Table B-1. LEC Interstate Revenue ($) - 1985-1998

Year	End User Revenue	Interstate Switched Access Revenue	Special Access Revenue	Total Interstate Revenue
1985	1499413893	10906203190	1960688644	14366305727
1986	2400475814	10484265170	2574800716	15459541700
1987	3090639929	9611996187	2657677439	15360313555
1988	3604221000	9662529000	2539698000	15806448000
1989	4398692000	9092575000	2253922000	15745189000
1990	4679142000	8595750000	2209064000	15483956000
1991	4828177000	8514130000	2119037000	15461344000
1992	4963262000	8650880000	2153565000	15767707000
1993	5244094000	8999065000	2097997000	16341156000
1994	5589662000	9293783000	2217125000	17100570000
1995	5770285000	9332869000	2529667000	17632821000
1996	5930960000	9409639000	3070598000	18411197000
1997	6268026000	8763815000	3851028000	18882869000
1998	7928205000	7447289000	4894584000	20270078000

Source: Federal Communications Commission, *Statistics of Communication Common Carriers* [various years]

Table B-2. LEC Revenue ($) by Type of Service[1] - 1985-1998

Year	Local Service Revenue	Intrastate Toll and Intrastate Access Service Revenue	Interstate Service Revenue	Total Revenue
1985	26960554164	13047095682	14366305727	54373955573
1986	28626174049	13538946795	15459541700	57624662544
1987	29150842991	14166723124	15360313555	58677879670
1988	29226988000	14994975000	15806448000	60028411000
1989	29973157000	14868219000	15745189000	60586565000
1990	30699085000	15014729000	15483956000	61197770000
1991	32059008000	14522276000	15461344000	62042628000
1992	33359990000	14225181000	15767707000	63352878000
1993	34598957000	14496831000	16341156000	65436944000
1994	35758637000	14355983000	17100570000	67215190000
1995	37684860000	13123225000	17632821000	68440906000
1996	40523387000	12987476000	18411197000	71922060000
1997	42460592000	12308613000	18882869000	73652074000
1998	45643024000	12236469000	20270078000	78149571000

[1] This excludes miscellaneous services.

Source: Federal Communications Commission, *Statistics of Communication Common Carriers* [various years]

Table B-3. Interstate Output Index - 1985-1998

Year	End User Revenue Share	Interstate Switched Access Revenue Share	Special Access Revenue Share	Number of Access Lines	Number of Switched Access Minutes	Number of Special Access Lines	Laspeyres Output Index	Paasche Output Index	Fisher Ideal Output Index	Fisher Ideal Chained Output Index
1985	0.10437	0.75915	0.13647	92671959	156853820000	1230590	1	1	1	1
1986	0.15527	0.67817	0.16655	95333884	157302701000	1664101	1.05324	1.05225	1.05275	1.05275
1987	0.20120	0.62576	0.17302	98228585	173154171000	1764445	1.08309	1.07881	1.08095	1.13797
1988	0.22802	0.61130	0.16067	98270787	187663836000	2701817	1.14444	1.11496	1.12960	1.28546
1989	0.27936	0.57748	0.14314	101190050	210406134000	2448090	1.06576	1.05892	1.06233	1.36559
1990	0.30219	0.55513	0.14266	103857988	231960296000	3518005	1.12908	1.11449	1.12176	1.53188
1991	0.31227	0.55067	0.13705	107383807	246710182000	5151699	1.11181	1.09485	1.10330	1.69012
1992	0.31477	0.54864	0.13658	108938065	262187655000	6033139	1.06251	1.06025	1.06138	1.79387
1993	0.32091	0.55069	0.12838	112196681	278173161000	10153615	1.13614	1.10261	1.11925	2.00781
1994	0.32686	0.54347	0.12965	115264861	298342017323	13824365	1.09511	1.08680	1.09095	2.19042
1995	0.32724	0.52928	0.14346	119887506	334981582000	16107677	1.10126	1.09992	1.10059	2.41077
1996	0.32213	0.51108	0.16677	125333996	363445050000	20775150	1.10141	1.10070	1.10105	2.65440
1997	0.33194	0.46411	0.20394	131618657	387587696669	28051449	1.10851	1.10823	1.10837	2.94207
1998	0.39112	0.36740	0.24146	138481147	407903661000	34142101	1.08591	1.08785	1.08688	3.19768

Source: Federal Communications Commission, *Statistics of Communication Common Carriers* [various years] and Federal Communications Commission, *Monitoring Reports* [various years]

Table B-4. Total LEC Output Index - 1985-1998

Year	Revenue Share - Local	Revenue Share - Intrastate Toll	Revenue Share - Interstate	Local DEMs (000)	Intrastate DEMs (000)	Interstate Fisher Ideal Chained Output Index	Laspeyres Output Index	Paasche Output Index	Fisher Ideal Output Index	Fisher Ideal Chained Output Index	Growth Rate (%)
1985	0.4958	0.2400	0.2642	1380145900	164191177	1	1	1	1	1	
1986	0.4968	0.2350	0.2683	1396014000	173173536	1.05275	1.03276	1.03218	1.03247	1.03247	3.19590
1987	0.4968	0.2414	0.2618	1404776000	183597411	1.13797	1.03908	1.03778	1.03843	1.07215	3.77145
1988	0.4869	0.2498	0.2633	1469781200	191904837	1.28546	1.06784	1.06673	1.06728	1.14430	6.51202
1989	0.4947	0.2454	0.2599	1496826800	207298177	1.36559	1.04541	1.04429	1.04485	1.19562	4.38736
1990	0.5016	0.2453	0.2530	1514588700	217913904	1.53188	1.05008	1.04755	1.04881	1.25399	4.76646
1991	0.5167	0.2341	0.2492	1512946987	219713721	1.69012	1.02751	1.02531	1.02641	1.28711	2.60724
1992	0.5266	0.2245	0.2489	1558762543	224278538	1.79387	1.03580	1.03567	1.03573	1.33311	3.51158
1993	0.5287	0.2215	0.2497	1640600472	227540869	2.00781	1.06059	1.05960	1.06010	1.41324	5.83650
1994	0.5320	0.2136	0.2544	1719329169	235362364	2.19042	1.05559	1.05559	1.05559	1.49181	5.41052
1995	0.5506	0.1917	0.2576	1802545593	246926539	2.41077	1.06183	1.06161	1.06172	1.58389	5.98968
1996	0.5634	0.1806	0.2560	1955027929	263719641	2.65440	1.08554	1.08570	1.08562	1.71951	8.21567
1997	0.5765	0.1671	0.2564	2179309093	273526580	2.94207	1.09909	1.09937	1.09923	1.89015	9.46127
1998	0.5841	0.1566	0.2594	2275450746	286005821	3.19768	1.05533	1.05512	1.05523	1.99454	5.37567

Source: Federal Communications Commission, *Statistics of Communication Common Carriers* [various years] and Federal Communications Commission, *Monitoring Reports* [various years]

Table B-5. Price of Labor - 1985-1998

Year	Labor Compensa-Tion ($)	Number of Employees	ARMIS Salaries+ Wages ($000)	ARMIS Benefits ($000)	Ratio	Excess Benefits ($)	Adjusted Labor Compensa-tion ($)	Labor Price (original) ($)	Labor Price (adjusted) ($)	Labor Price Index (original)	Labor Price Index (adjusted)	Labor Price - % Change (original)	Labor Price - % Change (adjusted)
			A	B	B/(A+B)								
1985	16991572326	504113					16991572326	33705.88008	33705.88008	1.00000	1.00000		
1986	16728435454	482698					16728435454	34656.11097	34656.11097	1.02819	1.02819	2.78018	2.78018
1987	16978905847	477714					16978905847	35541.98924	35541.98924	1.05447	1.05447	2.52407	2.52407
1988	17030359791	466827	15033849	3636033	0.19475	0	17030359791	36481.09426	36481.09426	1.08234	1.08234	2.60794	2.60794
1989	16910850694	461149	14977589	3669768	0.19680	0	16910850694	36671.12082	36671.12082	1.08797	1.08797	0.51954	0.51954
1990	17586868921	443105	15230268	3768099	0.19834	0	17586868921	39690.07102	39690.07102	1.17754	1.17754	7.91115	7.91115
1991	17186211200	414457	15038534	4537703	0.23180	622455600	16563755600	41466.81369	39964.95559	1.23025	1.18570	4.37924	0.69019
1992	17160988000	411167	14976159	4920448	0.24730	941126600	16219861400	41737.26977	39448.35408	1.23828	1.17037	0.65011	-1.30106
1993	17956438000	395639	15479969	5918883	0.27660	1639112600	16317325400	45385.91494	41242.96493	1.34653	1.22361	8.38073	4.44882
1994	17154284000	367196	15085400	6539928	0.30242	2214862400	14939421600	46716.96859	40685.14254	1.38602	1.20706	2.89056	-1.36176
1995	16203522000	346843	15088974	5677574	0.27340	1524264400	14679257600	46717.16598	42322.48481	1.38602	1.25564	0.00042	3.94555
1996	18457448000	338040	15337179	5140712	0.25104	1045133800	17412314200	54601.37262	51509.62667	1.61994	1.52821	15.59473	19.64502
1997	17451673000	338177	15358125	4395933	0.22253	445121400	17006551600	51605.14464	50288.90670	1.53104	1.49199	-5.64377	-2.39842
1998	18262990000	345317	15302883	4263993	0.21792	350617800	17912372200	52887.60762	51872.25709	1.56909	1.53897	2.45477	3.09996

Source: Federal Communications Commission, *Statistics of Communication Common Carriers* [various years] and ARMIS Reports 43-02, Table I.B.

Table B-6. Capital Stock Adjustments and the Average Rate of Depreciation - 1985-1998
(Dollar amounts shown in 000)

Year	TPIS.BOY	Capital Additions	TPIS.EOY	Capital Retires	Adjustment Factor	Adjusted Capital Additions	Adjusted TPIS.EOY	Depreciation Accruals	Adjusted Depreciation Rate
	A	B	C	D=A+B-C	E	F=B*E	G+A+F-D	H	I=H/((A+G)/2)
1985	138879365	15001998	149061793	4819570	0.888	13321774	147381569	10241376	7.15527
1986	149061793	14842725	159010189	4894329	0.888	13180340	157347804	11826961	7.71971
1987	159010189	14138370	168505114	4643445	0.888	12554873	166921617	13311655	8.16837
1988	168505114	14284742	175860216	6929640	1	14284742	175860216	13134992	7.62852
1989	175860216	13283569	182978381	6165404	1	13283569	182978381	13420810	7.48014
1990	182978381	14476334	187168695	10286020	1	14476334	187168695	13439933	7.26194
1991	187168695	14527049	192034545	9661199	1	14527049	192034545	13200593	6.96228
1992	192034545	14611866	196411915	10234496	1	14611866	196411915	13337581	6.86714
1993	196411915	14860116	203082418	8189613	1	14860116	203082418	14032782	7.02527
1994	203082418	14717999	209325562	8474855	1	14717999	209325562	14863196	7.20801
1995	209325562	15374568	217430207	7269923	1	15374568	217430207	15358553	7.19782
1996	217430207	18026150	227317120	8139237	1	18026150	227317120	16252281	7.30855
1997	227317120	18253199	236896179	8674140	1	18253199	236896179	16667034	7.18077
1998	236896179	18553791	248970288	6479682	1	18553791	248970288	17154619	7.06145
								avg[1](85-98)	7.30180
								var[2](85-98)	0.11142

[1] avg denotes the arithmetic mean of the series.
[2] var denotes the variance of the series.
Source: FCC Form M

Table B-7. Quantity of Capital for 1985-1998 and the Imputed Cost of Capital for 1991
(Dollar amounts shown in 000)

Year	Benchmark Capital Stock	Adjusted Capital Additions	BEA Composite Asset Price Index	Capital Stock Quantity	Capital Stock Quantity Index	Property Income /w Depreciation	Imputed Cost of Capital
1984				103903095			
1985	109602959	13321774	1	109602959	1	23445593794	
1986		13180340	1.01048	114643584	1.04599	26792578943	
1987		12554873	1.02734	118493306	1.08111	27701751800	
1988		14284742	1.03047	123703569	1.12865	26866209000	
1989		13283569	1.07018	127083465	1.15949	25845853000	
1990		14476334	1.08973	131088425	1.19603	25584541000	
1991		14527049	1.10222	134696416	1.22895	24641357000	0.18798
1992		14611866	1.10830	138045138	1.2595	26477135000	
1993		14860116	1.11231	141325020	1.28943	26914823000	
1994		14717999	1.11766	144174285	1.31542	26366385000	
1995		15374568	1.11481	147438176	1.3452	27166096000	
1996		18026150	1.11862	152787122	1.39401	30414808000	
1997		18253199	1.11764	157962763	1.44123	30679731000	
1998		18553791	1.11769	163028757	1.48745	33830949286	

Source: Table B-6 and National the Income and Product Accounts compiled by the Bureau of Economic Analysis of the U.S. Department of Commerce

Table B-8. Cost of Capital - 1985-1998

Year	Moody's Baa Corporate Bond Rate (%)	Imputed Competitive Cost of Capital ($)	Competitive Cost of Capital Index
1985	12.72	0.21717	1.00000
1986	10.39	0.19387	0.89271
1987	10.58	0.19577	0.90146
1988	10.83	0.19827	0.91297
1989	10.18	0.19177	0.88304
1990	10.36	0.19357	0.89133
1991	9.8	0.18797	0.86554
1992	8.98	0.17977	0.82778
1993	7.93	0.16927	0.77944
1994	8.62	0.17617	0.81121
1995	8.2	0.17197	0.79187
1996	8.05	0.17047	0.78496
1997	7.86	0.16857	0.77621
1998	7.22	0.16217	0.74674

Source: Moody's Baa Corporate Bond Rate is from Table B-73 of the *Economic Report of the President- 1999*, U.S. Government Printing Office, Washington, DC, 1999.

Table B-9. Materials Input Quantity - 1985-1998

Year	Materials Price Index	Adjusted Total Operating Expense ($)	Depreciation and Amortization Expense ($)	Adjusted Employee Compensation ($)	Materials Expense ($)	Materials Quantity	Materials Quantity Index
	A	B	C	D	E=B-C-D	F=E/A	
1985	1.00000	40609705224	10024710656	16991572326	13593422242	13593422242	1
1986	1.03135	40262200069	11592001248	16728435454	11941763367	11578768961	0.85179
1987	1.05353	42242744320	13316999560	16978905847	11946838913	11339818432	0.83421
1988	1.08639	45494083588	13646937000	17030359791	14816786797	13638527159	1.00332
1989	1.12623	47773003404	13860101000	16910850694	17002051710	15096429424	1.11057
1990	1.17203	49160848820	13931515000	17586868921	17642464899	15052912382	1.10737
1991	1.20494	50278593400	13499778000	16563755600	20215059800	16776818597	1.23419
1992	1.23480	48875289820	13822882000	16219861400	18832546420	15251495319	1.12198
1993	1.25535	49744107201	13244514000	16317325400	20182267801	16077004661	1.18270
1994	1.29144	53129310801	15068058000	14939421600	23121831201	17903914391	1.31710
1995	1.32167	54381863101	15556284000	14679257600	24146321501	18269554050	1.34400

1996	1.36140	54780054849	16377242000	17412314200	20990498649	15418318385	1.13425
1997	1.39550	57364316191	16758832000	17006551600	23598932591	16910736361	1.24404
1998	1.43074	58408447446	17646242000	17912372200	22849833246	15970695654	1.17488

Source: Materials price index comes from the Input/Output Tables compiled by the Bureau of Economic Analysis of the U.S. Department of Commerce, depreciation and amortization expense data come from the *Statistics of Communication Common Carriers*, and the other values are derived as detailed in the text.

Table B-10. Factor of Production Shares of Total Payments - 1985-1998

Year	Adjusted Labor Compensation ($)	Property Income /w Depreciation ($)	Adjusted Materials Payment ($)	Adjusted Total Factor Payments ($)	Labor Share	Capital Share	Materials Share
1985	16991572326	22565165047	13593422242	53150159615	0.31969	0.42455	0.25576
1986	16728435454	21249284636	11941763367	49919483458	0.33511	0.42567	0.23922
1987	16978905847	22444359210	11946838913	51370103970	0.33052	0.43691	0.23256
1988	17030359791	23494272047	14816786797	55341418635	0.30773	0.42453	0.26773
1989	16910850694	23723264293	17002051710	57636166697	0.29341	0.41160	0.29499
1990	17586868921	24600194384	17642464899	59829528203	0.29395	0.41117	0.29488
1991	16563755600	24641359753	20215059800	61420175153	0.26968	0.40119	0.32913
1992	16219861400	24215061717	18832546420	59267469536	0.27367	0.40857	0.31776
1993	16317325400	23367604541	20182267801	59867197742	0.27256	0.39032	0.33712
1994	14939421600	24897949618	23121831201	62959202419	0.23729	0.39546	0.36725
1995	14679257600	24794387029	24146321501	63619966130	0.23073	0.38973	0.37954
1996	17412314200	25134537868	20990498649	63537350717	0.27405	0.39559	0.33036
1997	17006551600	25756104311	23598932591	66361588503	0.25627	0.38812	0.35561
1998	17912372200	25617626841	22849833246	66379832287	0.26985	0.38592	0.34423

Source: Federal Communications Commission, *Statistics of Communication Common Carriers* [various years] with adjustments as described in the text.

Table B-11. Total LEC Input Quantity Index - 1985-1998

Year	Labor Share	Capital Share	Materials Share	Labor Quantity	Capital Quantity Index	Materials Quantity Index	Laspeyres Input Quantity Index	Paasche Input Quantity Index	Fisher Ideal Input Quantity Index	Fisher Ideal Chained Input Quantity Index	Growth Rate (%)
1985	0.31969	0.42455	0.25576	504113	1	1	1	1	1	1	
1986	0.33511	0.42567	0.23922	482698	1.04599	0.85179	0.96804	0.96360	0.96582	0.96582	-3.47804
1987	0.33052	0.43691	0.23256	477714	1.08111	0.83421	1.00590	1.00588	1.00589	0.97150	0.58715
1988	0.30773	0.42453	0.26773	466827	1.12865	1.00332	1.05882	1.05913	1.05898	1.02880	5.73029
1989	0.29341	0.41160	0.29499	461149	1.15949	1.11057	1.03648	1.03715	1.03681	1.06668	3.61531
1990	0.29395	0.41117	0.29488	443105	1.19603	1.10737	1.00064	0.99974	1.00019	1.06688	0.01899
1991	0.26968	0.40119	0.32913	414457	1.22895	1.23419	1.02608	1.02662	1.02635	1.09499	2.60077
1992	0.27367	0.40857	0.31776	411167	1.25950	1.12198	0.97791	0.97651	0.97721	1.07003	-2.30554
1993	0.27256	0.39032	0.33712	395639	1.28943	1.18270	1.01657	1.01592	1.01625	1.08742	1.61153
1994	0.23729	0.39546	0.36725	367196	1.31542	1.31710	1.02658	1.02765	1.02712	1.11690	2.67569
1995	0.23073	0.38973	0.37954	346843	1.34520	1.34400	1.00330	1.00269	1.00300	1.12025	0.29912
1996	0.27405	0.39559	0.33036	338040	1.39401	1.13425	0.94905	0.94842	0.94874	1.06282	-5.26234
1997	0.25627	0.38812	0.35561	338177	1.44123	1.24404	1.04549	1.04625	1.04587	1.11157	4.48479
1998	0.26985	0.38592	0.34423	345317	1.48745	1.17488	0.99809	0.99732	0.99770	1.10902	-0.22988

Source: Table B-10, Federal Communications Commission, *Statistics of Communication Common Carriers* [various years], Table B-7, and Table B-9.

Table B-12. Summary of the Components of LECs' Price Cap X-Factor (excluding the Consumer Productivity Dividend) - 1985-1998

Year	U.S. Nonfarm Business Sector TFP Growth Rate (%)	LECs' Output Growth Rate (%)	LECs' Input Growth Rate (%)	LECs' TFP Growth Rate (%)	TFP Differential (%)	U.S. Nonfarm Business Sector Input Price Growth Rate (%)	LECs' Input Price Growth Rate (%)	Input Price Differential (%)	X-factor (%)	Previous X-factor[1] (%)
	A	B	C	D = B-C	E = D-A	F	G	H = F-G	I = E+H	J
1986	1.10166	3.19590	-3.47804	6.67394	5.57228	2.80830	-3.15211	5.96041	11.53269	-0.5
1987	-0.39920	3.77146	0.58715	3.18431	3.58351	2.53178	1.92376	0.60802	4.19153	5.0
1988	0.29955	6.51202	5.73029	0.78173	0.48218	3.72958	2.39282	1.33676	1.81894	5.0
1989	0.19920	4.38736	3.61531	0.77206	0.57285	3.03629	-1.52894	4.56522	5.13808	7.9
1990	-0.69895	4.76646	0.01899	4.74748	5.44643	3.30913	3.88344	-0.57432	4.87211	8.8
1991	-1.41274	2.60725	2.60077	0.00647	1.41921	2.05824	-0.13437	2.19261	3.61182	5.8
1992	1.61294	3.51159	-2.30554	5.81713	4.20419	2.88104	-1.36727	4.24830	8.45250	3.4
1993	0.09995	5.83651	1.61153	4.22497	4.12502	3.71664	-0.64768	4.36432	8.48934	4.7
1994	0.39880	5.41052	2.67569	2.73483	2.33603	3.50341	2.22171	1.28171	3.61774	5.4
1995	0.29806	5.98969	0.29912	5.69056	5.39250	1.96268	0.84015	1.12253	6.51503	6.8
1996	1.47713	8.21568	-5.26234	13.47802	12.00089	1.38258	5.65415	-4.27157	7.72932	
1997	0.39024	9.46127	4.48479	4.97648	4.58623	1.89887	-0.22680	2.125670	6.71190	
1998	0.59259	5.37568	-0.22988	5.60556	5.01297	0.71810	0.18976	0.52834	5.54131	
				avg[2](86-98)	4.21033			1.80677	6.01710	
				var[3](86-98)	8.08404			6.48203	6.22591	
				avg(91-98)	4.88463			1.44899	6.33362	

var(91-98)	8.81863	6.38164	3.33409	
avg(86-95)	3.31342	2.51056	5.82398	5.23
var(86-95)	3.55698	4.06310	7.69230	5.93
avg(91-95)	3.49539	2.64189	6.13729	5.22
var(91-95)	2.03050	1.98155	4.75223	1.29

[1] X-factor reported in the *1997 Price Cap Review Order*.

[2] avg denotes the arithmetic mean of the series.

[3] var denotes the variance of the series.

Source: Bureau of Labor Statistics' Multifactor Productivity Table 2: Private Nonfarm Business: Productivity and Related Indexes (annual and quarterly tables), Table B-4, Table B-11, and Table B-13.

Table B-13. Total LEC Input Price Index - 1985-1998

Year	Labor Share	Capital Share	Materials Share	Labor Price Index	Capital Price Index	Materials Price Index	Laspeyres Input Price Index	Paasche Input Price Index	Fisher Ideal Input Price Index	Fisher Ideal Chained Input Price Index	Growth Rate (%)
1985	0.31969	0.42455	0.25576	1	1	1	1	1	1	1	
1986	0.33511	0.42567	0.23922	1.02819	0.89271	1.03135	0.97148	0.96647	0.96897	0.96897	-3.15211
1987	0.33052	0.43691	0.23256	1.05447	0.90146	1.05353	1.01788	1.01768	1.01778	0.98620	1.76258
1988	0.30773	0.42453	0.26773	1.08234	0.91297	1.08639	1.02157	1.02184	1.02170	1.00760	2.14711
1989	0.29341	0.41160	0.29499	1.08797	0.88304	1.12623	0.99750	0.99801	0.99776	1.00534	-0.22468
1990	0.29395	0.41117	0.29488	1.17754	0.89133	1.17203	1.04001	1.03918	1.03960	1.04515	3.88344
1991	0.26968	0.40119	0.32913	1.18570	0.86555	1.20494	0.99842	0.99889	0.99866	1.04375	-0.13437
1992	0.27367	0.40857	0.31776	1.17037	0.82779	1.23480	0.98717	0.98567	0.98642	1.02958	-1.36727
1993	0.27256	0.39032	0.33712	1.22361	0.77944	1.25535	0.99388	0.99321	0.99354	1.02293	-0.64768
1994	0.23729	0.39546	0.36725	1.20706	0.81121	1.29144	1.02192	1.02302	1.02247	1.04591	2.22171
1995	0.23073	0.38973	0.37954	1.25564	0.79187	1.32167	1.00872	1.00816	1.00844	1.05473	0.84015
1996	0.27405	0.39559	0.33036	1.52821	0.78497	1.36140	1.05810	1.05824	1.05817	1.11609	5.65415
1997	0.25627	0.38812	0.35561	1.49199	0.77622	1.39550	0.99737	0.99810	0.99773	1.11356	-0.22680
1998	0.26985	0.38592	0.34423	1.53897	0.74675	1.43074	1.00231	1.00149	1.00190	1.11568	0.18976

Source: Table B-10, Table B-5, Table B-8, and Table B-9.

Appendix C

The Staff Imputed X Study

Florence Setzer

This study estimates an X-factor for LEC price caps by solving for the past X-factor that would have allowed price cap LECs on average to achieve the return they would have had if they had been subject to competitive market forces. The study is based on the reported interstate operating revenues, operating expenses, and average net investment of price cap LECs and on an estimate of the elasticity of demand for interstate telephone services. The calculations show the effects on the revenues and operating income of price cap LECs, as well as on the welfare of consumers of telecommunications services, of setting the X-factor at a level producing a competitive return. These calculations assume that the hypothetical X-factor remained in effect from the inception of price caps in 1991 through the end of the period. An adjustment is made for the change in the quantity of output sold as a response to changes in price. In order to examine trends over time in the rate of productivity growth, the study also calculates for individual years the X-factor that would have been necessary to prevent the rate of return from rising above that of the previous year. For comparison with the 1997 and 1999 TFP Studies, calculations were also made assuming no demand response and using data for the RBOCs only, rather than for all price cap LECs. Calculations were performed for 1995, for comparison with the 1997 TFP study, and for 1998, to make use of the most recent data available.

The effects of a hypothetical X-factor are estimated by first calculating the change in price, output, and revenue that would have occurred in each year if that X-factor had been in effect. The calculation of these effects for an X-factor of 6.5 percent, the X-factor (including CPD) chosen in the *1997 Price Cap Review Order*,[1] is shown in Table C-1. Separate calculations are made for some carriers because not all carriers chose the same X-factor during the period of sharing, so that the effects of moving to a new X-factor differ among carriers. The second column of Table C-1 shows the actual X-factor, taken from Tariff Review Plan ("TRP") data submitted by the carriers. A minimum X-factor of 4.0 percent is used because that level was imposed retroactively by the Commission on carriers that chose lower X-factors.[2] The difference between the actual and hypothetical X-factors is shown in the third column. The fourth column is an index of the cumulative price change over time resulting from the change in the X-factor. The fifth column shows the percentage change in price in each year relative to the actual price in that year resulting from the cumulative effect of the changed X-factor. If the 6.5 percent X-factor had been in effect for the entire price cap period, prices would have been between 10.7 percent and 11.79 percent lower than they actually were in 1998.

The last two columns of Table C-1 show the change in output and revenue resulting from a given X-factor change. Because X-factors change on July 1, the beginning of the tariff year, an average of the

[1] *Price Cap Performance Review for Local Exchange Carriers*, Fourth Report and Order in CC Docket No. 94-1 and Second Report and Order in CC Docket No. 96-262, 12 FCC Rcd 16642, 16697 (1997) ("*1997 Price Cap Review Order*").

[2] *Price Cap Performance Review for Local Exchange Carriers*, First Report and Order, CC Docket No. 94-1, 10 FCC Rcd 8961, 8971 (1995) ("*1995 Price Cap Review Order*").

prices, both actual and hypothetical, in adjacent tariff years is used in the calculation. The percentage change in output was calculated by assuming that a 1 percent reduction in price results in an increase in output purchased of 0.2 percent.[3] This assumes that all reductions in access prices are passed on to interstate end-user customers. The percentage change in revenue is calculated taking account of both the price change and the output change.[4]

The effects of changes in the X-factor are calculated separately for each carrier using data on operating revenue, operating expense, and average net investment reported by the carriers on FCC Form 492-A. These data are shown in Table C-2 for 1995 and 1998. Aggregate results are shown in Table C-3. For each carrier, adjusted operating revenue under the hypothetical X-factor is calculated by adjusting actual revenue for the change in price and level of output, as reflected in the final column of Table C-1. Operating expense is adjusted for the change in federal and state taxes, which together are assumed to be 39 percent of revenues. We have no evidence of the effects of an increase in output on costs, but short-run marginal costs are generally believed to be very low.[5] Consequently we assume that costs other than taxes are unchanged by the increase in output, and make no further adjustments in operating expense.

Adjusted operating expense is subtracted from adjusted operating revenue to give after-tax profits, which are reported as adjusted operating income. Adjusted operating income and average net

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[3] We assume that access costs constitute 40 percent of the costs of interstate service and that the short-run price elasticity of demand for interstate service is -0.5. Thus, we would expect the elasticity of demand for interstate services with respect to a change in the price of access to be around -0.2, assuming that all changes in the price of access are passed on to end-user customers. Access charges accounted for 37 percent of AT&T's costs in 1997. FCC, *Statistics of Communications Common Carriers*, (1997/1998 ed.) at 3. The Commission adopted a short-run demand elasticity for toll service of -0.47 in 1986. *Annual 1987 Access Tariff Filings*, Memorandum Opinion and Order, 2 FCC Rcd 866, 909 at Chart A, p.1 (1986). Taylor finds no evidence that the toll market has become either more or less elastic than in 1980. Lester D. Taylor, *Telecommunications Demand in Theory and Practice* 259 (1994). In a recent paper, using data from 1984 through 1993, Kahai, Kaserman and Mayo estimated the short-run market demand elasticity for interstate long-distance service to be -0.49. They note that Taylor reports a range of demand elasticities in recent studies lying, in general, between –0.5 and –0.75 for intraLATA toll calling. Simran K. Kahai *et al.*, *Is the "Dominant Firm" Dominant? An Empirical Analysis of AT&T's Market Power*, 39 J.L. & Econ. 499 (1996), citing Lester D. Taylor, *Pricing of Telecommunications Services: Comment*, 8 Rev. Ind. Organ. 17 (1993). Our estimate falls at the low end of this range, so that our estimates of the increase in output in response to an increase in the X factor may be biased downward, and the effect on the rate of return may be biased upward. Thus a larger X factor may be needed to produce a given reduction in the rate of return.

[4] The percentage change in revenue is given by:

$$RCH = PCH + (1+PCH)*OCH$$

where

RCH = percentage change in operating revenue

PCH = percentage change in price

OCH = percentage change in output.

[5] Bridger M. Mitchell & Ingo Vogelsang, *Telecommunications Pricing: Theory and Practice* 14 (1991).

investment, which is assumed to be unchanged by the increase in output, are summed for all companies. An average adjusted rate of return is calculated for the industry as the ratio of adjusted operating income to average net investment for all firms in the industry. As shown in the first line of Table C-3, the average rate of return in 1998 if the X-factor of 6.5 percent had been in effect since 1991 would have been 11.88 percent. Thus an X-factor of 6.5 percent for the entire period of price caps would still have allowed carriers on average to earn returns above the target rate in 1998.

The benefits to consumers of the rate reduction resulting from the given X-factor are shown by the change in consumer surplus (the final column in Table C-3). The calculation of consumer surplus assumes that IXCs pass on the entire reduction in access prices to end-user customers. The change in consumer surplus consists of two parts: the benefit accruing from the lower price of the amount of output originally purchased, and the benefit accruing from the additional output purchased because of the reduction in price, which would have been forgone had the price remained at the original level.[6] Because of the increase in output resulting from the reduction in price, the increase in consumer welfare is larger than the reduction in LECs' revenues. If the 6.5 percent X-factor had been in effect for the whole period beginning in 1991, benefits to consumers from lower prices in 1998 would have been $2.95 billion.

The second and third lines of Table C-3 show the calculation of the X-factor required to produce a competitive rate of return in 1995 and 1998. The background calculations of percentage changes in price, output, and revenue have not been presented because these calculations can easily be replicated. The required rate of return for each year was found by adjusting the rate of return approved by the Commission at the inception of price caps by the basis-point change in bond rates over the period to reflect the action of competitive capital markets.[7] The precise level of the X-factor required to reach the target rate of return in each case was found by trial and error. The estimated X-factor using data through 1995 was 7.10 percent; using data through 1998 the required X-factor was 7.71 percent.

For comparison with the TFP studies, the calculations were repeated assuming no demand stimulation and using data only for the RBOCs. The results are shown in the last two lines of Table C-3. These calculations show required X-factors of 6.61 percent in 1995 and 6.97 percent in 1998. Note that these numbers are lower than those using data for all price cap LECs and including a demand adjustment,

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[6] The change in consumer surplus is approximated by:

CSCH = -OR*(PCH + PCH*OCH/2)

where

CSCH = change in consumer surplus

OR = actual operating revenue

PCH = percentage change in price

OCH = percentage change in output.

This estimate assumes that the demand curve is linear and that the income effect of the price change is small. *See* Brian R. Binger and Elizabeth Hoffman, *Microeconomics with Calculus* 202-211 (1985).

[7] Moody's Baa bond rate, which was also used in the 1999 staff TFP study, was used.

but somewhat higher than those for the same time periods in the 1999 staff TFP study. The data on which they are based have not been adjusted for accounting biases in the data as have the TFP data. On the other hand, they are based on interstate services only, so they more closely reflect price cap services. This result suggests that more accurate data and assumptions would increase the TFP estimates.

Table C-4 shows the X-factor required in each year to maintain the average rate of return at the level of the previous year. This single-year X-factor was calculated for each year from 1992, the first full year of price caps, through 1998. To make this calculation, operating revenues in each year were adjusted to account for the effects of sharing and low-end adjustments.[8] This calculation resulted in an estimate of the revenues that would have resulted from the action of a given X-factor in the absence of sharing and low-end adjustments. Operating expenses were correspondingly adjusted for the change in taxes. In addition, for years through 1994, the actual X-factor in effect for each carrier at the time, rather than the retroactive X-factor imposed later, was used.[9] The X-factor calculation was performed as described above, except that changes in output and revenue were based on the difference between the actual and hypothetical X-factors in a given year rather than on the cumulative price level change from the beginning of the period. As Table C-4 shows, the X-factor required to maintain the rate of return of the previous year trended upward, though not monotonically, from a low of 5.50 percent in 1992 to a high of 8.51 percent in 1998. This appears to reflect an increase in the rate of productivity growth over the period of price caps, and suggests that an X-factor based on an average over the period is likely to underestimate the rate of productivity growth.

[8] Data on sharing and low-end adjustments from annual TRP submissions were used. Because TRP data are based on tariff years, which begin on July 1, and the other data underlying the X-factor calculation are based on calendar years, the sharing and low-end adjustment data for adjacent tariff years were averaged for use with the calendar year data.

[9] New X-factors go into effect at the beginning of the tariff year on July 1. Like the sharing and low-end adjustment data, the actual X-factors in effect in the first six months and the last six months of the calendar year were averaged to arrive at an estimated actual X-factor for the calendar year.

Table C-1

HISTORIC PRICE, OUTPUT, AND REVENUE CHANGES RESULTING FROM HYPOTHETICAL X FACTOR

Hypothetical X Factor	6.50%
End user price elasticity	-0.5
Access price elasticity*	-0.2

CALENDAR YEAR	Actual X Factor**	X Factor Change	Cumulative Price Index	Price Change	Output Change	Revenue Change
Ameritech, Bell Atlantic, NYNEX, SBC, GTE, others* **						
1991	4.00%	2.50%	0.975	-2.50%	0.25%	-1.13%
1992	4.00%	2.50%	0.951	-4.94%	0.74%	-3.00%
1993	4.00%	2.50%	0.927	-7.31%	1.23%	-4.98%
1994	4.00%	2.50%	0.904	-9.63%	1.69%	-6.92%
1995	5.30%	1.20%	0.893	-10.72%	2.03%	-8.35%
1996	5.30%	1.20%	0.882	-11.79%	2.25%	-9.25%
1997	6.50%	0.00%	0.882	-11.79%	2.36%	-9.71%
1998	6.50%	0.00%	0.882	-11.79%	2.36%	-9.71%
BellSouth						
1991	4.00%	2.50%	0.975	-2.50%	0.25%	-1.13%
1992	4.30%	2.20%	0.954	-4.65%	0.71%	-2.88%
1993	4.00%	2.50%	0.930	-7.03%	1.17%	-4.74%
1994	4.00%	2.50%	0.906	-9.35%	1.64%	-6.69%
1995	5.30%	1.20%	0.896	-10.44%	1.98%	-8.11%
1996	5.30%	1.20%	0.885	-11.52%	2.20%	-9.02%
1997	6.50%	0.00%	0.885	-11.52%	2.30%	-9.48%
1998	6.50%	0.00%	0.885	-11.52%	2.30%	-9.48%
Pacific Telesis						
1991	4.30%	2.20%	0.978	-2.20%	0.22%	-0.99%
1992	4.30%	2.20%	0.956	-4.35%	0.66%	-2.64%
1993	4.00%	2.50%	0.933	-6.74%	1.11%	-4.50%
1994	4.00%	2.50%	0.909	-9.07%	1.58%	-6.45%
1995	5.30%	1.20%	0.898	-10.17%	1.92%	-7.88%
1996	5.30%	1.20%	0.888	-11.24%	2.14%	-8.79%
1997	6.50%	0.00%	0.888	-11.24%	2.25%	-9.25%
1998	6.50%	0.00%	0.888	-11.24%	2.25%	-9.25%
U S West						
1991	4.30%	2.20%	0.978	-2.20%	0.22%	-0.99%
1992	4.30%	2.20%	0.956	-4.35%	0.66%	-2.64%
1993	4.30%	2.20%	0.935	-6.46%	1.08%	-4.38%
1994	4.30%	2.20%	0.915	-8.51%	1.50%	-6.10%
1995	5.30%	1.20%	0.904	-9.61%	1.81%	-7.41%
1996	5.30%	1.20%	0.893	-10.70%	2.03%	-8.33%
1997	6.50%	0.00%	0.893	-10.70%	2.14%	-8.79%
1998	6.50%	0.00%	0.893	-10.70%	2.14%	-8.79%
Sprint						
1991	4.00%	2.50%	0.975	-2.50%	0.25%	-1.13%
1992	4.00%	2.50%	0.951	-4.94%	0.74%	-3.00%
1993	4.00%	2.50%	0.927	-7.31%	1.23%	-4.98%
1994	4.07%	2.43%	0.904	-9.56%	1.69%	-6.89%
1995	5.30%	1.20%	0.894	-10.65%	2.02%	-8.29%
1996	5.30%	1.20%	0.883	-11.72%	2.24%	-9.20%
1997	6.50%	0.00%	0.883	-11.72%	2.34%	-9.65%
1998	6.50%	0.00%	0.883	-11.72%	2.34%	-9.65%

Source: See text

* Assumes access = 40% of IXC costs, and all price reductions passed on to end user customers

** In effect 7/1 of each year

*** Assumes "others" chose lowest X factor 1991-1994

Table C-2

FINANCIAL DATA FOR PRICE CAP LECS

Price Cap Company	Operating Revenue* (000)	Operating Expense (000)	Average Net Investment (000)
1995			
Ameritech	$2,314,807	$1,795,638	$3,093,308
Bell Atlantic	$6,177,664	$5,121,678	$8,122,916
BellSouth	$3,341,690	$2,613,050	$4,618,137
Pacific Telesis	$1,742,343	$1,346,448	$2,505,561
SBC	$2,091,805	$1,646,644	$3,327,268
U S West	$2,416,832	$1,954,164	$3,855,836
GTE	$2,729,239	$2,195,426	$4,422,624
Sprint	$1,028,598	$778,826	$1,335,617
Others	$498,379	$403,046	$728,670
All	$22,341,357	$17,854,920	$32,009,937
1998			
Ameritech	$2,553,594	$1,918,674	$2,794,765
Bell Atlantic	$6,453,096	$5,378,333	$8,380,851
BellSouth	$3,794,553	$2,842,101	$4,578,390
Pacific Telesis	$2,027,231	$1,639,515	$2,645,273
SBC	$2,359,902	$2,022,258	$3,407,300
U S West	$2,670,048	$2,089,034	$3,513,985
GTE	$3,222,880	$2,354,224	$4,432,509
Sprint	$1,130,092	$857,222	$1,400,433
Others	$939,899	$739,759	$1,241,895
All	$25,151,295	$19,841,120	$32,395,401

Source: FCC Form 492-A

* Interstate Revenue

Table C-3

X FACTOR REQUIRED FOR COMPETITIVE AGGREGATE RETURN

Year	X-Factor Since 1991	Actual Operating Revenue* (000)	Adjusted Operating Revenue (000)	Actual Operating Expense (000)	Adjusted Operating Expense** (000)	Actual Operating Income (000)	Adjusted Operating Income (000)	Average Net Investment (000)	Actual Rate of Return ____	Competitive Rate of Return ____	Change in Consumer Surplus*** (000)
All Price Cap LECs, Demand Elasticity = -0.2											
1998 with 1997 X****	6.50%	$25,151,295	$22,753,012	$19,841,120	$18,905,790	$5,310,176	$3,847,222	$32,395,401	16.39%	11.88%	$2,947,187
1995	7.10%	$22,341,357	$20,051,518	$17,854,920	$16,961,883	$4,486,437	$3,089,635	$32,009,937	14.02%	9.65%	$2,810,519
1998	7.71%	$25,151,295	$21,053,989	$19,841,120	$18,243,171	$5,310,176	$2,810,819	$32,395,401	16.39%	8.68%	$4,979,309
RBOCs Only, No Demand Response											
1995	6.61%	$18,085,141	$16,208,672	$14,477,622	$13,745,799	$3,607,519	$2,462,873	$25,523,026	14.13%	9.65%	$1,876,469
1998	6.97%	$19,858,424	$16,948,374	$15,889,915	$14,754,996	$3,968,510	$2,193,379	$25,320,564	15.67%	8.66%	$2,910,050

Source: See text.

* Interstate revenue.
** Assumes federal + state tax rate = 39 percent.
*** Assumes all price reductions passed on to end user customers.
**** X-factor chosen in *1997 Price Cap Review Order*.

Table C-4

X-FACTOR REQUIRED TO MAINTAIN UNCHANGED RATE OF RETURN FROM PREVIOUS YEAR

Year	X-Factor (%)
1992	5.50
1993	5.94
1994	5.51
1995	6.83
1996	7.90
1997	6.57
1998	8.51

Source: See text.