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# NONPARAMETRIC ESTIMATES OF THE COMPONENTS OF PRODUCTIVITY AND PROFITABILITY CHANGE IN U.S. AGRICULTURE[1]

by

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**Abstract:** Profitability change can be decomposed into the product of a total factor productivity (TFP) index and an index of relative price change. O'Donnell (2008) shows that the TFP index can be further decomposed into an index of technical change and various indexes of efficiency change – these indexes measure changes in productivity resulting from movements in the production frontier, movements by firms towards the frontier, and movements by firms around the frontier to capture economies of scale and scope. The O'Donnell decomposition methodology can be applied in any multiple-input multiple-output setting, it makes no assumptions concerning the optimising behaviour of firms or the degree of competition in product markets, and it only involves components that can be unambiguously interpreted as measures of either technical change or efficiency change. This paper uses the methodology to decompose spatially- and temporally-transitive Lowe indexes of TFP change in U.S. agriculture for the period 1960-2004. To implement the methodology, data envelopment analysis (DEA) is used to estimate separate production frontiers for each of the ten farm production regions identified by the USDA Economic Research Service (ERS). California and Florida are found to be the most profitable and productive states. In most states, the main drivers of TFP change over the 45-year study period appear to have been technical change and scale and mix efficiency change. For example, Texas is found to have experienced a 40% increase in productivity due to technical change and a 32% increase in productivity due to economies of scale and scope, resulting in an overall productivity increase of 1.40 × 1.32 – 1 = 85%; in Tennessee, the combined effects of technical progress (122%), technical efficiency improvement (1%) and diseconomies of scale and scope (-24%) resulted in an net productivity increase of 2.22 × 1.01 × 0.76 – 1 = 70%.

**KEYWORDS**: Technical Change, Technical Efficiency, Economies of Scale, Economies of Scope, Scale Efficiency, Mix Efficiency, Lowe indexes.

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## 1. INTRODUCTION

It is difficult to find any coherent estimates of the technical change and efficiency change components of indexes of U.S. agricultural productivity growth – some estimates of technical change and efficiency change are available (e.g., Morrison Paul and Nehring (2005); Morrison Paul, Nehring and Banker (2004)), but they are not coherent in the sense that they do not combine to yield valid productivity indexes; some recognisable productivity indexes have been decomposed into various components (e.g., Capalbo (1988)), but not all of these components have unambiguous interpretations as measures of technical change or efficiency change. The unavailability of a coherent set of estimates of the technical change and efficiency change components of productivity growth can lead to poor public policy – policy-makers cannot properly assess whether the payoffs from improving the rate of technical progress (e.g., through increased R&D expenditure) are more or less likely to outweigh the payoffs from improving either levels of technical efficiency (e.g., through education and training programs) or scale and mix efficiency (e.g., by using taxes and subsidies to change relative prices). This paper addresses the problem by decomposing productivity indexes for U.S. agriculture into an exhaustive set of recognisable measures of technical change, technical efficiency change, and scale and mix efficiency change.

The analysis in this paper is conducted within the aggregate quantity-price framework of O'Donnell (2008). O'Donnell uses carefully-defined price and quantity aggregates to demonstrate that profitability change (a measure of value change) can be decomposed into the product of a terms-of-trade index (a measure of price change) and a *multiplicatively-complete* total factor productivity (TFP) index (a measure of quantity change). Moreover, he shows that any multiplicatively-complete TFP index can be exhaustively decomposed into the product of measures of technical change and several meaningful measures of efficiency change. Unlike some other TFP decomposition methodologies, the O'Donnell (2008) methodology does not depend on any assumptions concerning the technology, firm behaviour, or the level of competition in input or output markets. The class of multiplicatively-complete TFP indexes includes the well-known Paasche, Laspeyres, Fisher, Tornquist and Hicks-Moorsteen indexes, but not the Malmquist TFP index of Caves, Christensen and Diewert (1982).

O'Donnell (2010b) shows how data envelopment analysis (DEA) methodology can be used to compute and decompose the distance-based Hicks-Moorsteen TFP index. This paper shows how DEA can be used to decompose price-based Laspeyres, Paasche, Fisher and Lowe indexes. Lowe indexes are especially useful for the analysis of panel data because they are temporally and spatially transitive. Other transitive index numbers are available, but these fail one or more important axioms from index number theory. This paper illustrates the sensitivity of indexes of (the components of) TFP change to differences in the choice of TFP index number formula.

The paper analyses state-level panel data obtained from the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA). Each observation is a record of the prices and quantities of three outputs (livestock, crops, other outputs) and four inputs (capital, land, labour, materials) in a particular state in a particular year. The panel comprises 2160 observations covering $N$ = 48 states over the $T$ = 45 years from 1960 to 2004. Further details concerning the construction of the data can be accessed from Ball, Hallahan and Nehring (2004).

The structure of the paper is as follows. Section 2 summarises the aggregate quantity-price framework developed by O'Donnell (2008) for decomposing profitability change into its price change and quantity change components. This section explains that, for rational efficient firms, deteriorations in the (expected) agricultural terms-of-trade should lead to improvements in agricultural productivity. It also explains why increased levels of economic integration can be expected to lead to convergence in rates of productivity growth. A graphical illustration of these ideas reveals that steady increases in agricultural productivity in California and New Mexico have been offset by steady declines in the agricultural terms-of-trade, with the net result that profitability levels in these states have remained relatively stable.

Section 3 discusses price-based index numbers that can be used for measuring TFP change. The focus in this section is on a set of Lowe TFP indexes that satisfy all economically-relevant axioms and tests from index number theory. A graphical illustration in this section reveals that Lowe indexes of productivity change in California are visually indistinguishable from Fisher indexes of the type computed by, for example, Alston et al. (2010) and Ball et al. (2004). However, Lowe indexes of TFP change in New Mexico are quite different from Fisher indexes.

Section 4 summarises the O'Donnell (2008) approach to decomposing TFP indexes into economically-meaningful measures of technical change (movements in the boundary of the production possibilities set), technical efficiency change (movements towards the boundary), and scale and mix efficiency change (movements around the boundary to capture economies of scale and scope). A graphical illustration reveals that the main drivers of productivity change in California and New Mexico have been technical change and scale and mix efficiency change.

Sections 5 presents DEA problems for estimating levels of (and therefore changes in) pure technical, scale and mix efficiency in a way that is consistent with the construction of Paasche, Laspeyres, Fisher and Lowe TFP indexes. The technical efficiency and scale efficiency problems are the standard output- and input-oriented linear programs discussed in, for example, Charnes et al. (1994). The mix efficiency linear programming problem is a generalisation of the mix-efficiency problem developed by O'Donnell (2010b). The illustration in this section shows how estimates of mix efficiency in New Mexico vary with different implicit choices of productivity index number formula.

Sections 6 shows how DEA methodology can be used to estimate the maximum level of productivity possible using a production technology. Like the mix efficiency estimates, these estimates of maximum productivity vary with different implicit choices of index number formula. This section presents graphs of spatially- and temporally-transitive Lowe indexes of technical change in the Pacific and Southern Plains farm production regions.

Section 7 presents a complete tabular summary of the output-oriented components of agricultural profitability and productivity change in each of the 48 contiguous states. The index numbers presented in this section are both spatially and temporally transitive. Among other things, they reveal that Oregon experienced the highest rate of productivity growth over the sample period, and Wyoming experienced the lowest. Florida and California were consistently the most productive and profitable states.

The paper is concluded in Section 8.

## 2. THE COMPONENTS OF PROFITABILITY CHANGE

O'Donnell (2008) uses an aggregate quantity-price framework to demonstrate that a simple index of profitability change can be written as the product of a terms-of-trade index and a multiplicatively-complete TFP index. This section outlines the framework and draws two important implications for productivity analysis: first, if profitability levels are constant, productivity change can be measured as the inverse of the change in the terms of trade; second, irrespective of the rate of technical change, variations in (expected) input and output prices can be expected to give rise to changes in levels of agricultural productivity.

Let $x_{nt} \in \Re_+^K$, $q_{nt} \in \Re_+^J$, $w_{nt} \in \Re_+^K$ and $p_{nt} \in \Re_+^J$ denote vectors of input and output quantities and prices for firm *n* in period *t*. O'Donnell (2008) defines the TFP of the firm as $TFP_{nt} = Q_{nt} / X_{nt}$ where $Q_{nt} \equiv Q(q_{nt})$ is an aggregate output and $X_{nt} \equiv X(x_{nt})$ is an aggregate input. The only requirements placed on the aggregator functions *Q*(.) and *X*(.) are that they be non-negative, non-decreasing and linearly homogeneous. If TFP is defined this way then the index that measures the TFP of firm *n* in period *t* relative to the TFP of firm *m* in period *s* is

$$(1) \qquad TFP_{ms,nt} = \frac{TFP_{nt}}{TFP_{ms}} = \frac{Q_{nt} / X_{nt}}{Q_{ms} / X_{ms}} = \frac{Q_{nt} / Q_{ms}}{X_{nt} / X_{ms}} = \frac{Q_{ms,nt}}{X_{ms,nt}}$$

where $Q_{ms,nt} \equiv Q_{nt} / Q_{ms}$ and $X_{ms,nt} \equiv X_{nt} / X_{ms}$ are output and input quantity indexes. Thus, within this framework, productivity growth is a measure of output growth divided by a measure of input growth, as usual. O'Donnell (2008) uses the term *multiplicatively-complete* to refer to TFP indexes that can be written in terms of aggregate input and output quantities as in (1). Examples include the well-known Laspeyres, Paasche, Tornquist and Fisher binary TFP indexes. The Malmquist TFP index of Caves et al. (1982) is not multiplicatively-complete.

Associated with any non-zero aggregate quantities are the aggregate prices $P_{nt} = p'_{nt} q_{nt} / Q_{nt}$ and $W_{nt} = w'_{nt} x_{nt} / X_{nt}$. Thus, profit can be written $\pi_{nt} = P_{nt} Q_{nt} - W_{nt} X_{nt}$ and profitability can be written $PROF_{nt} = P_{nt} Q_{nt} / W_{nt} X_{nt}$. Moreover, the index number that measures the profitability of firm *n* in period *t* relative to firm *m* in period *s* can be written

$$(2) \qquad PROF_{ms,nt} = \frac{PROF_{nt}}{PROF_{ms}} = \left( \frac{P_{nt} Q_{nt}}{W_{nt} X_{nt}} \right) \left( \frac{W_{ms} X_{ms}}{P_{ms} Q_{ms}} \right) = \left( \frac{P_{ms,nt}}{W_{ms,nt}} \right) \left( \frac{Q_{ms,nt}}{X_{ms,nt}} \right) = TT_{ms,nt} \times TFP_{ms,nt}$$

where $P_{ms,nt} = P_{nt} / P_{ms}$ is an output price index, $W_{ms,nt} = W_{nt} / W_{ms}$ is an input price index and $TT_{ms,nt} = P_{ms,nt} / W_{ms,nt}$ is a terms-of-trade index measuring output price change relative to input price change. It is clear from equation (2) that if the reference and comparison firms receive the same prices for their outputs and pay the same prices for their inputs then the terms-of-trade index will take the value one and any changes in profitability will be plausibly attributed entirely to changes in TFP; if the two firms use the same inputs to produce the same outputs then any changes in profitability will be attributed entirely to changes in prices; and if profitability is constant then a TFP index can be computed as the inverse of the terms-of-trade index.

This aggregate quantity-price framework can be used to provide important insights into the behaviour of rational profit-maximising multiple-input-multiple-output firms. To illustrate, Figure 1 depicts the aggregate output and input of firm *n* in period *t* in two dimensional-aggregate quantity space (point A). In this figure, the curved line passing through point E is the boundary of the set of all aggregate-output aggregate-input combinations that are technically feasible in period *t*. The definition (1) means that the TFP of a firm operating at any point in aggregate quantity space is the slope of the ray from the origin to that point: for example, the TFP of the firm operating at point A is $TFP_{nt} = Q_{nt} / X_{nt} =$ slope 0A, and the TFP of the firm operating at point E is $TFP_t^* = Q_t^* / X_t^* =$ slope 0E. The solid line passing through point K in Figure 1 is an isoprofit line with slope $-W_{nt} / P_{nt}$ and intercept $\pi_{nt}^* / P_{nt}$, and the fact that this line is tangent to the production frontier means that point K maximises profit at aggregate prices $P_{nt}$ and $W_{nt}$. For the technology represented in Figure 1 (there are other technologies where this may not be true), the point of maximum profit will coincide with the point of maximum productivity if and only if the maximum TFP possible using the technology (the slope of the ray 0E) equals the inverse of the terms of trade (the slope of the isoprofit line). This equality between the terms-of-trade and the level of maximum productivity is a characteristic of perfectly competitive markets and, in such cases, profits are zero. Moreover, any rational efficient firm that has a benefit function that is increasing in net returns will be drawn away from the point of maximum productivity in response to an improvement in the terms of trade, to a point such as K or G. The associated inequality between the terms-of-trade and the level of maximum productivity is a characteristic of non-competitive markets and, in such cases, profits are strictly non-zero. Point G in Figure 1 is the profit maximising solution in the limiting case where all inputs are relatively costless. For rational efficient firms, the economically feasible region of production is the region of locally-decreasing returns to scale between points E and G. Productivity levels fall and profits rise as rational efficient firms move optimally from point E to point G. Conversely, productivity increases and profits fall as rational efficient firms respond optimally to a deterioration in their terms of trade.

This inverse relationship between productivity and the terms of trade has two interesting implications. First, it provides a rationale for microeconomic reform programs designed to increase levels of competition in agricultural output and input markets – deteriorations in the terms of trade that result from increased competition will tend to drive firms towards points of maximum productivity. Second, it provides an explanation for the observed convergence in rates of agricultural productivity growth in regions, states and countries that are becoming increasingly integrated and/or globalised – firms that strictly prefer more income to less and who face the same technology and prices will optimally choose to operate at the same point on the production frontier, they will make similar adjustments to their production choices in response to changes in the common terms of trade, and they will thus experience similar rates of productivity change.

An empirical illustration of the inverse relationship between the terms-of-trade and agricultural productivity is provided in Figures 2 and 3. The indexes depicted in Figure 2 measure changes in profitability (dPROF), total factor productivity (dTFP) and the terms of trade (dTT) in California over the period 1960 to 2004 (California 1960 = 1)[2]. The indexes in Figure 3 measure changes in the same variables for New Mexico over the same period (California 1960 = 1). Observe from both figures that deteriorations in the terms-of-trade have generally and

[2] All computations were made using Version 2.0 of the DPIN software written by O'Donnell (2010a) and available at http://www.uq.edu.au/economics/cepa/dpin.htm.

plausibly been associated with increases in productivity. Significant reductions in profitability levels in both states in the early 1980s were due to the fact that productivity improvements were not enough to offset significant deteriorations in the agricultural terms-of-trade.

## 3. LOWE TFP INDEXES

O'Donnell (2008) explicitly identifies the non-decreasing linearly homogeneous aggregator functions that underpin Laspeyres, Paasche, Fisher, Tornquist, Hicks-Moorsteen and Konus-type price, quantity and TFP indexes. Unfortunately, these indexes are generally unsuitable for inter-temporal and inter-spatial comparisons of productivity because they violate at least one important axiom or test from index number theory. This paper uses a very simple linear aggregator function to obtain TFP indexes that satisfy most, if not all, economically-relevant index number axioms and tests. Specifically, the paper aggregates outputs and inputs using the functions

$$(3) \qquad Q(q_{nt}, p) = p'q_{nt} \qquad \text{and} \qquad X(x_{nt}, w) = w'x_{nt}$$

where $p$ and $w$ are pre-determined firm- and time-invariant reference prices. The associated indexes that measure the output quantity, input quantity and TFP of firm $n$ in period $t$ relative to firm $m$ in period $s$ are:

$$(4) \qquad Q_{ms,nt} = \frac{Q(q_{nt}, p)}{Q(q_{ms}, p)} = \frac{p'q_{nt}}{p'q_{ms}}$$

$$(5) \qquad X_{ms,nt} = \frac{X(x_{nt}, w)}{X(x_{ms}, w)} = \frac{w'x_{nt}}{w'x_{ms}}$$

$$(6) \qquad TFP_{ms,nt} = \frac{Q_{ms,nt}}{X_{ms,nt}} = \frac{p'q_{nt}}{p'q_{ms}} \frac{w'x_{ms}}{w'x_{nt}}$$

These indices are ratios of the values of different baskets of goods evaluated at the same set of reference prices. They are a type of Lowe index, named after Lowe (1823). Details concerning the properties and widespread use of Lowe price and quantity indexes can be accessed from Balk and Diewert (2003) and Hill (2008). Importantly, any pair of price vectors may be used as reference prices in (4) to (6), including hypothetical vectors. In this paper, reference prices are formed as non-zero linear functions of the prices observed in the dataset.

Lowe indices satisfy a number of important axioms and tests. To avoid repetition, most of the following discussion is couched in terms of the Lowe output quantity index (4). Analogous results are available for the input quantity index (5) and the TFP index (6).

The Lowe output quantity index (4) is a function $Q(q_{ms}, q_{nt}, p)$ that satisfies the following axioms:

A.1 Monotonicity[3]: $Q(q_{ms}, q_{ik}, p) > Q(q_{ms}, q_{nt}, p)$ if $q_{ik} \geq q_{nt}$ and $Q(q_{ik}, q_{nt}, p) < Q(q_{ms}, q_{nt}, p)$ if $q_{ik} \geq q_{ms}$.

A.2 Linear homogeneity: $Q(q_{ms}, \lambda q_{nt}, p) = \lambda Q(q_{ms}, q_{nt}, p)$ for $\lambda > 0$.

A.3 Identity: $Q(q_{nt}, q_{nt}, p) = 1$.

A.4 Homogeneity of degree 0: $Q(\lambda q_{ms}, \lambda q_{nt}, p) = Q(q_{ms}, q_{nt}, p)$ for $\lambda > 0$.

A.5 Commensurability: $Q(q_{ms}\Lambda, q_{nt}\Lambda, p\Lambda^{-1}) = Q(q_{ms}, q_{nt}, p)$ where $\Lambda$ is a diagonal matrix with diagonal elements strictly greater than 0.

A.6 Proportionality: $Q(q_{ms}, \lambda q_{ms}, p) = \lambda$ for $\lambda > 0$.

It also satisfies the following tests:

T.1 Transitivity (or circular) test: $Q_{mt,nt} = Q_{mt,hr} Q_{hr,nt}$.

T.2 Product test: $R_{ms,nt} \equiv p'_{nt} q_{nt} / p'_{ms} q_{ms} = P_{ms,nt} Q_{ms,nt}$.

T.3 Time and space reversal test: $Q_{ms,nt} = 1 / Q_{nt,ms}$.

Axioms A.1 to A.6 are important if an index number is to be useful for economic analysis: the monotonicity axiom requires that the index increases with increases in any element of the comparison vector $q_{nt}$ and/or any decreases in any element of the reference vector $q_{ms}$; linear homogeneity means that a proportionate increase in the comparison vector will cause the same proportionate increase in the index; the identity axiom means that if the comparison and reference vectors are identical then the index number takes the value 1; homogeneity of degree 0 means that multiplication of the comparison and reference vectors by the same constant will leave the index number unchanged; commensurability means that a change in the units of measurement of an output (e.g., from kilograms to tonnes) does not change the value of the index; and proportionality means that if the comparison vector is proportionate to the reference vector then the index number is equal to the factor of proportionality.

Tests T.1 to T.3 are arguably just as important as the axioms: the transitivity test says the index number that directly compares the outputs of a comparison firm/period with the outputs of a reference firm/period is identical to the index number computed when the comparison is made through an intermediate firm/period; the product test says that a value index can be decomposed into the product of a price index and a quantity index; and the time and space reversal test requires that the index number comparing the outputs of a comparison firm/period with the outputs of a reference firm/period is the inverse of the index number obtained when the output vectors are interchanged. Recall from the previous section that, in the O'Donnell (2008) aggregate price-quantity framework, the aggregate output price $P_{nt} = p'_{nt} q_{nt} / Q_{nt}$ is constructed in a way that guarantees the product test is satisfied for all multiplicatively-complete TFP indexes and their associated implicit terms-of-trade indexes.

Any number of price vectors can be used as the reference price vector in (4), so there are infinitely many Lowe indexes $Q(q_{ms}, q_{nt}, p)$ that satisfy A.1 to A.6 and T.1 to T.3. On the input side, any number of vectors can be used as the reference price vector in (5). Examples include the following reference price pairs:

[3] The notation $q_{ms} \geq q_{nt}$ means that $q_{ims} \geq q_{int}$ for all $i = 1, ..., J$ and there exists at least one value $i \in \{1, ..., J\}$ where $q_{ims} \geq q_{int}$.

(7) $p = p_{nt}$ and $w = w_{nt}$

(8) $p = \bar{p}_t \equiv N^{-1}\sum_{n=1}^{N} p_{nt}$ and $w = \bar{w}_t \equiv N^{-1}\sum_{n=1}^{N} w_{nt}$

(9) $p = \bar{p}_s \equiv N^{-1}\sum_{n=1}^{N} p_{ns}$ and $w = \bar{w}_s \equiv N^{-1}\sum_{n=1}^{N} w_{ns}$

(10) $p = \bar{p} \equiv NT^{-1}\sum_{n=1}^{N}\sum_{t=1}^{T} p_{nt}$ and $w = \bar{w} \equiv NT^{-1}\sum_{n=1}^{N}\sum_{t=1}^{T} w_{nt}$

Every pair of reference prices defines a different type of Lowe index satisfying A.1 to A.6 and T.1 to T.3. Some vectors may be more useful in some empirical contexts than in others. For example, the period-*t* mean prices in (8) are likely to be useful in applications where prices are strongly trending and the only interest is in multilateral comparisons of the outputs and inputs of firms in period *t*. In this paper, where prices may be trending and there is interest in both inter-temporal and inter-spatial comparisons, Lowe TFP indexes are computed using the reference prices in (10).

For the empirical application in this paper, the particular attraction of Lowe indices is that they are both temporally and spatially transitive. An alternative method for constructing transitive indexes is to compute intransitive binary indices and then apply a geometric averaging procedure proposed by Elteto and Koves (1964) and Szulc (1964). For example, if the binary index $Q_{ms,nt}$ is intransitive then the so-called EKS solution to the transitivity problem is to compute

(11) $$Q_{ms,nt}^{EKS} = \prod_{h=1}^{N}\prod_{r=1}^{T}\left(Q_{ms,hr}Q_{hr,nt}\right)^{1/NT}$$

Ball et al. (2004) have applied this method to binary Fisher indexes to obtain a panel of transitive TFP indexes for U.S. agriculture. Unfortunately, index numbers constructed using (11) fail the identity axiom A.3.

To illustrate the differences between Lowe and EKS-type transitive indexes, Figure 4 shows measures of agricultural TFP in California (CA) and New Mexico (NM) relative to California in 1960. The dotted lines in this figure are computed by applying the EKS procedure to binary Fisher indexes, and the solid lines are the Lowe indexes defined by (6) where the reference vectors *p* and *w* are the sample mean prices given by (10) (these Lowe indexes were depicted earlier in Figures 2 and 3). Note that the EKS-Fisher and Lowe indexes reveal a similar pattern of productivity change in New Mexico[4], but the EKS-Fisher index is significantly higher than the Lowe index. The Lowe TFP index is the preferred index because, not only is it transitive, it also satisfies the identity axiom and is multiplicatively-complete. The following section describes how multiplicatively-complete TFP indexes can be decomposed into economically-relevant components.

[4] The correlation coefficient is 0.99. The correlation coefficient between Lowe and EKS-Fisher indexes of TFP change for all states in all time periods is also 0.99.

**4. THE COMPONENTS OF TFP CHANGE**

O'Donnell (2008) has shown that *any* multiplicatively-complete TFP index can be decomposed into measures of technical change and various measures of efficiency change. Among the efficiency change components are input- and output-oriented measures of technical, scale and mix efficiency change.

The O'Donnell (2008) decomposition methodology involves identifying points of economic interest in aggregate quantity space. For illustrative purposes, consider a two-output technology with firm $n$ in period $t$ producing the output vector $q_{nt} = (q_{1nt}, q_{2nt})'$. Let $p_{nt} = (p_{1nt}, p_{2nt})'$ be the associated vector of output prices and, for a simple exposition that is consistent with the Lowe indexes presented in Figure 4, let outputs be aggregated using the Lowe output aggregator function (3) defined over reference price vector $p = (p_1, p_2)'$. Figure 5 depicts measures of technical, mix and revenue-allocative efficiency for this firm in output space: the curved line passing through points V and R is the familiar production possibilities frontier; the solid line passing through point R is an isorevenue line with slope $-p_{1nt} / p_{2nt}$ and intercept $p'_{nt} q^*_{nt} / p_{2nt}$; and the dashed line passing through point A is an iso-aggregate-output line with slope $-p_1 / p_2$ and intercept $Q_{nt} / p_2$. For the firm producing $q_{nt}$, maximising output while holding the output mix fixed involves a move from point A to point C, and an increase in the aggregate output from $Q_{nt}$ to $\bar{Q}_{nt}$; maximising revenue without any restrictions on the output mix involves a move to point R and an increase in the aggregate output to $\breve{Q}_{nt}$; and maximising output without any restrictions on the output mix involves a move to point V and an increase in the aggregate output to $\hat{Q}_{nt}$. Associated measures of efficiency are the Farrell (1957) output-oriented measure of technical efficiency $OTE_{nt} = Q_{nt} / \bar{Q}_{nt}$, the common measure of revenue-allocative efficiency $RAE_{nt} = \bar{Q}_{nt} / \breve{Q}_{nt}$, and the O'Donnell (2008) measure of output-oriented mix efficiency, $OME_{nt} = \bar{Q}_{nt} / \hat{Q}_{nt}$.

Figure 6 maps the points A, C, R and V from Figure 5 into aggregate quantity space. In this figure, the curved line passing through point C is what O'Donnell (2008) refers to as a mix-restricted frontier – the boundary of the set of all technically-feasible aggregate input-output combinations that have the same input and output mix as the firm operating at point A. The curved line passing through points V and E is the unrestricted production frontier depicted earlier in Figure 1 – it is the boundary of the production possibilities set when all mix restrictions are relaxed. Recall that the maximum TFP that is possible using this technology is the TFP at point E: $TFP_t^* = Q_t^* / X_t^* = \text{slope 0E}$. O'Donnell (2008) defines TFP efficiency to be the difference between observed TFP and the TFP at this so-called point of maximum productivity (MP):

$$(12) \qquad TFPE_{nt} = \frac{TFP_{nt}}{TFP_t^*} = \frac{\text{slope 0A}}{\text{slope 0E}}$$

It is clear from Figure 6 that TFP efficiency can be decomposed as:

$$(13) \qquad TFPE_{nt} = \frac{\text{slope 0A}}{\text{slope 0E}} = \frac{\text{slope 0A}}{\text{slope 0C}} \times \frac{\text{slope 0C}}{\text{slope 0R}} \times \frac{\text{slope 0R}}{\text{slope 0E}}$$

or, in terms of aggregate outputs and inputs,

$$(14) \qquad TFPE_{nt} = \frac{Q_{nt}}{X_{nt}} \frac{X_t^*}{Q_t^*} = \left( \frac{Q_{nt}}{\bar{Q}_{nt}} \right) \left( \frac{\bar{Q}_{nt}}{\breve{Q}_{nt}} \right) \left( \frac{\breve{Q}}{X_{nt}} \frac{X_t^*}{Q_t^*} \right)$$

or, in terms of measures of efficiency,

$$(15) \qquad TFPE_{nt} = OTE_{nt} \times RAE_{nt} \times RSME_{nt}$$

where $RSME_{nt} = \text{slope}\,0\text{R}/\text{slope}\,0\text{E}$ denotes revenue-scale-mix efficiency (a measure of the difference between TFP at a revenue-allocatively efficient point and TFP at the point of maximum productivity). There are as many economically-meaningful decompositions of TFP efficiency as there are economically-meaningful points in aggregate quantity space. For example, O'Donnell (2008) considers the alternative output-oriented decompositions:

$$(16) \qquad TFPE_{nt} = OTE_{nt} \times OSE_{nt} \times RME_{nt}$$

$$(17) \qquad TFPE_{nt} = OTE_{nt} \times OME_{nt} \times ROSE_{nt}$$

where $OSE_{nt} = \text{slope}\,0\text{C}/\text{slope}\,0\text{D}$ is the common measure of output-oriented scale efficiency (a measure of the difference between TFP at a technically efficient point and the maximum TFP possible holding the output- and input mixes fixed); $ROSE_{nt} = \text{slope}\,0\text{V}/\text{slope}\,0\text{E}$ denotes residual output-oriented scale efficiency (a measure of the difference between TFP at a mix-efficient point and the point of maximum productivity); and $RME_{nt} = \text{slope}\,0\text{D}/\text{slope}\,0\text{E}$ denotes residual mix efficiency (a measure of the difference between TFP at a scale-efficient point and the point of maximum productivity).

Multiplicatively-complete TFP indexes can be conveniently decomposed by rearranging equation (12) as $TFP_{nt} = TFP_t^* \times TFPE_{nt}$. An analogous equation holds for firm *m* in period *s*. Thus, the TFP index of firm *n* in period *t* relative to firm *m* in period *s* can be written

$$(18) \qquad TFP_{ms,nt} = \frac{TFP_{nt}}{TFP_{ms}} = \left( \frac{TFP_t^*}{TFP_s^*} \right) \left( \frac{TFPE_{nt}}{TFPE_{ms}} \right)$$

The first term in parentheses is a measure of the difference in the maximum productivity possible in the two periods and is a natural measure of technical change. Thus, equation (18) reveals that TFP change can be exhaustively decomposed into a measure of technical change and a measure of efficiency change (O'Donnell, 2008). Equations (15) to (17) can be used to further decompose the efficiency change component into any number of meaningful measures. For example, any multiplicatively-complete TFP index can be decomposed into measures of technical change, technical efficiency change, and a combined measure of scale and mix efficiency change:

$$(19) \qquad TFP_{ms,nt} = \frac{TFP_{nt}}{TFP_{ms}} = \left(\frac{TFP_t^*}{TFP_s^*}\right)\left(\frac{OTE_{nt}}{OTE_{ms}}\right)\left(\frac{OSME_{nt}}{OSME_{ms}}\right)$$

where $OSME_{nt} = OSE_{nt} \times RME_{nt}$ denotes output-oriented scale-mix efficiency (a move from the technically-efficient point C in Figure 2 to the point of maximum productivity E).

An empirical illustration of the particular decomposition given by (19) is provided in Figures 7 and 8, where changes in agricultural TFP in California and New Mexico have been (exhaustively) decomposed into technical change (dTech), output-oriented technical efficiency change (dOTE), and output-oriented scale-mix efficiency change (dOSME) components. It is evident from these figures that the main long-term driver of TFP change in these states has been technical change, and the main short-term driver has been scale and mix efficiency change. The next two sections show how data envelopment analysis (DEA) was used to identify these efficiency change and technical change components.

## 5. TECHNICAL, SCALE AND MIX EFFICIENCY

The full menu of data envelopment analysis (DEA) and stochastic frontier analysis (SFA) methods are available for estimating the production frontiers depicted in Figures 5 and 6, and for identifying technically, scale and mix efficient points. O'Donnell (2010b) shows how DEA can be used to estimate the frontier and identify measures of output- and input-oriented mix efficiency associated with a distance-based Hicks-Moorsteen TFP index. This section shows how DEA can be used to obtain the measures of mix efficiency associated with price-based Paasche, Laspeyres, Fisher and Lowe TFP indexes. This section reveals that in the case of the Paasche TFP index the output- and input-oriented measures of mix efficiency are identical to well-known measures of revenue- and cost-allocative efficiency.

A useful starting point is a well-known DEA problem for estimating measures of technical and scale efficiency. If the technology exhibits variable returns to scale then the inverse of the Farrell (1957) output-oriented measure of technical efficiency for firm $n$ in period $t$ can be found as the solution to

$$(20a) \qquad \bar{Q}_{nt} / Q_{nt} = \max_{\theta, z} \quad \lambda$$

$$(20b) \qquad \text{s.t.} \quad \lambda q_{nt} - \sum_{i=1}^{N} \sum_{r=1}^{t} \theta_{ir} q_{ir} \leq 0$$

$$(20c) \qquad \sum_{i=1}^{N} \sum_{r=1}^{t} \theta_{ir} x_{ir} \leq x_{nt}$$

$$(20d) \qquad \sum_{i=1}^{N} \sum_{r=1}^{t} \theta_{ir} = 1$$

$$(20e) \qquad z_{nt}, \theta_{ir} \geq 0 \text{ for } i = 1, ..., N \text{ and } r = 1, ..., t$$

If the constraint (20d) is relaxed then the estimated technology will exhibit constant returns to scale. Estimates of output-oriented scale efficiency are computed by taking the ratio of the technical efficiency scores estimated under these alternative returns to scale assumptions.

To compute a measure of output-oriented mix efficiency it is convenient to first write the linear program (20) in the following equivalent form:

$$\begin{array}{llll}
(21a) & \bar{Q}_{nt} / Q_{nt} = & \max\limits_{\theta,z} & Q(z_{nt}) / Q(q_{nt}) \\
(21b) & & \text{s.t.} & z_{nt} - \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir} q_{ir} \leq 0 \\
(21c) & & & \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir} x_{ir} \leq x_{nt} \\
(21d) & & & \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir} = 1 \\
(21e) & & & z_{nt} - \lambda q_{nt} = 0 \\
(21f) & & & z_{nt}, \theta_{ir} \geq 0 \text{ for } i = 1,...,N \text{ and } r = 1,...,t
\end{array}$$

where $Q(.)$ is *any* non-decreasing linearly- homogeneous output aggregator function. The equivalence of problems (20) and (21) can be established by substituting constraint (21e) into the objective function (21a) and noting that, since the aggregator function is linearly homogeneous, $Q(\lambda q_{nt}) / Q(q_{nt}) = \lambda$. Writing (20) in the form of (21) is useful because constraint (21e) makes it explicit that output-oriented technical efficiency is a measure of the maximum increase in TFP (or aggregate output) that is possible while holding the input level (and therefore the aggregate input) and the output mix fixed. Moreover, it suggests that an estimate of the output-oriented mix efficiency of firm $n$ in period $t$ ($OME_{nt}$) can be obtained by simply relaxing the mix constraint (21e). The DEA problem then becomes

$$\begin{array}{llll}
(22a) & \hat{Q}_{nt} / Q_{nt} = & \max\limits_{\theta,z} & Q(z) / Q(q_{nt}) \\
(22b) & & \text{s.t.} & z - \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir} q_{ir} \leq 0 \\
(22c) & & & \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir} x_{ir} \leq x_{nt} \\
(22d) & & & \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir} = 1 \\
(22e) & & & z, \theta_{ir} \geq 0 \text{ for } i = 1,...,N \text{ and } r = 1,...,t
\end{array}$$

Unlike the solution to the technical efficiency problem (20), the solution to the mix efficiency problem (22) depends on the choice of aggregator function. If interest lies in identifying the output-oriented mix efficiency change component of a particular multiplicatively-complete TFP index, then the aggregator function should be the function that underpins that index. For example, if the TFP index is a simple Paasche index then the aggregator function should be $Q(q) = p_{nt}' q$ and the objective function (22a) becomes

$$\begin{array}{llll}
(22a') & \hat{Q}_{nt} / Q_{nt} = & \max\limits_{\theta,z} & p_{nt}' z / p_{nt}' q_{nt}
\end{array}$$

Note that the optimised value of this particular objective function will be the ratio of maximum revenue to observed revenue – the inverse of the common measure of revenue efficiency ($RE_{nt}$). Thus, the output-oriented mix efficiency component of a binary Paasche TFP index is the standard measure of revenue-allocative efficiency: $OME_{nt} = RAE_{nt} = RE_{nt}/OTE_{nt}$.

In this paper the TFP index is the Lowe index given by (6), underpinned by the aggregator function (3). To estimate mix-efficiency in a manner consistent with the computation of this TFP index, the objective function (22a) should be replaced with:

$$\text{(22a'')} \qquad \hat{Q}_{nt} / Q_{nt} = \max_{\theta,z} \quad \bar{p}'z / \bar{p}'q_{nt}$$

Similar problems are available for identifying the output-oriented mix efficiency levels associated with Laspeyres indexes, and for computing DEA estimates of input-oriented technical efficiency (*ITE*), input-oriented mix efficiency (*IME*), cost efficiency (*CE*) and cost-allocative efficiency (*IME* = *CAE* = *CE*/*ITE*) associated with Paasche, Laspeyres and Lowe indexes. The efficiency components of the Fisher index can be computed as the geometric average of the Laspeyres and Paasche measures.

To illustrate the computation of these measures, and the fact that the solution to the mix efficiency problem depends on the choice of aggregator function, output- and input-oriented measures of technical, scale and mix efficiency for New Mexico are presented in Figures 9 and 10. In Figure 9, the dashed and dotted lines labelled OME-L and OME-P are measures of output-oriented mix efficiency obtained using the Laspeyres and Paasche aggregator functions $Q(q) = p'_{ms}q$ and $Q(q) = p'_{nt}q$ respectively; the solid line labelled OME-F is the Fisher measure obtained as the geometric average of the Laspeyres and Paasche measures; and the solid line labelled OME is the measure obtained using the Lowe output aggregator function in (3) and the reference output price in (10). The corresponding input-oriented measures are presented in Figure 10. The transitive Lowe measures of input- and output-oriented mix efficiency both differ significantly from the intransitive Fisher measures, and this partly explains the divergence between the Fisher and Lowe TFP indexes depicted in Figure 4.

## 6. MAXIMUM PRODUCTIVITY AND THE RATE OF TECHNICAL CHANGE

The maximum TFP possible using the production technology is the TFP at point E in Figure 1: $TFP_t^* = Q_t^* / X_t^* =$ slope 0E. Points of maximum productivity can be estimated using a DEA problem that is closely related to problem (22). Problem (22) allows outputs to vary freely but holds the input vector fixed. The point of maximum productivity is estimated by solving a less restrictive problem that allows both inputs and outputs to vary freely:

$$\text{(23a)} \qquad TFP_t^* = \max_{\theta_{ir}, z, v} \quad Q(z)$$

$$\text{(23b)} \qquad \text{s.t.} \quad \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir}q_{ir} \geq z$$

$$\text{(23c)} \qquad v - \sum_{i=1}^{N}\sum_{r=1}^{t}\theta_{ir}x_{ir} \geq 0$$

$$\text{(23d)} \qquad X(v) = 1$$

$$\text{(23e)} \qquad z, v, \theta_{ir} \geq 0 \text{ for } i = 1,...,N \text{ and } r = 1,...,t$$

where the constraint (23d) is a normalising constraint that plays the same role as a normalising constraint in the dual form of the output-oriented technical efficiency problem (20). Again, the solution to problem (23) depends on the choices of input and output aggregator functions. Again, if interest centres on identifying the technical change component of a multiplicatively-complete TFP index then the aggregator functions and prices should be those that underpin that index. For example, if the TFP index is the Paasche index then the objective function (23a) and the constraint (23d) should be replaced with

$$\text{(23a')} \qquad TFP_{nt}^* = \max_{\theta_{ir}, z, v} \quad p_{nt}'z$$

$$\text{(23d')} \qquad w_{nt}'v = 1$$

In this case, the optimised value of the objective function is the maximum profitability that can be achieved by firm *n* in period *t*. This level of maximum profitability is of considerable economic interest, but not for purposes of measuring technical change – as a measure of technical change it is implausible because it varies with observed prices even when the production possibilities set represented by constraints (23b) and (23c) remains unchanged. Laspeyres and Fisher TFP indexes also contain technical change components that vary even when the technology is fixed. In contrast, the technical change component of the Lowe TFP index is robust to differences in the prices faced by different firms. If the TFP index is a Lowe index defined over reference vectors $\bar{p}$ and $\bar{w}$ then (23a) and (23d) should be replaced with

$$\text{(23a'')} \qquad TFP_t^* = \max_{\theta_{ir}, z, v} \quad \bar{p}'z$$

$$\text{(23d')} \qquad \bar{w}'v = 1$$

and the associated measure of technical change is plausibly identical for every firm.

The estimates of technical change are identical for all states that face the same production technology. In this paper, ten separate variable returns to scale production technologies have been estimated for the ten farm production regions identified by the USDA ERS. A list of the states in each region is provided in Table 1. Note that California is assumed to face a "Pacific" production technology while New Mexico is assumed to face a "Mountain" production technology. Estimates of the maximum productivity possible in California and New Mexico are represented by the (different) technical change indexes (dTECH) depicted in Figures 7 and 8. These indexes are transitive indexes formed by dividing the estimated maximum TFP in each region in each time period by the estimated maximum TFP in the Pacific region in 1960.

Variations in levels of maximum productivity are due to inward and outward movements in the production frontier in the region of local constant returns to scale (point E in Figure 1). A common view is that these movements are due to variations in technical know-how. O'Donnell (2010b) takes a broader view of technical change and attributes movements in the production frontier to variations in *any* factors that are not accounted for by the input and output variables in the data set. Aside from the stock of scientific and technical knowledge, these "environmental" factors may include anything from measures of soil quality to seasonal conditions – if environmental factors are favourable for agricultural production then the maximum output possible using any given level of included inputs will be higher than the maximum output possible when environmental conditions are poor. Cross-sectional patterns of variation in environmental factors have been partially accounted for in this paper by estimating separate production frontiers for each of the ten ERS regions listed in Table 1. To account for variations in environmental factors over time, these technologies have been estimated using DEA models that allow for a small amount of technical regress. This involves using a moving window of observations to estimate the technology in each region. For example, the Pacific region production technology has been estimated using a moving five-year window of observations, while the Mountain region production technology has been estimated using a two-year window. The size of the window was determined by the number of states in each region and reflects a desire to estimate each regional frontier using at least twice as many observations as there are input and output variables in the dataset. The final column in Table 1 is the size of the window used to estimate the technology in each region. The estimated rate of technical change in New Mexico and other Southern Plains states is lower than in California and other Pacific states partly because large windows have the effect of dampening estimated rates of technical change – as the size of the window approaches the time-series dimension of the data set the estimated rate of technical change will approach zero and any productivity change will be attributed entirely to efficiency change.

## 7. ESTIMATES OF THE COMPONENTS OF PROFITABILITY AND PRODUCTIVITY CHANGE

This section reports a complete and coherent panel of estimates of the components of state-level agricultural profitability and productivity change.

The indexes reported in Table 2 compare levels of profitability in each state with the level of profitability in California in 1960. This table can be used to make both inter-spatial and inter-temporal comparisons: for example, the element in the FL column in the first row reveals that the level of profitability in Florida in 1960 was 23% higher than in California, making it the most profitable agricultural state at that time; the last row reveals that the level of profitability in Florida in 2004 was 3% lower than it had been in California in 1960; the first and last elements in the FL column together reveal that profitability in Florida in 2004 was 21% lower than it had been in 1960 (0.969/1.234 = 0.785); and the first and last elements in the GA column reveal that Georgia experienced a 26.3% increase in profitability over the sample period (0.924/0.732 = 1.262), the largest increase of any state.

Associated with the profitability indexes reported in Table 2 are panels of TFP indexes and indexes measuring changes in the terms of trade. The productivity indexes are reported in Table 3; the terms-of-trade indexes are not reported but can be easily derived from Tables 2 and 3 using equation (2). Again, the indexes reported in Table 3 can be used to make both inter-temporal and inter-spatial comparisons. For example, it is evident that California and Florida were the most productive states throughout the sample period; Wyoming was the least productive state; Oregon experienced the largest increase in productivity (1.603/0.514 = 3.11); and Wyoming experienced the lowest increase in productivity (0.591/0.417 = 1.417).

The indexes reported in Table 4 are indexes of technical change in each of the ERS farm production regions (Base = Pacific in 1960). These indexes reveal that the regions with highest potential productivity over the sample period were the Southeast region (1960-1979, 1999-2004) and the Pacific region (1980-1998). Between 1960 and 2004, the maximum productivity possible using the technology available in the Mountain region increased by 140% (1.548/0.645 = 2.4), higher than any other region; the maximum productivity in the Southern Plains region increased by only 40% (0.957/0.684 = 1.4), a smaller increase than any other region. These relativities partly reflect the window lengths discussed in Section 6.

The indexes reported in Table 5 measure output-oriented technical efficiency levels in each state and year relative to California in 1960. It happens that California is estimated to have been fully technically efficient in 1960, so the indexes in Table 5 can also be viewed as efficiency scores. Thus, for example, the index numbers in the CT column indicate that Connecticut was only 91% technically efficient in 1960 (from an output-oriented perspective), and did not become fully technically efficient until 1981. When assessing the estimates reported in Table 5, it is useful to bear in mind that technical efficiency is a measure of the distance between an observed data point and a point on the production frontier. Thus, variations in technical efficiency scores will reflect variations in productive performance as well as variations in the position of the frontier. Productive performance will vary as more or fewer mistakes are made during the production process (e.g., mistakes in the timing of farm operations, such as planting and harvesting), while the position of the frontier will vary with the environmental variables discussed in Section 6.

The indexes reported in Table 6 measure changes in scale and mix efficiency relative to California in 1960. The index number at the intersection of the first row and the KS column indicates that Kansas was 12.3% more scale and mix efficient than California in 1960. However, by 2004 California was 12.9% more scale and mix efficient than Kansas (1.123/0.995 = 1.129). In 2004, the most scale and mix efficient states were California, Idaho, Illinois, Minnesota, Nebraska and Texas. The least scale and mix efficient state was West Virginia.

Finally, it is useful to remember that the technical change and efficiency change estimates reported in Tables 4, 5, and 6 combine to yield the indexes of productivity change reported in Table 3. To illustrate, the Southern Plains column in Table 4 and the TX columns in Tables 5 and 6 reveal that Texas experienced a 40% increase in productivity due to technical change (0.957/0.684 = 1.399), no increase in productivity due to improvements in technical efficiency, and a 32% increase in productivity due to economies of scale and scope (1.123/0.849 = 1.323), resulting in an overall productivity increase of 1.399 × 1.323 – 1 = 85% (in Table 3, 1.075/0.581 = 1.85); in Tennessee, the combined effects of technical progress (122%), technical efficiency improvement (1%) and diseconomies of scale and scope (-24%) resulted in an net productivity increase of 2.22 × 1.01 × 0.76 – 1 = 70%.

## 7. CONCLUSION

This paper extends the work of O'Donnell (2008) and O'Donnell (2010b) by developing and applying methodology for decomposing price-based multiplicatively-complete TFP index numbers. This class of index numbers includes Laspeyres, Paasche, Fisher and Lowe TFP indexes. The decomposition is exhaustive in the sense that all the components of these indexes can be unambiguously interpreted as measures of technical change or efficiency change. The efficiency change components include familiar measures of technical and scale efficiency change, as well as the O'Donnell (2008) measure of mix-efficiency change. The paper explains that rational efficient firms will be tend to move around the boundary of the production possibilities in response to changes in (expected) input and output prices. In the case of general but regular production technologies, these movements lead to changes in productivity as firms experience economies or diseconomies of scale or scope. These ideas are illustrated using state-level data on US agricultural inputs and outputs. The results suggest that the main driver of productivity growth in US agriculture from 1960-2004 has been technical change.

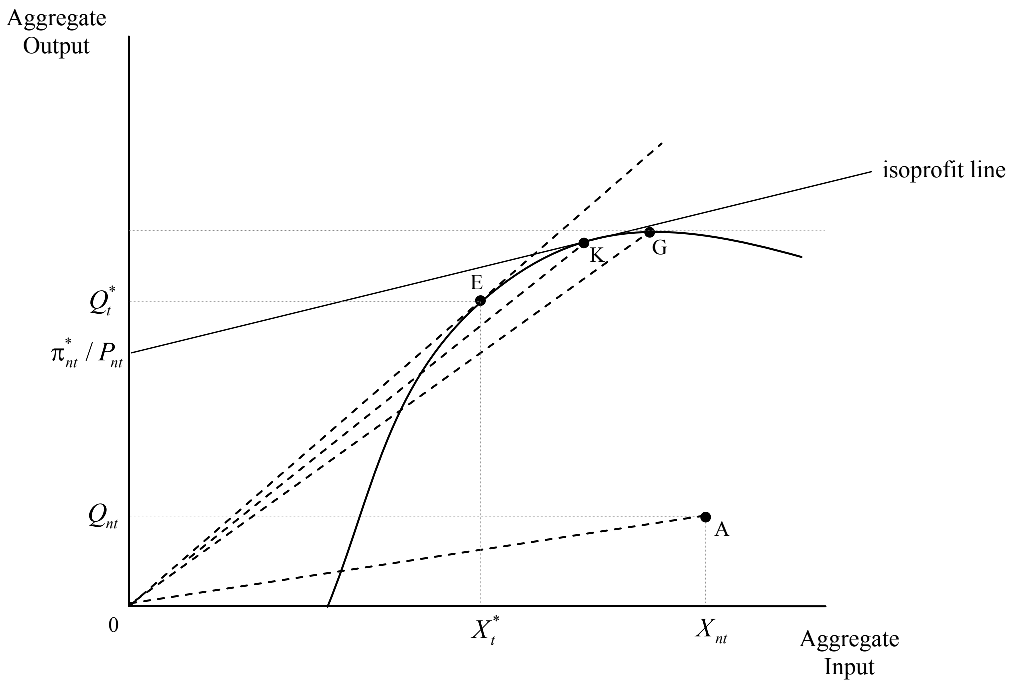


Figure 1. Productivity, Profitability and the Terms of Trade

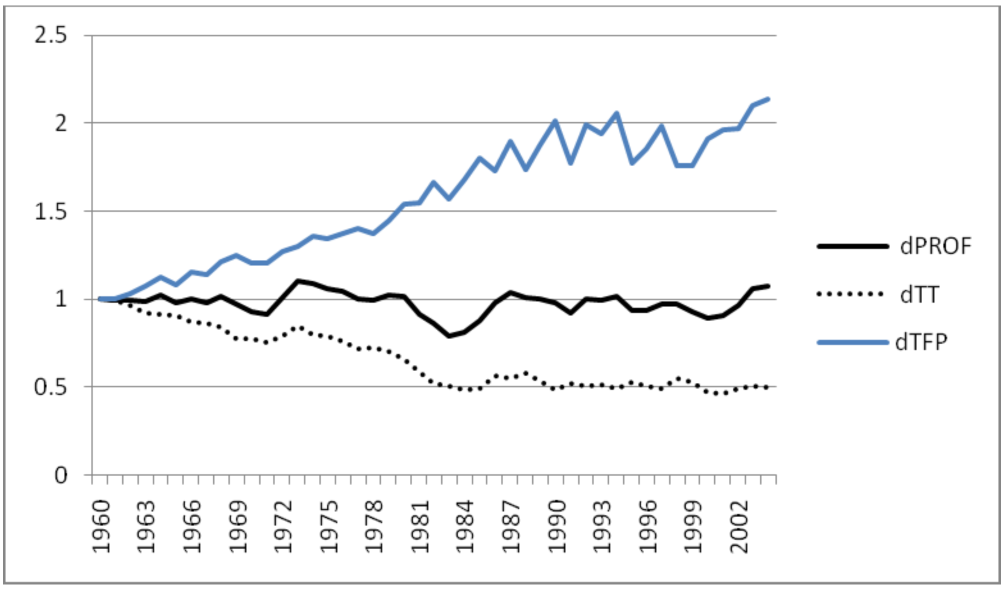


Figure 2. Indexes Measuring Changes in Profitability, TFP and the Terms of Trade: California Relative to California in 1960

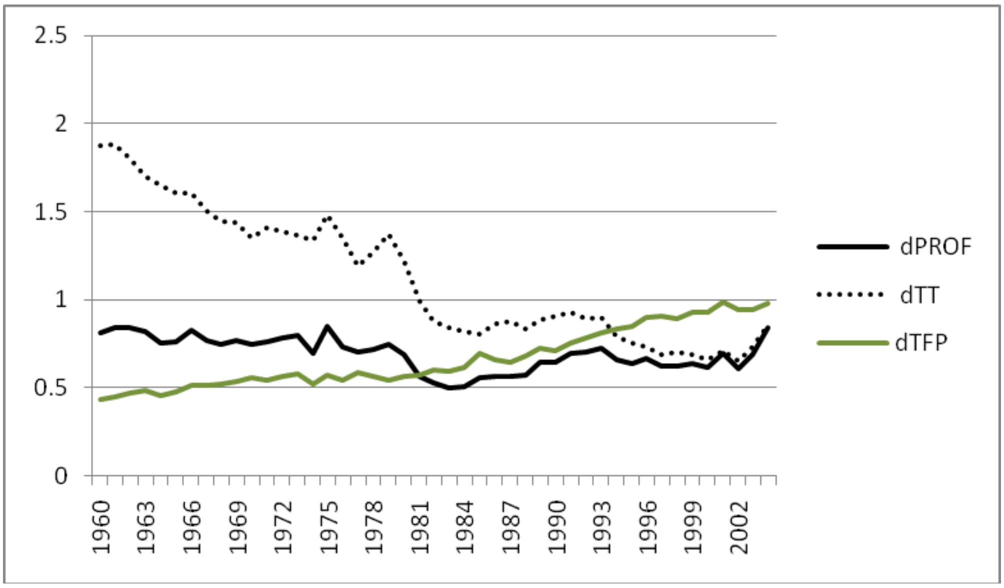


Figure 3. Indexes Measuring Changes in Profitability, TFP and the Terms of Trade: New Mexico Relative to California in 1960

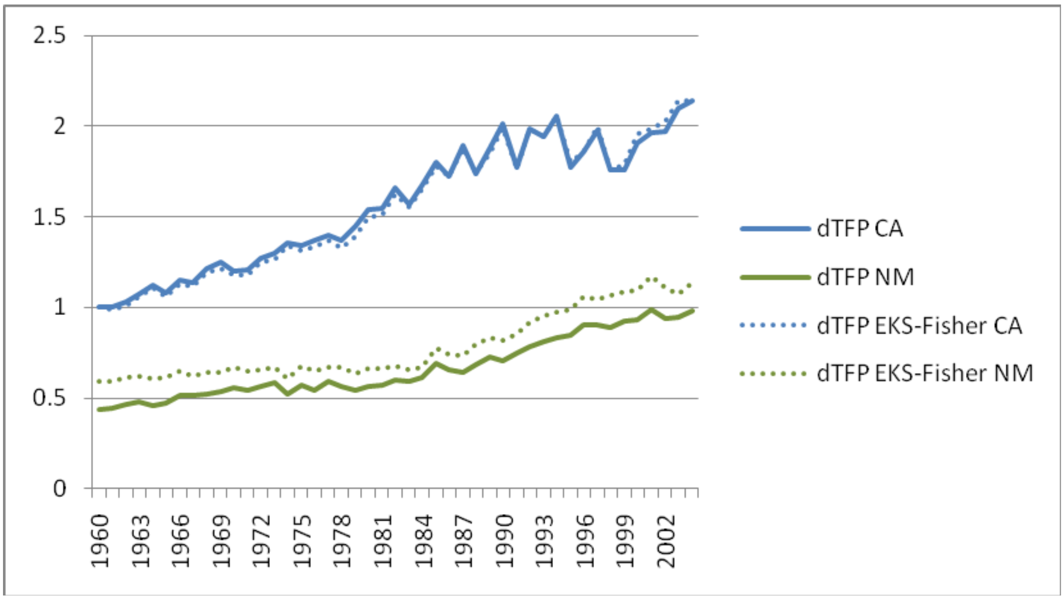


Figure 4. Indexes of TFP Change: California and New Mexico relative to California in 1960.

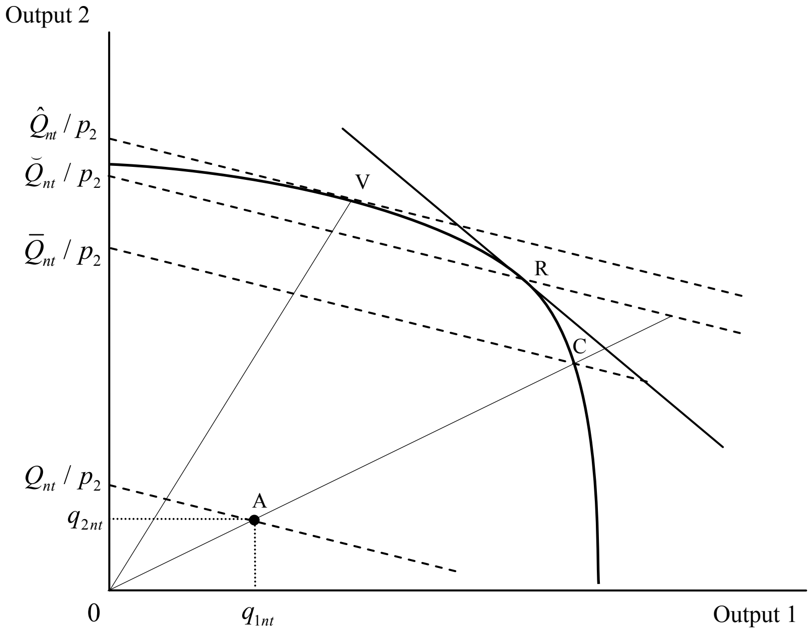


Figure 5. Output-Oriented Measures of Efficiency

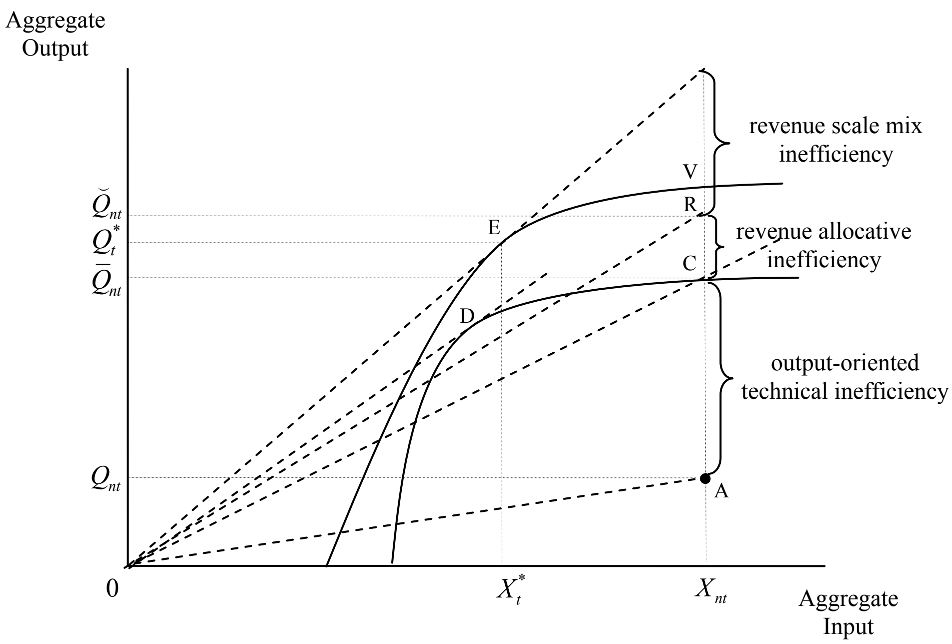


Figure 6. Output-Oriented Measures of Efficiency

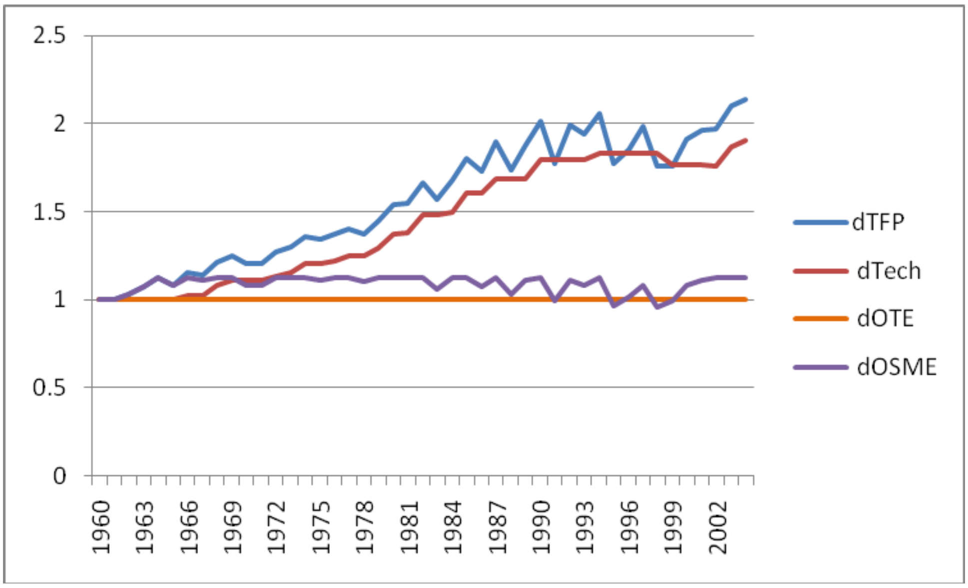


Figure 7. Output-Oriented Components of TFP Change: California, 1960-2004

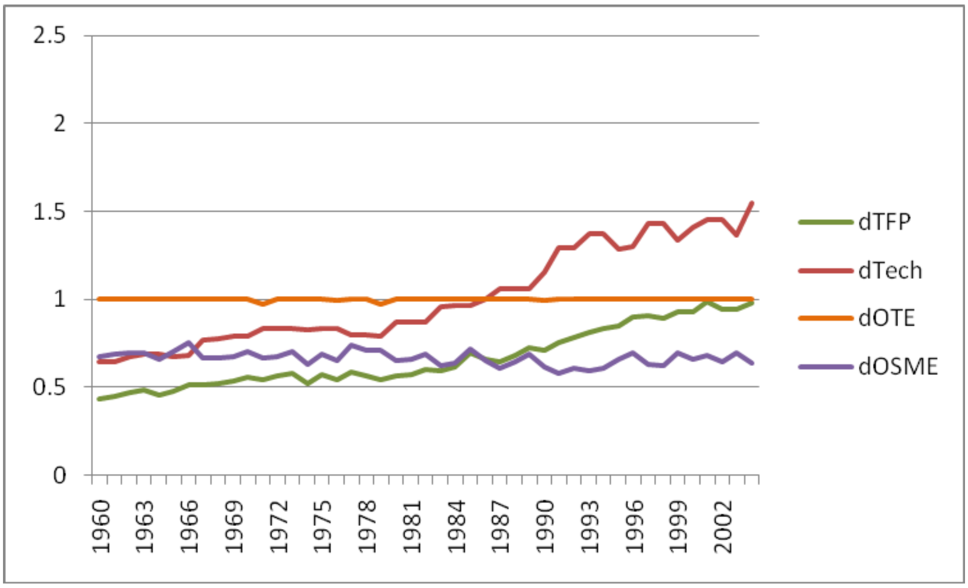


Figure 8. Output-Oriented Components of TFP Change: New Mexico, 1960-2004

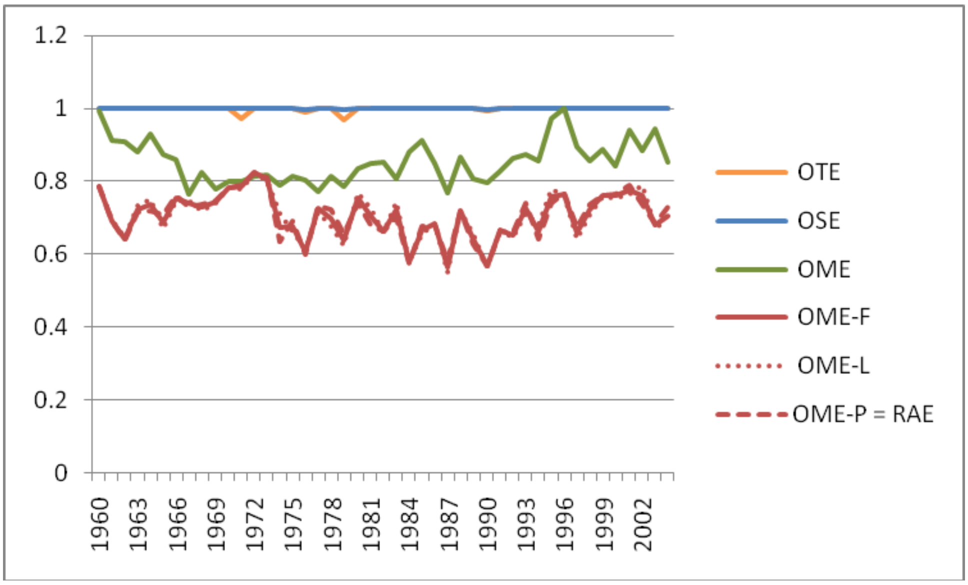


Figure 9. Output-Oriented Technical Efficiency, Scale Efficiency and Mix Efficiency – New Mexico.

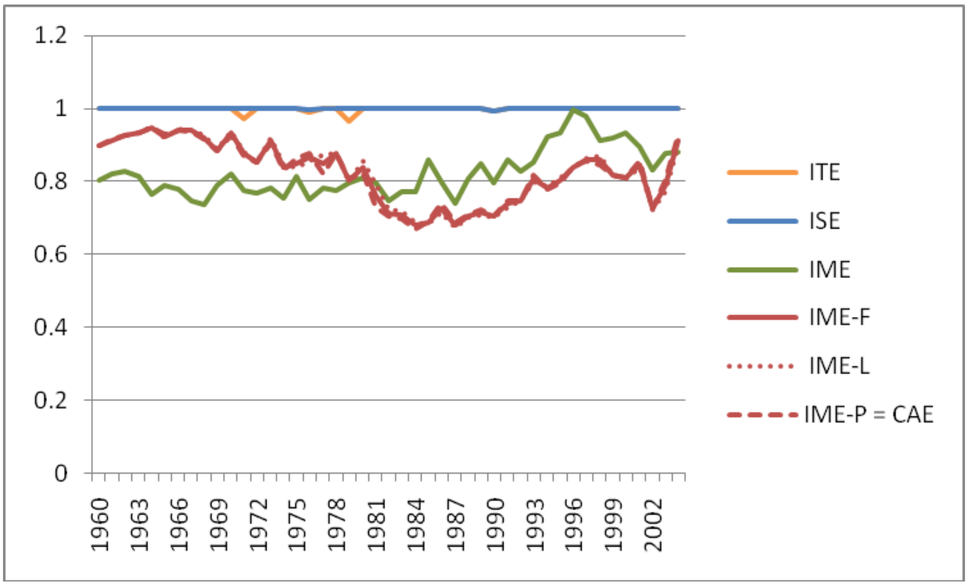


Figure 10. Input-Oriented Technical Efficiency, Scale Efficiency and Mix Efficiency – New Mexico.

Table 1. USDA ERS Farm Production Regions

| Region | States | Window |
|---|---|---|
| Pacific | CA, OR, WA | 5 |
| Mountain | AZ, CO, ID, MT, NM, NV, UT, WY | 2 |
| Northern Plains | KS, ND, NE, SD | 4 |
| Southern Plains | OK, TX | 8 |
| Corn Belt | IA, IL, IN, MO, OH | 3 |
| Southeast | AL, FL, GA, SC | 4 |
| Northeast | CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT | 2 |
| Lake States | MI, MN, WI | 5 |
| Appalacian | KY, NC, TN, VA, WV | 3 |
| Delta States | AR, LA, MS | 5 |

Table 2. Indexes of Profitability Change (California 1960 = 1)

| | AL | AR | AZ | CA | CO | CT | DE | FL | GA | IA | ID | IL | IN | KS | KY | LA | MA | MD | ME | MI | MN | MO | MS | MT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 0.851 | 0.851 | 0.982 | 1.000 | 0.756 | 0.614 | 0.808 | 1.234 | 0.732 | 0.734 | 0.748 | 0.813 | 0.670 | 0.853 | 0.784 | 0.776 | 0.649 | 0.684 | 0.805 | 0.587 | 0.750 | 0.693 | 0.827 | 0.786 |
| 1961 | 0.858 | 0.934 | 1.064 | 0.996 | 0.740 | 0.610 | 0.780 | 1.340 | 0.770 | 0.777 | 0.735 | 0.879 | 0.724 | 0.841 | 0.846 | 0.797 | 0.627 | 0.681 | 0.681 | 0.603 | 0.801 | 0.739 | 0.892 | 0.722 |
| 1962 | 0.837 | 0.898 | 0.996 | 0.990 | 0.708 | 0.584 | 0.772 | 1.332 | 0.756 | 0.753 | 0.774 | 0.850 | 0.718 | 0.848 | 0.800 | 0.800 | 0.617 | 0.661 | 0.682 | 0.596 | 0.744 | 0.712 | 0.827 | 0.905 |
| 1963 | 0.888 | 0.912 | 1.056 | 0.989 | 0.711 | 0.591 | 0.750 | 1.279 | 0.799 | 0.759 | 0.771 | 0.858 | 0.723 | 0.795 | 0.760 | 0.815 | 0.623 | 0.648 | 0.663 | 0.579 | 0.786 | 0.710 | 0.926 | 0.855 |
| 1964 | 0.850 | 0.950 | 0.981 | 1.025 | 0.731 | 0.588 | 0.722 | 1.292 | 0.762 | 0.748 | 0.737 | 0.794 | 0.647 | 0.785 | 0.790 | 0.758 | 0.634 | 0.645 | 0.747 | 0.576 | 0.726 | 0.647 | 0.844 | 0.770 |
| 1965 | 0.850 | 0.917 | 0.994 | 0.977 | 0.732 | 0.622 | 0.786 | 1.214 | 0.784 | 0.793 | 0.769 | 0.893 | 0.726 | 0.824 | 0.748 | 0.731 | 0.634 | 0.693 | 0.863 | 0.551 | 0.781 | 0.712 | 0.832 | 0.816 |
| 1966 | 0.823 | 0.985 | 1.001 | 1.003 | 0.781 | 0.666 | 0.697 | 1.190 | 0.809 | 0.813 | 0.752 | 0.845 | 0.704 | 0.818 | 0.689 | 0.793 | 0.675 | 0.661 | 0.749 | 0.560 | 0.815 | 0.723 | 0.880 | 0.850 |
| 1967 | 0.768 | 0.868 | 0.989 | 0.980 | 0.762 | 0.658 | 0.746 | 1.169 | 0.783 | 0.758 | 0.774 | 0.819 | 0.669 | 0.793 | 0.732 | 0.790 | 0.625 | 0.685 | 0.610 | 0.537 | 0.763 | 0.707 | 0.768 | 0.803 |
| 1968 | 0.750 | 0.859 | 0.961 | 1.017 | 0.788 | 0.624 | 0.737 | 1.159 | 0.731 | 0.735 | 0.745 | 0.746 | 0.670 | 0.781 | 0.671 | 0.781 | 0.632 | 0.659 | 0.637 | 0.527 | 0.771 | 0.733 | 0.696 | 0.825 |
| 1969 | 0.785 | 0.841 | 0.961 | 0.970 | 0.765 | 0.601 | 0.831 | 1.177 | 0.780 | 0.732 | 0.779 | 0.766 | 0.701 | 0.798 | 0.714 | 0.711 | 0.602 | 0.717 | 0.694 | 0.485 | 0.768 | 0.675 | 0.701 | 0.807 |
| 1970 | 0.752 | 0.867 | 0.904 | 0.928 | 0.756 | 0.640 | 0.756 | 1.053 | 0.744 | 0.706 | 0.745 | 0.682 | 0.620 | 0.767 | 0.653 | 0.752 | 0.616 | 0.670 | 0.671 | 0.475 | 0.771 | 0.678 | 0.695 | 0.775 |
| 1971 | 0.790 | 0.844 | 0.907 | 0.910 | 0.766 | 0.643 | 0.745 | 1.158 | 0.764 | 0.699 | 0.783 | 0.774 | 0.660 | 0.822 | 0.661 | 0.767 | 0.635 | 0.649 | 0.676 | 0.502 | 0.783 | 0.715 | 0.768 | 0.772 |
| 1972 | 0.830 | 0.904 | 0.876 | 1.006 | 0.780 | 0.582 | 0.823 | 1.218 | 0.786 | 0.770 | 0.809 | 0.806 | 0.675 | 0.854 | 0.721 | 0.826 | 0.588 | 0.687 | 0.672 | 0.556 | 0.789 | 0.759 | 0.828 | 0.873 |
| 1973 | 0.889 | 1.136 | 0.906 | 1.102 | 0.834 | 0.608 | 0.970 | 1.208 | 0.861 | 0.886 | 0.926 | 0.944 | 0.819 | 0.980 | 0.772 | 0.975 | 0.610 | 0.746 | 0.863 | 0.681 | 0.978 | 0.847 | 0.945 | 0.952 |
| 1974 | 0.772 | 0.960 | 0.958 | 1.085 | 0.824 | 0.606 | 0.889 | 1.096 | 0.807 | 0.773 | 0.932 | 0.792 | 0.706 | 0.854 | 0.784 | 0.878 | 0.593 | 0.721 | 0.817 | 0.696 | 0.821 | 0.681 | 0.817 | 0.772 |
| 1975 | 0.840 | 1.037 | 0.937 | 1.057 | 0.823 | 0.681 | 0.997 | 1.285 | 0.850 | 0.801 | 0.831 | 0.969 | 0.761 | 0.856 | 0.661 | 0.831 | 0.658 | 0.785 | 0.747 | 0.754 | 0.763 | 0.719 | 0.797 | 0.859 |
| 1976 | 0.876 | 0.969 | 1.003 | 1.046 | 0.804 | 0.657 | 0.942 | 1.249 | 0.834 | 0.751 | 0.850 | 0.863 | 0.802 | 0.807 | 0.814 | 0.893 | 0.662 | 0.739 | 0.829 | 0.688 | 0.674 | 0.702 | 0.899 | 0.750 |
| 1977 | 0.763 | 0.918 | 0.847 | 1.003 | 0.719 | 0.637 | 0.805 | 1.123 | 0.700 | 0.704 | 0.713 | 0.749 | 0.683 | 0.760 | 0.785 | 0.788 | 0.624 | 0.625 | 0.724 | 0.703 | 0.758 | 0.709 | 0.841 | 0.599 |
| 1978 | 0.781 | 0.891 | 0.794 | 0.992 | 0.695 | 0.695 | 0.748 | 1.138 | 0.807 | 0.764 | 0.756 | 0.750 | 0.730 | 0.659 | 0.781 | 0.752 | 0.665 | 0.698 | 0.663 | 0.680 | 0.729 | 0.732 | 0.857 | 0.642 |
| 1979 | 0.769 | 0.872 | 0.820 | 1.019 | 0.711 | 0.697 | 0.747 | 1.094 | 0.798 | 0.747 | 0.729 | 0.812 | 0.704 | 0.759 | 0.783 | 0.778 | 0.631 | 0.686 | 0.649 | 0.702 | 0.734 | 0.760 | 0.876 | 0.623 |
| 1980 | 0.669 | 0.725 | 0.763 | 1.012 | 0.682 | 0.649 | 0.623 | 1.045 | 0.708 | 0.661 | 0.772 | 0.625 | 0.657 | 0.652 | 0.714 | 0.649 | 0.620 | 0.572 | 0.590 | 0.686 | 0.658 | 0.606 | 0.717 | 0.568 |
| 1981 | 0.674 | 0.785 | 0.740 | 0.910 | 0.665 | 0.637 | 0.675 | 0.935 | 0.763 | 0.698 | 0.715 | 0.679 | 0.592 | 0.629 | 0.758 | 0.598 | 0.639 | 0.601 | 0.636 | 0.648 | 0.652 | 0.681 | 0.721 | 0.553 |
| 1982 | 0.698 | 0.714 | 0.714 | 0.863 | 0.649 | 0.715 | 0.702 | 0.897 | 0.826 | 0.596 | 0.663 | 0.643 | 0.601 | 0.643 | 0.698 | 0.580 | 0.624 | 0.598 | 0.695 | 0.589 | 0.599 | 0.565 | 0.709 | 0.538 |
| 1983 | 0.666 | 0.615 | 0.640 | 0.790 | 0.637 | 0.635 | 0.712 | 0.894 | 0.746 | 0.506 | 0.707 | 0.478 | 0.473 | 0.581 | 0.591 | 0.578 | 0.629 | 0.550 | 0.612 | 0.565 | 0.544 | 0.492 | 0.641 | 0.505 |
| 1984 | 0.680 | 0.720 | 0.670 | 0.815 | 0.645 | 0.679 | 0.701 | 0.892 | 0.803 | 0.619 | 0.689 | 0.639 | 0.631 | 0.638 | 0.698 | 0.606 | 0.660 | 0.625 | 0.670 | 0.586 | 0.624 | 0.505 | 0.692 | 0.443 |
| 1985 | 0.678 | 0.728 | 0.679 | 0.878 | 0.654 | 0.697 | 0.782 | 0.964 | 0.774 | 0.636 | 0.670 | 0.712 | 0.661 | 0.682 | 0.757 | 0.576 | 0.685 | 0.648 | 0.619 | 0.627 | 0.654 | 0.632 | 0.732 | 0.397 |
| 1986 | 0.719 | 0.723 | 0.719 | 0.976 | 0.717 | 0.773 | 0.864 | 1.039 | 0.808 | 0.767 | 0.712 | 0.748 | 0.694 | 0.735 | 0.712 | 0.611 | 0.736 | 0.660 | 0.653 | 0.633 | 0.702 | 0.638 | 0.709 | 0.617 |
| 1987 | 0.727 | 0.794 | 0.774 | 1.038 | 0.695 | 0.755 | 0.788 | 1.084 | 0.828 | 0.726 | 0.790 | 0.736 | 0.712 | 0.753 | 0.732 | 0.696 | 0.695 | 0.673 | 0.682 | 0.675 | 0.699 | 0.659 | 0.834 | 0.662 |
| 1988 | 0.806 | 0.842 | 0.797 | 1.010 | 0.705 | 0.732 | 0.874 | 1.150 | 0.850 | 0.609 | 0.748 | 0.591 | 0.564 | 0.712 | 0.674 | 0.815 | 0.707 | 0.678 | 0.668 | 0.623 | 0.603 | 0.614 | 0.858 | 0.500 |
| 1989 | 0.811 | 0.829 | 0.786 | 1.003 | 0.739 | 0.726 | 0.890 | 1.166 | 0.912 | 0.747 | 0.822 | 0.782 | 0.704 | 0.700 | 0.812 | 0.667 | 0.649 | 0.650 | 0.648 | 0.657 | 0.652 | 0.673 | 0.744 | 0.660 |
| 1990 | 0.754 | 0.783 | 0.759 | 0.979 | 0.765 | 0.753 | 0.803 | 1.016 | 0.839 | 0.705 | 0.830 | 0.706 | 0.664 | 0.767 | 0.711 | 0.674 | 0.633 | 0.650 | 0.688 | 0.602 | 0.624 | 0.609 | 0.722 | 0.676 |
| 1991 | 0.844 | 0.782 | 0.812 | 0.921 | 0.719 | 0.736 | 0.797 | 1.110 | 0.925 | 0.661 | 0.864 | 0.704 | 0.606 | 0.735 | 0.721 | 0.625 | 0.751 | 0.605 | 0.688 | 0.622 | 0.613 | 0.603 | 0.740 | 0.748 |
| 1992 | 0.818 | 0.875 | 0.856 | 1.000 | 0.740 | 0.776 | 0.797 | 1.176 | 0.977 | 0.760 | 0.854 | 0.800 | 0.689 | 0.810 | 0.776 | 0.695 | 0.705 | 0.665 | 0.740 | 0.595 | 0.638 | 0.649 | 0.829 | 0.714 |
| 1993 | 0.782 | 0.768 | 0.847 | 0.991 | 0.757 | 0.757 | 0.768 | 1.044 | 0.869 | 0.566 | 0.907 | 0.691 | 0.652 | 0.781 | 0.735 | 0.630 | 0.660 | 0.610 | 0.704 | 0.573 | 0.504 | 0.524 | 0.703 | 0.818 |
| 1994 | 0.824 | 0.841 | 0.761 | 1.012 | 0.683 | 0.746 | 0.810 | 1.063 | 0.983 | 0.746 | 0.751 | 0.758 | 0.665 | 0.742 | 0.716 | 0.631 | 0.672 | 0.626 | 0.699 | 0.596 | 0.615 | 0.608 | 0.763 | 0.628 |
| 1995 | 0.736 | 0.831 | 0.842 | 0.934 | 0.643 | 0.714 | 0.727 | 0.997 | 0.944 | 0.759 | 0.805 | 0.647 | 0.578 | 0.674 | 0.642 | 0.682 | 0.633 | 0.583 | 0.622 | 0.649 | 0.616 | 0.578 | 0.793 | 0.686 |
| 1996 | 0.708 | 0.886 | 0.818 | 0.933 | 0.700 | 0.736 | 0.746 | 1.001 | 0.950 | 0.817 | 0.823 | 0.753 | 0.702 | 0.770 | 0.690 | 0.753 | 0.729 | 0.680 | 0.615 | 0.517 | 0.670 | 0.680 | 0.839 | 0.594 |
| 1997 | 0.752 | 0.875 | 0.765 | 0.970 | 0.678 | 0.621 | 0.683 | 1.035 | 0.933 | 0.760 | 0.745 | 0.723 | 0.693 | 0.770 | 0.648 | 0.619 | 0.662 | 0.629 | 0.584 | 0.551 | 0.572 | 0.624 | 0.804 | 0.521 |
| 1998 | 0.758 | 0.811 | 0.877 | 0.969 | 0.689 | 0.647 | 0.756 | 1.108 | 0.898 | 0.685 | 0.765 | 0.638 | 0.610 | 0.663 | 0.619 | 0.523 | 0.579 | 0.623 | 0.656 | 0.561 | 0.559 | 0.482 | 0.806 | 0.548 |
| 1999 | 0.773 | 0.770 | 0.820 | 0.925 | 0.688 | 0.681 | 0.751 | 1.054 | 0.878 | 0.578 | 0.747 | 0.599 | 0.554 | 0.685 | 0.644 | 0.522 | 0.564 | 0.631 | 0.668 | 0.586 | 0.592 | 0.431 | 0.709 | 0.515 |
| 2000 | 0.688 | 0.703 | 0.748 | 0.891 | 0.645 | 0.685 | 0.740 | 1.062 | 0.811 | 0.626 | 0.721 | 0.639 | 0.582 | 0.619 | 0.722 | 0.481 | 0.570 | 0.594 | 0.711 | 0.528 | 0.553 | 0.518 | 0.639 | 0.464 |
| 2001 | 0.757 | 0.766 | 0.840 | 0.907 | 0.725 | 0.654 | 0.835 | 1.013 | 0.862 | 0.624 | 0.784 | 0.651 | 0.649 | 0.623 | 0.637 | 0.521 | 0.562 | 0.625 | 0.697 | 0.524 | 0.545 | 0.492 | 0.693 | 0.470 |
| 2002 | 0.676 | 0.701 | 0.934 | 0.965 | 0.661 | 0.580 | 0.776 | 0.937 | 0.757 | 0.648 | 0.728 | 0.611 | 0.556 | 0.583 | 0.506 | 0.507 | 0.529 | 0.562 | 0.585 | 0.515 | 0.534 | 0.448 | 0.744 | 0.465 |
| 2003 | 0.840 | 0.799 | 0.833 | 1.059 | 0.722 | 0.610 | 0.849 | 0.981 | 0.878 | 0.587 | 0.740 | 0.656 | 0.588 | 0.660 | 0.582 | 0.624 | 0.572 | 0.572 | 0.669 | 0.600 | 0.616 | 0.488 | 0.817 | 0.486 |
| 2004 | 0.890 | 0.874 | 1.057 | 1.073 | 0.789 | 0.680 | 0.920 | 0.969 | 0.924 | 0.766 | 0.917 | 0.798 | 0.730 | 0.640 | 0.682 | 0.592 | 0.617 | 0.691 | 0.694 | 0.674 | 0.675 | 0.679 | 0.843 | 0.665 |

Table 2 cont. Indexes of Profitability Change (California 1960 = 1)

| | NC | ND | NE | NH | NJ | NM | NV | NY | OH | OK | OR | PA | RI | SC | SD | TN | TX | UT | VA | VT | WA | WI | WV | WY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 0.809 | 0.901 | 0.761 | 0.539 | 0.789 | 0.813 | 0.695 | 0.679 | 0.544 | 0.971 | 0.699 | 0.578 | 0.589 | 0.688 | 0.842 | 0.725 | 0.842 | 0.641 | 0.686 | 0.657 | 0.733 | 0.691 | 0.559 | 0.734 |
| 1961 | 0.809 | 0.725 | 0.732 | 0.552 | 0.804 | 0.838 | 0.694 | 0.691 | 0.566 | 0.924 | 0.669 | 0.594 | 0.588 | 0.726 | 0.846 | 0.782 | 0.882 | 0.628 | 0.695 | 0.652 | 0.725 | 0.730 | 0.528 | 0.751 |
| 1962 | 0.790 | 1.103 | 0.738 | 0.547 | 0.775 | 0.840 | 0.732 | 0.663 | 0.560 | 0.849 | 0.677 | 0.567 | 0.604 | 0.734 | 0.906 | 0.727 | 0.823 | 0.665 | 0.698 | 0.613 | 0.741 | 0.727 | 0.492 | 0.785 |
| 1963 | 0.747 | 0.958 | 0.686 | 0.545 | 0.777 | 0.818 | 0.744 | 0.699 | 0.572 | 0.794 | 0.656 | 0.594 | 0.633 | 0.754 | 0.858 | 0.703 | 0.824 | 0.651 | 0.601 | 0.634 | 0.733 | 0.707 | 0.485 | 0.773 |
| 1964 | 0.761 | 0.872 | 0.678 | 0.542 | 0.751 | 0.753 | 0.642 | 0.690 | 0.558 | 0.744 | 0.632 | 0.592 | 0.698 | 0.744 | 0.793 | 0.674 | 0.760 | 0.620 | 0.669 | 0.620 | 0.702 | 0.667 | 0.473 | 0.717 |
| 1965 | 0.688 | 0.936 | 0.721 | 0.582 | 0.788 | 0.762 | 0.672 | 0.717 | 0.587 | 0.792 | 0.650 | 0.607 | 0.665 | 0.770 | 0.891 | 0.669 | 0.793 | 0.672 | 0.654 | 0.607 | 0.715 | 0.733 | 0.473 | 0.740 |
| 1966 | 0.721 | 0.909 | 0.776 | 0.629 | 0.835 | 0.827 | 0.743 | 0.740 | 0.640 | 0.737 | 0.685 | 0.598 | 0.673 | 0.808 | 0.895 | 0.641 | 0.862 | 0.665 | 0.612 | 0.645 | 0.781 | 0.784 | 0.444 | 0.780 |
| 1967 | 0.705 | 0.850 | 0.720 | 0.580 | 0.793 | 0.767 | 0.700 | 0.706 | 0.559 | 0.692 | 0.660 | 0.620 | 0.591 | 0.816 | 0.861 | 0.628 | 0.770 | 0.693 | 0.619 | 0.593 | 0.774 | 0.733 | 0.444 | 0.769 |
| 1968 | 0.638 | 0.842 | 0.698 | 0.613 | 0.764 | 0.747 | 0.682 | 0.686 | 0.574 | 0.656 | 0.649 | 0.582 | 0.594 | 0.676 | 0.873 | 0.595 | 0.768 | 0.664 | 0.591 | 0.631 | 0.757 | 0.768 | 0.419 | 0.711 |
| 1969 | 0.692 | 0.869 | 0.726 | 0.604 | 0.759 | 0.765 | 0.794 | 0.693 | 0.563 | 0.626 | 0.642 | 0.591 | 0.617 | 0.741 | 0.851 | 0.633 | 0.756 | 0.653 | 0.610 | 0.638 | 0.695 | 0.718 | 0.404 | 0.712 |
| 1970 | 0.672 | 0.766 | 0.655 | 0.548 | 0.707 | 0.749 | 0.764 | 0.664 | 0.559 | 0.612 | 0.623 | 0.585 | 0.678 | 0.696 | 0.795 | 0.581 | 0.756 | 0.650 | 0.580 | 0.630 | 0.648 | 0.712 | 0.379 | 0.692 |
| 1971 | 0.687 | 0.893 | 0.711 | 0.602 | 0.687 | 0.762 | 0.768 | 0.656 | 0.568 | 0.611 | 0.634 | 0.569 | 0.635 | 0.731 | 0.853 | 0.601 | 0.716 | 0.662 | 0.585 | 0.651 | 0.694 | 0.735 | 0.389 | 0.727 |
| 1972 | 0.761 | 0.956 | 0.754 | 0.636 | 0.668 | 0.779 | 0.810 | 0.626 | 0.571 | 0.672 | 0.723 | 0.567 | 0.584 | 0.730 | 0.945 | 0.616 | 0.755 | 0.683 | 0.610 | 0.650 | 0.794 | 0.739 | 0.407 | 0.763 |
| 1973 | 0.921 | 1.232 | 0.798 | 0.647 | 0.746 | 0.794 | 0.844 | 0.678 | 0.613 | 0.804 | 0.831 | 0.605 | 0.624 | 0.828 | 0.985 | 0.693 | 0.881 | 0.768 | 0.696 | 0.655 | 0.928 | 0.769 | 0.444 | 0.800 |
| 1974 | 0.914 | 0.995 | 0.700 | 0.527 | 0.716 | 0.696 | 0.661 | 0.650 | 0.662 | 0.737 | 0.865 | 0.569 | 0.637 | 0.840 | 0.815 | 0.660 | 0.766 | 0.657 | 0.683 | 0.682 | 0.993 | 0.711 | 0.440 | 0.702 |
| 1975 | 0.950 | 1.051 | 0.811 | 0.636 | 0.663 | 0.846 | 0.687 | 0.629 | 0.697 | 0.736 | 0.825 | 0.570 | 0.784 | 0.833 | 0.850 | 0.635 | 0.838 | 0.696 | 0.690 | 0.733 | 1.018 | 0.709 | 0.464 | 0.670 |
| 1976 | 0.929 | 0.903 | 0.735 | 0.652 | 0.686 | 0.733 | 0.739 | 0.625 | 0.682 | 0.731 | 0.791 | 0.637 | 0.757 | 0.840 | 0.723 | 0.708 | 0.834 | 0.674 | 0.679 | 0.772 | 0.898 | 0.718 | 0.479 | 0.682 |
| 1977 | 0.805 | 0.659 | 0.715 | 0.564 | 0.647 | 0.699 | 0.647 | 0.611 | 0.603 | 0.639 | 0.674 | 0.575 | 0.679 | 0.707 | 0.788 | 0.642 | 0.738 | 0.602 | 0.611 | 0.689 | 0.796 | 0.777 | 0.388 | 0.597 |
| 1978 | 0.866 | 0.808 | 0.735 | 0.590 | 0.666 | 0.718 | 0.637 | 0.650 | 0.674 | 0.658 | 0.693 | 0.625 | 0.623 | 0.756 | 0.754 | 0.681 | 0.697 | 0.563 | 0.611 | 0.735 | 0.839 | 0.739 | 0.475 | 0.633 |
| 1979 | 0.787 | 0.707 | 0.740 | 0.649 | 0.657 | 0.746 | 0.709 | 0.675 | 0.710 | 0.811 | 0.693 | 0.635 | 0.587 | 0.778 | 0.790 | 0.732 | 0.755 | 0.584 | 0.640 | 0.727 | 0.793 | 0.780 | 0.510 | 0.692 |
| 1980 | 0.696 | 0.565 | 0.665 | 0.564 | 0.621 | 0.689 | 0.695 | 0.658 | 0.644 | 0.668 | 0.696 | 0.588 | 0.573 | 0.612 | 0.638 | 0.616 | 0.652 | 0.568 | 0.537 | 0.682 | 0.766 | 0.746 | 0.461 | 0.618 |
| 1981 | 0.723 | 0.695 | 0.710 | 0.533 | 0.639 | 0.567 | 0.582 | 0.664 | 0.555 | 0.611 | 0.590 | 0.591 | 0.553 | 0.654 | 0.609 | 0.628 | 0.640 | 0.563 | 0.598 | 0.657 | 0.756 | 0.656 | 0.406 | 0.556 |
| 1982 | 0.728 | 0.632 | 0.697 | 0.528 | 0.656 | 0.524 | 0.596 | 0.630 | 0.534 | 0.680 | 0.578 | 0.586 | 0.718 | 0.697 | 0.640 | 0.596 | 0.631 | 0.506 | 0.542 | 0.703 | 0.679 | 0.647 | 0.337 | 0.478 |
| 1983 | 0.694 | 0.592 | 0.608 | 0.543 | 0.629 | 0.498 | 0.568 | 0.599 | 0.468 | 0.571 | 0.576 | 0.551 | 0.644 | 0.581 | 0.555 | 0.459 | 0.568 | 0.498 | 0.510 | 0.628 | 0.720 | 0.570 | 0.354 | 0.454 |
| 1984 | 0.766 | 0.615 | 0.692 | 0.523 | 0.653 | 0.504 | 0.541 | 0.615 | 0.621 | 0.540 | 0.590 | 0.580 | 0.672 | 0.683 | 0.639 | 0.576 | 0.549 | 0.509 | 0.577 | 0.586 | 0.703 | 0.624 | 0.394 | 0.448 |
| 1985 | 0.752 | 0.685 | 0.728 | 0.526 | 0.685 | 0.558 | 0.551 | 0.611 | 0.628 | 0.581 | 0.596 | 0.612 | 0.781 | 0.684 | 0.630 | 0.593 | 0.587 | 0.515 | 0.575 | 0.633 | 0.690 | 0.630 | 0.432 | 0.467 |
| 1986 | 0.791 | 0.748 | 0.753 | 0.549 | 0.684 | 0.567 | 0.568 | 0.667 | 0.628 | 0.659 | 0.696 | 0.660 | 0.827 | 0.671 | 0.690 | 0.576 | 0.615 | 0.624 | 0.617 | 0.650 | 0.770 | 0.716 | 0.460 | 0.563 |
| 1987 | 0.791 | 0.729 | 0.763 | 0.568 | 0.719 | 0.566 | 0.629 | 0.722 | 0.652 | 0.656 | 0.712 | 0.628 | 0.858 | 0.741 | 0.762 | 0.605 | 0.643 | 0.655 | 0.661 | 0.703 | 0.823 | 0.736 | 0.453 | 0.568 |
| 1988 | 0.836 | 0.481 | 0.736 | 0.599 | 0.687 | 0.571 | 0.634 | 0.656 | 0.588 | 0.657 | 0.765 | 0.607 | 0.847 | 0.769 | 0.615 | 0.575 | 0.645 | 0.678 | 0.701 | 0.682 | 0.789 | 0.632 | 0.421 | 0.559 |
| 1989 | 0.915 | 0.684 | 0.770 | 0.534 | 0.668 | 0.643 | 0.697 | 0.682 | 0.652 | 0.646 | 0.742 | 0.629 | 0.714 | 0.951 | 0.619 | 0.643 | 0.671 | 0.694 | 0.720 | 0.672 | 0.795 | 0.725 | 0.493 | 0.597 |
| 1990 | 0.905 | 0.700 | 0.761 | 0.494 | 0.619 | 0.643 | 0.732 | 0.654 | 0.649 | 0.629 | 0.740 | 0.603 | 0.591 | 0.733 | 0.744 | 0.620 | 0.686 | 0.704 | 0.696 | 0.647 | 0.838 | 0.638 | 0.482 | 0.678 |
| 1991 | 0.971 | 0.740 | 0.812 | 0.575 | 0.618 | 0.696 | 0.743 | 0.648 | 0.532 | 0.601 | 0.763 | 0.578 | 0.700 | 0.796 | 0.745 | 0.634 | 0.718 | 0.705 | 0.722 | 0.668 | 0.868 | 0.605 | 0.490 | 0.718 |
| 1992 | 0.971 | 0.845 | 0.867 | 0.642 | 0.619 | 0.699 | 0.710 | 0.675 | 0.623 | 0.692 | 0.709 | 0.659 | 0.642 | 0.819 | 0.760 | 0.713 | 0.763 | 0.739 | 0.732 | 0.794 | 0.854 | 0.599 | 0.522 | 0.768 |
| 1993 | 0.936 | 0.736 | 0.778 | 0.600 | 0.661 | 0.726 | 0.805 | 0.653 | 0.570 | 0.697 | 0.723 | 0.581 | 0.632 | 0.728 | 0.735 | 0.651 | 0.751 | 0.723 | 0.686 | 0.723 | 0.875 | 0.536 | 0.508 | 0.722 |
| 1994 | 0.990 | 0.720 | 0.787 | 0.616 | 0.758 | 0.656 | 0.682 | 0.654 | 0.620 | 0.698 | 0.675 | 0.584 | 0.624 | 0.830 | 0.724 | 0.633 | 0.763 | 0.662 | 0.723 | 0.736 | 0.845 | 0.568 | 0.548 | 0.569 |
| 1995 | 0.930 | 0.661 | 0.737 | 0.490 | 0.660 | 0.635 | 0.635 | 0.604 | 0.599 | 0.556 | 0.634 | 0.549 | 0.567 | 0.801 | 0.668 | 0.601 | 0.626 | 0.567 | 0.674 | 0.630 | 0.810 | 0.550 | 0.463 | 0.583 |
| 1996 | 0.941 | 0.772 | 0.871 | 0.543 | 0.722 | 0.662 | 0.666 | 0.615 | 0.560 | 0.572 | 0.610 | 0.586 | 0.618 | 0.709 | 0.807 | 0.591 | 0.626 | 0.575 | 0.646 | 0.689 | 0.848 | 0.611 | 0.396 | 0.576 |
| 1997 | 0.909 | 0.525 | 0.733 | 0.427 | 0.626 | 0.624 | 0.638 | 0.553 | 0.598 | 0.651 | 0.659 | 0.526 | 0.535 | 0.744 | 0.703 | 0.585 | 0.644 | 0.620 | 0.598 | 0.603 | 0.759 | 0.535 | 0.450 | 0.646 |
| 1998 | 0.795 | 0.601 | 0.642 | 0.429 | 0.625 | 0.625 | 0.663 | 0.598 | 0.555 | 0.588 | 0.637 | 0.506 | 0.525 | 0.709 | 0.728 | 0.518 | 0.619 | 0.642 | 0.587 | 0.613 | 0.770 | 0.447 | 0.479 | 0.558 |
| 1999 | 0.743 | 0.512 | 0.663 | 0.438 | 0.640 | 0.639 | 0.646 | 0.661 | 0.483 | 0.564 | 0.585 | 0.550 | 0.545 | 0.691 | 0.703 | 0.437 | 0.595 | 0.632 | 0.544 | 0.622 | 0.699 | 0.467 | 0.428 | 0.584 |
| 2000 | 0.852 | 0.615 | 0.637 | 0.425 | 0.699 | 0.613 | 0.671 | 0.608 | 0.552 | 0.616 | 0.579 | 0.591 | 0.551 | 0.705 | 0.630 | 0.459 | 0.576 | 0.564 | 0.570 | 0.614 | 0.687 | 0.425 | 0.347 | 0.520 |
| 2001 | 0.868 | 0.537 | 0.662 | 0.473 | 0.628 | 0.698 | 0.682 | 0.670 | 0.504 | 0.636 | 0.608 | 0.574 | 0.565 | 0.711 | 0.593 | 0.491 | 0.605 | 0.633 | 0.547 | 0.651 | 0.685 | 0.481 | 0.456 | 0.549 |
| 2002 | 0.714 | 0.555 | 0.632 | 0.441 | 0.539 | 0.610 | 0.645 | 0.565 | 0.482 | 0.646 | 0.643 | 0.499 | 0.529 | 0.628 | 0.561 | 0.433 | 0.690 | 0.558 | 0.505 | 0.540 | 0.721 | 0.465 | 0.390 | 0.473 |
| 2003 | 0.723 | 0.754 | 0.685 | 0.496 | 0.584 | 0.690 | 0.684 | 0.621 | 0.552 | 0.624 | 0.700 | 0.571 | 0.581 | 0.716 | 0.720 | 0.512 | 0.655 | 0.617 | 0.500 | 0.608 | 0.789 | 0.538 | 0.390 | 0.548 |
| 2004 | 0.853 | 0.760 | 0.771 | 0.554 | 0.625 | 0.842 | 0.827 | 0.676 | 0.587 | 0.675 | 0.835 | 0.619 | 0.628 | 0.762 | 0.740 | 0.491 | 0.678 | 0.741 | 0.564 | 0.681 | 0.786 | 0.576 | 0.398 | 0.617 |

Table 3. Indexes of TFP Change (California 1960 = 1)

| | AL | AR | AZ | CA | CO | CT | DE | FL | GA | IA | ID | IL | IN | KS | KY | LA | MA | MD | ME | MI | MN | MO | MS | MT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 0.652 | 0.591 | 0.683 | 1.000 | 0.681 | 0.601 | 0.751 | 1.021 | 0.669 | 0.837 | 0.694 | 0.819 | 0.665 | 0.703 | 0.566 | 0.496 | 0.554 | 0.622 | 0.611 | 0.511 | 0.715 | 0.624 | 0.521 | 0.484 |
| 1961 | 0.684 | 0.645 | 0.708 | 1.000 | 0.682 | 0.628 | 0.786 | 1.102 | 0.742 | 0.872 | 0.724 | 0.855 | 0.686 | 0.692 | 0.617 | 0.515 | 0.582 | 0.633 | 0.674 | 0.548 | 0.747 | 0.649 | 0.577 | 0.432 |
| 1962 | 0.668 | 0.659 | 0.693 | 1.029 | 0.642 | 0.625 | 0.787 | 1.188 | 0.744 | 0.867 | 0.756 | 0.861 | 0.718 | 0.681 | 0.618 | 0.544 | 0.611 | 0.637 | 0.695 | 0.572 | 0.703 | 0.636 | 0.572 | 0.521 |
| 1963 | 0.738 | 0.693 | 0.737 | 1.076 | 0.667 | 0.667 | 0.837 | 1.049 | 0.808 | 0.925 | 0.773 | 0.912 | 0.763 | 0.676 | 0.642 | 0.590 | 0.649 | 0.659 | 0.720 | 0.581 | 0.765 | 0.688 | 0.664 | 0.538 |
| 1964 | 0.741 | 0.754 | 0.708 | 1.123 | 0.681 | 0.669 | 0.813 | 1.038 | 0.804 | 0.933 | 0.758 | 0.891 | 0.719 | 0.684 | 0.692 | 0.603 | 0.659 | 0.677 | 0.714 | 0.620 | 0.731 | 0.660 | 0.680 | 0.544 |
| 1965 | 0.760 | 0.793 | 0.751 | 1.080 | 0.653 | 0.704 | 0.874 | 1.133 | 0.817 | 0.927 | 0.755 | 0.956 | 0.764 | 0.724 | 0.648 | 0.630 | 0.659 | 0.709 | 0.697 | 0.599 | 0.742 | 0.699 | 0.689 | 0.588 |
| 1966 | 0.736 | 0.790 | 0.765 | 1.152 | 0.719 | 0.734 | 0.843 | 1.179 | 0.853 | 0.952 | 0.765 | 0.897 | 0.721 | 0.701 | 0.636 | 0.653 | 0.702 | 0.701 | 0.697 | 0.592 | 0.762 | 0.665 | 0.703 | 0.573 |
| 1967 | 0.697 | 0.741 | 0.765 | 1.137 | 0.735 | 0.756 | 0.982 | 1.239 | 0.904 | 0.982 | 0.861 | 1.005 | 0.800 | 0.745 | 0.727 | 0.696 | 0.717 | 0.789 | 0.738 | 0.598 | 0.783 | 0.698 | 0.699 | 0.593 |
| 1968 | 0.723 | 0.821 | 0.809 | 1.214 | 0.761 | 0.732 | 0.939 | 1.160 | 0.863 | 0.991 | 0.872 | 0.943 | 0.830 | 0.787 | 0.709 | 0.761 | 0.719 | 0.770 | 0.789 | 0.642 | 0.818 | 0.777 | 0.757 | 0.630 |
| 1969 | 0.780 | 0.818 | 0.865 | 1.250 | 0.761 | 0.750 | 1.089 | 1.273 | 0.918 | 0.968 | 0.884 | 0.983 | 0.872 | 0.833 | 0.759 | 0.735 | 0.751 | 0.853 | 0.784 | 0.649 | 0.805 | 0.707 | 0.789 | 0.599 |
| 1970 | 0.811 | 0.857 | 0.845 | 1.203 | 0.791 | 0.755 | 1.054 | 1.156 | 0.950 | 0.960 | 0.886 | 0.896 | 0.802 | 0.817 | 0.747 | 0.807 | 0.801 | 0.846 | 0.796 | 0.654 | 0.839 | 0.710 | 0.788 | 0.587 |
| 1971 | 0.882 | 0.882 | 0.813 | 1.206 | 0.804 | 0.794 | 1.094 | 1.232 | 1.028 | 1.035 | 0.939 | 1.062 | 0.927 | 0.911 | 0.779 | 0.794 | 0.819 | 0.846 | 0.866 | 0.685 | 0.901 | 0.813 | 0.837 | 0.618 |
| 1972 | 0.899 | 0.918 | 0.818 | 1.269 | 0.819 | 0.724 | 1.181 | 1.288 | 1.018 | 1.025 | 0.935 | 1.036 | 0.859 | 0.893 | 0.781 | 0.807 | 0.778 | 0.864 | 0.891 | 0.737 | 0.862 | 0.785 | 0.866 | 0.620 |
| 1973 | 0.836 | 0.899 | 0.841 | 1.298 | 0.824 | 0.718 | 1.165 | 1.359 | 0.956 | 1.040 | 0.930 | 1.016 | 0.852 | 0.915 | 0.762 | 0.758 | 0.749 | 0.852 | 0.784 | 0.715 | 0.915 | 0.767 | 0.856 | 0.588 |
| 1974 | 0.936 | 0.878 | 0.891 | 1.356 | 0.822 | 0.761 | 1.186 | 1.453 | 1.113 | 0.974 | 0.929 | 0.880 | 0.774 | 0.863 | 0.827 | 0.771 | 0.834 | 0.873 | 0.768 | 0.715 | 0.818 | 0.736 | 0.858 | 0.612 |
| 1975 | 0.987 | 1.080 | 0.868 | 1.341 | 0.821 | 0.800 | 1.187 | 1.628 | 1.147 | 0.966 | 0.939 | 1.050 | 0.863 | 0.907 | 0.788 | 0.901 | 0.858 | 0.923 | 0.898 | 0.831 | 0.821 | 0.752 | 0.976 | 0.680 |
| 1976 | 0.938 | 0.968 | 0.884 | 1.373 | 0.869 | 0.719 | 1.233 | 1.553 | 1.050 | 0.948 | 0.893 | 0.973 | 0.915 | 0.874 | 0.849 | 0.865 | 0.803 | 0.892 | 0.847 | 0.736 | 0.754 | 0.710 | 0.909 | 0.671 |
| 1977 | 0.930 | 1.034 | 0.850 | 1.399 | 0.853 | 0.755 | 1.145 | 1.505 | 1.000 | 0.985 | 0.893 | 0.988 | 0.893 | 0.955 | 0.954 | 0.883 | 0.794 | 0.885 | 0.819 | 0.873 | 0.963 | 0.863 | 0.947 | 0.601 |
| 1978 | 0.922 | 0.996 | 0.825 | 1.373 | 0.815 | 0.787 | 1.070 | 1.405 | 1.065 | 1.022 | 0.884 | 0.988 | 0.913 | 0.770 | 0.829 | 0.847 | 0.798 | 0.933 | 0.814 | 0.831 | 0.887 | 0.818 | 0.950 | 0.617 |
| 1979 | 0.933 | 1.089 | 0.887 | 1.449 | 0.848 | 0.816 | 1.182 | 1.318 | 1.073 | 1.037 | 0.883 | 1.042 | 0.926 | 0.848 | 0.899 | 0.911 | 0.769 | 0.934 | 0.824 | 0.856 | 0.917 | 0.858 | 0.952 | 0.544 |
| 1980 | 0.832 | 0.917 | 0.854 | 1.541 | 0.835 | 0.760 | 1.007 | 1.456 | 1.020 | 1.018 | 0.975 | 0.919 | 0.883 | 0.777 | 0.839 | 0.768 | 0.740 | 0.825 | 0.730 | 0.858 | 0.874 | 0.763 | 0.774 | 0.567 |
| 1981 | 0.959 | 1.147 | 0.948 | 1.546 | 0.881 | 0.773 | 1.162 | 1.461 | 1.142 | 1.194 | 0.974 | 1.080 | 0.935 | 0.835 | 0.994 | 0.856 | 0.807 | 0.886 | 0.748 | 0.919 | 0.970 | 0.973 | 0.960 | 0.678 |
| 1982 | 1.097 | 1.188 | 0.956 | 1.661 | 0.952 | 0.940 | 1.195 | 1.503 | 1.329 | 1.085 | 0.976 | 1.132 | 1.046 | 0.947 | 1.034 | 0.983 | 0.799 | 0.987 | 0.958 | 0.948 | 0.966 | 0.829 | 1.071 | 0.715 |
| 1983 | 1.067 | 0.972 | 0.899 | 1.569 | 0.946 | 0.877 | 1.260 | 1.530 | 1.237 | 0.894 | 1.073 | 0.806 | 0.761 | 0.859 | 0.944 | 0.911 | 0.845 | 0.960 | 0.900 | 0.852 | 0.868 | 0.718 | 0.933 | 0.673 |
| 1984 | 1.052 | 1.164 | 0.928 | 1.676 | 0.975 | 0.930 | 1.141 | 1.567 | 1.293 | 1.119 | 1.086 | 1.075 | 1.064 | 0.967 | 1.144 | 1.052 | 0.911 | 1.092 | 0.920 | 0.929 | 0.986 | 0.834 | 1.013 | 0.579 |
| 1985 | 1.141 | 1.195 | 0.961 | 1.799 | 1.001 | 1.020 | 1.346 | 1.647 | 1.381 | 1.243 | 1.069 | 1.266 | 1.153 | 1.038 | 1.260 | 0.969 | 0.989 | 1.177 | 0.988 | 1.064 | 1.063 | 0.987 | 1.123 | 0.453 |
| 1986 | 1.101 | 1.129 | 0.993 | 1.726 | 0.994 | 1.101 | 1.251 | 1.711 | 1.243 | 1.214 | 1.124 | 1.240 | 1.055 | 1.010 | 1.090 | 0.975 | 1.079 | 1.096 | 1.050 | 1.026 | 1.046 | 0.944 | 0.980 | 0.733 |
| 1987 | 1.115 | 1.261 | 0.986 | 1.896 | 0.904 | 1.057 | 1.300 | 1.656 | 1.323 | 1.137 | 1.191 | 1.239 | 1.105 | 1.025 | 1.060 | 0.995 | 1.107 | 1.159 | 0.999 | 0.990 | 1.044 | 0.888 | 1.119 | 0.751 |
| 1988 | 1.159 | 1.342 | 0.930 | 1.736 | 0.954 | 1.114 | 1.372 | 1.757 | 1.499 | 1.020 | 1.168 | 0.978 | 0.927 | 0.991 | 0.969 | 1.102 | 1.196 | 1.167 | 1.087 | 0.960 | 0.920 | 0.822 | 1.117 | 0.522 |
| 1989 | 1.148 | 1.289 | 1.075 | 1.876 | 0.960 | 1.011 | 1.328 | 1.729 | 1.506 | 1.244 | 1.186 | 1.351 | 1.215 | 0.955 | 1.130 | 0.984 | 1.213 | 1.128 | 0.983 | 1.074 | 1.140 | 0.978 | 1.038 | 0.730 |
| 1990 | 1.166 | 1.266 | 1.003 | 2.011 | 1.019 | 1.127 | 1.408 | 1.752 | 1.424 | 1.221 | 1.296 | 1.349 | 1.211 | 1.083 | 1.052 | 1.129 | 1.195 | 1.163 | 1.074 | 1.088 | 1.148 | 0.930 | 1.102 | 0.753 |
| 1991 | 1.284 | 1.281 | 1.066 | 1.774 | 1.057 | 1.099 | 1.457 | 1.779 | 1.528 | 1.249 | 1.451 | 1.227 | 1.115 | 1.090 | 1.140 | 1.060 | 1.292 | 1.189 | 1.078 | 1.069 | 1.125 | 0.933 | 1.159 | 0.829 |
| 1992 | 1.186 | 1.458 | 1.120 | 1.988 | 1.105 | 1.219 | 1.455 | 1.862 | 1.572 | 1.465 | 1.422 | 1.521 | 1.409 | 1.157 | 1.241 | 1.151 | 1.155 | 1.228 | 1.192 | 1.159 | 1.198 | 1.084 | 1.318 | 0.766 |
| 1993 | 1.242 | 1.293 | 1.138 | 1.940 | 1.141 | 1.200 | 1.446 | 1.815 | 1.492 | 1.109 | 1.541 | 1.383 | 1.274 | 1.115 | 1.192 | 1.028 | 1.128 | 1.221 | 1.168 | 1.161 | 0.965 | 0.937 | 1.115 | 0.900 |
| 1994 | 1.279 | 1.414 | 1.166 | 2.058 | 1.136 | 1.160 | 1.450 | 1.933 | 1.694 | 1.565 | 1.446 | 1.565 | 1.413 | 1.262 | 1.272 | 1.164 | 1.113 | 1.271 | 1.105 | 1.184 | 1.236 | 1.066 | 1.206 | 0.775 |
| 1995 | 1.145 | 1.324 | 1.075 | 1.773 | 1.114 | 1.343 | 1.403 | 1.858 | 1.628 | 1.348 | 1.420 | 1.284 | 1.240 | 1.048 | 1.154 | 1.088 | 1.187 | 1.201 | 1.233 | 1.179 | 1.177 | 0.945 | 1.221 | 0.887 |
| 1996 | 1.160 | 1.495 | 1.203 | 1.856 | 1.138 | 1.388 | 1.514 | 1.932 | 1.645 | 1.502 | 1.458 | 1.449 | 1.336 | 1.201 | 1.271 | 1.243 | 1.319 | 1.356 | 1.328 | 1.157 | 1.257 | 1.108 | 1.237 | 0.804 |
| 1997 | 1.166 | 1.580 | 1.283 | 1.980 | 1.202 | 1.254 | 1.345 | 1.945 | 1.692 | 1.514 | 1.609 | 1.410 | 1.400 | 1.324 | 1.189 | 1.101 | 1.341 | 1.198 | 1.199 | 1.184 | 1.188 | 1.107 | 1.206 | 0.795 |
| 1998 | 1.146 | 1.515 | 1.315 | 1.759 | 1.281 | 1.290 | 1.310 | 1.988 | 1.545 | 1.551 | 1.495 | 1.491 | 1.418 | 1.276 | 1.160 | 0.929 | 1.273 | 1.199 | 1.312 | 1.206 | 1.317 | 1.103 | 1.204 | 0.787 |
| 1999 | 1.205 | 1.493 | 1.405 | 1.759 | 1.292 | 1.385 | 1.316 | 1.934 | 1.640 | 1.507 | 1.496 | 1.445 | 1.345 | 1.241 | 1.166 | 1.017 | 1.404 | 1.231 | 1.337 | 1.276 | 1.323 | 1.021 | 1.176 | 0.787 |
| 2000 | 1.213 | 1.491 | 1.385 | 1.909 | 1.232 | 1.523 | 1.427 | 2.021 | 1.705 | 1.503 | 1.580 | 1.525 | 1.432 | 1.148 | 1.267 | 0.941 | 1.484 | 1.365 | 1.544 | 1.208 | 1.301 | 1.122 | 1.136 | 0.699 |
| 2001 | 1.264 | 1.588 | 1.456 | 1.962 | 1.365 | 1.436 | 1.419 | 2.155 | 1.808 | 1.529 | 1.634 | 1.586 | 1.509 | 1.223 | 1.199 | 1.134 | 1.420 | 1.307 | 1.454 | 1.180 | 1.249 | 1.152 | 1.231 | 0.718 |
| 2002 | 1.241 | 1.643 | 1.391 | 1.972 | 1.248 | 1.362 | 1.694 | 2.000 | 1.778 | 1.678 | 1.484 | 1.515 | 1.428 | 1.111 | 1.065 | 1.126 | 1.360 | 1.334 | 1.311 | 1.290 | 1.411 | 1.108 | 1.301 | 0.725 |
| 2003 | 1.443 | 1.738 | 1.529 | 2.099 | 1.207 | 1.337 | 1.835 | 1.897 | 1.811 | 1.495 | 1.523 | 1.558 | 1.499 | 1.164 | 1.101 | 1.165 | 1.442 | 1.506 | 1.343 | 1.296 | 1.373 | 1.086 | 1.387 | 0.783 |
| 2004 | 1.354 | 1.694 | 1.646 | 2.140 | 1.235 | 1.539 | 1.656 | 1.960 | 1.718 | 1.775 | 1.738 | 1.849 | 1.718 | 1.227 | 1.093 | 1.162 | 1.572 | 1.532 | 1.447 | 1.339 | 1.427 | 1.283 | 1.319 | 0.877 |

Table 3 cont. Indexes of TFP Change (California 1960 = 1)

| | NC | ND | NE | NH | NJ | NM | NV | NY | OH | OK | OR | PA | RI | SC | SD | TN | TX | UT | VA | VT | WA | WI | WV | WY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 0.656 | 0.553 | 0.686 | 0.483 | 0.781 | 0.433 | 0.517 | 0.730 | 0.622 | 0.747 | 0.514 | 0.585 | 0.531 | 0.555 | 0.623 | 0.536 | 0.581 | 0.543 | 0.540 | 0.631 | 0.632 | 0.680 | 0.395 | 0.417 |
| 1961 | 0.679 | 0.449 | 0.665 | 0.523 | 0.797 | 0.445 | 0.497 | 0.765 | 0.631 | 0.733 | 0.532 | 0.614 | 0.557 | 0.574 | 0.597 | 0.580 | 0.584 | 0.546 | 0.570 | 0.683 | 0.649 | 0.712 | 0.409 | 0.419 |
| 1962 | 0.721 | 0.646 | 0.689 | 0.538 | 0.802 | 0.466 | 0.540 | 0.765 | 0.651 | 0.673 | 0.551 | 0.613 | 0.633 | 0.606 | 0.635 | 0.577 | 0.571 | 0.570 | 0.588 | 0.687 | 0.688 | 0.737 | 0.401 | 0.422 |
| 1963 | 0.737 | 0.599 | 0.693 | 0.560 | 0.811 | 0.481 | 0.569 | 0.828 | 0.686 | 0.681 | 0.564 | 0.658 | 0.718 | 0.638 | 0.641 | 0.600 | 0.608 | 0.576 | 0.548 | 0.722 | 0.724 | 0.738 | 0.415 | 0.453 |
| 1964 | 0.800 | 0.609 | 0.708 | 0.564 | 0.784 | 0.456 | 0.563 | 0.823 | 0.683 | 0.706 | 0.575 | 0.669 | 0.760 | 0.657 | 0.615 | 0.625 | 0.607 | 0.579 | 0.607 | 0.734 | 0.753 | 0.773 | 0.433 | 0.447 |
| 1965 | 0.730 | 0.658 | 0.730 | 0.587 | 0.825 | 0.474 | 0.587 | 0.868 | 0.696 | 0.768 | 0.598 | 0.695 | 0.712 | 0.694 | 0.663 | 0.632 | 0.643 | 0.613 | 0.608 | 0.733 | 0.761 | 0.762 | 0.429 | 0.440 |
| 1966 | 0.762 | 0.617 | 0.808 | 0.637 | 0.850 | 0.515 | 0.588 | 0.868 | 0.731 | 0.695 | 0.643 | 0.681 | 0.737 | 0.689 | 0.661 | 0.583 | 0.646 | 0.618 | 0.596 | 0.754 | 0.820 | 0.777 | 0.422 | 0.462 |
| 1967 | 0.827 | 0.617 | 0.820 | 0.623 | 0.862 | 0.511 | 0.579 | 0.888 | 0.716 | 0.669 | 0.658 | 0.742 | 0.695 | 0.746 | 0.712 | 0.595 | 0.613 | 0.674 | 0.646 | 0.763 | 0.880 | 0.788 | 0.461 | 0.500 |
| 1968 | 0.781 | 0.694 | 0.824 | 0.630 | 0.852 | 0.518 | 0.582 | 0.862 | 0.768 | 0.700 | 0.677 | 0.726 | 0.678 | 0.666 | 0.729 | 0.626 | 0.641 | 0.676 | 0.644 | 0.790 | 0.878 | 0.808 | 0.449 | 0.485 |
| 1969 | 0.855 | 0.685 | 0.879 | 0.627 | 0.869 | 0.533 | 0.650 | 0.871 | 0.754 | 0.675 | 0.718 | 0.740 | 0.742 | 0.732 | 0.690 | 0.669 | 0.628 | 0.683 | 0.672 | 0.813 | 0.875 | 0.776 | 0.453 | 0.486 |
| 1970 | 0.884 | 0.602 | 0.804 | 0.626 | 0.863 | 0.555 | 0.644 | 0.895 | 0.771 | 0.656 | 0.713 | 0.768 | 0.791 | 0.701 | 0.665 | 0.655 | 0.645 | 0.717 | 0.680 | 0.865 | 0.859 | 0.800 | 0.461 | 0.489 |
| 1971 | 0.911 | 0.820 | 0.909 | 0.723 | 0.871 | 0.542 | 0.663 | 0.912 | 0.843 | 0.630 | 0.763 | 0.781 | 0.814 | 0.801 | 0.756 | 0.702 | 0.639 | 0.746 | 0.702 | 0.897 | 0.948 | 0.863 | 0.489 | 0.523 |
| 1972 | 0.956 | 0.721 | 0.874 | 0.784 | 0.796 | 0.561 | 0.638 | 0.850 | 0.804 | 0.662 | 0.792 | 0.763 | 0.744 | 0.755 | 0.770 | 0.680 | 0.662 | 0.750 | 0.715 | 0.896 | 0.981 | 0.840 | 0.488 | 0.510 |
| 1973 | 1.021 | 0.727 | 0.861 | 0.739 | 0.833 | 0.582 | 0.662 | 0.855 | 0.724 | 0.747 | 0.764 | 0.750 | 0.786 | 0.787 | 0.745 | 0.681 | 0.752 | 0.753 | 0.712 | 0.869 | 0.939 | 0.812 | 0.467 | 0.493 |
| 1974 | 1.101 | 0.662 | 0.794 | 0.666 | 0.875 | 0.521 | 0.631 | 0.875 | 0.795 | 0.775 | 0.837 | 0.733 | 0.723 | 0.870 | 0.715 | 0.717 | 0.730 | 0.740 | 0.775 | 0.898 | 0.999 | 0.812 | 0.471 | 0.529 |
| 1975 | 1.197 | 0.751 | 0.877 | 0.787 | 0.831 | 0.572 | 0.646 | 0.877 | 0.863 | 0.829 | 0.844 | 0.738 | 0.882 | 0.947 | 0.721 | 0.774 | 0.810 | 0.729 | 0.776 | 0.951 | 1.106 | 0.810 | 0.482 | 0.514 |
| 1976 | 1.146 | 0.738 | 0.851 | 0.741 | 0.786 | 0.543 | 0.654 | 0.819 | 0.865 | 0.785 | 0.859 | 0.762 | 0.730 | 0.854 | 0.626 | 0.750 | 0.769 | 0.716 | 0.785 | 0.921 | 1.071 | 0.778 | 0.464 | 0.529 |
| 1977 | 1.061 | 0.703 | 0.955 | 0.685 | 0.825 | 0.589 | 0.669 | 0.853 | 0.857 | 0.851 | 0.829 | 0.767 | 0.726 | 0.869 | 0.767 | 0.777 | 0.789 | 0.689 | 0.803 | 0.879 | 1.057 | 0.862 | 0.434 | 0.515 |
| 1978 | 1.126 | 0.797 | 0.893 | 0.711 | 0.827 | 0.567 | 0.592 | 0.868 | 0.843 | 0.722 | 0.784 | 0.816 | 0.755 | 0.881 | 0.740 | 0.754 | 0.711 | 0.646 | 0.793 | 0.894 | 1.049 | 0.823 | 0.505 | 0.483 |
| 1979 | 1.031 | 0.712 | 0.916 | 0.798 | 0.819 | 0.544 | 0.653 | 0.893 | 0.917 | 0.818 | 0.784 | 0.852 | 0.766 | 0.925 | 0.748 | 0.788 | 0.748 | 0.676 | 0.823 | 0.883 | 1.018 | 0.827 | 0.542 | 0.487 |
| 1980 | 1.039 | 0.604 | 0.852 | 0.699 | 0.808 | 0.565 | 0.687 | 0.873 | 0.850 | 0.772 | 0.915 | 0.786 | 0.764 | 0.805 | 0.705 | 0.690 | 0.696 | 0.686 | 0.743 | 0.794 | 1.106 | 0.838 | 0.553 | 0.493 |
| 1981 | 1.120 | 0.935 | 0.998 | 0.702 | 0.894 | 0.573 | 0.683 | 0.902 | 0.886 | 0.815 | 0.832 | 0.907 | 0.757 | 0.975 | 0.788 | 0.833 | 0.807 | 0.803 | 0.849 | 0.831 | 1.156 | 0.858 | 0.549 | 0.532 |
| 1982 | 1.138 | 0.914 | 1.024 | 0.726 | 0.970 | 0.598 | 0.818 | 0.993 | 0.933 | 1.034 | 0.866 | 0.887 | 1.071 | 1.096 | 0.886 | 0.862 | 0.873 | 0.758 | 0.854 | 1.001 | 1.194 | 0.915 | 0.491 | 0.508 |
| 1983 | 1.183 | 0.802 | 0.897 | 0.841 | 0.967 | 0.594 | 0.808 | 0.961 | 0.758 | 0.906 | 0.896 | 0.859 | 0.953 | 0.914 | 0.752 | 0.634 | 0.807 | 0.806 | 0.902 | 0.949 | 1.261 | 0.852 | 0.560 | 0.510 |
| 1984 | 1.224 | 0.887 | 1.021 | 0.824 | 1.063 | 0.614 | 0.821 | 0.912 | 1.071 | 0.863 | 0.971 | 1.010 | 1.024 | 1.069 | 0.945 | 0.877 | 0.800 | 0.790 | 0.997 | 0.897 | 1.255 | 0.945 | 0.632 | 0.510 |
| 1985 | 1.331 | 0.987 | 1.120 | 0.847 | 1.123 | 0.694 | 0.805 | 1.043 | 1.153 | 0.899 | 0.984 | 1.087 | 1.255 | 1.154 | 0.928 | 0.949 | 0.897 | 0.806 | 1.020 | 0.976 | 1.301 | 0.959 | 0.705 | 0.515 |
| 1986 | 1.307 | 1.025 | 1.074 | 0.864 | 1.043 | 0.655 | 0.763 | 1.075 | 1.058 | 0.904 | 1.029 | 1.074 | 1.300 | 1.032 | 0.983 | 0.913 | 0.855 | 0.887 | 0.994 | 0.999 | 1.295 | 1.006 | 0.706 | 0.574 |
| 1987 | 1.390 | 0.959 | 1.062 | 0.894 | 1.163 | 0.642 | 0.802 | 1.086 | 1.091 | 0.873 | 1.106 | 1.082 | 1.465 | 1.173 | 0.930 | 0.978 | 0.830 | 0.933 | 1.062 | 1.003 | 1.341 | 0.982 | 0.672 | 0.532 |
| 1988 | 1.503 | 0.542 | 1.086 | 0.983 | 1.124 | 0.684 | 0.778 | 1.078 | 0.976 | 0.898 | 1.142 | 1.045 | 1.601 | 1.170 | 0.768 | 0.930 | 0.856 | 0.946 | 1.175 | 1.044 | 1.452 | 0.937 | 0.653 | 0.508 |
| 1989 | 1.523 | 0.823 | 1.127 | 0.904 | 1.198 | 0.724 | 0.840 | 1.083 | 1.077 | 0.895 | 1.066 | 1.060 | 1.437 | 1.408 | 0.887 | 0.944 | 0.926 | 0.963 | 1.220 | 1.038 | 1.365 | 1.068 | 0.698 | 0.536 |
| 1990 | 1.607 | 1.060 | 1.166 | 0.842 | 1.220 | 0.707 | 0.864 | 1.131 | 1.146 | 0.878 | 1.158 | 1.077 | 1.359 | 1.071 | 1.006 | 0.936 | 0.911 | 0.989 | 1.171 | 1.050 | 1.491 | 1.029 | 0.746 | 0.590 |
| 1991 | 1.722 | 1.028 | 1.217 | 0.980 | 1.313 | 0.750 | 0.844 | 1.152 | 1.044 | 0.837 | 1.176 | 1.045 | 1.294 | 1.182 | 1.033 | 0.964 | 0.969 | 0.983 | 1.192 | 1.180 | 1.385 | 1.084 | 0.721 | 0.623 |
| 1992 | 1.721 | 1.260 | 1.285 | 1.020 | 1.254 | 0.785 | 0.847 | 1.209 | 1.275 | 0.891 | 1.167 | 1.208 | 1.099 | 1.350 | 1.110 | 1.034 | 1.015 | 0.990 | 1.247 | 1.397 | 1.481 | 1.113 | 0.726 | 0.644 |
| 1993 | 1.759 | 1.023 | 1.172 | 1.065 | 1.337 | 0.810 | 0.944 | 1.225 | 1.140 | 0.883 | 1.246 | 1.172 | 1.113 | 1.202 | 1.013 | 0.991 | 1.026 | 1.076 | 1.177 | 1.295 | 1.581 | 1.061 | 0.740 | 0.620 |
| 1994 | 1.909 | 1.106 | 1.321 | 1.058 | 1.336 | 0.833 | 0.920 | 1.257 | 1.286 | 0.934 | 1.254 | 1.225 | 1.034 | 1.497 | 1.189 | 1.178 | 1.054 | 1.013 | 1.313 | 1.306 | 1.528 | 1.161 | 0.813 | 0.559 |
| 1995 | 1.765 | 1.021 | 1.164 | 0.888 | 1.319 | 0.847 | 0.986 | 1.240 | 1.136 | 0.821 | 1.146 | 1.180 | 1.219 | 1.277 | 1.025 | 1.025 | 0.942 | 1.023 | 1.184 | 1.177 | 1.574 | 1.104 | 0.771 | 0.655 |
| 1996 | 1.776 | 1.152 | 1.341 | 1.009 | 1.407 | 0.902 | 1.072 | 1.300 | 1.141 | 0.855 | 1.154 | 1.252 | 1.391 | 1.316 | 1.241 | 1.032 | 0.937 | 1.017 | 1.228 | 1.283 | 1.576 | 1.181 | 0.731 | 0.612 |
| 1997 | 1.691 | 1.022 | 1.278 | 0.922 | 1.277 | 0.906 | 1.098 | 1.211 | 1.320 | 0.926 | 1.286 | 1.127 | 1.300 | 1.285 | 1.170 | 0.975 | 1.007 | 1.099 | 1.120 | 1.183 | 1.605 | 1.166 | 0.718 | 0.663 |
| 1998 | 1.615 | 1.157 | 1.286 | 0.935 | 1.385 | 0.892 | 1.120 | 1.209 | 1.362 | 0.890 | 1.340 | 1.161 | 1.266 | 1.201 | 1.230 | 0.959 | 0.993 | 1.066 | 1.122 | 1.131 | 1.628 | 1.190 | 0.723 | 0.633 |
| 1999 | 1.568 | 1.096 | 1.249 | 0.946 | 1.332 | 0.926 | 1.135 | 1.318 | 1.265 | 0.953 | 1.264 | 1.193 | 1.290 | 1.315 | 1.182 | 0.866 | 1.070 | 1.097 | 1.107 | 1.151 | 1.635 | 1.241 | 0.724 | 0.671 |
| 2000 | 1.637 | 1.209 | 1.256 | 0.973 | 1.506 | 0.931 | 1.118 | 1.327 | 1.424 | 0.930 | 1.301 | 1.296 | 1.394 | 1.364 | 1.219 | 0.892 | 0.972 | 1.096 | 1.248 | 1.260 | 1.642 | 1.240 | 0.801 | 0.603 |
| 2001 | 1.734 | 1.160 | 1.344 | 1.021 | 1.398 | 0.985 | 1.137 | 1.349 | 1.325 | 0.910 | 1.277 | 1.189 | 1.427 | 1.442 | 1.172 | 0.965 | 1.005 | 1.134 | 1.231 | 1.249 | 1.640 | 1.239 | 0.780 | 0.616 |
| 2002 | 1.604 | 1.090 | 1.233 | 1.046 | 1.308 | 0.942 | 1.064 | 1.292 | 1.255 | 1.021 | 1.272 | 1.196 | 1.397 | 1.312 | 0.999 | 0.893 | 1.066 | 1.137 | 1.156 | 1.245 | 1.629 | 1.345 | 0.728 | 0.554 |
| 2003 | 1.505 | 1.339 | 1.309 | 1.098 | 1.390 | 0.946 | 1.073 | 1.355 | 1.365 | 0.971 | 1.398 | 1.301 | 1.461 | 1.419 | 1.162 | 0.982 | 1.022 | 1.111 | 1.193 | 1.327 | 1.731 | 1.394 | 0.731 | 0.610 |
| 2004 | 1.572 | 1.165 | 1.389 | 1.209 | 1.513 | 0.982 | 1.129 | 1.415 | 1.412 | 0.961 | 1.603 | 1.320 | 1.616 | 1.362 | 1.244 | 0.916 | 1.075 | 1.166 | 1.162 | 1.363 | 1.671 | 1.298 | 0.750 | 0.591 |

Table 4. Indexes of Technical Change (Pacific 1960 = 1)

| | Pacific | Mountain | Northern Plains | Southern Plains | Corn Belt | Southeast | Northeast | Lake States | Appalacian | Delta States |
|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 1.000 | 0.645 | 0.626 | 0.684 | 0.776 | 1.058 | 0.710 | 0.688 | 0.642 | 0.671 |
| 1961 | 1.000 | 0.645 | 0.626 | 0.684 | 0.776 | 1.058 | 0.710 | 0.688 | 0.642 | 0.671 |
| 1962 | 1.000 | 0.674 | 0.626 | 0.684 | 0.776 | 1.058 | 0.715 | 0.688 | 0.642 | 0.671 |
| 1963 | 1.000 | 0.688 | 0.626 | 0.684 | 0.823 | 1.058 | 0.746 | 0.688 | 0.657 | 0.671 |
| 1964 | 1.000 | 0.688 | 0.631 | 0.684 | 0.831 | 1.058 | 0.746 | 0.688 | 0.712 | 0.671 |
| 1965 | 1.000 | 0.675 | 0.650 | 0.684 | 0.851 | 1.058 | 0.778 | 0.688 | 0.712 | 0.706 |
| 1966 | 1.026 | 0.682 | 0.720 | 0.684 | 0.851 | 1.050 | 0.778 | 0.692 | 0.712 | 0.706 |
| 1967 | 1.026 | 0.767 | 0.730 | 0.684 | 0.895 | 1.103 | 0.875 | 0.702 | 0.737 | 0.706 |
| 1968 | 1.081 | 0.777 | 0.734 | 0.684 | 0.895 | 1.103 | 0.875 | 0.728 | 0.737 | 0.731 |
| 1969 | 1.113 | 0.787 | 0.783 | 0.684 | 0.895 | 1.133 | 0.970 | 0.728 | 0.761 | 0.731 |
| 1970 | 1.113 | 0.789 | 0.783 | 0.684 | 0.883 | 1.133 | 0.970 | 0.748 | 0.787 | 0.763 |
| 1971 | 1.113 | 0.836 | 0.811 | 0.684 | 0.946 | 1.133 | 0.974 | 0.803 | 0.812 | 0.785 |
| 1972 | 1.130 | 0.836 | 0.811 | 0.684 | 0.946 | 1.147 | 1.052 | 0.803 | 0.852 | 0.817 |
| 1973 | 1.156 | 0.833 | 0.815 | 0.669 | 0.946 | 1.210 | 1.052 | 0.815 | 0.909 | 0.817 |
| 1974 | 1.208 | 0.828 | 0.815 | 0.690 | 0.926 | 1.294 | 1.056 | 0.815 | 0.981 | 0.817 |
| 1975 | 1.208 | 0.836 | 0.815 | 0.738 | 0.935 | 1.450 | 1.057 | 0.815 | 1.066 | 0.962 |
| 1976 | 1.223 | 0.836 | 0.815 | 0.738 | 0.935 | 1.450 | 1.098 | 0.815 | 1.066 | 0.962 |
| 1977 | 1.246 | 0.796 | 0.850 | 0.758 | 0.935 | 1.450 | 1.098 | 0.858 | 1.066 | 0.962 |
| 1978 | 1.246 | 0.796 | 0.850 | 0.758 | 0.910 | 1.450 | 1.020 | 0.858 | 1.020 | 0.962 |
| 1979 | 1.290 | 0.790 | 0.850 | 0.758 | 0.928 | 1.383 | 1.053 | 0.858 | 1.003 | 0.970 |
| 1980 | 1.372 | 0.868 | 0.850 | 0.758 | 0.928 | 1.340 | 1.053 | 0.858 | 1.003 | 0.970 |
| 1981 | 1.377 | 0.868 | 0.888 | 0.758 | 1.063 | 1.302 | 1.034 | 0.864 | 0.998 | 1.021 |
| 1982 | 1.480 | 0.869 | 0.912 | 0.920 | 1.063 | 1.339 | 1.064 | 0.864 | 1.014 | 1.058 |
| 1983 | 1.480 | 0.955 | 0.912 | 0.920 | 1.063 | 1.362 | 1.123 | 0.864 | 1.053 | 1.058 |
| 1984 | 1.493 | 0.968 | 0.912 | 0.920 | 1.008 | 1.396 | 1.123 | 0.878 | 1.090 | 1.058 |
| 1985 | 1.603 | 0.968 | 0.997 | 0.920 | 1.128 | 1.467 | 1.199 | 0.948 | 1.186 | 1.064 |
| 1986 | 1.603 | 1.001 | 0.997 | 0.920 | 1.128 | 1.524 | 1.199 | 0.948 | 1.186 | 1.064 |
| 1987 | 1.689 | 1.061 | 0.997 | 0.920 | 1.128 | 1.524 | 1.305 | 0.948 | 1.238 | 1.123 |
| 1988 | 1.689 | 1.061 | 0.997 | 0.920 | 1.104 | 1.565 | 1.426 | 0.948 | 1.338 | 1.195 |
| 1989 | 1.689 | 1.056 | 1.004 | 0.920 | 1.203 | 1.565 | 1.426 | 1.016 | 1.356 | 1.195 |
| 1990 | 1.791 | 1.155 | 1.038 | 0.825 | 1.203 | 1.565 | 1.280 | 1.022 | 1.432 | 1.195 |
| 1991 | 1.791 | 1.292 | 1.084 | 0.863 | 1.203 | 1.585 | 1.297 | 1.022 | 1.534 | 1.195 |
| 1992 | 1.791 | 1.292 | 1.144 | 0.904 | 1.355 | 1.659 | 1.297 | 1.067 | 1.534 | 1.298 |
| 1993 | 1.791 | 1.373 | 1.144 | 0.914 | 1.355 | 1.659 | 1.296 | 1.067 | 1.567 | 1.298 |
| 1994 | 1.833 | 1.373 | 1.177 | 0.938 | 1.394 | 1.721 | 1.291 | 1.101 | 1.701 | 1.298 |
| 1995 | 1.833 | 1.288 | 1.177 | 0.938 | 1.394 | 1.721 | 1.291 | 1.101 | 1.701 | 1.298 |
| 1996 | 1.833 | 1.299 | 1.195 | 0.938 | 1.394 | 1.721 | 1.348 | 1.120 | 1.701 | 1.332 |
| 1997 | 1.833 | 1.433 | 1.195 | 0.938 | 1.348 | 1.733 | 1.348 | 1.120 | 1.582 | 1.407 |
| 1998 | 1.833 | 1.433 | 1.195 | 0.938 | 1.382 | 1.770 | 1.234 | 1.173 | 1.582 | 1.407 |
| 1999 | 1.764 | 1.333 | 1.195 | 0.953 | 1.382 | 1.770 | 1.250 | 1.178 | 1.506 | 1.407 |
| 2000 | 1.764 | 1.408 | 1.179 | 0.953 | 1.382 | 1.800 | 1.375 | 1.178 | 1.458 | 1.407 |
| 2001 | 1.764 | 1.455 | 1.197 | 0.953 | 1.413 | 1.919 | 1.375 | 1.178 | 1.545 | 1.414 |
| 2002 | 1.756 | 1.455 | 1.197 | 0.953 | 1.495 | 1.919 | 1.508 | 1.256 | 1.545 | 1.463 |
| 2003 | 1.869 | 1.362 | 1.197 | 0.953 | 1.495 | 1.919 | 1.635 | 1.256 | 1.545 | 1.547 |
| 2004 | 1.906 | 1.548 | 1.237 | 0.957 | 1.647 | 1.919 | 1.635 | 1.271 | 1.428 | 1.547 |

Table 5. Indexes of Output-Oriented Technical Efficiency Change (California 1960 = 1)

| | AL | AR | AZ | CA | CO | CT | DE | FL | GA | IA | ID | IL | IN | KS | KY | LA | MA | MD | ME | MI | MN | MO | MS | MT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 0.969 | 1.000 | 1.000 | 1.000 | 1.000 | 0.912 | 1.000 | 1.000 | 0.891 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.983 | 1.000 | 1.000 | 0.931 | 0.905 | 1.000 | 1.000 | 1.000 | 1.000 | 0.963 |
| 1961 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.935 | 1.000 | 1.000 | 0.968 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.950 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.894 |
| 1962 | 0.997 | 1.000 | 1.000 | 1.000 | 1.000 | 0.943 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.920 | 1.000 | 1.000 | 0.974 | 1.000 | 0.983 | 1.000 |
| 1963 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.933 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.894 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.975 |
| 1964 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.905 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.891 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.992 |
| 1965 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.963 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.988 | 1.000 | 1.000 | 0.902 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1966 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.949 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.980 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.991 |
| 1967 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.956 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.996 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.999 |
| 1968 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.940 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.998 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1969 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.948 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.955 | 1.000 | 0.949 |
| 1970 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.923 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.989 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.952 |
| 1971 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.947 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.960 |
| 1972 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.922 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.975 |
| 1973 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.898 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.901 |
| 1974 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.964 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.982 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.976 |
| 1975 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.952 | 1.000 | 1.000 | 1.000 | 0.974 | 1.000 | 1.000 | 1.000 | 1.000 | 0.915 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1976 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.858 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.953 | 1.000 | 1.000 | 0.878 | 1.000 | 0.995 | 0.999 | 1.000 | 0.985 | 0.991 | 1.000 | 0.998 | 0.996 |
| 1977 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.951 | 1.000 | 0.986 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.982 | 0.904 |
| 1978 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.935 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.882 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.958 |
| 1979 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.978 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.961 | 0.930 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.814 |
| 1980 | 0.987 | 1.000 | 1.000 | 1.000 | 1.000 | 0.931 | 0.960 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.878 | 0.982 | 0.927 | 1.000 | 0.979 | 1.000 | 1.000 | 1.000 | 1.000 | 0.771 | 0.867 |
| 1981 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.957 | 0.959 |
| 1982 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.983 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.992 |
| 1983 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.923 |
| 1984 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.853 |
| 1985 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.710 |
| 1986 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.911 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1987 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.934 | 1.000 | 1.000 | 1.000 | 0.932 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1988 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.868 | 1.000 | 1.000 | 1.000 | 0.975 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1989 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.926 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.863 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1990 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.920 | 1.000 | 1.000 | 1.000 | 0.934 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1991 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.945 | 1.000 | 1.000 | 1.000 | 0.881 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1992 | 0.988 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.993 | 1.000 | 0.944 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1993 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.995 | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 1.000 | 0.932 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1994 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.906 | 1.000 | 1.000 | 1.000 | 1.000 | 0.896 |
| 1995 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 0.855 | 1.000 | 1.000 | 1.000 | 0.955 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1996 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.991 | 1.000 | 1.000 | 1.000 | 1.000 | 0.983 | 1.000 | 1.000 | 1.000 | 0.984 | 1.000 | 1.000 | 1.000 | 1.000 | 0.954 |
| 1997 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.940 | 1.000 | 1.000 | 1.000 | 0.978 | 1.000 | 1.000 | 1.000 | 1.000 | 0.964 |
| 1998 | 0.974 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.877 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1999 | 0.964 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 2000 | 0.970 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 2001 | 0.931 | 1.000 | 1.000 | 1.000 | 1.000 | 0.950 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.988 | 1.000 | 0.975 | 0.992 | 0.996 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 2002 | 0.966 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.994 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.903 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 2003 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.974 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.995 | 1.000 | 1.000 | 1.000 | 0.954 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 2004 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.997 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Table 5 cont. Indexes of Output-Oriented Technical Efficiency Change (California 1960 = 1)

| | NC | ND | NE | NH | NJ | NM | NV | NY | OH | OK | OR | PA | RI | SC | SD | TN | TX | UT | VA | VT | WA | WI | WV | WY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 1.000 | 1.000 | 1.000 | 0.828 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.890 | 1.000 | 0.989 | 1.000 | 0.982 | 1.000 | 1.000 | 1.000 | 0.992 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1961 | 1.000 | 1.000 | 1.000 | 0.852 | 1.000 | 1.000 | 1.000 | 1.000 | 0.979 | 1.000 | 1.000 | 0.897 | 1.000 | 0.973 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.985 |
| 1962 | 1.000 | 1.000 | 1.000 | 0.826 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.992 | 0.930 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1963 | 1.000 | 1.000 | 1.000 | 0.903 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.922 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.969 |
| 1964 | 1.000 | 1.000 | 1.000 | 0.988 | 0.997 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.899 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.967 |
| 1965 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.868 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.957 |
| 1966 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.879 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.989 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1967 | 1.000 | 1.000 | 1.000 | 0.837 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.966 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.945 |
| 1968 | 1.000 | 1.000 | 1.000 | 0.975 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.948 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.897 |
| 1969 | 1.000 | 1.000 | 1.000 | 0.922 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.906 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.898 |
| 1970 | 1.000 | 1.000 | 1.000 | 0.836 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.936 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.889 |
| 1971 | 1.000 | 1.000 | 1.000 | 0.893 | 1.000 | 0.972 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.909 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.897 |
| 1972 | 1.000 | 1.000 | 1.000 | 0.977 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.923 | 1.000 | 1.000 | 1.000 | 0.986 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.845 |
| 1973 | 1.000 | 1.000 | 1.000 | 0.927 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.976 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.968 | 0.994 | 1.000 | 1.000 | 1.000 | 0.887 |
| 1974 | 1.000 | 1.000 | 0.968 | 0.974 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.978 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 1975 | 1.000 | 1.000 | 1.000 | 1.000 | 0.976 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.955 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.904 |
| 1976 | 1.000 | 1.000 | 1.000 | 0.926 | 1.000 | 0.991 | 1.000 | 1.000 | 0.992 | 1.000 | 1.000 | 0.956 | 1.000 | 1.000 | 1.000 | 0.958 | 1.000 | 0.993 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.868 |
| 1977 | 1.000 | 1.000 | 1.000 | 0.915 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.909 | 1.000 | 1.000 | 1.000 | 1.000 | 0.933 | 1.000 | 0.991 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.951 |
| 1978 | 1.000 | 1.000 | 1.000 | 0.970 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.919 | 0.951 | 1.000 | 1.000 | 1.000 | 1.000 | 0.838 | 1.000 | 1.000 | 0.952 | 1.000 | 1.000 | 1.000 | 1.000 | 0.801 |
| 1979 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.968 | 1.000 | 1.000 | 1.000 | 1.000 | 0.950 | 1.000 | 1.000 | 1.000 | 1.000 | 0.878 | 1.000 | 1.000 | 1.000 | 0.991 | 1.000 | 1.000 | 1.000 | 0.803 |
| 1980 | 1.000 | 1.000 | 1.000 | 0.982 | 1.000 | 1.000 | 1.000 | 1.000 | 0.989 | 1.000 | 0.976 | 1.000 | 1.000 | 1.000 | 1.000 | 0.806 | 0.926 | 1.000 | 1.000 | 0.959 | 1.000 | 1.000 | 1.000 | 0.813 |
| 1981 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.889 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.877 |
| 1982 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.860 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.766 |
| 1983 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.715 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.753 |
| 1984 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.831 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.749 |
| 1985 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.843 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.735 |
| 1986 | 1.000 | 1.000 | 1.000 | 0.965 | 0.975 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.864 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.794 |
| 1987 | 1.000 | 1.000 | 1.000 | 0.945 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.920 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.722 |
| 1988 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.816 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.829 |
| 1989 | 1.000 | 1.000 | 1.000 | 0.919 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.962 | 1.000 | 1.000 | 1.000 | 0.980 | 1.000 | 1.000 | 1.000 | 0.831 |
| 1990 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.992 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.977 | 1.000 | 1.000 | 1.000 | 0.982 | 1.000 | 1.000 | 1.000 | 0.885 |
| 1991 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.989 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.757 |
| 1992 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.983 | 1.000 | 1.000 | 0.965 | 1.000 | 1.000 | 1.000 | 1.000 | 0.992 |
| 1993 | 1.000 | 1.000 | 1.000 | 0.922 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.842 | 1.000 | 1.000 | 0.952 | 0.973 | 1.000 | 1.000 | 1.000 | 0.823 |
| 1994 | 1.000 | 1.000 | 1.000 | 0.926 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.717 |
| 1995 | 1.000 | 1.000 | 1.000 | 0.863 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.996 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.874 |
| 1996 | 1.000 | 1.000 | 1.000 | 0.865 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.929 | 0.986 | 1.000 | 0.954 | 1.000 | 1.000 | 1.000 | 1.000 | 0.820 |
| 1997 | 1.000 | 1.000 | 1.000 | 0.816 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.947 | 1.000 | 1.000 | 1.000 | 1.000 | 0.793 |
| 1998 | 1.000 | 1.000 | 1.000 | 0.939 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.971 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.915 |
| 1999 | 1.000 | 1.000 | 1.000 | 0.906 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.854 | 1.000 | 1.000 | 0.915 | 1.000 | 1.000 | 1.000 | 1.000 | 0.916 |
| 2000 | 1.000 | 1.000 | 1.000 | 0.911 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.937 | 1.000 | 1.000 | 0.987 | 1.000 | 1.000 | 1.000 | 1.000 | 0.791 |
| 2001 | 1.000 | 1.000 | 1.000 | 0.852 | 0.994 | 1.000 | 1.000 | 1.000 | 0.982 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.976 | 1.000 | 1.000 | 1.000 | 1.000 | 0.817 |
| 2002 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.909 | 1.000 | 1.000 | 0.982 | 0.964 | 1.000 | 1.000 | 1.000 | 0.854 |
| 2003 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.987 | 0.935 | 1.000 | 1.000 | 1.000 | 1.000 | 0.781 |
| 2004 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.933 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.992 | 1.000 | 1.000 | 0.989 | 1.000 | 1.000 | 1.000 | 1.000 | 0.707 |

Table 6. Indexes of Output-Oriented Scale and Mix Efficiency Change (California 1960 = 1)

| | AL | AR | AZ | CA | CO | CT | DE | FL | GA | IA | ID | IL | IN | KS | KY | LA | MA | MD | ME | MI | MN | MO | MS | MT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 0.636 | 0.880 | 1.059 | 1.000 | 1.056 | 0.928 | 1.058 | 0.965 | 0.710 | 1.078 | 1.076 | 1.055 | 0.857 | 1.123 | 0.896 | 0.738 | 0.780 | 0.941 | 0.951 | 0.742 | 1.038 | 0.804 | 0.776 | 0.780 |
| 1961 | 0.647 | 0.960 | 1.098 | 1.000 | 1.059 | 0.947 | 1.107 | 1.042 | 0.724 | 1.123 | 1.123 | 1.101 | 0.884 | 1.106 | 0.961 | 0.767 | 0.820 | 0.939 | 0.949 | 0.795 | 1.086 | 0.835 | 0.860 | 0.749 |
| 1962 | 0.633 | 0.982 | 1.029 | 1.029 | 0.953 | 0.928 | 1.101 | 1.123 | 0.703 | 1.116 | 1.123 | 1.109 | 0.924 | 1.088 | 0.963 | 0.810 | 0.855 | 0.969 | 0.972 | 0.831 | 1.049 | 0.819 | 0.867 | 0.773 |
| 1963 | 0.697 | 1.032 | 1.071 | 1.076 | 0.968 | 0.959 | 1.123 | 0.992 | 0.764 | 1.123 | 1.123 | 1.108 | 0.926 | 1.081 | 0.978 | 0.878 | 0.869 | 0.988 | 0.965 | 0.845 | 1.111 | 0.835 | 0.989 | 0.802 |
| 1964 | 0.700 | 1.123 | 1.028 | 1.123 | 0.989 | 0.992 | 1.091 | 0.981 | 0.760 | 1.123 | 1.101 | 1.072 | 0.865 | 1.085 | 0.971 | 0.898 | 0.883 | 1.018 | 0.957 | 0.901 | 1.061 | 0.794 | 1.013 | 0.796 |
| 1965 | 0.719 | 1.123 | 1.112 | 1.080 | 0.967 | 0.940 | 1.123 | 1.070 | 0.772 | 1.089 | 1.119 | 1.123 | 0.898 | 1.115 | 0.920 | 0.893 | 0.848 | 1.010 | 0.896 | 0.870 | 1.078 | 0.821 | 0.977 | 0.871 |
| 1966 | 0.701 | 1.119 | 1.123 | 1.123 | 1.055 | 0.994 | 1.083 | 1.123 | 0.812 | 1.118 | 1.122 | 1.054 | 0.847 | 0.973 | 0.893 | 0.925 | 0.903 | 0.919 | 0.896 | 0.855 | 1.100 | 0.781 | 0.996 | 0.849 |
| 1967 | 0.631 | 1.050 | 0.998 | 1.108 | 0.958 | 0.904 | 1.123 | 1.123 | 0.819 | 1.098 | 1.123 | 1.123 | 0.894 | 1.020 | 0.987 | 0.986 | 0.822 | 0.902 | 0.843 | 0.852 | 1.116 | 0.780 | 0.991 | 0.773 |
| 1968 | 0.656 | 1.123 | 1.041 | 1.123 | 0.979 | 0.890 | 1.074 | 1.051 | 0.782 | 1.107 | 1.123 | 1.054 | 0.927 | 1.073 | 0.962 | 1.041 | 0.822 | 0.882 | 0.901 | 0.881 | 1.123 | 0.868 | 1.034 | 0.811 |
| 1969 | 0.688 | 1.118 | 1.098 | 1.123 | 0.966 | 0.815 | 1.123 | 1.123 | 0.810 | 1.082 | 1.123 | 1.098 | 0.975 | 1.063 | 0.997 | 1.006 | 0.775 | 0.880 | 0.808 | 0.891 | 1.105 | 0.827 | 1.079 | 0.802 |
| 1970 | 0.715 | 1.123 | 1.071 | 1.081 | 1.002 | 0.843 | 1.087 | 1.020 | 0.838 | 1.088 | 1.123 | 1.026 | 0.908 | 1.043 | 0.949 | 1.058 | 0.826 | 0.872 | 0.821 | 0.874 | 1.123 | 0.804 | 1.033 | 0.782 |
| 1971 | 0.778 | 1.123 | 0.972 | 1.084 | 0.962 | 0.860 | 1.123 | 1.087 | 0.907 | 1.094 | 1.123 | 1.123 | 0.979 | 1.123 | 0.960 | 1.012 | 0.840 | 0.869 | 0.889 | 0.853 | 1.123 | 0.860 | 1.066 | 0.770 |
| 1972 | 0.784 | 1.123 | 0.979 | 1.123 | 0.980 | 0.746 | 1.123 | 1.123 | 0.888 | 1.084 | 1.118 | 1.095 | 0.908 | 1.100 | 0.917 | 0.988 | 0.739 | 0.821 | 0.847 | 0.918 | 1.074 | 0.830 | 1.059 | 0.760 |
| 1973 | 0.690 | 1.100 | 1.010 | 1.123 | 0.990 | 0.759 | 1.107 | 1.123 | 0.790 | 1.099 | 1.117 | 1.074 | 0.900 | 1.123 | 0.837 | 0.927 | 0.712 | 0.809 | 0.745 | 0.877 | 1.123 | 0.810 | 1.048 | 0.784 |
| 1974 | 0.723 | 1.074 | 1.076 | 1.123 | 0.992 | 0.748 | 1.123 | 1.123 | 0.860 | 1.052 | 1.122 | 0.950 | 0.835 | 1.059 | 0.859 | 0.943 | 0.790 | 0.827 | 0.727 | 0.877 | 1.004 | 0.794 | 1.049 | 0.757 |
| 1975 | 0.680 | 1.123 | 1.038 | 1.110 | 0.981 | 0.795 | 1.123 | 1.123 | 0.790 | 1.060 | 1.123 | 1.123 | 0.922 | 1.113 | 0.808 | 0.936 | 0.811 | 0.874 | 0.849 | 1.020 | 1.008 | 0.804 | 1.015 | 0.813 |
| 1976 | 0.647 | 1.006 | 1.057 | 1.123 | 1.039 | 0.764 | 1.123 | 1.071 | 0.724 | 1.014 | 1.068 | 1.092 | 0.978 | 1.072 | 0.907 | 0.899 | 0.735 | 0.813 | 0.771 | 0.917 | 0.934 | 0.759 | 0.946 | 0.806 |
| 1977 | 0.641 | 1.075 | 1.068 | 1.123 | 1.072 | 0.723 | 1.043 | 1.052 | 0.690 | 1.053 | 1.123 | 1.057 | 0.955 | 1.123 | 0.895 | 0.917 | 0.724 | 0.806 | 0.746 | 1.018 | 1.123 | 0.923 | 1.002 | 0.835 |
| 1978 | 0.636 | 1.035 | 1.037 | 1.101 | 1.025 | 0.825 | 1.049 | 0.969 | 0.734 | 1.123 | 1.111 | 1.085 | 1.003 | 0.905 | 0.922 | 0.881 | 0.782 | 0.915 | 0.798 | 0.969 | 1.034 | 0.898 | 0.988 | 0.809 |
| 1979 | 0.674 | 1.123 | 1.123 | 1.123 | 1.073 | 0.792 | 1.123 | 0.953 | 0.776 | 1.117 | 1.118 | 1.123 | 0.997 | 1.038 | 0.965 | 0.938 | 0.730 | 0.887 | 0.782 | 0.998 | 1.069 | 0.924 | 0.982 | 0.847 |
| 1980 | 0.629 | 0.945 | 0.984 | 1.123 | 0.961 | 0.775 | 0.996 | 1.087 | 0.761 | 1.097 | 1.123 | 0.989 | 0.952 | 1.041 | 0.852 | 0.854 | 0.702 | 0.801 | 0.693 | 1.000 | 1.019 | 0.822 | 1.034 | 0.753 |
| 1981 | 0.737 | 1.123 | 1.091 | 1.123 | 1.014 | 0.747 | 1.123 | 1.123 | 0.877 | 1.123 | 1.122 | 1.016 | 0.879 | 0.940 | 0.996 | 0.839 | 0.780 | 0.856 | 0.723 | 1.064 | 1.123 | 0.916 | 0.983 | 0.814 |
| 1982 | 0.820 | 1.123 | 1.100 | 1.123 | 1.095 | 0.884 | 1.123 | 1.123 | 0.992 | 1.039 | 1.123 | 1.065 | 0.984 | 1.038 | 1.020 | 0.928 | 0.751 | 0.927 | 0.900 | 1.097 | 1.118 | 0.780 | 1.012 | 0.829 |
| 1983 | 0.783 | 0.918 | 0.940 | 1.060 | 0.990 | 0.781 | 1.123 | 1.123 | 0.908 | 0.841 | 1.123 | 0.758 | 0.716 | 0.941 | 0.896 | 0.860 | 0.752 | 0.855 | 0.802 | 0.986 | 1.005 | 0.675 | 0.882 | 0.764 |
| 1984 | 0.753 | 1.100 | 0.959 | 1.123 | 1.007 | 0.829 | 1.016 | 1.123 | 0.926 | 1.111 | 1.123 | 1.066 | 1.056 | 1.060 | 1.049 | 0.994 | 0.811 | 0.973 | 0.819 | 1.058 | 1.123 | 0.828 | 0.957 | 0.702 |
| 1985 | 0.778 | 1.123 | 0.993 | 1.123 | 1.035 | 0.851 | 1.123 | 1.123 | 0.942 | 1.102 | 1.105 | 1.123 | 1.022 | 1.040 | 1.063 | 0.910 | 0.825 | 0.981 | 0.824 | 1.123 | 1.122 | 0.875 | 1.055 | 0.659 |
| 1986 | 0.723 | 1.061 | 0.992 | 1.077 | 0.993 | 0.918 | 1.043 | 1.123 | 0.816 | 1.077 | 1.123 | 1.099 | 0.935 | 1.012 | 1.009 | 0.916 | 0.900 | 0.914 | 0.876 | 1.082 | 1.104 | 0.837 | 0.922 | 0.732 |
| 1987 | 0.732 | 1.123 | 0.929 | 1.123 | 0.852 | 0.838 | 0.996 | 1.087 | 0.868 | 1.008 | 1.123 | 1.099 | 0.980 | 1.027 | 0.916 | 0.886 | 0.849 | 0.888 | 0.821 | 1.045 | 1.101 | 0.787 | 0.997 | 0.707 |
| 1988 | 0.741 | 1.123 | 0.877 | 1.028 | 0.899 | 0.781 | 0.962 | 1.123 | 0.958 | 0.924 | 1.100 | 0.886 | 0.840 | 0.993 | 0.834 | 0.922 | 0.839 | 0.818 | 0.781 | 1.013 | 0.971 | 0.745 | 0.934 | 0.492 |
| 1989 | 0.734 | 1.078 | 1.018 | 1.111 | 0.909 | 0.766 | 0.931 | 1.105 | 0.962 | 1.034 | 1.123 | 1.123 | 1.010 | 0.951 | 0.833 | 0.823 | 0.850 | 0.791 | 0.798 | 1.058 | 1.123 | 0.813 | 0.869 | 0.692 |
| 1990 | 0.745 | 1.059 | 0.869 | 1.123 | 0.883 | 0.880 | 1.100 | 1.120 | 0.910 | 1.015 | 1.123 | 1.121 | 1.007 | 1.044 | 0.799 | 0.945 | 0.934 | 0.909 | 0.898 | 1.064 | 1.123 | 0.773 | 0.922 | 0.652 |
| 1991 | 0.810 | 1.072 | 0.825 | 0.990 | 0.818 | 0.847 | 1.123 | 1.123 | 0.964 | 1.038 | 1.123 | 1.020 | 0.927 | 1.005 | 0.787 | 0.887 | 0.996 | 0.917 | 0.944 | 1.046 | 1.100 | 0.775 | 0.969 | 0.642 |
| 1992 | 0.723 | 1.123 | 0.867 | 1.110 | 0.855 | 0.939 | 1.122 | 1.123 | 0.948 | 1.081 | 1.101 | 1.123 | 1.040 | 1.011 | 0.809 | 0.886 | 0.897 | 0.946 | 0.973 | 1.086 | 1.123 | 0.800 | 1.015 | 0.593 |
| 1993 | 0.749 | 0.996 | 0.829 | 1.083 | 0.832 | 0.926 | 1.116 | 1.095 | 0.900 | 0.818 | 1.123 | 1.026 | 0.940 | 0.974 | 0.788 | 0.792 | 0.870 | 0.942 | 0.967 | 1.089 | 0.905 | 0.692 | 0.859 | 0.656 |
| 1994 | 0.743 | 1.089 | 0.849 | 1.123 | 0.827 | 0.898 | 1.123 | 1.123 | 0.984 | 1.123 | 1.053 | 1.123 | 1.014 | 1.073 | 0.748 | 0.896 | 0.862 | 0.984 | 0.945 | 1.075 | 1.123 | 0.765 | 0.929 | 0.630 |
| 1995 | 0.665 | 1.020 | 0.834 | 0.967 | 0.865 | 1.040 | 1.086 | 1.079 | 0.946 | 0.967 | 1.102 | 0.953 | 0.889 | 0.891 | 0.794 | 0.838 | 0.919 | 0.930 | 1.000 | 1.070 | 1.068 | 0.678 | 0.940 | 0.689 |
| 1996 | 0.674 | 1.123 | 0.926 | 1.013 | 0.876 | 1.030 | 1.123 | 1.122 | 0.956 | 1.087 | 1.123 | 1.039 | 0.958 | 1.005 | 0.761 | 0.933 | 0.978 | 1.006 | 1.001 | 1.034 | 1.123 | 0.795 | 0.929 | 0.649 |
| 1997 | 0.673 | 1.123 | 0.895 | 1.080 | 0.838 | 0.930 | 0.998 | 1.123 | 0.977 | 1.123 | 1.123 | 1.046 | 1.039 | 1.108 | 0.800 | 0.782 | 0.995 | 0.889 | 0.909 | 1.058 | 1.061 | 0.821 | 0.857 | 0.575 |
| 1998 | 0.664 | 1.077 | 0.917 | 0.960 | 0.894 | 1.045 | 1.062 | 1.123 | 0.873 | 1.123 | 1.043 | 1.079 | 1.026 | 1.068 | 0.837 | 0.660 | 1.032 | 0.972 | 1.064 | 1.028 | 1.123 | 0.799 | 0.856 | 0.549 |
| 1999 | 0.706 | 1.061 | 1.054 | 0.997 | 0.969 | 1.108 | 1.053 | 1.092 | 0.926 | 1.091 | 1.123 | 1.046 | 0.974 | 1.039 | 0.774 | 0.722 | 1.123 | 0.985 | 1.070 | 1.083 | 1.123 | 0.739 | 0.835 | 0.591 |
| 2000 | 0.695 | 1.060 | 0.984 | 1.082 | 0.875 | 1.108 | 1.038 | 1.123 | 0.947 | 1.088 | 1.123 | 1.104 | 1.037 | 0.974 | 0.869 | 0.669 | 1.079 | 0.993 | 1.123 | 1.026 | 1.104 | 0.812 | 0.807 | 0.496 |
| 2001 | 0.707 | 1.123 | 1.001 | 1.112 | 0.938 | 1.099 | 1.032 | 1.123 | 0.942 | 1.083 | 1.123 | 1.123 | 1.068 | 1.021 | 0.786 | 0.802 | 1.060 | 0.958 | 1.062 | 1.001 | 1.060 | 0.815 | 0.870 | 0.494 |
| 2002 | 0.670 | 1.123 | 0.956 | 1.123 | 0.858 | 0.903 | 1.123 | 1.048 | 0.927 | 1.123 | 1.020 | 1.014 | 0.955 | 0.928 | 0.690 | 0.769 | 0.902 | 0.884 | 0.962 | 1.027 | 1.123 | 0.741 | 0.889 | 0.498 |
| 2003 | 0.752 | 1.123 | 1.123 | 1.123 | 0.886 | 0.839 | 1.123 | 0.989 | 0.944 | 1.000 | 1.119 | 1.042 | 1.003 | 0.972 | 0.716 | 0.753 | 0.882 | 0.922 | 0.862 | 1.031 | 1.093 | 0.727 | 0.896 | 0.575 |
| 2004 | 0.706 | 1.095 | 1.064 | 1.123 | 0.798 | 0.941 | 1.013 | 1.021 | 0.895 | 1.077 | 1.123 | 1.123 | 1.043 | 0.995 | 0.765 | 0.751 | 0.962 | 0.937 | 0.885 | 1.054 | 1.123 | 0.779 | 0.852 | 0.566 |

Table 6 cont. Indexes of Output-Oriented Scale and Mix Efficiency Change (California 1960 = 1)

| | NC | ND | NE | NH | NJ | NM | NV | NY | OH | OK | OR | PA | RI | SC | SD | TN | TX | UT | VA | VT | WA | WI | WV | WY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960 | 1.021 | 0.883 | 1.097 | 0.820 | 1.100 | 0.672 | 0.802 | 1.028 | 0.800 | 1.092 | 0.514 | 0.926 | 0.748 | 0.531 | 0.995 | 0.851 | 0.849 | 0.843 | 0.842 | 0.895 | 0.632 | 0.988 | 0.616 | 0.647 |
| 1961 | 1.057 | 0.718 | 1.062 | 0.863 | 1.123 | 0.690 | 0.772 | 1.077 | 0.830 | 1.072 | 0.532 | 0.964 | 0.784 | 0.557 | 0.954 | 0.903 | 0.853 | 0.848 | 0.888 | 0.962 | 0.649 | 1.035 | 0.636 | 0.661 |
| 1962 | 1.123 | 1.032 | 1.102 | 0.912 | 1.123 | 0.692 | 0.801 | 1.070 | 0.839 | 0.983 | 0.555 | 0.922 | 0.886 | 0.573 | 1.015 | 0.899 | 0.835 | 0.846 | 0.916 | 0.961 | 0.688 | 1.071 | 0.624 | 0.627 |
| 1963 | 1.123 | 0.957 | 1.108 | 0.831 | 1.087 | 0.698 | 0.827 | 1.110 | 0.833 | 0.995 | 0.564 | 0.957 | 0.962 | 0.603 | 1.024 | 0.914 | 0.890 | 0.836 | 0.835 | 0.969 | 0.724 | 1.072 | 0.632 | 0.679 |
| 1964 | 1.123 | 0.966 | 1.123 | 0.766 | 1.054 | 0.662 | 0.817 | 1.103 | 0.821 | 1.032 | 0.575 | 0.997 | 1.019 | 0.621 | 0.975 | 0.877 | 0.887 | 0.841 | 0.852 | 0.984 | 0.753 | 1.123 | 0.607 | 0.671 |
| 1965 | 1.025 | 1.013 | 1.123 | 0.754 | 1.060 | 0.702 | 0.870 | 1.116 | 0.817 | 1.123 | 0.598 | 1.029 | 0.916 | 0.655 | 1.020 | 0.887 | 0.940 | 0.908 | 0.853 | 0.942 | 0.761 | 1.106 | 0.602 | 0.681 |
| 1966 | 1.070 | 0.857 | 1.123 | 0.819 | 1.093 | 0.755 | 0.862 | 1.115 | 0.858 | 1.016 | 0.626 | 0.996 | 0.947 | 0.656 | 0.918 | 0.819 | 0.944 | 0.906 | 0.836 | 0.981 | 0.799 | 1.123 | 0.592 | 0.678 |
| 1967 | 1.123 | 0.846 | 1.123 | 0.852 | 0.985 | 0.666 | 0.755 | 1.015 | 0.799 | 0.979 | 0.641 | 0.878 | 0.794 | 0.676 | 0.975 | 0.808 | 0.896 | 0.879 | 0.877 | 0.872 | 0.858 | 1.123 | 0.626 | 0.691 |
| 1968 | 1.060 | 0.946 | 1.123 | 0.739 | 0.974 | 0.667 | 0.749 | 0.985 | 0.858 | 1.024 | 0.626 | 0.875 | 0.775 | 0.604 | 0.994 | 0.850 | 0.938 | 0.870 | 0.874 | 0.903 | 0.812 | 1.110 | 0.610 | 0.695 |
| 1969 | 1.123 | 0.874 | 1.123 | 0.702 | 0.896 | 0.676 | 0.825 | 0.898 | 0.843 | 0.987 | 0.645 | 0.842 | 0.765 | 0.646 | 0.881 | 0.879 | 0.918 | 0.867 | 0.883 | 0.838 | 0.786 | 1.066 | 0.595 | 0.688 |
| 1970 | 1.123 | 0.769 | 1.026 | 0.772 | 0.889 | 0.703 | 0.816 | 0.922 | 0.874 | 0.959 | 0.641 | 0.845 | 0.816 | 0.618 | 0.850 | 0.832 | 0.943 | 0.908 | 0.864 | 0.892 | 0.772 | 1.070 | 0.586 | 0.697 |
| 1971 | 1.123 | 1.011 | 1.120 | 0.832 | 0.894 | 0.667 | 0.793 | 0.936 | 0.891 | 0.922 | 0.685 | 0.882 | 0.835 | 0.706 | 0.932 | 0.865 | 0.935 | 0.892 | 0.865 | 0.921 | 0.852 | 1.075 | 0.603 | 0.697 |
| 1972 | 1.123 | 0.888 | 1.078 | 0.763 | 0.756 | 0.671 | 0.763 | 0.808 | 0.850 | 0.968 | 0.700 | 0.785 | 0.707 | 0.658 | 0.949 | 0.810 | 0.968 | 0.897 | 0.840 | 0.852 | 0.868 | 1.047 | 0.573 | 0.723 |
| 1973 | 1.123 | 0.893 | 1.057 | 0.757 | 0.792 | 0.698 | 0.794 | 0.812 | 0.766 | 1.117 | 0.661 | 0.730 | 0.747 | 0.650 | 0.915 | 0.749 | 1.123 | 0.905 | 0.808 | 0.831 | 0.812 | 0.997 | 0.514 | 0.668 |
| 1974 | 1.123 | 0.813 | 1.007 | 0.648 | 0.829 | 0.629 | 0.762 | 0.829 | 0.858 | 1.123 | 0.693 | 0.710 | 0.685 | 0.672 | 0.878 | 0.731 | 1.057 | 0.894 | 0.791 | 0.850 | 0.827 | 0.996 | 0.480 | 0.639 |
| 1975 | 1.123 | 0.921 | 1.076 | 0.745 | 0.806 | 0.684 | 0.772 | 0.829 | 0.922 | 1.123 | 0.699 | 0.731 | 0.834 | 0.653 | 0.885 | 0.725 | 1.097 | 0.872 | 0.728 | 0.900 | 0.916 | 0.994 | 0.452 | 0.681 |
| 1976 | 1.074 | 0.905 | 1.044 | 0.729 | 0.716 | 0.655 | 0.782 | 0.746 | 0.933 | 1.062 | 0.702 | 0.725 | 0.665 | 0.589 | 0.769 | 0.734 | 1.042 | 0.862 | 0.736 | 0.839 | 0.876 | 0.954 | 0.435 | 0.728 |
| 1977 | 0.995 | 0.826 | 1.122 | 0.681 | 0.751 | 0.740 | 0.841 | 0.777 | 0.916 | 1.123 | 0.732 | 0.699 | 0.661 | 0.599 | 0.902 | 0.781 | 1.042 | 0.873 | 0.753 | 0.801 | 0.848 | 1.005 | 0.407 | 0.681 |
| 1978 | 1.103 | 0.937 | 1.050 | 0.719 | 0.811 | 0.713 | 0.744 | 0.851 | 0.926 | 1.037 | 0.661 | 0.800 | 0.740 | 0.607 | 0.870 | 0.882 | 0.938 | 0.812 | 0.816 | 0.876 | 0.842 | 0.959 | 0.495 | 0.758 |
| 1979 | 1.029 | 0.837 | 1.077 | 0.758 | 0.777 | 0.711 | 0.827 | 0.848 | 0.987 | 1.079 | 0.640 | 0.809 | 0.727 | 0.669 | 0.880 | 0.895 | 0.987 | 0.855 | 0.821 | 0.847 | 0.789 | 0.964 | 0.540 | 0.768 |
| 1980 | 1.037 | 0.710 | 1.002 | 0.676 | 0.767 | 0.651 | 0.791 | 0.829 | 0.926 | 1.019 | 0.684 | 0.746 | 0.725 | 0.600 | 0.829 | 0.853 | 0.991 | 0.790 | 0.741 | 0.785 | 0.806 | 0.976 | 0.552 | 0.699 |
| 1981 | 1.123 | 1.052 | 1.123 | 0.679 | 0.864 | 0.659 | 0.786 | 0.872 | 0.833 | 1.075 | 0.604 | 0.877 | 0.732 | 0.749 | 0.887 | 0.939 | 1.065 | 0.924 | 0.851 | 0.803 | 0.839 | 0.994 | 0.551 | 0.699 |
| 1982 | 1.123 | 1.002 | 1.123 | 0.682 | 0.911 | 0.688 | 0.941 | 0.933 | 0.878 | 1.123 | 0.585 | 0.834 | 1.006 | 0.819 | 0.971 | 0.988 | 0.948 | 0.872 | 0.842 | 0.941 | 0.807 | 1.059 | 0.485 | 0.763 |
| 1983 | 1.123 | 0.879 | 0.983 | 0.750 | 0.861 | 0.622 | 0.845 | 0.856 | 0.714 | 0.984 | 0.605 | 0.765 | 0.849 | 0.671 | 0.824 | 0.842 | 0.876 | 0.843 | 0.856 | 0.845 | 0.852 | 0.986 | 0.532 | 0.708 |
| 1984 | 1.123 | 0.972 | 1.119 | 0.734 | 0.947 | 0.634 | 0.848 | 0.812 | 1.062 | 0.938 | 0.650 | 0.899 | 0.912 | 0.766 | 1.036 | 0.968 | 0.869 | 0.817 | 0.915 | 0.799 | 0.841 | 1.076 | 0.580 | 0.704 |
| 1985 | 1.123 | 0.989 | 1.123 | 0.706 | 0.936 | 0.717 | 0.832 | 0.870 | 1.023 | 0.977 | 0.614 | 0.906 | 1.047 | 0.787 | 0.930 | 0.949 | 0.974 | 0.833 | 0.860 | 0.813 | 0.812 | 1.012 | 0.594 | 0.724 |
| 1986 | 1.103 | 1.028 | 1.077 | 0.747 | 0.892 | 0.654 | 0.762 | 0.897 | 0.938 | 0.983 | 0.642 | 0.896 | 1.084 | 0.677 | 0.985 | 0.892 | 0.929 | 0.887 | 0.838 | 0.833 | 0.808 | 1.061 | 0.596 | 0.722 |
| 1987 | 1.123 | 0.961 | 1.064 | 0.725 | 0.892 | 0.605 | 0.756 | 0.833 | 0.968 | 0.948 | 0.655 | 0.829 | 1.123 | 0.770 | 0.932 | 0.859 | 0.902 | 0.879 | 0.857 | 0.769 | 0.794 | 1.036 | 0.543 | 0.695 |
| 1988 | 1.123 | 0.543 | 1.089 | 0.689 | 0.788 | 0.644 | 0.733 | 0.756 | 0.884 | 0.975 | 0.676 | 0.732 | 1.123 | 0.747 | 0.770 | 0.852 | 0.930 | 0.891 | 0.878 | 0.732 | 0.860 | 0.989 | 0.488 | 0.577 |
| 1989 | 1.123 | 0.820 | 1.123 | 0.690 | 0.840 | 0.685 | 0.795 | 0.759 | 0.895 | 0.972 | 0.631 | 0.743 | 1.007 | 0.899 | 0.883 | 0.723 | 1.006 | 0.912 | 0.899 | 0.743 | 0.808 | 1.052 | 0.514 | 0.610 |
| 1990 | 1.123 | 1.021 | 1.123 | 0.658 | 0.953 | 0.618 | 0.748 | 0.884 | 0.953 | 1.064 | 0.646 | 0.841 | 1.062 | 0.684 | 0.969 | 0.669 | 1.105 | 0.857 | 0.818 | 0.835 | 0.832 | 1.007 | 0.521 | 0.578 |
| 1991 | 1.123 | 0.949 | 1.123 | 0.756 | 1.012 | 0.580 | 0.653 | 0.888 | 0.868 | 0.970 | 0.656 | 0.806 | 0.998 | 0.746 | 0.953 | 0.635 | 1.123 | 0.761 | 0.778 | 0.910 | 0.773 | 1.060 | 0.470 | 0.637 |
| 1992 | 1.122 | 1.101 | 1.123 | 0.787 | 0.966 | 0.607 | 0.656 | 0.932 | 0.941 | 0.986 | 0.652 | 0.931 | 0.847 | 0.814 | 0.970 | 0.686 | 1.123 | 0.766 | 0.842 | 1.077 | 0.827 | 1.044 | 0.473 | 0.502 |
| 1993 | 1.123 | 0.894 | 1.024 | 0.891 | 1.031 | 0.590 | 0.688 | 0.945 | 0.842 | 0.967 | 0.695 | 0.904 | 0.859 | 0.725 | 0.885 | 0.752 | 1.123 | 0.784 | 0.790 | 1.027 | 0.882 | 0.995 | 0.472 | 0.549 |
| 1994 | 1.123 | 0.940 | 1.123 | 0.885 | 1.035 | 0.607 | 0.670 | 0.974 | 0.923 | 0.995 | 0.684 | 0.949 | 0.801 | 0.870 | 1.011 | 0.692 | 1.123 | 0.738 | 0.772 | 1.012 | 0.833 | 1.055 | 0.478 | 0.568 |
| 1995 | 1.038 | 0.868 | 0.990 | 0.797 | 1.021 | 0.657 | 0.766 | 0.960 | 0.815 | 0.875 | 0.625 | 0.914 | 0.944 | 0.742 | 0.871 | 0.605 | 1.004 | 0.794 | 0.696 | 0.911 | 0.859 | 1.003 | 0.453 | 0.582 |
| 1996 | 1.044 | 0.964 | 1.123 | 0.865 | 1.044 | 0.694 | 0.825 | 0.964 | 0.818 | 0.911 | 0.629 | 0.928 | 1.032 | 0.764 | 1.039 | 0.653 | 1.013 | 0.783 | 0.757 | 0.951 | 0.860 | 1.055 | 0.430 | 0.575 |
| 1997 | 1.069 | 0.856 | 1.070 | 0.838 | 0.947 | 0.632 | 0.766 | 0.898 | 0.979 | 0.987 | 0.702 | 0.836 | 0.965 | 0.741 | 0.980 | 0.616 | 1.073 | 0.767 | 0.748 | 0.878 | 0.875 | 1.041 | 0.454 | 0.583 |
| 1998 | 1.021 | 0.968 | 1.076 | 0.807 | 1.123 | 0.622 | 0.781 | 0.980 | 0.986 | 0.948 | 0.731 | 0.941 | 1.026 | 0.678 | 1.030 | 0.624 | 1.058 | 0.744 | 0.710 | 0.916 | 0.888 | 1.014 | 0.457 | 0.483 |
| 1999 | 1.041 | 0.918 | 1.045 | 0.835 | 1.066 | 0.695 | 0.851 | 1.054 | 0.916 | 1.000 | 0.716 | 0.954 | 1.032 | 0.743 | 0.990 | 0.673 | 1.123 | 0.823 | 0.803 | 0.920 | 0.927 | 1.054 | 0.480 | 0.549 |
| 2000 | 1.123 | 1.025 | 1.065 | 0.776 | 1.096 | 0.661 | 0.794 | 0.965 | 1.031 | 0.975 | 0.738 | 0.943 | 1.014 | 0.758 | 1.034 | 0.653 | 1.020 | 0.778 | 0.867 | 0.917 | 0.931 | 1.052 | 0.549 | 0.541 |
| 2001 | 1.123 | 0.969 | 1.123 | 0.872 | 1.023 | 0.677 | 0.781 | 0.981 | 0.955 | 0.955 | 0.724 | 0.865 | 1.038 | 0.751 | 0.979 | 0.625 | 1.054 | 0.779 | 0.816 | 0.909 | 0.930 | 1.052 | 0.505 | 0.518 |
| 2002 | 1.038 | 0.911 | 1.030 | 0.693 | 0.867 | 0.647 | 0.732 | 0.856 | 0.840 | 1.072 | 0.724 | 0.793 | 0.926 | 0.683 | 0.834 | 0.636 | 1.119 | 0.781 | 0.762 | 0.856 | 0.927 | 1.071 | 0.472 | 0.446 |
| 2003 | 0.974 | 1.118 | 1.093 | 0.672 | 0.850 | 0.695 | 0.788 | 0.829 | 0.913 | 1.019 | 0.748 | 0.796 | 0.894 | 0.739 | 0.971 | 0.636 | 1.073 | 0.827 | 0.827 | 0.812 | 0.926 | 1.110 | 0.473 | 0.574 |
| 2004 | 1.101 | 0.941 | 1.123 | 0.740 | 0.925 | 0.634 | 0.729 | 0.865 | 0.919 | 1.004 | 0.841 | 0.807 | 0.988 | 0.709 | 1.006 | 0.646 | 1.123 | 0.754 | 0.823 | 0.834 | 0.877 | 1.021 | 0.525 | 0.540 |

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