

# 3 | ANALYSIS OF CHRISTENSEN/USTA'S X-FACTOR RESULTS

**Corrections to the new Christensen/USTA X-factor results produce a significantly greater X-Factor than the 2.8% claimed by USTA and even the highest 5.3% level adopted by the Commission in the *First Report and Order*.**

In the preceding section of this report, we identified a number of serious errors in the new Christensen/USTA TFP study – most of them carried over from Christensen/USTA's original study. In this report, as in our earlier report, we have offered specific ways in which some of the problems inherent in the Christensen/USTA studies could be corrected. In this section, we attempt to quantify the effect upon the X-factor that would result were these corrections made, or at a minimum, identify the direction of the bias introduced by the specific errors made by Christensen. In several cases, a lack of data does not permit us to quantify precisely the effect upon the X-factor that results from a needed correction to the Christensen/USTA study. This is particularly the case with respect to data for Christensen's nine company sample covering the entire post-divestiture period.

Notwithstanding these limitations in the data, the results of our analysis clearly demonstrate that when the required corrections are made to the Christensen/USTA study, the X-factor will be found to be considerably greater than the 2.1% claimed by USTA and even the highest 5.3% value adopted by the Commission in the *First Report and Order*.

Table 2 on the following page summarizes the results of the various corrections that we have been able to address, including:

- Calculation of TFP for services subject to the interstate jurisdiction (as discussed on pp. 6-10 of this report, pp. 49-50, 55-56, of earlier report);
- Calculation of a LEC-US input price differential (as discussed on pp. 11-24 of this report, pp. 29-35 of earlier report);
- Replacement of an economy-wide cost of capital that fails to reflect the expected rate of return for the LECs (as discussed on pp. 27-31 of this report);

- Replacement of general economy-wide depreciation rates that are not applicable to the LECs (as discussed on p. 33 of this report, pp. 20-23 of earlier report); and
- Adjustment to the rental price equation to reflect the debt/equity distinction (as discussed on pp. 31-32 of this report, p. 19 of earlier report).

### Effects of corrections on 1989-1994 results

As displayed in Table 2, the X-factor for interstate LEC services including the input price differential (IPD) and a 0.5% Consumer Productivity Dividend (CPD), increases from the 2.8% result reported by Christensen to between 6.4% and 8.4%.

Because USTA has provided TFPRP-quality data only for the expanded eleven company sample for the five year periods (1989 to 1993, and 1990 to 1994) selected by Christensen, the results presented in Table 2 are necessarily limited to that particular sample

over those particular time periods. As discussed earlier in this report, the appropriate time period to apply in a long-term LEC price cap plan is the entire post-divestiture period, and as shown later, X-factor results for that period are measurably higher.

	<u>TFP</u>	<u>Input Price Diff.</u>	<u>CPD</u>	<u>X- Factor</u>
1989-1993	5.2%	2.7%	0.5%	8.4%
1990-1994	5.3%	0.6%	0.5%	6.4%
1989-1994	5.3%	2.0%	0.5%	7.8%

### Effects of hedonic adjustments on 1989 -1994 results

In our earlier report, the importance of hedonic price changes for telecommunications inputs was firmly established.<sup>104</sup> To demonstrate the degree of sensitivity of the X-factor result to the inclusion of hedonic adjustments, we estimated the effect of a modest 10% annual downward adjustment in the asset price deflators most closely associated with

104. Moreover, as discussed in our earlier report, the recognition of hedonic effects on the cost of LEC capital inputs vis-a-vis the economy-wide capital inputs as a whole adds further weight to the importance of incorporating an explicit input price differential in the price cap formula

computers to reflect the persistent and significant technological advances and product improvements that have occurred in the computer industry over the past decade.<sup>105</sup> Incorporation of this highly conservative adjustment for quality effects, as summarized in Table 3, increases the corrected interstate X-factor for Christensen's eleven company sample for the period 1989 to 1994 into the range of 7.4% to 9.5%.

	<u>TFP</u>	<u>Input Price Diff.</u>	<u>CPD</u>	<u>X- Factor</u>
1989-1993	4.3%	4.7%	0.5%	9.5%
1990-1994	4.2%	2.7%	0.5%	7.4%
1989-1994	4.3%	4.1%	0.5%	8.9%

As we noted in our earlier report, use of more precise hedonic adjustments is likely to produce even higher X-factor results. Unfortunately, there is very little in the way of concrete empirical research in the hedonic literature pertaining specifically to the telecommunications industry in the post-divestiture period. As discussed in our earlier report, however, seminal empirical research by Robert Gordon firmly establishes the necessity and significance of quality adjustments on asset price deflators for LEC capital equipment in the pre-divestiture period.<sup>106</sup> New empirical research in this challenging area is expected to be forthcoming in the near future.<sup>107</sup>

**Limitations in the data provided by USTA precludes complete analysis of the Christensen TFP results.**

As noted above, and for the reasons discussed in the preceding section of this report, the appropriate time period to apply in a long-term LEC price cap plan is the entire post-

105. See ETI Report, pp. 57-58.

106. See ETI Report, p. 37; also Norsworthy Statement, Appendix A, p. 54.

107. See Norsworthy Statement, Appendix A, p. 57.

divestiture period. The Christensen/USTA study does provide a number of TFP results for the nine company sample covering the entire post-divestiture study period, up through 1993 (i.e., 1984 to 1993).<sup>108</sup> Unfortunately, however, USTA has chosen *not* to provide the underlying data associated with these particular TFP results in a straightforward manner comparable to that provided for the truncated period 1989 to 1994.<sup>109</sup> Accordingly, we have been effectively precluded from analyzing the effects of the needed corrections (delineated at the outset of this section) to Christensen's new "simplified" TFP results for the entire post-divestiture period – the period most appropriate in our view for a long-term LEC price cap plan.

### Effects of corrections on 1984-1993 results

Christensen does provide a number of sensitivity analyses in his "simplified" study which compare the results of his original study to those of his new studies for the period 1984 to 1993.<sup>110</sup> Based on the examination of those sensitivity studies, it is reasonable to conclude that the TFP results for the full post-divestiture period produced by the new "simplified study" are quite similar, and tend to be somewhat higher, vis-a-vis those produced by the original studies for that same 1984 to 1993 period.<sup>111</sup>

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108. See Christensen "simplified" study, Tables E-1, 1, 2, 3, 4, 5, 6, 7, and 8.

109. This issue is discussed further in the following section of this report on empirical requirements.

110. See footnote 108, *infra*.

111. For example, Table 2 in Christensen's "simplified" study compares the TFP growth from the original study which used billed revenue with the TFP result from the "simplified" study which uses booked revenue. As shown in Table 2, TFP results for the 1984 to 1993 period in the "simplified" study are higher by 0.2% due to this one change. As another example, Table 5 in Christensen's "simplified" study compares the TFP growth from the original study which used TPIs as asset price deflators with the TFP result from the "simplified" study which uses BEA price indexes. As shown in Table 5, TFP results for the 1984 to 1993 period in the "simplified" study are higher by 0.1% due to this one change. As mentioned earlier in this report, TFP results were shown not to change at all due to the use of the three-year moving average approach in the rental price equation in Christensen's "simplified" study. See Table 6, Christensen's "simplified" study.

Accordingly, it is reasonable to assume that the corrected Christensen X-factor results of our previous analysis will provide a good proxy for the results that would be obtained if similar corrections were applied to Christensen's new TFP results. The results of our previous analysis are replicated in Table 4.

Table 4

**SUMMARY OF RESULTS  
CORRECTED INTERSTATE X-FACTOR  
BASED ON ORIGINAL STUDY  
1984 TO 1993 STUDY PERIOD**

	<u>TFP</u>	<u>Input Price Diff.</u>	<u>CPD</u>	<u>X- Factor</u>
<i>Corrected</i>	6.0%	3.4%	0.5%	9.9%
<i>Corrected/ Quality Adjusted</i>	5.5%	4.3%	0.5%	10.3%

**If the TFP method for establishing the X-factor is to be utilized, the various corrections identified in this report must be adopted, such that the levels of the X-factor being offered to the LECs are significantly increased to levels in the range presented here.**

In our TFP analysis, we attempt to address the major empirical shortcomings of the Christensen/USTA study as discussed in the preceding section. We believe the few key corrections we have analyzed, both in this report and in our earlier report, clearly demonstrate that the correct X-Factor is significantly greater than the paltry 2.8% claimed by USTA and is well above even the highest 5.3% level adopted by the Commission in the *First Report and Order*. The failure of the Commission to adopt a correct interstate X-Factor of the order of magnitude that we have identified will result in substantial LEC overcharges, creating unprecedented windfall profits for these companies.

**Because many of the complex issues surrounding the calculation of a TFP-based X-factor are not resolved, the TFP method does not lend itself to either the mechanical annual updating process or the elimination of sharing as envisioned under USTA's proposal.**

Because of the serious errors that remain uncorrected in the new "simplified" study, as we discussed in our earlier report, it would be incorrect for the Commission to adopt the moving average approach being recommended by USTA – as opposed to an explicit LEC performance review – as a means of updating a TFP-based X-factor. The complex issues surrounding the calculation of a TFP-based X-factor, as discussed in this report and in the reports of other economic experts, are not likely to be fully resolved in the near term because of data limitations. Accordingly, they do not lend themselves to a mechanical annual updating process such as envisioned under USTA's proposal.

Similarly, because of the difficulties in correctly calculating a TFP-based X-factor, USTA's moving average proposal is not an effective substitute for either the consumer productivity dividend or sharing components of the LEC price cap plan. These components remain essential to protecting consumers against misspecification of the X-factor and ensuring that consumers benefit directly from incentive regulation, and accordingly they should be retained. Sharing also can serve the purpose, as it has under the Commission's interim rules, of encouraging LECs to voluntarily select the highest possible X-factor, but the levels of X-factors being offered to the LEC must be significantly increased to levels in the range presented in this report.

## 4 | EMPIRICAL REQUIREMENTS

**Notwithstanding a number of improvements in the “simplified” Study relating to the use of publicly available data, the new “simplified” Christensen/USTA study is still deficient with respect to the Commission’s empirical requirements.**

As discussed at length in the earlier ETI report,<sup>112</sup> the original Christensen Study did not, as a threshold matter, satisfy the empirical requirements identified in the FFNRPM as necessary in order to meet the Commission’s general criteria for an X-factor adopted in a long-term price cap plan.<sup>113</sup> We noted that significant changes in the data used and the information provided would have to occur in order to bring the Christensen/USTA study into compliance with the Commission’s empirical requirements. In response to the FFNRPM, USTA has substituted the use of publicly available sources of data for most of the proprietary data it had relied upon in the original study. USTA has also submitted a “Total Factor Productivity Review Plan (TFPRP)” that displays most of the inputs and calculations necessary to develop the productivity offset. In addition, USTA has responded to a number of information requests pursuant to Paragraph 15 of the FFNRPM, in which the Commission directed that:

*Any party submitting studies, proposed methods for calculating an X-factor, or other empirical information must furnish promptly upon request by Commission staff or any party to this proceeding workpapers and any other data necessary to replicate the results submitted in this proceeding. If a party fails to do so, we will*

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112. See ETI Report, Chapter 2.

113. In our earlier report, we pointed out a number of fundamental empirical-related deficiencies in the original Christensen study, including: (1) the inclusion of data that did not come from publicly available and verifiable series; (2) the aggregation of data from nine individual LECs in a manner that cannot be audited or verified given the confidential proprietary treatment of that data; (3) the reliance upon revised data series that are not documented; and (4) the failure to take into account hedonic effects upon capital input prices. See ETI Report, pp. 5-13.

## *Empirical Requirements*

accord no weight to those studies, methods, or empirical information in our deliberations. (*italics added*)

However, notwithstanding these improvements relating to the use of publicly available data and the provision of additional supporting materials, the new "simplified" Christensen/USTA study remains deficient with respect to the Commission's empirical requirements. In particular, USTA has failed to provide the data and in the form "*necessary to replicate the results submitted in this proceeding*" as required under Paragraph 15, at least within the timeframe of the proceeding. As evident by the limitations of our X-factor analysis described in the preceding section, USTA's failure to provide the data necessary to allow replication of *all* results submitted by USTA in this proceeding (as opposed to just the subset of results selected by USTA) seriously limits the nature of the analysis that can be performed by other parties, thereby precluding a full consideration of the many empirical issues raised by the Commission in the FFNRPM.

Because USTA provided only very limited backup material concomitant with its Comments, the Ad Hoc Committee served a set of data requests on USTA seeking the full array of underlying data relied upon in the "simplified" study as well as additional information needed to replicate Christensen's TFP results and conclusions regarding the input price differential.<sup>114</sup> In a response dated February 8, 1996, USTA provided a very limited subset of the requested information, i.e., the individual company data underlying the expanded eleven company sample results for the 1989 to 1993 and the 1990 to 1994 study periods. Another installment of data was finally provided by USTA in a response dated February 23, 1996. In this latest and apparently final installment, USTA has provided a significant quantity of data that is seemingly responsive to Ad Hoc's requests. However, while USTA has provided a significant quantity of data, the quality of the data in terms of organization, intelligibility, completeness, documentation, etc., is conspicuously inferior to the first installment of data. Indeed, closer examination of the data provided in the later installment reveals that this data is neither readily reconcilable to data or results presented in USTA's Comments nor easily worked with so as to allow replication and further analysis of those results.<sup>115</sup> We are continuing to work with the data provide by USTA, but the disjointed manner in which the data was provided makes that process extremely tedious, time-consuming, and costly.

In its transmittal of the first installment of data, USTA argues (seemingly in anticipation of other party complaints) that "[p]arties to this proceeding seeking to understand and replicate the TFP results on which USTA is relying for its recommended

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114. Information requests of the Ad Hoc Committee to USTA, dated January 30, 1996.

115. We understand that Ad Hoc may pursue the matter of USTA's data responses further before the Commission.

## *Empirical Requirements*

productivity offset in the long-term price cap plan should direct their attention to this data set [relating to the eleven company sample five year moving average results], and the results shown in Table 9."<sup>116</sup> In making this argument, USTA attempts (quite inappropriately) to restrict other parties' ability to analyze key results and conclusions presented in USTA's Comments concerning the nine company full post-divestiture period sample (as shown in Tables E-1, 1, 2, 3, 4, 5, 6, 7, and 8) and the input price differential (as discussed in Christensen Appendix 3 and USTA Attachment C, the NERA paper.

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116. *Ex Parte* Letter from Charles D. Cosson, USTA, to William S. Caton, Secretary, Federal Communications Commission, dated February 8, 1996.

## **Appendix A**

# **STATISTICAL ANALYSES OF INPUT PRICE DIFFERENTIAL**

- A1 Statistical test rejects hypothesis that input price differential is zero
- A2 Regression analysis of telephone input price growth demonstrates the significance of divestiture 1949-1992
- A3 Regression analysis of telephone input price growth demonstrates the significance of divestiture 1949-1993
- A4 Regression analysis of telephone input price differential demonstrates the significance of divestiture 1942-1992
- A5 Regression analysis of telephone input price differential demonstrates the significance of divestiture 1942-1993
- A6 Regression of input price growth excluding 1990 outlier demonstrates significance of divestiture
- A7 Regression of input price growth excluding 1990 outlier shows significant divestiture variable and insignificant 1990-92 dummy
- A8 Regression of input price differential excluding 1990 outlier shows significant divestiture variable and insignificant 1990-92 dummy
- A9 Lincoln telephone regression of input price change excluding 1990 outlier shows significance of divestiture
- A10 When 1990 Outlier is Excluded, the Cox Test rejects the hypothesis that "H2 is Correct" (Data to 1992)
- A11 When 1990 Outlier is Excluded, the Cox Test rejects the hypothesis that "H2 is Correct" (Data to 1993)

**TABLE A1**

**STATISTICAL TEST REJECTS HYPOTHESIS THAT INPUT PRICE DIFFERENTIAL IS ZERO**

<u>Year</u>	Original LEC Input Price Change	"Simplified" LEC Input Price Change	U.S. Input Price Change	Original LEC-US Input Price Growth	"Simplified" LEC-US Input Price Growth
1984	1.8%	1.8%	7.4%	-5.6%	-5.6%
1985	0.1%	0.1%	4.0%	-3.9%	-3.9%
1986	1.3%	1.3%	3.8%	-2.5%	-2.5%
1987	1.7%	1.7%	3.1%	-1.4%	-1.4%
1988	-3.2%	-3.2%	4.4%	-7.6%	-7.6%
1989	-3.7%	-3.0%	4.1%	-7.8%	-7.1%
1990	11.9%	3.7%	4.2%	7.7%	-0.5%
1991	1.3%	3.5%	2.9%	-1.6%	0.6%
1992	4.4%	5.4%	5.1%	-0.7%	0.3%
<b>Mean</b> 1984-92	1.73%	1.26%	4.33%	-2.23%	-2.76%
<b>Test of Hypothesis</b>	<b>H<sub>0</sub>: IPD equals Zero</b> <b>H<sub>a</sub>: IPD different then Zero</b>				
Standard Deviation				0.0485	0.0318
t-Statistic				-1.30	<b>-2.45</b>
Critical Values (7 df)					
(95%)				2.365	2.365
(90%)				1.895	1.895
Conclusion				Accept H <sub>0</sub> (as in Christensen)	<b>REJECT H<sub>0</sub></b>

**SOURCES:**

Christensen February 1995 Affidavit and ETI calculations based on USTA TFP Review Plan.

**TABLE A2**

**REGRESSION ANALYSIS OF TELEPHONE INPUT PRICE GROWTH  
DEMONSTRATES THE SIGNIFICANCE OF DIVESTITURE  
1949-1992**

Year	Original LEC Input Price Change	"Simplified" LEC Input Price Change	U.S. Input Price Change	Divestiture Binary Dummy	Moody's Pub Util Bonds	1990-2 Dummy
A	B	B2	C	D	E	F
1949	3.2%	3.2%	-1.0%	0	2.66%	0
1950	5.1%	5.1%	6.3%	0	2.62%	0
1951	8.8%	8.8%	7.9%	0	2.86%	0
1952	8.6%	8.6%	1.2%	0	2.98%	0
1953	2.4%	2.4%	3.7%	0	3.20%	0
1954	1.9%	1.9%	0.6%	0	2.90%	0
1955	5.4%	5.4%	6.6%	0	3.06%	0
1956	1.7%	1.7%	0.7%	0	3.38%	0
1957	-1.1%	-1.1%	3.7%	0	3.89%	0
1958	3.3%	3.3%	0.5%	0	3.79%	0
1959	5.4%	5.4%	7.0%	0	4.38%	0
1960	4.2%	4.2%	-0.6%	0	4.41%	0
1961	3.9%	3.9%	3.6%	0	4.35%	0
1962	2.2%	2.2%	4.4%	0	4.33%	0
1963	1.0%	1.0%	3.8%	0	4.28%	0
1964	6.0%	6.0%	4.5%	0	4.40%	0
1965	0.5%	0.5%	5.7%	0	4.49%	0
1966	1.1%	1.1%	4.6%	0	5.13%	0
1967	1.9%	1.9%	2.0%	0	5.51%	0
1968	4.2%	4.2%	4.4%	0	6.18%	0
1969	2.1%	2.1%	3.7%	0	7.03%	0
1970	3.8%	3.8%	3.3%	0	8.04%	0
1971	4.2%	4.2%	6.8%	0	7.39%	0
1972	8.0%	8.0%	7.2%	0	7.21%	0
1973	0.6%	0.6%	6.3%	0	7.44%	0
1974	5.9%	5.9%	4.2%	0	8.57%	0
1975	14.2%	14.2%	9.4%	0	8.83%	0
1976	10.7%	10.7%	9.1%	0	8.43%	0
1977	6.1%	6.1%	8.6%	0	8.02%	0
1978	7.6%	7.6%	7.8%	0	8.73%	0
1979	7.2%	7.2%	8.2%	0	9.63%	0
1980	14.6%	14.6%	6.6%	0	11.94%	0
1981	11.6%	11.6%	9.9%	0	14.17%	0
1982	12.1%	12.1%	3.7%	0	13.79%	0
1983	12.8%	12.8%	5.6%	0	12.04%	0
1984	1.8%	1.8%	7.4%	1	12.71%	0
1985	0.1%	0.1%	4.0%	1	11.37%	0
1986	1.3%	1.3%	3.8%	1	9.02%	0
1987	1.7%	1.7%	3.1%	1	9.38%	0
1988	-3.2%	-3.2%	4.4%	1	9.71%	0
1989	-3.7%	-3.0%	4.1%	1	9.26%	0
1990	11.9%	3.7%	4.2%	1	9.32%	1
1991	1.3%	3.5%	2.9%	1	8.77%	1
1992	4.4%	5.4%	5.1%	1	8.14%	1
1993	0.9%	5.1%	2.5%	1	7.18%	1

  

ORIGINAL DATA				
Permanent Shift Hypothesis (Bush-Uretsky)				
Constant				-0.0027
Std Err of Y Est				0.0347
R Squared				0.4322
No. of Observations				44
Degrees of Freedom				40
	US IPr	Divestiture	Moody	
X Coefficient(s)	0.3402	-0.0579	0.6489	
Std Err of Coef.	0.2338	0.0152	0.2093	
t-Statistic	1.4553	-3.8142	3.1007	
F-statistic	10.1512			
Temporary Shift Hypothesis (NERA)				
Constant				-0.0061
Std Err of Y Est				0.0309
R Squared				0.5600
No. of Observations				44
Degrees of Freedom				39
	US IPr	Divestiture	Moody	1990-1992
X Coefficient(s)	0.3209	-0.0851	0.7174	0.0740
Std Err of Coef.	0.2085	0.0158	0.1877	0.0220
t-Statistic	1.5392	-5.3981	3.8225	3.3658
F-statistic	12.4114			

  

SUBSTITUTING NEW INPUT PRICE CHANGE DATA FOR 1989-1992				
Permanent Shift Hypothesis (Bush-Uretsky)				
Constant				-0.00247
Std Err of Y Est				0.03093
R Squared				0.505528
No. of Observations				44
Degrees of Freedom				40
	US IPr	Divestiture	Moody	
X Coefficient(s)	0.334649	-0.06276	0.649835	
Std Err of Coef.	0.208565	0.013553	0.18672	
t-Statistic	1.6045	-4.8305	3.4803	
F-statistic	13.6314			
Temporary Shift Hypothesis (NERA)				
Constant				-0.00501
Std Err of Y Est				0.028695
R Squared				0.585035
No. of Observations				44
Degrees of Freedom				39
	US IPr	Divestiture	Moody	1990-1992
X Coefficient(s)	0.32008	-0.06323	0.701492	0.055824338
Std Err of Coef.	0.19357	0.014635	0.174258	0.020421741
t-Statistic	1.6536	-5.6870	4.0256	2.7336
F-statistic	13.7460			

SOURCE:  
Christensen February 1995 Affidavit; ETI calculations based on USTA TFP Review Plan and NERA Report.

**TABLE A3**

**REGRESSION ANALYSIS OF TELEPHONE INPUT PRICE GROWTH  
DEMONSTRATES THE SIGNIFICANCE OF DIVESTITURE  
1949-1993**

Year	Original	"Simplified"	U.S. Input Price Change	Divestiture Binary Dummy	Moody's Pub Util Bonds	1990-2 Dummy
	LEC Input Price Change	LEC Input Price Change				
A	B	B2	C	D	E	F
1949	3.2%	3.2%	-1.0%	0	2.66%	0
1950	5.1%	5.1%	6.3%	0	2.62%	0
1951	8.8%	8.8%	7.9%	0	2.86%	0
1952	8.6%	8.6%	1.2%	0	2.96%	0
1953	2.4%	2.4%	3.7%	0	3.20%	0
1954	1.9%	1.9%	0.6%	0	2.90%	0
1955	5.4%	5.4%	6.6%	0	3.06%	0
1956	1.7%	1.7%	0.7%	0	3.36%	0
1957	-1.1%	-1.1%	3.7%	0	3.89%	0
1958	3.3%	3.3%	0.5%	0	3.79%	0
1959	5.4%	5.4%	7.0%	0	4.38%	0
1960	4.2%	4.2%	-0.6%	0	4.41%	0
1961	3.9%	3.9%	3.6%	0	4.35%	0
1962	2.2%	2.2%	4.4%	0	4.33%	0
1963	1.0%	1.0%	3.8%	0	4.26%	0
1964	6.0%	6.0%	4.5%	0	4.40%	0
1965	0.5%	0.5%	5.7%	0	4.49%	0
1966	1.1%	1.1%	4.6%	0	5.13%	0
1967	1.9%	1.9%	2.0%	0	5.51%	0
1968	4.2%	4.2%	4.4%	0	6.18%	0
1969	2.1%	2.1%	3.7%	0	7.03%	0
1970	3.8%	3.8%	3.3%	0	8.04%	0
1971	4.2%	4.2%	6.8%	0	7.39%	0
1972	8.0%	8.0%	7.2%	0	7.21%	0
1973	0.6%	0.6%	6.3%	0	7.44%	0
1974	5.9%	5.9%	4.2%	0	8.57%	0
1975	14.2%	14.2%	9.4%	0	8.83%	0
1976	10.7%	10.7%	9.1%	0	8.43%	0
1977	6.1%	6.1%	8.6%	0	8.02%	0
1978	7.6%	7.6%	7.8%	0	8.73%	0
1979	7.2%	7.2%	8.2%	0	9.63%	0
1980	14.6%	14.6%	6.6%	0	11.94%	0
1981	11.6%	11.6%	9.9%	0	14.17%	0
1982	12.1%	12.1%	3.7%	0	13.79%	0
1983	12.8%	12.8%	5.6%	0	12.04%	0
1984	1.8%	1.8%	7.4%	1	12.71%	0
1985	0.1%	0.1%	4.0%	1	11.37%	0
1986	1.3%	1.3%	3.8%	1	9.02%	0
1987	1.7%	1.7%	3.1%	1	9.38%	0
1988	-3.2%	-3.2%	4.4%	1	9.71%	0
1989	-3.7%	-3.0%	4.1%	1	9.26%	0
1990	11.9%	3.7%	4.2%	1	9.32%	1
1991	1.3%	3.5%	2.9%	1	8.77%	1
1992	4.4%	5.4%	5.1%	1	8.14%	1
1993	0.9%	5.1%	2.5%	1	7.18%	1

SOURCE:  
Christensen February 1995 Affidavit; ETI calculations based on USTA TFP Review  
Plan and NERA Report.

**ORIGINAL DATA INCLUDING 1993**

**Permanent Shift Hypothesis (Bush-Uretsky)**

Constant	-0.00205
Std Err of Y Est	0.034309
R Squared	0.439392
No. of Observations	45
Degrees of Freedom	41
	US IPr Divestiture Moody
X Coefficient(s)	0.336373 -0.05629 0.641844
Std Err of Coef.	0.231152 0.01445 0.206356
t-Statistic	1.4552 -3.8955 3.1104
F-statistic	10.7116

**Temporary Shift Hypothesis (NERA)**

Constant	-0.00691
Std Err of Y Est	0.030857
R Squared	0.557601
No. of Observations	45
Degrees of Freedom	40
	US IPr Divestiture Moody 1990-1992
X Coefficient(s)	0.330482 -0.0853 0.72361 0.065868845
Std Err of Coef.	0.207899 0.015736 0.187269 0.020148276
t-Statistic	1.5896 -5.4205 3.8640 3.2693
F-statistic	12.6040

**SUBSTITUTING NEW INPUT PRICE CHANGE DATA FOR 1989-1993**

**Permanent Shift Hypothesis (Bush-Uretsky)**

Constant	0.0002
Std Err of Y Est	0.031853
R Squared	0.462615
No. of Observations	45
Degrees of Freedom	41
	US IPr Divestiture Moody
X Coefficient(s)	0.318385 -0.05578 0.61988
Std Err of Coef.	0.214808 0.013416 0.191587
t-Statistic	1.4836 -4.1573 3.2355
F-statistic	11.7651

**Temporary Shift Hypothesis (NERA)**

Constant	-0.00437
Std Err of Y Est	0.028543
R Squared	0.579045
No. of Observations	45
Degrees of Freedom	40
	US IPr Divestiture Moody 1990-1992
X Coefficient(s)	0.312841 -0.08307 0.69683 0.061990949
Std Err of Coef.	0.192309 0.014556 0.173225 0.018637322
t-Statistic	1.6268 -5.7072 4.0227 3.3262
F-statistic	13.7555

**TABLE A4**

**REGRESSION ANALYSIS OF TELEPHONE INPUT PRICE  
DIFFERENTIAL DEMONSTRATES THE SIGNIFICANCE OF DIVESTITURE  
1949-1992**

Year	Original LEC-US Input Price Growth	"Simplified" LEC-US Input Price Growth	Divestiture Binary Dummy	Moody's Pub Util Bonds	1990-2 Dummy
A	B	B2	C	D	E
1949	4.2%	4.2%	0	2.66%	0
1950	-1.2%	-1.2%	0	2.62%	0
1951	0.9%	0.9%	0	2.86%	0
1952	7.4%	7.4%	0	2.96%	0
1953	-1.3%	-1.3%	0	3.20%	0
1954	1.3%	1.3%	0	2.90%	0
1955	-1.2%	-1.2%	0	3.06%	0
1956	1.0%	1.0%	0	3.36%	0
1957	-4.8%	-4.8%	0	3.89%	0
1958	2.8%	2.8%	0	3.79%	0
1959	-1.6%	-1.6%	0	4.38%	0
1960	4.8%	4.8%	0	4.41%	0
1961	0.3%	0.3%	0	4.35%	0
1962	-2.2%	-2.2%	0	4.33%	0
1963	-2.8%	-2.8%	0	4.26%	0
1964	1.5%	1.5%	0	4.40%	0
1965	-5.2%	-5.2%	0	4.49%	0
1966	-3.5%	-3.5%	0	5.13%	0
1967	-0.1%	-0.1%	0	5.51%	0
1968	-0.2%	-0.2%	0	6.18%	0
1969	-1.6%	-1.6%	0	7.03%	0
1970	0.5%	0.5%	0	8.04%	0
1971	-2.6%	-2.6%	0	7.39%	0
1972	0.8%	0.8%	0	7.21%	0
1973	-5.7%	-5.7%	0	7.44%	0
1974	1.7%	1.7%	0	8.57%	0
1975	4.8%	4.8%	0	8.83%	0
1976	1.6%	1.6%	0	8.43%	0
1977	-2.5%	-2.5%	0	8.02%	0
1978	-0.2%	-0.2%	0	8.73%	0
1979	-1.0%	-1.0%	0	9.63%	0
1980	8.0%	8.0%	0	11.94%	0
1981	1.7%	1.7%	0	14.17%	0
1982	8.4%	8.4%	0	13.79%	0
1983	7.2%	7.2%	0	12.04%	0
1984	-5.6%	-5.6%	1	12.71%	0
1985	-3.9%	-3.9%	1	11.37%	0
1986	-2.5%	-2.5%	1	9.02%	0
1987	-1.4%	-1.4%	1	9.38%	0
1988	-7.6%	-7.6%	1	9.71%	0
1989	-7.8%	-7.1%	1	9.26%	0
1990	7.7%	-0.5%	1	9.32%	1
1991	-1.6%	0.6%	1	8.77%	1
1992	-0.7%	0.3%	1	8.14%	1
1993	-3.4%	2.6%	1	7.18%	1

  

ORIGINAL DATA			
<b>Permanent Shift Hypothesis (Bush-Uretsky)</b>			
Constant			-0.0157
Std Err of Y Est			0.0375
R Squared			0.1702
No. of Observations			44
Degrees of Freedom			41
	Divestiture	Moody	
X Coefficient(s)	-0.0440	0.3464	
Std Err of Coef.	0.0155	0.1944	
t-Statistic	<b>-2.8330</b>	1.7818	
F-statistic	4.2036		
<b>Temporary Shift Hypothesis (NERA)</b>			
Constant			-0.0194
Std Err of Y Est			0.0344
R Squared			0.3179
No. of Observations			44
Degrees of Freedom			40
	Divestiture	Moody	1990-1992
X Coefficient(s)	-0.0701	0.4045	0.0721
Std Err of Coef.	0.0168	0.1796	0.0245
t-Statistic	<b>-4.1737</b>	2.2527	2.9429
F-statistic	6.2128		
<b>SUBSTITUTING NEW INPUT PRICE GROWTH DATA FOR 1989-1992</b>			
<b>Permanent Shift Hypothesis (Bush-Uretsky)</b>			
Constant			-0.01561
Std Err of Y Est			0.034216
R Squared			0.227337
No. of Observations			44
Degrees of Freedom			41
	Divestiture	Moody	
X Coefficient(s)	-0.04873	0.344778	
Std Err of Coef.	0.014182	0.177418	
t-Statistic	<b>-3.4359</b>	1.9433	
F-statistic	6.0316		
<b>Temporary Shift Hypothesis (NERA)</b>			
Constant			-0.01834
Std Err of Y Est			0.032508
R Squared			0.319583
No. of Observations			44
Degrees of Freedom			40
	Divestiture	Moody	1990-1992
X Coefficient(s)	-0.06818	0.388164	0.05384932
Std Err of Coef.	0.015854	0.169589	0.02312687
t-Statistic	<b>-4.3006</b>	2.2889	2.3284
F-statistic	6.2619		

SOURCE:  
Christensen February 1995 Affidavit; ETI calculations based on USTA TFP  
Review Plan and NERA Report.

**TABLE A5**

**REGRESSION ANALYSIS OF TELEPHONE INPUT PRICE DIFFERENTIAL DEMONSTRATES THE SIGNIFICANCE OF DIVESTITURE 1949-1993**

Year	Original LEC-US Input Price Growth	"Simplified" LEC-US Input Price Growth	Divestiture Binary Dummy	Moody's Pub Util Bonds	1990-2 Dummy
A	B	B2	C	D	E
1949	4.2%	4.2%	0	2.86%	0
1950	-1.2%	-1.2%	0	2.62%	0
1951	0.9%	0.9%	0	2.86%	0
1952	7.4%	7.4%	0	2.96%	0
1953	-1.3%	-1.3%	0	3.20%	0
1954	1.3%	1.3%	0	2.90%	0
1955	-1.2%	-1.2%	0	3.06%	0
1956	1.0%	1.0%	0	3.36%	0
1957	-4.8%	-4.8%	0	3.89%	0
1958	2.8%	2.8%	0	3.79%	0
1959	-1.6%	-1.6%	0	4.38%	0
1960	4.8%	4.8%	0	4.41%	0
1961	0.3%	0.3%	0	4.35%	0
1962	-2.2%	-2.2%	0	4.33%	0
1963	-2.8%	-2.8%	0	4.26%	0
1964	1.5%	1.5%	0	4.40%	0
1965	-5.2%	-5.2%	0	4.49%	0
1966	-3.5%	-3.5%	0	5.13%	0
1967	-0.1%	-0.1%	0	5.51%	0
1968	-0.2%	-0.2%	0	6.18%	0
1969	-1.6%	-1.6%	0	7.03%	0
1970	0.5%	0.5%	0	8.04%	0
1971	-2.6%	-2.6%	0	7.39%	0
1972	0.8%	0.8%	0	7.21%	0
1973	-5.7%	-5.7%	0	7.44%	0
1974	1.7%	1.7%	0	8.57%	0
1975	4.8%	4.8%	0	8.83%	0
1976	1.6%	1.6%	0	8.43%	0
1977	-2.5%	-2.5%	0	8.02%	0
1978	-0.2%	-0.2%	0	8.73%	0
1979	-1.0%	-1.0%	0	9.63%	0
1980	8.0%	8.0%	0	11.94%	0
1981	1.7%	1.7%	0	14.17%	0
1982	8.4%	8.4%	0	13.79%	0
1983	7.2%	7.2%	0	12.04%	0
1984	-5.6%	-5.6%	1	12.71%	0
1985	-3.9%	-3.9%	1	11.37%	0
1986	-2.5%	-2.5%	1	9.02%	0
1987	-1.4%	-1.4%	1	9.38%	0
1988	-7.6%	-7.6%	1	9.71%	0
1989	-7.8%	-7.1%	1	9.26%	0
1990	7.7%	-0.5%	1	9.32%	1
1991	-1.6%	0.6%	1	8.77%	1
1992	-0.7%	0.3%	1	8.14%	1
1993	-3.4%	2.6%	1	7.18%	1

  

ORIGINAL DATA INCLUDING 1993			
Permanent Shift Hypothesis (Bush-Uretsky)			
Constant			-0.01568
Std Err of Y Est			0.037048
R Squared			0
No. of Observations			45
Degrees of Freedom			42
	Divestiture	Moody	
X Coefficient(s)	-0.0439	0.3459	
Std Err of Coef.	0.0146	0.1906	
t-Statistic	-3.0050	1.8148	
F-statistic	4.7055		
Temporary Shift Hypothesis (NERA)			
Constant			-0.02028
Std Err of Y Est			0.034551
R Squared			0.306397
No. of Observations			45
Degrees of Freedom			41
	Divestiture	Moody	1990-1992
X Coefficient(s)	-0.07063	0.418992	0.06091546
Std Err of Coef.	0.016842	0.179797	0.02255983
t-Statistic	-4.1938	2.3304	2.7002
F-statistic	6.0372		
SUBSTITUTING NEW INPUT PRICE GROWTH DATA FOR 1989-1993			
Permanent Shift Hypothesis (Bush-Uretsky)			
Constant			-0.0131
Std Err of Y Est			0.035123
R Squared			0.175779
No. of Observations			45
Degrees of Freedom			42
	Divestiture	Moody	
X Coefficient(s)	-0.04089	0.304749	
Std Err of Coef.	0.013858	0.18069	
t-Statistic	-2.9506	1.6866	
F-statistic	4.4786		
Temporary Shift Hypothesis (NERA)			
Constant			-0.01773
Std Err of Y Est			0.032377
R Squared			0.316288
No. of Observations			45
Degrees of Freedom			41
	Divestiture	Moody	1990-1992
X Coefficient(s)	-0.06779	0.378384	0.06136497
Std Err of Coef.	0.015783	0.168485	0.0211404
t-Statistic	-4.2954	2.2458	2.9027
F-statistic	6.3223		

SOURCE:  
Christensen February 1995 Affidavit; ETI calculations based on USTA TFP Review Plan and NERA Report.

**TABLE A6**

**REGRESSION OF INPUT PRICE GROWTH  
EXCLUDING 1990 OUTLIER  
DEMONSTRATES SIGNIFICANCE OF DIVESTITURE**

Year	Original				Moody's Pub Util Bonds
	LEC Input Price Change	U.S. Input Price Change	Divestiture Binary Dummy		
A	B	C	D	E	
1949	3.2%	-1.0%	0	2.66%	
1950	5.1%	6.3%	0	2.62%	
1951	8.8%	7.9%	0	2.86%	
1952	8.6%	1.2%	0	2.96%	
1953	2.4%	3.7%	0	3.20%	
1954	1.9%	0.6%	0	2.90%	
1955	5.4%	6.6%	0	3.06%	
1956	1.7%	0.7%	0	3.36%	
1957	-1.1%	3.7%	0	3.89%	
1958	3.3%	0.5%	0	3.79%	
1959	5.4%	7.0%	0	4.38%	
1960	4.2%	-0.6%	0	4.41%	
1961	3.9%	3.6%	0	4.35%	
1962	2.2%	4.4%	0	4.33%	
1963	1.0%	3.8%	0	4.26%	
1964	6.0%	4.5%	0	4.40%	
1965	0.5%	5.7%	0	4.49%	
1966	1.1%	4.6%	0	5.13%	
1967	1.9%	2.0%	0	5.51%	
1968	4.2%	4.4%	0	6.18%	
1969	2.1%	3.7%	0	7.03%	
1970	3.8%	3.3%	0	8.04%	
1971	4.2%	6.8%	0	7.39%	
1972	8.0%	7.2%	0	7.21%	
1973	0.6%	6.3%	0	7.44%	
1974	5.9%	4.2%	0	8.57%	
1975	14.2%	9.4%	0	8.83%	
1976	10.7%	9.1%	0	8.43%	
1977	6.1%	8.6%	0	8.02%	
1978	7.6%	7.8%	0	8.73%	
1979	7.2%	8.2%	0	9.63%	
1980	14.6%	6.6%	0	11.94%	
1981	11.6%	9.9%	0	14.17%	
1982	12.1%	3.7%	0	13.79%	
1983	12.8%	5.6%	0	12.04%	
1984	1.8%	7.4%	1	12.71%	
1985	0.1%	4.0%	1	11.37%	
1986	1.3%	3.8%	1	9.02%	
1987	1.7%	3.1%	1	9.38%	
1988	-3.2%	4.4%	1	9.71%	
1989	-3.7%	4.1%	1	9.26%	
1991	1.3%	2.9%	1	8.77%	
1992	4.4%	5.1%	1	8.14%	

**Permanent Hypothesis (Bush/Uretsky)**

Constant			-0.0027
Std Err of Y Est			0.0347
R Squared			0.4322
No. of Observations			44
Degrees of Freedom			40
X Coefficient(s)	US IPr	Divestiture	Moody
Std Err of Coef.	0.3402	-0.0579	0.6489
	0.2338	0.0152	0.2093
t-Statistic	1.4553	-3.8142	3.1007
F-statistic	10.1512		

**Permanent Hypothesis (Bush/Uretsky) without 1990 Outlier**

Constant			-0.00346
Std Err of Y Est			0.030254
R Squared			0.550244
No. of Observations			43
Degrees of Freedom			39
X Coefficient(s)	US IPr	Divestiture	Moody
Std Err of Coef.	0.336987	-0.07159	0.663815
	0.204014	0.013767	0.182689
t-Statistic	1.6518	-5.2000	3.6336
F-statistic	15.9046		

SOURCES:  
Christensen February 1995 Affidavit and NERA Report

**TABLE A7**

**REGRESSION OF INPUT PRICE GROWTH  
EXCLUDING 1990 OUTLIER  
SHOWS SIGNIFICANT DIVESTITURE VARIABLE  
AND INSIGNIFICANT 1990-92 DUMMY**

Year	Original LEC Input Price Change	U.S. Input Price Change	Divestiture Binary Dummy	Moody's Pub Util Bonds	1990-2 Dummy
A	B	C	D	E	F
1949	3.2%	-1.0%	0	2.66%	0
1950	5.1%	6.3%	0	2.62%	0
1951	8.8%	7.9%	0	2.86%	0
1952	8.6%	1.2%	0	2.96%	0
1953	2.4%	3.7%	0	3.20%	0
1954	1.9%	0.6%	0	2.90%	0
1955	5.4%	6.6%	0	3.06%	0
1956	1.7%	0.7%	0	3.36%	0
1957	-1.1%	3.7%	0	3.89%	0
1958	3.3%	0.5%	0	3.79%	0
1959	5.4%	7.0%	0	4.38%	0
1960	4.2%	-0.6%	0	4.41%	0
1961	3.9%	3.6%	0	4.35%	0
1962	2.2%	4.4%	0	4.33%	0
1963	1.0%	3.8%	0	4.26%	0
1964	6.0%	4.5%	0	4.40%	0
1965	0.5%	5.7%	0	4.49%	0
1966	1.1%	4.6%	0	5.13%	0
1967	1.9%	2.0%	0	5.51%	0
1968	4.2%	4.4%	0	6.18%	0
1969	2.1%	3.7%	0	7.03%	0
1970	3.8%	3.3%	0	8.04%	0
1971	4.2%	6.8%	0	7.39%	0
1972	8.0%	7.2%	0	7.21%	0
1973	0.6%	6.3%	0	7.44%	0
1974	5.9%	4.2%	0	8.57%	0
1975	14.2%	9.4%	0	8.83%	0
1976	10.7%	9.1%	0	8.43%	0
1977	6.1%	8.6%	0	8.02%	0
1978	7.6%	7.8%	0	8.73%	0
1979	7.2%	8.2%	0	9.63%	0
1980	14.6%	6.6%	0	11.94%	0
1981	11.6%	9.9%	0	14.17%	0
1982	12.1%	3.7%	0	13.79%	0
1983	12.8%	5.6%	0	12.04%	0
1984	1.8%	7.4%	1	12.71%	0
1985	0.1%	4.0%	1	11.37%	0
1986	1.3%	3.8%	1	9.02%	0
1987	1.7%	3.1%	1	9.36%	0
1988	-3.2%	4.4%	1	9.71%	0
1989	-3.7%	4.1%	1	9.26%	0
1991	1.3%	2.9%	1	8.77%	1
1992	4.4%	5.1%	1	8.14%	1
1993	0.9%	2.5%	1	7.18%	1

**Temporary Shift Hypothesis (NERA) without 1990 Outlier**

<b>1949-92</b>				
Constant				-0.00533
Std Err of Y Est				0.029282
R Squared				0.589506
No. of Observations				43
Degrees of Freedom				38
	US IPr	Divestiture	Moody	1990-1992
X Coefficient(s)	0.325948	-0.08446	0.701965	0.045896
Std Err of Coef.	0.197539	0.014937	0.177943	0.024074
t-Statistic	1.6500	<b>-5.6544</b>	3.9449	<b>1.9065</b>
F-statistic	13.6429			
<b>1949-93</b>				
Constant				-0.00544
Std Err of Y Est				0.028913
R Squared				0.595806
No. of Observations				44
Degrees of Freedom				39
	US IPr	Divestiture	Moody	1990-1992
X Coefficient(s)	0.327506	-0.08448	0.702551	0.044037
Std Err of Coef.	0.194808	0.014748	0.175666	0.020715
t-Statistic	1.6812	<b>-5.7278</b>	3.9994	<b>2.1259</b>
F-statistic	14.3721			

SOURCES:  
NERA Report

**TABLE A8**

**REGRESSION OF INPUT PRICE DIFFERENTIAL  
EXCLUDING 1990 OUTLIER  
SHOWS SIGNIFICANT DIVESTITURE VARIABLE  
AND INSIGNIFICANT 1990-92 DUMMY**

Year	LEC-US Input Price Growth	Divestiture Binary Dummy	Moody's Pub Util Bonds	1990-2 Dummy
A	B	C	D	E
1949	4.2%	0	2.66%	0
1950	-1.2%	0	2.62%	0
1951	0.9%	0	2.86%	0
1952	7.4%	0	2.96%	0
1953	-1.3%	0	3.20%	0
1954	1.3%	0	2.90%	0
1955	-1.2%	0	3.06%	0
1956	1.0%	0	3.36%	0
1957	-4.8%	0	3.89%	0
1958	2.8%	0	3.79%	0
1959	-1.6%	0	4.38%	0
1960	4.8%	0	4.41%	0
1961	0.3%	0	4.35%	0
1962	-2.2%	0	4.33%	0
1963	-2.8%	0	4.26%	0
1964	1.5%	0	4.40%	0
1965	-5.2%	0	4.49%	0
1966	-3.5%	0	5.13%	0
1967	-0.1%	0	5.51%	0
1968	-0.2%	0	6.18%	0
1969	-1.6%	0	7.03%	0
1970	0.5%	0	8.04%	0
1971	-2.6%	0	7.39%	0
1972	0.8%	0	7.21%	0
1973	-5.7%	0	7.44%	0
1974	1.7%	0	8.57%	0
1975	4.8%	0	8.83%	0
1976	1.6%	0	8.43%	0
1977	-2.5%	0	8.02%	0
1978	-0.2%	0	8.73%	0
1979	-1.0%	0	9.63%	0
1980	8.0%	0	11.94%	0
1981	1.7%	0	14.17%	0
1982	8.4%	0	13.79%	0
1983	7.2%	0	12.04%	0
1984	-5.6%	1	12.71%	0
1985	-3.9%	1	11.37%	0
1986	-2.5%	1	9.02%	0
1987	-1.4%	1	9.38%	0
1988	-7.6%	1	9.71%	0
1989	-7.8%	1	9.26%	0
1991	-1.6%	1	8.77%	1
1992	-0.7%	1	8.14%	1
1993	-3.4%	1	7.18%	1

**Temporary Shift Hypothesis (NERA) without 1990 Outlier**

<b>1949-92</b>			
Constant			-0.01853
Std Err of Y Est			0.033036
R Squared			0.327817
No. of Observations			43
Degrees of Freedom			39
X Coefficient(s)	Divestiture	Moody	1990-1992
Std Err of Coef.	-0.06953	0.391131	0.043488
t-Statistic	-4.3152	2.2679	1.6018
F-statistic	6.3400		
<b>1949-93</b>			
Constant			-0.01878
Std Err of Y Est			0.032699
R Squared			0.334911
No. of Observations			44
Degrees of Freedom			40
X Coefficient(s)	Divestiture	Moody	1990-1992
Std Err of Coef.	-0.06969	0.395176	0.03774
t-Statistic	-4.3709	2.3185	1.6110
F-statistic	6.7141		

SOURCES:  
NERA Report

**TABLE A9**

**LINCOLN TELEPHONE  
REGRESSION OF INPUT PRICE CHANGE EXCLUDING 1990 OUTLIER  
SHOWS SIGNIFICANCE OF DIVESTITURE**

Year	LEC Input Price Change	U.S. Input Price Change	Lincoln Divestiture Binary Dummy	Moody's Pub Util Bonds	1990-2 Dummy
A	B	C	E	D	E
1949	3.2%	-1.0%	0	2.66%	0
1950	5.1%	6.3%	0	2.62%	0
1951	8.8%	7.9%	0	2.86%	0
1952	8.6%	1.2%	0	2.96%	0
1953	2.4%	3.7%	0	3.20%	0
1954	1.9%	0.6%	0	2.90%	0
1955	5.4%	6.6%	0	3.06%	0
1956	1.7%	0.7%	0	3.36%	0
1957	-1.1%	3.7%	0	3.89%	0
1958	3.3%	0.5%	0	3.79%	0
1959	5.4%	7.0%	0	4.38%	0
1960	4.2%	-0.6%	0	4.41%	0
1961	3.9%	3.6%	0	4.35%	0
1962	2.2%	4.4%	0	4.33%	0
1963	1.0%	3.8%	0	4.26%	0
1964	6.0%	4.5%	0	4.40%	0
1965	0.5%	5.7%	0	4.49%	0
1966	1.1%	4.6%	0	5.13%	0
1967	1.9%	2.0%	0	5.51%	0
1968	4.2%	4.4%	0	6.18%	0
1969	2.1%	3.7%	0	7.03%	0
1970	3.8%	3.3%	0	8.04%	0
1971	4.2%	6.8%	0	7.39%	0
1972	8.0%	7.2%	0	7.21%	0
1973	0.6%	6.3%	0	7.44%	0
1974	5.9%	4.2%	0	8.57%	0
1975	14.2%	9.4%	0	8.83%	0
1976	10.7%	9.1%	0	8.43%	0
1977	6.1%	8.6%	0	8.02%	0
1978	7.6%	7.8%	0	8.73%	0
1979	7.2%	8.2%	0	9.63%	0
1980	14.6%	6.6%	0	11.94%	0
1981	11.6%	9.9%	0	14.17%	0
1982	12.1%	3.7%	0	13.79%	0
1983	12.8%	5.6%	0	12.04%	0
1984	1.8%	7.4%	1	12.71%	0
1985	0.1%	4.0%	1	11.37%	0
1986	1.3%	3.8%	1	9.02%	0
1987	1.7%	3.1%	1	9.38%	0
1988	-3.2%	4.4%	1	9.71%	0
1989	-3.7%	4.1%	1	9.26%	0
1990	11.9%	4.2%	0	9.32%	1
1991	1.3%	2.9%	0	8.77%	1
1992	4.4%	5.1%	0	8.14%	1

**Lincoln Telephone Temporary Shift Hypothesis**

**With Lincoln divestiture dummy (1984-89)**

Constant	-0.00616		
Std Err of Y Est	0.030644		
R Squared	0.556392		
No. of Observations	44		
Degrees of Freedom	40		
X Coefficient(s)	US IPr	Divestiture	Moody
Std Err of Coef.	0.345386	-0.08301	0.687441
t-Statistic	1.7075	-5.4601	3.8489
F-statistic	16.7233		

**Same as above plus new dummy for 1990-92.**

Constant	-0.00605			
Std Err of Y Est	0.030907			
R Squared	0.560046			
No. of Observations	44			
Degrees of Freedom	39			
X Coefficient(s)	US IPr	Divestiture	Moody	1990-1992
Std Err of Coef.	0.3209	-0.08509	0.717439	-0.01106
t-Statistic	1.5392	-5.3981	3.8225	-0.5691
F-statistic	12.4114			

**Lincoln Telephone Temporary Shift Hypothesis without 1990 outlier**

**Same as 1. above, excluding 1990 outlier**

Constant	-0.00588		
Std Err of Y Est	0.030064		
R Squared	0.555876		
No. of Observations	43		
Degrees of Freedom	39		
X Coefficient(s)	US IPr	Divestiture	Moody
Std Err of Coef.	0.384484	-0.07957	0.63406
t-Statistic	1.9229	-5.2800	3.5546
F-statistic	16.2711		

**Same as 2. above, excluding 1990 outlier**

<b>Regression Output:</b>					
Constant	-0.00533				
Std Err of Y Est	0.029282				
R Squared	0.589506				
No. of Observations	43				
Degrees of Freedom	38				
X Coefficient(s)	US IPr	Divestiture	Moody	1990-1992	
Std Err of Coef.	0.325948	-0.08446	0.701965	-0.03856	
t-Statistic	1.6500	-5.6544	3.9449	-1.7644	
F-statistic	13.6429				

SOURCES:  
Comments Lincoln Telephone

## TABLE A10

### WHEN 1990 OUTLIER IS EXCLUDED, THE COX TEST REJECTS THE HYPOTHESIS THAT "H2 IS CORRECT" (Data to 1992)

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**HYPOTHESIS: "H2 IS CORRECT"**

Method of estimation = Ordinary Least Squares  
Dependent variable: RES90  
Current sample: 49 to 92  
Number of observations: 44

Mean of dependent variable =  $-.162611E-07$   
Std. dev. of dependent var. = 1.77870  
Sum of squared residuals = 69.9362  
Variance of residuals = 1.74840  
Std. error of regression = 1.32227  
R-squared = .485922  
Adjusted R-squared = .447366  
Durbin-Watson statistic = .372441  
F-statistic (zero slopes) = 12.6030  
Schwarz Bayes. Info. Crit. = .807411  
Log of likelihood function = -72.6280

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-.328552	.518144	-.634095
CPE	-.138078	.087278	-1.58205
D90	-4.03357	.655981	-6.14891
MOODY	.219436	.077067	2.84734

Q21 = -0.57694      Critical Value (95%): -1.96  
NORMAL Test Statistic: -0.5769407, Two-tailed area: .56398

**CONCLUSION: "H2 IS CORRECT" IS ACCEPTED**

**HYPOTHESIS: "H2 IS CORRECT"; EXCLUDING 1990 OUTLIER**

Method of estimation = Ordinary Least Squares  
Dependent variable: RES90  
Current sample: 49 to 91  
Number of observations: 43

Mean of dependent variable =  $.349517E-08$   
Std. dev. of dependent var. = 1.49330  
Sum of squared residuals = 58.8462  
Variance of residuals = 1.50888  
Std. error of regression = 1.22836  
R-squared = .371689  
Adjusted R-squared = .323357  
Durbin-Watson statistic = .488638  
F-statistic (zero slopes) = 7.69039  
Schwarz Bayes. Info. Crit. = .663605  
Log of likelihood function = -67.7595

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-.240867	.481398	-.499950
CPE	-.106022	.081692	-1.29783
D90	-2.95738	.615705	-4.80324
MOODY	.166962	.072881	2.29090

Q21 = -2.25090      Critical Value (95%): -1.96  
NORMAL Test Statistic: **-2.250898**, Two-tailed area: .02439

**CONCLUSION: "H2 IS CORRECT" IS REJECTED**

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## TABLE A11

### WHEN 1990 OUTLIER IS EXCLUDED, THE COX TEST REJECTS THE HYPOTHESIS THAT "H2 IS CORRECT" (Data to 1993)

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**HYPOTHESIS: "H2 IS CORRECT"**

Method of estimation = Ordinary Least Squares

Dependent variable: RES90

Current sample: 49 to 93

Number of observations: 45

Mean of dependent variable =  $-.723327E-08$   
Std. dev. of dependent var. = 1.84337  
Sum of squared residuals = 64.2115  
Variance of residuals = 1.56613  
Std. error of regression = 1.25145  
R-squared = .570526  
Adjusted R-squared = .539101  
Durbin-Watson statistic = .351522  
F-statistic (zero slopes) = 18.1552  
Schwarz Bayes. Info. Crit. = .693890  
Log of likelihood function = -71.8514

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-.411900	.488271	-.843589
CPE	-.146753	.081450	-1.80176
D90	-4.55516	.617223	-7.38009
MOODY	.244251	.072489	3.36948

Q21 = -1.63224                      Critical Value (95%): -1.96  
NORMAL Test Statistic: -1.632236, Two-tailed area: .10263

**CONCLUSION: "H2 IS CORRECT" IS ACCEPTED****HYPOTHESIS: "H2 IS CORRECT"; EXCLUDING 1990 OUTLIER**

Method of estimation = Ordinary Least Squares

Dependent variable: RES90

Current sample: 49 to 92

Number of observations: 44

Mean of dependent variable =  $.102869E-07$   
Std. dev. of dependent var. = 1.62470  
Sum of squared residuals = 58.6723  
Variance of residuals = 1.46681  
Std. error of regression = 1.21112  
R-squared = .483089  
Adjusted R-squared = .444321  
Durbin-Watson statistic = .387562  
F-statistic (zero slopes) = 12.4609  
Schwarz Bayes. Info. Crit. = .631795  
Log of likelihood function = -68.7644

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-.334944	.472626	-.708688
CPE	-.124244	.079353	-1.56572
D90	-3.68743	.603098	-6.11415
MOODY	.204942	.071351	2.87232

Q21 = -3.76852                      Critical Value (95%): -1.96  
NORMAL Test Statistic: -3.768523, Two-tailed area: .00016

**CONCLUSION: "H2 IS CORRECT" IS REJECTED**

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