.0071	-0.0501
75	1984	-0.0807	0.0083	0.0591
79	1975			
79	1978	-0.2654	-0.0254	-0.0496
79	1981	0.0013	-0.0079	-0.2597
79	1984	-0.1057	0.0089	-0.2246
80	1975			

CO	YEAR	CRAIG	ECON	SUPER
80	1978	-0.1972	-0.0242	-0.0506
80	1981	-0.7006	-0.0072	-0.0545
80	1984	-0.2520	0.008	0.0142
81	1975			
81	1978	-0.0461	-0.0249	0.1917
81	1981	-0.0724	-0.0074	0.0439
81	1984	-0.0301	0.0094	0.0597
85	1975			
85	1978	-0.1418	-0.024	-0.0209
85	1981	0.0385	-0.0067	-0.2649
85	1984	-0.1092	0.0103	0.1083
89	1975			
89	1978	-0.0898	-0.0227	0.0149
89	1981	0.0033	-0.0063	-0.0119
89	1984	-0.2092	0.0095	0.0482
91	1975			
91	1978	-0.0844	-0.0234	-0.1088
91	1981	-0.2144	-0.0076	0.1104
91	1984	-0.3994	0.0076	0.0839
94	1975			
94	1978	0.0289	-0.0215	-0.1652
94	1981	0.0773	-0.0033	0.3512
94	1984	-0.1639	0.0152	-0.1645
97	1975			
97	1978	-0.1935	-0.0218	0.0579
97	1981	0.3305	-0.0056	-0.0422
97	1984	-0.1100	0.0099	-0.0301
98	1975			
98	1978	-0.3781	-0.022	0.2759
98	1981	0.1584	-0.0049	0.0506
98	1984	-0.0377	0.0117	0.0676
99	1975			
99	1978	-0.1714	-0.0237	0.1365
99	1981	0.1397	-0.0077	0.0709
99	1984	-0.1297	0.0078	-0.0999
101	1975			
101	1978	0.0998	-0.0233	0.0992
101	1981	0.1093	-0.0072	-0.0772
101	1984	0.0081	0.0082	-0.1241
102	1975			
102	1978	-0.2402	-0.0228	0.1284
102	1981	-0.0479	-0.0072	-0.0147
102	1984	-0.1458	0.0088	0.0075
103	1975			
103	1978	-0.1151	-0.0234	-0.0357
103	1981	-0.2037	-0.0063	-0.0088
103	1984	0.0658	0.0094	-0.0577
104	1975			
104	1978	-0.3179	-0.0257	0.2468
104	1981	-0.4149	-0.01	-0.0466
104	1984	-0.1577	0.0057	-0.0981

CO	YEAR	CRAIG	ECON	SUPER
107	1975			
107	1978	-0.0426	-0.0229	-0.0224
107	1981	-0.5195	-0.0078	0.0523
107	1984	0.2083	0.0068	-0.0819
108	1975			
108	1978	-0.1786	-0.0229	-0.0061
108	1981	-0.2762	-0.0082	0.0155
108	1984	-0.1494	0.0061	0.0101
109	1975			
109	1978	-0.0972	-0.0238	0.0124
109	1981	-0.0004	-0.0075	0.0708
109	1984	-0.0565	0.0076	-0.0619
110	1975			
110	1978	0.0206	-0.0216	-0.1002
110	1981	0.0761	-0.0044	0.0324
110	1984	-0.1438	0.0126	0.0500
111	1975			
111	1978	0.0680	-0.026	0.1084
111	1981	-0.1556	-0.0084	0.0054
111	1984	0.1318	0.0086	0.0003
114	1975			
114	1978	0.3601	-0.0241	0.0501
114	1981	-0.1560	-0.0077	0.0412
114	1984	0.0750	0.0079	0.0067
115	1975			
115	1978	-0.2078	-0.023	-0.0191
115	1981	-0.0021	-0.0072	-0.0836
115	1984	0.0000	0.0075	0.0513
116	1975			
116	1978	-0.2010	-0.0234	0.0510
116	1981	-0.4191	-0.0073	0.0276
116	1984	-0.4652	0.0086	-0.0344
117	1975			
117	1978	-0.0824	-0.0233	0.0877
117	1981	-0.1264	-0.0077	-0.1573
117	1984	-0.1986	0.0078	-0.0920
119	1975			
119	1978	-0.0099	-0.0233	-0.0735
119	1981	0.0204	-0.0073	0.1459
119	1984	-0.1561	0.0077	0.0793
120	1975			
120	1978	-0.1625	-0.0218	0.0885
120	1981	-0.0706	-0.0066	-0.0903
120	1984	0.0773	0.0083	0.1058
121	1975			
121	1978	0.0444	-0.0248	0.0604
121	1981	-0.1393	-0.0087	-0.0615
121	1984	0.1334	0.0068	-0.0263
122	1975			
122	1978	-0.1567	-0.0245	-0.0329
122	1981	-0.1411	-0.0083	-0.0285

CO	YEAR	CRAIG	ECON	SUPER
122	1984	-0.0812	0.0065	0.4029
123	1975			
123	1978	0.0509	-0.0224	-0.1559
123	1981	-0.0984	-0.0053	-0.0284
123	1984	0.1716	0.0112	-0.1037
124	1975			
124	1978	-0.1338	-0.0248	-0.4196
124	1981	-0.1084	-0.0074	-0.0885
124	1984	-0.1851	0.0077	0.1620
126	1975			
126	1978	-0.1059	-0.0224	0.1317
126	1981	-0.2719	-0.0072	0.0067
126	1984	-0.0013	0.0083	-0.1130
128	1975			
128	1978	-0.4304	-0.0256	-0.0087
128	1981	0.5232	-0.0087	0.0068
128	1984	-0.0973	0.0076	-0.0828
132	1975			
132	1978	-0.1450	-0.022	0.0057
132	1981	-0.2685	-0.0051	-0.1208
132	1984	-0.1681	0.0107	0.1154
133	1975			
133	1978	-0.0233	-0.0227	-0.0060
133	1981	0.0755	-0.0068	-0.0613
133	1984	-0.0382	0.0081	-0.0099
135	1975			
135	1978	-0.1052	-0.0216	0.0167
135	1981	-0.1100	-0.0063	-0.0618
135	1984	-0.1424	0.008	-0.1591
138	1975			
138	1978	-0.1420	-0.025	-0.1206
138	1981	-0.0075	-0.0074	0.1510
138	1984	0.0617	0.0086	-0.0641
140	1975			
140	1978	-0.3150	-0.0247	0.0340
140	1981	0.2560	-0.008	0.0603
140	1984	-0.1982	0.0079	-0.1980
142	1975			
142	1978	-0.0465	-0.0248	0.2189
142	1981	-0.0859	-0.0068	0.0807
142	1984	-0.0289	0.01	0.0374
143	1975			
143	1978	-0.2766	-0.0228	0.1247
143	1981	-0.1015	-0.0063	0.0609
143	1984	-0.0265	0.0092	-0.1077
150	1975			
150	1978	-0.1370	-0.0239	0.1245
150	1981	0.0109	-0.0076	0.1209
150	1984	0.0797	0.0082	-0.2321
153	1975			
153	1978	-0.0141	-0.0211	0.0939

CO	YEAR	CRAIG	ECON	SUPER
153	1981	-0.3229	-0.0038	-0.0658
153	1984	0.0531	0.0131	-0.0358
155	1975			
155	1978	-0.2116	-0.0233	-0.0742
155	1981	-0.0589	-0.0055	-0.4938
155	1984	-0.2037	0.0125	-0.0440
156	1975			
156	1978	0.0366	-0.0258	0.0127
156	1981	-0.1103	-0.009	0.0110
156	1984	-0.1779	0.0066	0.0399
157	1975			
157	1978	0.2829	-0.0257	-0.0416
157	1981	-0.2917	-0.0072	0.0927
157	1984	-0.0201	0.0096	0.1205
159	1975			
159	1978	0.2911	-0.0222	0.0264
159	1981	-0.0630	-0.0076	-0.1147
159	1984	0.0351	0.0064	0.0921
161	1975			
161	1978	0.1767	-0.0233	-0.1769
161	1981	-0.2540	-0.0079	0.1440
161	1984	0.0003	0.007	0.0843
162	1975			
162	1978	-0.1395	-0.023	0.0602
162	1981	0.0132	-0.0056	-0.0285
162	1984	0.0404	0.0109	-0.1403
165	1975			
165	1978	-0.0182	-0.0244	0.0121
165	1981	-0.0478	-0.009	-0.0243
165	1984	-0.0249	0.0062	0.0808
166	1975			
166	1978	-0.1392	-0.0249	0.0736
166	1981	0.1061	-0.0084	0.0299
166	1984	0.0324	0.0074	0.0706
167	1975			
167	1978	-0.1256	-0.0251	0.1775
167	1981	-0.0908	-0.0086	-0.0759
167	1984	0.1386	0.0076	0.1236

APPENDIX D

REGIONAL CLASSIFICATION OF 95 COMPANIES

APPENDIX D

REGIONAL CLASSIFICATION OF 95 ELECTRIC UTILITY COMPANIIES

REGION	
1	NORTHEASTERN CONNECTICUT,DELAWARE,DISTRICT OF COLUBBIA,MAINE, MARYLAND,MASSACHUSETTS,NEW HAMPSHIRE,NEW JERSEY, NEW YORK,PENNSYLVANIA,RHODE ISLAND,VERMONT, VIRGINIA,WEST VIRGINIA
2	GREAT LAKES ILLINOIS,INDIANA,KENTUCKY,MICHIGAN,OHIO,WISCONSIN
3	NORTH CENTRAL IOWA,KANSAS,MINNESOTA,MISOURI,NEBRASKA,NORTH DAKOTA, SOUTH DAKOTA
4	NORTHWEST IDAHO,MONTANA,OREGON,WASHINGTON,WYOMING
5	SOUTHWESTERN ARIZONA,CALIFORNIA,COLORADO,NEVADA,NEW MEXICO,UTAH
6	SOUTH CENTRAL ARKANSAS,LOUISIANA,OKLAHOMA,TEXAS
7	SOUTHEASTERN ALABAMA,FLORIDA,GEORGIA,MISSISSIPI,NORTH CAROLINA, TENNESSEE
8	OTHERS ALASKA,HAWAII,PUETTO RICO,VIRGIN ISLANDS

CO	COMPANY NAME	REGION
1	ALABAMA	7
4	APPALACHIAN	1
6	ATLANTIC	1
7	BALTIMORE	1
12	CAMBRIDGE	1
14	CAROLINA	7
15	CENTRAL & SOUTH WEST	6
16	CENTRAL HUDSON	1
17	CENTRAL ILL PUB	2
19	CENTRAL MAINE	1
20	CENTRAL POWER & LIGHT	6
21	CENTRAL VERMONT	1

CO	COMPANY NAME	REGION
22	CILCORP	2
23	CINCINNATI GAS & ELECTRIC	2
25	CLEVELAND ELECTRIC ILLUM	2
26	COLUMBUS & SOUTHERN OHIO	2
27	COMMONWEALTH EDISON	2
28	COMMONWEALTH ELECTRIC CO	1
31	CONSOLIDATED EDISON OF NY	1
32	CONSUMERS POWER CO	2
35	DELMARVA POWER & LIGHT	1
36	DETROIT EDISON CO	2
38	DUKE POWER CO	7
39	DUQUESNE LIGHT CO	1
43	EL PASO ELECTRIC	6
44	EMPIRE DISTRICT ELECTRIC CO	3
45	FITCHBURG GAS & ELEC	1
46	FLORIDA POWER CORP	7
50	GEORGEA POWER	7
53	GULF POWER	7
54	GULF STATE UTILITIES CO	6
55	HAWAIIAN ELECTRIC CO	8
58	HOUSTON LIGHTING & P	6
59	IDAHO POWER CO	4
60	ILLINOIS POWER CO	2
61	INDIANA & MICHIGAN E	2
62	INDIANAPOLIS POWER	0
64	IOWA ELECTRIC LIGHT	3
65	IOWA POWER & LIGHT	3
67	IOWA SOUTHERN UTIL	3
68	IOWA - ILLINOIS GAS	3
70	JERSEY CENTRAL POWER	1
71	KANSAS CITY POWER	3
72	KANSAS GAS & ELECTRIC	3
74	KENTUCKY POWER	2
75	KENTUCKY UTILITIES C	2
79	LOUISIANA POWER & LIGHT	6
80	LOUISIANA GAS & ELEC	2
81	MADISON GAS & ELEC	2
85	METROPOLITAN EDISON	1
89	MISSISSIPPI POWER	7
91	MONONGAHELA POWER	1
94	MARRAGANSETT ELEC	1
97	NEW ENGLAND POWER	1
98	NEW ORLEANS PUBLIC	6
99	NEW YORK STATE ELEC	1
101	NIAGARA MOHAWK POWER	1
102	NORTHEAST UTILITIES	1
103	NOTHERN INDIANA PUB	2
104	NOTHERN STATES POWER - MN	3
107	OHIO EDISON CO	2
108	OHIO POWER	2
109	OKLAHOMA GAS & ELECTRIC	6

CO	COMPANY NAME	REGION
110	ORANGE & ROCHLAND UT	1
111	OTTER TAIL POWER CO	3
114	PENNSYLVANIA ELECTRIC	1
115	PENNSYLVANIA POWER & LIGHT	1
116	PENNSYLVANIA POWER CO	1
117	PHILADELPHIA ELECTRIC	1
119	POTOMAC EDISON	1
120	POTOMAC ELECTRIC POWER	1
121	PUBLIC SERVICE CO OF COLO	5
122	PUBLIC SERVICE CO OF IND	2
123	PUBLIC SERVICE OF N.H.	1
124	PUBLIC SERVICE OF N MEX	5
126	PUBLIC SERVICE ELEC	1
128	ROCHESTER GAS & ELEC	1
132	SAVANNAH ELEC & POWER	7
133	SCANA CORP	7
135	SOUTHERN CALIF EDISON	5
138	SOUTHERN INDIANA GAS	2
140	SOUTHWESTERN ELEC	6
142	ST JOSEPH LIGHT & POWER	3
143	TAMPA ELECTRIC CO	7
150	TUCSON ELECTRIC POWER	5
153	UNITED ILLUMINATING	1
155	UPPER PENINSULA POWER	2
156	UTAH POWER & LIGHT	5
157	UTILCORP UNITED INC	3
159	VIRGINIA ELECTRIC	1
161	WEST PENN POWER	1
162	WEST TEXAS UTILITIES	6
165	WISCONSIN ELECTRIC	2
166	WISCONSIN POWER & LIGHT	2
167	WISCONSIN PUBLIC SERVICE	2

APPENDIX E

DATA ON DIFFERENT REGIONS: 1974 - 84

APPENDIX B

DATA ON DIFFERENT REGIONS: 1974-84

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
REGION 1: NORTHEASTERN											
1974	0.0997	17.6913	1.2000	35330	142.684	3800	10607	348991	0.3321	0.2380	0.4299
1975	0.1072	19.5030	1.2340	34326	138.940	3693	11288	352587	0.3562	0.2401	0.4037
1976	0.1105	21.7227	1.2026	34933	140.464	3837	12105	367912	0.3667	0.2521	0.3812
1977	0.1116	24.0884	1.3287	35527	139.637	3998	13501	379406	0.3574	0.2491	0.3935
1978	0.1125	26.0343	1.3560	35528	142.638	4065	14450	385390	0.3615	0.2570	0.3815
1979	0.1128	28.3501	1.6428	35105	144.544	3980	16257	377386	0.3457	0.2521	0.4022
1980	0.1159	30.9797	2.0297	34205	146.969	4023	18864	373154	0.3258	0.2414	0.4328
1981	0.1256	33.6069	2.2954	33601	149.722	3976	21331	375680	0.3362	0.2359	0.4279
1982	0.1322	36.8549	2.1372	34318	151.820	3888	22080	368237	0.3703	0.2534	0.3763
1983	0.1368	39.7173	2.1249	35897	152.754	4031	23819	383524	0.3856	0.2547	0.3596
1984	0.1389	42.6786	2.1432	36945	152.100	4182	25576	399076	0.3958	0.2538	0.3504
REGION 2: GREAT LAKES											
1974	0.1029	17.2222	0.6832	24582	97.353	3406	6534	304575	0.3873	0.2566	0.3562
1975	0.1099	19.1471	0.8380	24608	95.047	3472	7687	310172	0.3847	0.2368	0.3785
1976	0.1146	20.8506	0.8695	26055	95.794	3742	8683	336061	0.3953	0.2300	0.3747
1977	0.1166	22.7877	0.9719	27511	97.088	3868	9877	343476	0.3954	0.2240	0.3806
1978	0.1150	24.8772	1.1897	28903	104.309	4011	11711	376063	0.3710	0.2216	0.4075
1979	0.1175	27.3147	1.3000	29811	108.522	4129	13304	388837	0.3738	0.2228	0.4034
1980	0.1191	29.5964	1.4625	30379	112.664	4072	14900	377925	0.3765	0.2238	0.3997
1981	0.1291	32.4064	1.6031	30565	114.323	4069	16932	378973	0.3960	0.2188	0.3852
1982	0.1324	36.1348	1.6900	31972	116.814	3821	18306	356771	0.4166	0.2306	0.3528
1983	0.1423	38.9569	1.7054	32113	115.415	3997	19863	376939	0.4304	0.2264	0.3432
1984	0.1421	42.4911	1.6714	30740	114.252	4058	20251	388092	0.4254	0.2397	0.3349
REGION 3: NORTH CENTRAL											
1974	0.0936	16.2447	0.4591	4177	18.190	479	906	45124	0.4314	0.3261	0.2425
1975	0.1025	18.6240	0.5232	4171	18.073	553	1093	48042	0.4275	0.3079	0.2646
1976	0.1046	20.3088	0.5992	4326	18.344	609	1257	53677	0.4137	0.2963	0.2901
1977	0.1040	22.1906	0.6793	4479	18.707	671	1438	59711	0.3944	0.2888	0.3169
1978	0.1076	23.7426	0.8044	4701	18.980	687	1664	61069	0.3973	0.2708	0.3319
1979	0.1080	26.1105	0.9102	4824	18.978	659	1835	59611	0.4030	0.2700	0.3270
1980	0.1159	28.7419	1.0069	4837	19.538	682	2117	61692	0.4105	0.2653	0.3243
1981	0.1199	31.8777	1.0922	4770	19.976	701	2374	63581	0.4095	0.2682	0.3223
1982	0.1298	35.1352	1.1960	4834	20.434	661	2640	59870	0.4284	0.2720	0.2997
1983	0.1364	37.7015	1.2858	4986	20.008	686	2908	62551	0.4373	0.2594	0.3033
1984	0.1371	39.7631	1.3408	5155	20.506	668	3105	61184	0.4491	0.2626	0.2883

REGION 4: WESTERN

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1054	17.9779	0.7561	6622	25.748	851	1804	83979	0.3867	0.2566	0.3567
1975	0.1047	20.2913	1.0409	6638	25.809	911	2232	86714	0.3403	0.2347	0.4250
1976	0.1071	21.4609	1.1267	7157	25.642	913	2460	86600	0.3582	0.2237	0.4182
1977	0.1059	24.0940	1.3592	7660	26.743	1044	3051	100566	0.3236	0.2112	0.4652
1978	0.1053	26.3636	1.3685	8078	27.930	1055	3292	100320	0.3377	0.2237	0.4386
1979	0.1121	28.7344	1.6683	8442	28.617	1146	4079	110242	0.3295	0.2016	0.4689
1980	0.1154	33.7156	1.9879	8624	29.850	1116	4768	104716	0.3235	0.2111	0.4654
1981	0.1255	37.2000	2.3859	8923	31.046	1078	5630	102186	0.3380	0.2051	0.4568
1982	0.1312	41.7446	2.0597	9366	32.321	1092	5813	98379	0.3809	0.2321	0.3870
1983	0.1465	45.8373	1.8303	9634	33.204	1066	6113	96226	0.4318	0.2490	0.3193
1984	0.1536	49.5051	1.8130	9362	33.793	1091	6486	101355	0.4372	0.2579	0.3049

REGION 5: SOUTH CENTRAL

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1157	12.3034	0.4964	7513	32.434	1603	2064	145655	0.4211	0.1934	0.3856
1975	0.1151	13.7094	0.6970	7697	31.824	1619	2533	157383	0.3821	0.1723	0.4456
1976	0.1164	15.4382	0.9668	8231	31.076	1749	3272	170422	0.3366	0.1466	0.5168
1977	0.1184	17.7668	1.1792	9058	30.917	1922	4121	186317	0.3167	0.1333	0.5500
1978	0.1175	19.2840	1.3122	9715	32.277	2103	4874	202497	0.3061	0.1277	0.5662
1979	0.1157	21.3723	1.5419	10356	34.790	2106	5691	201849	0.2988	0.1307	0.5705
1980	0.1246	23.4638	1.8195	10981	36.042	2232	7028	216101	0.3018	0.1203	0.5779
1981	0.1376	26.2968	2.2116	11103	37.788	2254	8575	217173	0.3028	0.1159	0.5813
1982	0.1309	29.5029	2.6239	11851	40.593	2151	9639	205467	0.2901	0.1243	0.5857
1983	0.1402	32.7558	2.6326	13133	40.392	2066	10208	197229	0.3375	0.1296	0.5329
1984	0.1424	34.9175	2.6289	14069	41.207	2109	10935	201582	0.3613	0.1316	0.5071

REGION 6: SOUTHEASTERN

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.0966	14.2848	0.8556	13592	45.314	1804	3505	175177	0.3748	0.1847	0.4405
1975	0.1107	15.5696	0.9072	13650	44.305	1935	4096	176275	0.4031	0.1684	0.4285
1976	0.1137	17.4424	1.0068	14175	46.111	1959	4628	190611	0.4002	0.1738	0.4260
1977	0.1169	18.8406	1.1272	14526	50.592	2075	5360	200178	0.3857	0.1778	0.4364
1978	0.1206	20.2793	1.2100	14688	55.760	2129	6021	204063	0.3844	0.1878	0.4278
1979	0.1194	21.5619	1.3483	14982	59.356	2158	6730	211803	0.3774	0.1902	0.4324
1980	0.1242	24.0496	1.5142	15022	61.490	2312	7872	226743	0.3675	0.1879	0.4447
1981	0.1302	28.9934	1.7547	14627	63.992	2321	9166	227118	0.3532	0.2024	0.4444
1982	0.1351	32.1407	1.7562	14880	67.038	2278	9777	223527	0.3705	0.2204	0.4091
1983	0.1458	34.6737	1.5859	15153	70.031	2422	10718	236860	0.3855	0.2266	0.3880
1984	0.1515	36.6252	1.6850	15547	71.258	2554	11560	251618	0.4019	0.2258	0.3724

* All price indexes are the averages of 95 companies.

* All quantity indexes are the aggregate of 95 companies.

* See Appendix A for the notation and the unit of measurement of each variable.

APPENDIX F

DATA ON DIFFERENT TYPES OF GENERATION: 1974 - 84

APPENDIX F

DATA ON DIFFERENT TYPES OF GENERATION: 1974-84

GENERATION TYPE: GAS

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1149	12.0475	0.4683	6369	25.236	1374	1679	133897	0.4357	0.1811	0.3832
1975	0.1146	13.4240	0.6502	6544	24.861	1410	2070	137483	0.3960	0.1612	0.4427
1976	0.1153	15.1800	0.9160	7002	24.311	1532	2700	149799	0.3436	0.1367	0.5197
1977	0.1172	17.7932	1.1280	7639	24.106	1655	3385	160951	0.3218	0.1267	0.5515
1978	0.1161	19.2464	1.2672	8242	25.394	1806	4027	174604	0.3104	0.1214	0.5682
1979	0.1140	21.4679	1.5020	8801	27.670	1796	4716	172415	0.3019	0.1259	0.5721
1980	0.1231	23.7486	1.7833	9338	28.782	1899	5850	182208	0.3045	0.1168	0.5787
1981	0.1371	26.6333	2.1812	9449	30.466	1892	7139	182101	0.3084	0.1137	0.5780
1982	0.1290	29.8935	2.5828	10074	33.124	1803	7988	172542	0.2931	0.1240	0.5829
1983	0.1389	33.1021	2.5823	11195	34.135	1741	8535	166329	0.3409	0.1324	0.5267
1984	0.1416	35.1721	2.5778	11967	34.866	1770	9130	169389	0.3659	0.1343	0.4997

GENERATION TYPE: LIQUID

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1057	17.8430	1.4533	1486	7.845	163	533	14676	0.2945	0.2625	0.4430
1975	0.1127	19.0848	1.7492	1425	7.484	153	585	14179	0.2999	0.2440	0.4561
1976	0.1150	15.7726	1.7294	1412	7.288	158	610	15007	0.3062	0.2452	0.4486
1977	0.1188	23.9860	2.0495	1398	7.123	160	700	15218	0.2888	0.2439	0.4673
1978	0.1148	26.3859	2.1041	1408	7.137	164	744	15621	0.2838	0.2530	0.4631
1979	0.1246	28.6376	2.7608	1396	7.156	168	915	15928	0.2696	0.2239	0.5064
1980	0.1221	30.8709	4.0459	1377	7.195	170	1169	15966	0.2229	0.1900	0.5871
1981	0.1345	33.3010	5.6921	1332	7.120	168	1495	16007	0.2037	0.1586	0.6377
1982	0.1373	38.0701	5.3791	1380	7.077	160	1469	15373	0.2324	0.1834	0.5842
1983	0.1480	40.2960	4.7813	1474	6.918	177	1534	17218	0.2660	0.1817	0.5523
1984	0.1411	43.9737	4.9935	1506	6.891	176	1603	17033	0.2616	0.1891	0.5494

GENERATION TYPE: MIX WITHOUT NUCLEAR

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1050	17.2670	1.0162	10531	45.838	1394	3314	107240	0.3338	0.2388	0.4274
1975	0.1086	19.1832	1.3061	10401	44.725	1424	3952	112358	0.3125	0.2171	0.4704
1976	0.1140	21.1860	1.3964	11015	43.962	1431	4373	113427	0.3300	0.2130	0.4571
1977	0.1135	23.0241	1.5758	11786	44.368	1611	5188	130050	0.3138	0.1969	0.4893
1978	0.1130	25.0745	1.6487	12435	45.760	1669	5734	155082	0.3202	0.2001	0.4797
1979	0.1185	27.2328	1.9639	12926	46.744	1723	6831	152217	0.3182	0.1863	0.4954
1980	0.1188	30.5347	2.4182	13296	48.543	1667	7962	160443	0.3075	0.1862	0.5063
1981	0.1307	33.2305	2.8273	13522	49.786	1719	9517	164615	0.3156	0.1738	0.5106
1982	0.1325	36.8744	2.7077	14442	51.229	1577	9608	147224	0.3589	0.1966	0.4445
1983	0.1435	41.0708	2.5668	15422	50.993	1558	10232	146562	0.4045	0.2047	0.3908
1984	0.1310	44.6113	2.5491	15973	50.539	1610	9912	152089	0.3584	0.2275	0.4141

GENERATION TYPE: MIX WITH NUCLEAR

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.0962	17.6788	1.0198	37319	146.401	3974	10231	363896	0.3510	0.2530	0.3961
1975	0.1047	19.6292	1.0095	36358	142.788	3957	10959	374010	0.3797	0.2558	0.3645
1976	0.1099	22.0466	0.9947	36966	143.512	4229	12040	400656	0.3878	0.2628	0.3494
1977	0.1126	23.8967	1.0956	37593	146.802	4461	13550	418059	0.3804	0.2589	0.3607
1978	0.1156	25.9130	1.1240	37733	150.881	4653	14841	434629	0.3842	0.2635	0.3524
1979	0.1124	27.7956	1.3839	37977	155.318	4452	16536	416175	0.3664	0.2611	0.3725
1980	0.1162	30.6269	1.6986	37725	158.436	4554	19380	418539	0.3505	0.2504	0.3991
1981	0.1254	33.9878	1.8899	36970	162.381	4510	21923	414495	0.3594	0.2517	0.3888
1982	0.1323	37.4685	1.8213	37328	166.837	4351	23075	403693	0.3857	0.2709	0.3434
1983	0.1392	40.2555	1.8311	38377	169.429	4480	25019	416180	0.3995	0.2726	0.3279
1984	0.1426	43.3606	1.8170	39284	171.345	4562	26771	427908	0.4128	0.2775	0.3097

GENERATION TYPE: SOLID

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1040	16.0847	0.7587	35839	136.358	4989	9705	444385	0.3839	0.2260	0.3901
1975	0.1117	17.8465	0.8948	36101	133.966	5177	11429	487300	0.3855	0.2092	0.4053
1976	0.1132	19.5089	0.9513	38217	135.906	5393	12753	520536	0.3898	0.2079	0.4023
1977	0.1139	21.4223	1.0669	40021	140.909	5658	14602	542384	0.3799	0.2067	0.4134
1978	0.1125	23.1313	1.2502	41426	152.398	5706	16746	544439	0.3635	0.2105	0.4260
1979	0.1167	25.5803	1.3384	42023	157.546	5992	19012	575507	0.3662	0.2120	0.4218
1980	0.1202	27.8690	1.4785	41921	163.239	6071	21337	577482	0.3661	0.2132	0.4206
1981	0.1279	30.9758	1.6508	41911	166.670	6047	24257	582003	0.3757	0.2128	0.4115
1982	0.1325	34.3504	1.7169	43575	170.246	5897	26378	564775	0.3944	0.2217	0.3838
1983	0.1415	36.9322	1.6518	43996	169.649	6407	28494	598540	0.4087	0.2199	0.3714
1984	0.1432	39.5340	1.6997	44844	168.768	6435	30277	626500	0.4184	0.2204	0.3613

* All price indexes are the averages of 95 companies.
* All quantity indexes are the aggregate of 95 companies.
* See Appendix A for the notation and the unit of measurement of each variable.

APPENDIX G

DATA ON DIFFERENT OUTPUT LEVELS: 1974 - 84

APPENDIX G

DATA ON DIFFERENT OUTPUT LEVELS: 1974-84

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
OUTPUT LEVEL I (102 - 4510 Million KWH)											
1974	0.1062	14.9905	0.8202	4166	23.963	546	1250	47443	0.3542	0.2875	0.3583
1975	0.1142	16.2010	0.9773	4075	23.581	525	1404	46286	0.3623	0.2721	0.3656
1976	0.1201	16.1988	1.0285	4174	23.682	547	1558	46448	0.3698	0.2690	0.3612
1977	0.1198	19.7564	1.1906	4354	23.979	572	1790	48554	0.3548	0.2646	0.3806
1978	0.1216	21.5873	1.2908	4584	24.383	573	1995	48248	0.3650	0.2639	0.3711
1979	0.1254	23.1587	1.5575	4629	25.085	581	2309	52396	0.3568	0.2516	0.3916
1980	0.1269	25.3955	1.8728	4663	25.658	609	2710	55302	0.3386	0.2405	0.4209
1981	0.1332	28.0023	2.1580	4654	25.917	623	3124	57113	0.3372	0.2323	0.4304
1982	0.1412	30.8661	2.2517	4730	26.088	593	3343	53406	0.3598	0.2409	0.3993
1983	0.1479	34.0353	2.1895	4952	24.398	597	3507	54106	0.3906	0.2368	0.3726
1984	0.1530	36.0853	2.1948	5017	24.292	615	3740	55950	0.4048	0.2344	0.3608
OUTPUT LEVEL II (4537 - 9433 Million KWH)											
1974	0.1053	16.5626	0.8455	11844	51.257	1508	3371	138057	0.3699	0.2519	0.3783
1975	0.1099	18.8217	0.9348	11977	49.879	1531	3808	144158	0.3777	0.2465	0.3758
1976	0.1129	20.2125	0.9730	12744	50.293	1623	4250	152494	0.3892	0.2392	0.3716
1977	0.1123	22.6527	1.1152	13483	51.192	1740	4944	161567	0.3730	0.2346	0.3925
1978	0.1133	24.2579	1.2777	13999	53.253	1802	5667	167590	0.3657	0.2279	0.4063
1979	0.1132	27.0693	1.4578	14290	54.525	1779	6366	166122	0.3607	0.2318	0.4075
1980	0.1155	28.4671	1.7269	14127	56.383	1835	7302	163776	0.3463	0.2198	0.4339
1981	0.1233	31.3163	2.0239	13922	58.213	1837	8459	170865	0.3449	0.2155	0.4396
1982	0.1272	34.5619	2.0688	14719	58.107	1790	9086	165220	0.3714	0.2210	0.4075
1983	0.1391	37.4448	2.0490	15366	57.361	1888	10015	175536	0.3992	0.2145	0.3863
1984	0.1413	39.1335	2.0861	15581	57.082	1895	10529	178869	0.4124	0.2122	0.3755
OUTPUT LEVEL III (9613 - 17788 Million KWH)											
1974	0.0989	16.2286	0.8039	22684	86.941	3072	6124	265118	0.3664	0.2304	0.4032
1975	0.1072	17.9630	0.9439	22669	85.523	3104	7122	278702	0.3729	0.2157	0.4114
1976	0.1099	19.8427	0.9603	23755	85.990	3330	7904	300971	0.3795	0.2159	0.4046
1977	0.1154	21.5788	1.0592	24898	87.364	3434	9019	307165	0.3877	0.2090	0.4033
1978	0.1149	23.6392	1.2034	25647	90.089	3585	10294	341286	0.3740	0.2069	0.4191
1979	0.1161	25.4525	1.3464	26063	92.974	3701	11645	352427	0.3689	0.2032	0.4279
1980	0.1196	28.1495	1.5996	26261	95.896	3714	13511	352982	0.3605	0.1998	0.4397
1981	0.1286	30.5305	1.8211	26294	98.513	3715	15521	354841	0.3703	0.1938	0.4359
1982	0.1327	33.6670	1.8202	27200	101.540	3622	16513	344110	0.3938	0.2070	0.3992
1983	0.1395	36.2018	1.8292	28400	102.919	3708	17920	353230	0.4136	0.2079	0.3785
1984	0.1406	38.5333	1.8212	29595	103.060	3805	18429	367905	0.4085	0.2155	0.3760

OUTPUT LEVEL IV (17915 - 59681 Million KWH)

	PK	PL	PF	XK	XL	XF	TC	Q	SK	SL	SF
1974	0.1014	17.0013	0.8649	53596	201.471	6873	14804	623420	0.3671	0.2314	0.4016
1975	0.1085	18.8035	0.9608	52824	196.849	7079	16769	635781	0.3737	0.2207	0.4056
1976	0.1122	21.1063	1.0423	54659	197.062	7368	18886	711003	0.3731	0.2202	0.4067
1977	0.1125	23.0100	1.1920	56469	202.897	7894	21810	758223	0.3545	0.2141	0.4314
1978	0.1131	24.8023	1.2756	57812	215.980	8153	24301	778300	0.3516	0.2204	0.4280
1979	0.1141	26.9702	1.4983	58964	224.046	8183	27858	784202	0.3430	0.2169	0.4401
1980	0.1184	29.9029	1.7481	59430	230.455	8346	32390	794527	0.3368	0.2128	0.4504
1981	0.1287	33.4432	2.0091	59131	236.013	8290	37482	788220	0.3450	0.2106	0.4444
1982	0.1326	37.0948	2.0436	60964	245.073	7952	39910	755727	0.3650	0.2278	0.4072
1983	0.1411	40.0600	1.9439	62581	248.782	8343	42705	776814	0.3869	0.2334	0.3797
1984	0.1436	43.5211	1.9730	64433	250.352	8415	45744	806639	0.3989	0.2382	0.3629

* All price indexes are the averages of 95 companies.
* All quantity indexes are the aggregate of 95 companies.
* See Appendix A for the notation and the unit of measurement of each variable.