

Service Quality:

- . No specific additional service quality requirements were included in the legislation

Earnings Sharing with Ratepayers:

- . No earnings sharing required by legislation.

Competitive Safeguards

- . No cross subsidy allowed from regulated services to competitive services
- . Commission required to conduct proceeding to determine if cost allocation is required to assure no cross-subsidy.
- . Competitive price must be above LRIC.
- . Competitive service prices must include rates for basic and discretionary components plus LRIC
- . Basic and Discretionary components must be made available to other providers at same rates and terms issued by provider.
- . All discretionary services and all competitive services, except Directory Advertising, must be available for resale.

Depreciation

- . Depreciation was left to the company's discretion

Indiana

Status:

- Indiana Commission issued Order on June 30, 1994, approving Settlement Agreement between all parties and Ameritech Indiana.
- Most provisions of the Alternative Regulation Plan are contained in Settlement Agreement

Rate Adjustments/Current Rates:

- As part of the Settlement Agreement, Ameritech Indiana agreed to the several rate reductions and adjustments to its rate structure:
 - Reduction of \$2.21 in the monthly local charge for access to the long distance network (phased in three steps)
 - Elimination of touchtone charges for residence and business customers
 - Increase in call allowance for residential message rate service from 30 to 45 calls monthly
- Current Rates for local service disaggregate between three types of exchanges with class 3 exchanges being most urban and class 1 being most rural.
- About 20% of households and 11% of businesses pay additional charges because they are outside the base rate area (these charges are either \$2.55/month or \$5.05/month)
- Additional End-User Line charges are \$2.21 intrastate charges and \$3.50 in FCC mandated interstate line charges
- The state line charges are being phased out as part of the Settlement Agreement for the Opportunity Indiana Plan.

Price Index:

- Settlement Agreement does not use an explicit price index.
- Service prices for various baskets are capped and cannot increase, but may be decreased, during the duration of the Agreement (which runs until December 31st., 1997)
- In general, price decreases are allowed on 24 hour notice to customers and determination that price will remain above LRSIC + 1%.
- Other Services may be increased or decreased by Ameritech Indiana at any time

Rate Freeze:

- Rates for Basic Local Service and Basic Local Service-Related services are not allowed to increase during the duration of the Agreement with some exceptions but may be decreased.
- IntraLATA toll Basic Schedule for Residence Toll Service, Public Telephone Service and Carrier Access Services may be decreased

subject to the above requirements; also, no additional charges may be imposed that "increase the average revenue per minute of use of such service above 1993 calendar pro forma," unless 1+ presubscription is allowed in an exchange in which case rates could be increased or decreased

Service Classification:

- . Settlement Agreement divided services into Basic Local Service , Basic-Local-Service-Related Services and Other Services.
- . BLS was defined as voice-grade access to the network plus usage within the traditional local calling area.
- . BLS-related services include touchtone, basic custom calling features such as call waiting, three-way calling, and call forwarding among others, and directory assistance
- . Other services included every other service offered by Ameritech Indiana such as WATS, 800, Operator Services and Directory Services.

Service Quality:

- . No change in reporting requirements for service quality by Ameritech Indiana
- . No explicit linkage to rate freeze or adjustment to caps.

Earnings Sharing with Ratepayers:

- . No sharing of earnings required in Settlement Agreement.

Competitive Safeguards

- . Interim Imputation Agreement included in Settlement Agreement
- . Separate imputation proceeding is in progress to determine:
 - Level of service aggregation for imputation test
 - Reporting requirements for non-Ameritech Indiana carriers
 - Inclusion of various type of traffic in calculating price floors

Depreciation

- . The Commission explicitly rejected regulation of depreciation rates.

Illinois

Status:

- . Hearing Examiner Proposed Order on May, 3, 1994.
- . Commission approval is pending.

Rate Adjustments/Current Rates:

- . No rate adjustments were required.
- . Most exchanges have measured rate charges by minutes of use.
- . Prices vary depending on geographical location.
- . There is also a high volume usage discount which ranges from 11.50%-50% for usage rates over \$52.00, and \$832.00, respectively for business customers; and 3.8%-32.7% on usage rates over \$2.60, and \$104.00, respectively for residential customers.
- . Current rates for residential and business customers are deaveraged between Chicago and rest of state.
- . Local rates deaveraged according to distance called through bands A-D.

Price Index:

- . Formula
 - Change in GDPPI -3.8%
- . All revenues are included in the calculation of the price cap index.
- . Weighted change for a service basket may not exceed change in price cap index.
- . However, individual elements within a basket may not experience a price increase of greater than 5% per year above the price cap index.

Rate Freeze:

- . Rate freeze on basic residential services for 5 years.

Service Classification:

- . Plan divides services into four baskets.
- . Residence includes residence network access lines, Band A - D usage, touch-tone, Starline, Multi-ring, custom calling, advanced custom calling, and non-recurring charges.
- . Business includes business network access lines, Band A-D usage, touch-tone, ISDN, custom calling, advanced custom calling, ACBS, remote call forwarding, WATS, and non-recurring charges.
- . Carrier includes switched access, special access, cellular access and LIDB.
- . Other services include directory services, Chicago name and address, payphone, directory assistance, private line, and operator services

Service Quality:

- . Require company to file quarterly report
- . No direct effect on price cap index.

Earnings Sharing with Rate Payers:

- . No earnings sharing required

Competitive Safeguards

- . Imputation tests are required by statute from telecommunications carriers that provide both competitive and noncompetitive services
- . Services requiring imputation include usage sensitive services, message toll services, non-payphone operator services, 800 services and others.
- . Determination of whether certain other services require imputation tests are being considered separately
- . Statutory requirements on competitive services revenues requires them to cover in the aggregate or as a group their LRSICs, imputed costs and allocated common overhead expenses and residual revenue requirement

Depreciation

- . Hearing Examiner explicitly rejected regulation of depreciation rates.

Pennsylvania

Status:

- . Commission Order adopted June 23, 1994.
- . In approving Order, Commission explicitly rejected Administrative Law Judge's conclusions:
 - that Bell of Pennsylvania's rates were unjust and unreasonable
 - that earnings sharing should be included in the alternative regulation plan.

Rate Adjustments/Current Rates:

- . Commission Order based its conclusion that Bell of Pennsylvania's rates were reasonable on a report by NARUC stating that Bell of PA "offers third lowest residence exchange rates and second lowest business exchange rates of the former Bell Operating Companies."
- . Commission explicitly rejected Administrative Law Judge's finding that Bell of PA's rates were too high.
- . Commission determined that Bell of PA's current rates did not need any adjustments before instituting the Plan.
- . Current rates disaggregate exchanges from highest density central office (Class 1) to lowest density (Class 4).

Price Index:

- . Formula
 - Change in GDPPI - 2.93%
- . Bell of PA is allowed to file tariff changes to comply with the Price Stability Mechanism.
- . Commission can review price changes to determine if they comply with the PSM.
- . Commission restricted revenue neutral changes to within a market basket to protect more inelastic services from significant price increases.
- . However, Bell of PA can petition Commission to include several baskets to achieve revenue neutral price changes.
- . Competitive services rates are unregulated.

Rate Freeze:

- . Protected services rates (such as residential and business local exchange and special access) are frozen until December 31, 1999.
- . Price Stability Mechanism comes into effect after freeze.

Service Classification:

- . Instituted two main categories: Noncompetitive services (protected by the price cap index) and competitive services.
- . Noncompetitive protected services are grouped into four baskets/categories:
 - Residential Local Exchange Services: includes residential dial tone, local usage, touch tone, associated ordering, installation, restoration and disconnection charges.
 - Business Local Exchange Service: includes business dial tone, local usage, touch tone, associated ordering, installation, restoration and disconnection charges.
 - Carrier Switched Access Services: switched access services and associated ordering, installation, restoration and disconnection charges.
 - Carrier Special Access Services: special access services and associated ordering, installation, restoration and disconnection charges.
- . Competitive Services: Services not included in above market baskets such as: Billing and Collection, Directory Advertising (however, directory listings are designated as a Basic Service Function and the company is required to include this as a regulated tariff item), Centrex, Paging, Repeat Call and Speed Dialing - for which Bell of Pennsylvania must provide informational tariffs to the Commission.

Service Quality:

- . Service quality standards proposed by Bell of PA were approved by the Commission.

Earnings Sharing with Ratepayers:

- . No sharing of earnings is required by plan.

Competitive Safeguards

- . Separate proceeding is being initiated to examine competitive safeguards provisions focusing on unbundling, cost allocations, cost studies and imputation.

Depreciation

- . Commission will continue monitoring of depreciation expenses
- . A rulemaking procedure on depreciation and capital planning is pending

Wisconsin

Status:

- State legislature enacted a bill requiring the PUC to offer price regulation as an alternative to the LECs.
- Different offsets to the price index apply to large and small utilities.
- Ameritech Wisconsin has elected to be regulated under price regulation as of September, 1994

Rate Adjustments/Current Rates:

- Legislative mandate requires that any utility electing to become price regulated must reduce network access rates to both residential and business customers by 10%.
- Wisconsin Bell may only offer local measured rate service (measured per message)
- Rates do not vary by time of day or day of week.
- Current rates provide for a declining block pricing structure based on number of calls

Price Index:

- Basic Formula
Change in GDPPI - 3%.
- Offset reported is the maximum offset allowed by the statutes for utilities with more than 500,000 access lines
- Other Adjustments to offset for service quality, infrastructure and productivity (effective in six years) are included in the formula.
- Commission must consider the extent to which a utility has contributed to the Wisconsin advanced telecommunications fund, when adjusting the offsets
- The Commission may only change the offset 6 years after the bill was enacted and every 3 years thereafter, by no more than 1% per year.

Rate Freeze:

- Rate freeze for 3 years after election to become price regulated, for all services.
- Not covered under freeze: Basic message service (long distance intrastate toll service on a dial-1 basis between local exchanges).

Service Classification:

- Services are classified into three categories:
 - Basic Local Exchange
 - Intrastate Access
 - Other
- Basic Local Exchange

- Includes standard business access lines, usage for small businesses with no more than 3 access lines, basic message service
- Commission may include services necessary for universal service, and advanced services essential to the public interest
- After 3 year price freeze, increase in any rate element may not exceed the larger of 10% or the GDPPI
- Total revenue-weighted price index cannot exceed price cap index.
- . Intrastate Access rates may not exceed interstate rates for similar services and CCL must be eliminated upon receipt of interLATA certification
- . Other Services includes new services and Commission is not allowed to regulate prices for these services

Service Quality

- . Service quality penalty included in the formula for the price cap index.

Earnings Sharing with Rate Payers:

- . No earnings sharing required in statute.

Competitive Safeguards

- . The price of a service subject to an imputation test shall exceed the sum of:
 - 1) tariffed rates, including access, CCL, residual interconnect for the noncompetitive service in use; and
 - 2) total LRSIC of all other components of the utility's service offering.
- . A telecommunications carrier may not charge different rates for residential basic message, business basic message, or single-line wide-area service on routes of similar distances within the state, unless authorized by the Commission

Depreciation:

- . To be determined by the Commission.

June 24, 1994

**THE EFFECT OF INCENTIVE REGULATION ON
LOCAL EXCHANGE COMPANIES'
DEPLOYMENT OF DIGITAL INFRASTRUCTURE**

by

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EXECUTIVE SUMMARY

This study examines the investment patterns of all large local exchange telephone companies in the United States over time. This study identifies how different regulatory environments have influenced the recent historical pattern of investment in modern infrastructure equipment. It focuses exclusively on the post-divestiture experience of local telephone exchange companies (LECs). It examines the growth of fiber-optic deployment and of complementary equipment associated with the modernization of today's information infrastructure.

The study estimates the influence of different regulatory structures on infrastructure deployment by LECs. Our study is unique in that we relate individual LEC investment patterns to *LEC-specific* regulatory, demographic and economic characteristics. Thus, we isolate the contribution of state regulatory policies from that of other demographic and economic factors in the determination of infrastructure deployment at the state LEC rather than at the corporate level.

Our main findings are as follows:

- Incentive regulation policies, and in particular price regulation schemes, do influence the level of deployment of modern equipment at the local exchange level in a manner consistent with economic theory.
- More liberal regulatory environments lead to greater incentives to deploy modern equipment, and LECs respond to those incentives.
- Price regulation (and in particular price caps) is a more potent regulatory mechanism than the standard earnings sharing scheme.
- When associated with an earnings sharing scheme, price regulation is less effective in triggering infrastructure deployment than when it is implemented by itself.
- Price regulation would have increased infrastructure deployment by approximately 100% in those states that by 1991 have not adopted any incentive regulation scheme.

These results raise questions about the effectiveness of a popular regulatory instrument —earnings sharing schemes—, and highlight the effectiveness of generic price cap regulation. These results have implications for the design of regulatory policy at both the state and federal level. In particular, given the importance being currently placed on the development of the information superhighway, regulatory emphasis should be placed more on price regulation rather than on regulating profits.

TABLE OF CONTENTS

I. INTRODUCTION	1
II. INCENTIVE REGULATION AND INFRASTRUCTURE DEPLOYMENT	3
Investment in Modern Equipment under Rate of Return	3
Price Cap Methods	4
Price Stabilization Schemes	6
Earnings Sharing Schemes	7
Combinations of Price Regulation and Earnings sharing Schemes	10
III. THE EVOLUTION OF THE STATES' REGULATORY ENVIRONMENT	12
IV. AN EMPIRICAL FRAMEWORK	14
Main Empirical Hypotheses	14
Data Requirements	15
The Econometric Framework	16
V. DATA	19
Endogenous Variables	20
Exogenous variables	22
Economic and Demographic Data	22
The State Regulatory Environment: Incentive Regulation	25
The Regulatory Environment: General Conditions	29
VI. EMPIRICAL RESULTS	33
Preliminaries	33
Partial Adjustment Model	35
A Baseline Growth Model	39
VII. CONCLUSION	42
TABLE 1: INFRASTRUCTURE INVESTMENT	45
TABLE 2: PARTIAL ADJUSTMENT MODEL	46
TABLE 3: AVERAGE PREDICTED EFFECT OF INCENTIVE REGULATION	47
TABLE 4: FIBER OPTIC CABLE,BASELINE GROWTH MODEL	48
TABLE 5: BASELINE GROWTH MODEL	49
TABLE 6: AVERAGE PREDICTED EFFECT OF INCENTIVE REGULATION	50
FIGURE 1: THE STATES REGULATORY ENVIRONMENT	51
FIGURE 2: FIRMS SUBJECT TO PRICE REGULATION AS OF 1991	52
FIGURE 3: FIRMS SUBJECT TO EARNINGS SHARING AS OF 1991	53
FIGURE 4: DIGITAL GROWTH	54
APPENDICES	

L INTRODUCTION

The national telecommunications infrastructure did not arise overnight, nor did it arise under the guidance of any single policy vision or as part of a single commercial plan. Dramatic changes in regulations, many relating to the divestiture of AT&T, have accelerated the introduction of competitive forces into every aspect of telecommunications. Yet, as represented by the variety of regulations in place across the United States, there is still no general agreement about the appropriate approach for encouraging modernization of the US telephone system.

This study examines the investment patterns of all large local exchange telephone companies in the United States over time. It identifies how different regulatory environments have influenced the recent historical pattern of investment in modern infrastructure equipment. It focuses exclusively on the post-divestiture experience of local telephone exchange companies (LECs). It examines the growth of fiber-optic deployment and of complementary equipment associated with the modernization of today's information infrastructure.

This study takes advantage of the natural experiment provided by the two-tiered regulatory structure of the United States. This structure produces 51 different regulatory structures across hundreds of local exchange carriers. The study relates different regulatory structures to the different investment behavior observed. Our study is unique in that we relate LEC investment patterns to *LEC-specific* regulatory, demographic and economic characteristics. Thus, we isolate the contribution of state regulatory policies from that of other demographic and economic factors in the determination of infrastructure deployment at the state LEC rather than at

the corporate level.²

Our main findings are that regulatory policies, and in particular price regulation schemes, do influence the level of deployment of modern equipment at the local exchange level in a manner that is consistent with economic theory. This pattern persists in similar degrees for three of our four measures of infrastructure deployment – Fiber Optic cable, SS7 and ISDN, but not for digital stored program controlled switches. This pattern persists even though we control for demographic and economic features of the local service territories. The latter are important economic determinants of the demand for, and costs of, infrastructure deployment. Finally, our results hold for alternative specifications of the statistical relationship between regulatory and economic incentives and the infrastructure deployment.

We find that, in general, more liberal regulatory environments lead to greater incentives to deploy modern equipment, and that LECs respond to those incentives. By analyzing regulatory environments in more detail we find that price regulation (and in particular price caps) is a more

² We are aware of only one prior study that has attempted to estimate the impact of incentive schemes on infrastructure deployment. See Taylor, W.E., C.J. Zarkadas and J.D. Zona, "Incentive Regulation and the Diffusion of New Technology in Telecommunications," mimeo, NERA, 1992. We differ from their work in several dimensions, most importantly by the nature of our data. First, we include all large local exchange companies. Second, we have regulatory information specific to the firm. Third, our infrastructure and economic measures are at the LEC, rather than at the holding company level. Thus, we are able to isolate more clearly the impact of regulatory and economic factors in the infrastructure deployment decision. Other studies have attempted to estimate the impact of incentive scheme of telephone prices. See, for example, Mathios, Alan D. and Robert P. Rogers, The Impact of Alternative Forms of State Regulation of AT&T on Direct Dial Long Distance Telephone Rates, The RAND Journal of Economics, Vol. 20, No. 3, Autumn 1989

potent regulatory mechanism than the standard earnings sharing scheme. Indeed, we find that when associated with an earnings sharing scheme, price regulation is less effective in triggering infrastructure deployment than when it is implemented by itself. We simulate the effects of incentive regulations. We show that price regulation would have increased infrastructure deployment by approximately 100% in those states that by 1991 have not adopted any incentive regulation scheme. On the other hand, introducing earnings sharing schemes would not dramatically alter LECs' infrastructure deployment plans. These results raise questions about the effectiveness of a popular regulatory scheme, and highlights the effectiveness of generic price cap regulation.

II. INCENTIVE REGULATION AND INFRASTRUCTURE DEPLOYMENT

Investment in Modern Equipment under Rate of Return

The relation between the regulatory environment and infrastructure deployment is not a simple one. The traditional Averch-Johnson (A-J) approach to the analysis of rate-of-return regulation suggests that rate-of-return regulation promotes capital overinvestment. If this is correct, then traditional regulatory methods should be associated with overinvestment in equipment, including modern infrastructure. There are several reasons to think that the A-J approach is incorrect. First, as discussed by Joskow (1973),³ rate of return regulation has never operated in the way postulated by A-J. Regulators do not systematically bring companies' rate of return to the specified limit, but rather there is a subtle game between the companies and the

³ Joskow, P. 1973. "Pricing Decisions of Regulated Firms: A Behavioral Approach." Bell Journal of Economics and Management Science 118-140.

regulators in the calling for rate reviews. Second, traditional rate of return regulation involves accounting procedures, like the setting of relatively low depreciation rates, that have non-trivial profitability consequences and that impair the incentives to invest. More fundamentally, though, utility regulators have the ability to second guess the need for particular investments, drastically changing the utilities' investment calculus.⁴ The *ex-post* nature of investment questioning raises the potential for opportunistic behavior by the regulators. Thus, in the case of telecommunications, a LEC subject to the potential for such opportunistic behavior will be careful not to devote substantial investments to new technologies, i.e., fiber-optics, which regulators may, in a few years, declare "unprudent and unnecessary." Thus, while rate-of-return regulation may reduce incentives to cut costs, it may further reduce the incentives to introduce modern, and capital intensive, technologies.

Price Cap Methods

Regulatory methods that decouple prices from short term profits, like price-cap regulation, may provide LECs the right incentive to cut costs and innovate.⁵ Price cap rather than profit regulation also has the advantage of providing the regulated firm with some amount of pricing flexibility. Such pricing flexibility would allow the firm to rebalance its prices to increase the

⁴ See, for example, Teisberg, E.O., 1993 "Capital Investment Strategies under Uncertain Regulation," Rand Journal of Economics Vol 24, No. 4, pp: 591-604; Lyon, T.P. 1991, "Regulation with 20/20 Hindsight: 'Heads I Win, Tails You Lose?'" Rand Journal of Economics, Vol 22, No.4, pp: 581-295, and Spiller, P.T. 1993 "Institutions and Regulatory Commitment in Utilities' Privatizations," Industrial and Corporate Change, Vol 2, No.3, pp:387-450.

⁵ See Cabral, L. and M. Riordan, "Incentives for Cost Reduction under Price Cap Regulation," 1989 Journal of Regulatory Economics, Vol 1, pp: 133-147 for a theoretical comparison of the efficiency properties of price cap and rate of return.

usage of price sensitive service segments, to appropriately price and introduce new products (e.g., call waiting, call forwarding, answering and faxing services), and to compete more effectively with alternative service providers. In turn, the potential for introduction of new products and an increased competitiveness in relatively contested segments increases the LEC's demand for digital infrastructure.⁶

The efficiency implications of price cap regulation depend on several factors: the extent to which individual prices or basket of prices are subject to price caps; the magnitude of the productivity factor (the x in the British RPI-X system) in comparison to the level of underlying potential for cost cutting; and the periodicity and the considerations that enter in the review of the price cap regime. To a large extent, the process for reviewing price cap regimes is the cornerstone of price cap regulation. Systems of price regulation that review the x-factor very frequently based on the profitability performance of the company will have efficiency properties very close to those of rate of return regulation. The company will have a lower incentive to improve its efficiency if it anticipates that cost reductions will translate into immediate

⁶ There is, by now, a vast literature on the properties of price cap, starting with the work of Vogelsang, I. and J. Finsinger, 1979 "A Regulatory Adjustment Process for Optimal Pricing by a Multiproduct Monopoly Firm," Bell Journal of Economics, Vol 10, pp:157-171. Further work along the "mechanism design" approach is found in the 1989 Vol 20 Rand Journal of Economics Symposium on Price Cap Regulation. See also, Breautigam, R.R. and J.C. Panzar, 1993, "Effects of the Change from Rate of Return to Price Cap Regulation," American Economic Review, Vol 83, No. 2, pp:191-198. Apart from the initial work of Vogelsang and Finsinger, most of the recent literature has assumed that regulators have substantial informational processing capabilities and flexibility to impose prices and make transfers (for an exception, which we discuss in more detail below, see Schmalensee, R, 1989, "Good Regulatory Regimes," Rand Journal of Economics, Vol 20, No.3, pp: 417-436). The nature of these assumptions raises questions about the policy relevance of the different theoretical constructs.

recalibration of the regime and consequent price cuts.

Price Stabilization Schemes

An extreme case of a price cap is a price freeze or stabilization plan. In this type of plan, the company is required to hold the prices of its non-competitive services capped at a certain level. While usually the company may reduce rates below those nominal caps, the company commits not to increase its prices for a certain period of time. These plans usually arise as part of a "social contract" arrangement between the state Commission and the regulated company. The company's promise not to increase prices is accompanied by a Commission proposal to either not subject the company to a rate review throughout the period, or to provide the company with an earnings sharing scheme that allows it to increase its current profitability. Price stabilization schemes may not be sustainable if large economy wide price shocks threaten the profitability potential of the company. This risk, however, is absent in price-cap methods whose indexation features provide for a cushion against macro-economic shocks. In low inflation environments, though, the main difference between price cap and price freeze regimes is that while the former type provides for rebalancing of rates, the latter does not.

The relevance of rate rebalancing depends on the extent of cross-subsidies inherent in the initial price structure, and on the degree of competition in the non-regulated segments. Absent a strong need for rebalancing, and in the presence of low inflationary pressures, a price cap scheme with x close to the inflation rate, and a price freeze scheme may turn out to provide similar incentives. On the other hand, in the presence of large cross-subsidies, price-cap regimes, by

allowing rate rebalancing, may provide stronger investment incentives to the LEC. Finally, price cap regimes that have multiple sub-baskets, and that have price increase limitations for individual products may become indistinguishable from price freeze regimes.

Although price cap regimes have superior efficiency features than price freezes, their differential impact on incentives for infrastructure deployment is an empirical matter. In practice, given the low level of inflation throughout the period of analysis, the main theoretical advantage of price cap regulation over price freezes may have simply been the ability to rebalance rates. Below we explore whether in our sample price caps and price freezes provide similar investment incentives to LECs.

Earnings Sharing Schemes

Price regulation is only one aspect of the regulatory environment. Another important aspect is profit regulation. As it is well known, traditional rate of return regulation brings upper and lower bounds to the profitability of LECs. If profits are too low the firm will call for a rate review, while if profits are too high regulators may call for rebates or price reductions. Earnings sharing schemes institutionalize the previous ad-hoc process of rate reviews. A standard earnings sharing scheme is composed of a series of rate of return levels and a corresponding series of excess profit sharing between the company and its customers. For example, California's initial earnings sharing scheme with Pacific Bell and GTE called for two rate of return levels: 13% and 16.5%. The companies will keep all revenues if their profits provide an annual rate of return less than 13%. If their rate of return is between 13% and 16.5%, they will keep 50% of the excess

profits and rebate the excess revenues to their customers. Finally, if their profit levels exceed 16.5% they will rebate all excess revenues over 16.5% and half of the excess revenues in between 13% and 16.5%. In this way, the maximum rate of return that the company can obtain is 14.75%.^{7,8} Not all earnings sharing schemes provide for such maximum rate of returns. For example, Mississippi's earnings sharing scheme with Bell South calls for the company returning 50% of all earnings over 11.74%, while keeping all earnings when its rate of return is between 10.74 and 11.74%.

The efficiency implications of different earnings sharing schemes, then, will depend on the underlying economic conditions facing the company, the nature of the rate of return bands, the actual sharing arrangements, and the periodicity of the profit computation.⁹ The latter three are usually chosen as the result of bargaining between the state Commission and the regulated company. In principle, it could be feasible to design an earnings sharing scheme that, in a static environment, would motivate the company to undertake the (second-best) optimal level of investment.¹⁰

⁷ That is composed of the allowed 13% plus 1.75% which represents half the difference between 16.5% and 13%.

⁸ As Appendix 1 shows, GTE's earning scheme was changed for 1994-1996 so that it retains 100% of earnings less than 15.5% and rebates to its customers all earnings above 15.5%.

⁹ In some states, companies have to make quarterly computations of rate of return. See Appendix 3.

¹⁰ See Schmalensee, *supra note 5*, for a study showing that in a static (although uncertain) environment where regulators can commit to a particular cost sharing scheme, simple cost sharing has some advantages over simple price regulation. The main reason for the superiority of cost sharing over price regulation is that under price regulation unexpected cost

The "optimal" sharing rules, however, are complex, and require extensive information by the regulators. They involve flexible and, to some extent, counterintuitive pricing rules (e.g., high prices in "bad" states and low prices in "good" states of nature) and substantial lump sum payments among customers and firms.¹¹ Such complex schemes are not easily implementable both for practical and political considerations.¹² Simpler earnings sharing schemes, although more easily implementable, have substantially weaker efficiency properties.

Furthermore, the regulatory complexity of the schemes has to be taken into account when considering its overall cost and benefits. Earnings sharing schemes require the continuous monitoring of the LEC's profitability. As a consequence, they may eliminate the traditional regulatory lag associated with rate of return regulation.¹³ Thus, although formally earnings

increases may force the firm to decide not to produce. To prevent such events, the initial markups have to be set relatively high. Cost sharing provides for lower initial markups, thus increasing consumer welfare. While Schmalensee's argument is appropriate when analyzing price-freezes, it does not carry over to the analysis of price caps based on indexation. Since, in telecommunications, cost increases arise most probably from economy wide shocks (e.g., labor and material costs) rather than from sector-specific shocks, price caps based on indexation limit the need for increased markups to satisfy the participation constraint of the regulated company. This increase in the initial markup is at the core of Schmalensee's comparative result. In the absence of such need for an increased mark-up, Schmalensee's comparative result does not hold.

¹¹ These lump sum payments may be positive (i.e., transfers to the firm) or negative (rebates to customers). See Laffont, J.J. and J. Tirole, 1993, A Theory of Incentives in Procurement and Regulation, Cambridge, Mass: MIT Press for a general discussion of "optimal" regulatory schemes when regulators face informational asymmetries.

¹² For example, no legislature will delegate to the state regulatory commission discretion to set annual lump sum payments to the LEC. Furthermore, no commission could be expected to collect the required information and calculate the "optimal value" of such lump sum payments.

¹³ Under traditional rate of return regulation State Commissions do not usually call for rate reviews on a continuous basis. As a consequence, LECs capture some short run gains from

sharing schemes may provide LECs with a higher profitability rate than standard rate of return, whether they do so in fact depends on the Commissions' rate review practices.¹⁴ Finally, the continuous monitoring of the company's profitability increases the regulatory burden, with a direct cost to tax- and rate-payers.

Combinations of Price Regulation and Earnings sharing Schemes

The theoretical beauty of price-cap regulation is that regulators do not have to monitor the company's profitability on a continuous basis, and that prices are, at least in the short run, decoupled from costs and profits. This particularly advantageous feature of price cap regulation disappears when it is coupled with an earnings sharing scheme. Indeed, as we discussed above, earnings sharing schemes require regulators to monitor the company's profitability on a continuous basis and to request lump sum rebates if profits are deemed "excessive." Earnings sharing, then, limits the incentive features of price-cap because the profit increases associated with cost cutting, rate rebalancing and the introduction of new products may now be partially or totally taxed. If the latter is the binding case, though, there will be no difference with a rate of return regime where the allowed rate of return is set to the higher bound. Although the pricing flexibility associated with price-caps may have superior properties to the pricing flexibility

cost reductions. These incentives to cut costs will be eliminated by an earnings sharing scheme that continuously monitors the company's profitability.

¹⁴ Indeed, it is not surprising that in several states where State Commissions have offered LECs the opportunity to move away from rate of return towards earnings sharing schemes, most of the smaller LECs have chosen not to propose incentive plans.

associated with the traditional rate reviews,¹⁵ these advantages may provide only second order efficiency effects when profits are constrained. Indeed, it is possible to imagine that the combination of price cap and earnings sharing provides less investment incentives than either price cap or earnings sharing by themselves. Consider, for example, an earnings sharing scheme with a very narrow profitability band.¹⁶ The narrowness of the band implies that there is not much difference between earnings sharing and rate of return.¹⁷ Superimposing on that regime a price-cap system further constrains the feasible profitability of the company, thus limiting its investment incentives.

Similarly, a price freeze coupled with an earnings sharing scheme may have even worse properties than an earnings sharing scheme by itself. Indeed, because a price freeze exposes the company to cost shocks beyond its control while the earnings sharing scheme may substantially limit its upward profitability potential, firms may find price freezes coupled with earnings sharing schemes a riskier environment than straightforward rate of return, and may, as a consequence, limit their investment program.

To summarize, we have discussed three general incentive regulation schemes: price-cap,

¹⁵ In standard rate of return reviews effort is made to accomplish what may be an almost impossible task: separating LECs costs on a product by product basis. On a price-cap regime such attempts are obviated.

¹⁶ See below for a more in-depth discussion of the economics and practice of earnings sharing methods.

¹⁷ Connecticut's current regulation of SNET may fit that description. See Appendix 2.

price freezes or stabilization schemes, and earnings sharing. In principle, price cap regimes should provide stronger incentives than price freezes and the latter, in turn, should provide stronger incentives than earnings sharing schemes. Furthermore, coupling earnings sharing with price freezes or price cap may degrade regulatory performance from price regulation alone, and even from earnings sharing alone. Since the actual schemes chosen by state Commissions are, in all likelihood, not the optimal ones, it is an empirical matter which method (or combination) provides stronger incentives for cost cutting and investment.

III. THE EVOLUTION OF THE STATES' REGULATORY ENVIRONMENT

Price and profit regulation are only two of the many dimensions of states regulation of telecommunications. State Commissions regulate not just prices and profits but also the extent of competition in new and contested segments. For example, they regulate the extent of permissible bypass, whether to treat dominant firms differently, whether to allow intraLATA competition, whether to deregulate competitive services, whether to provide for local exchange competition (including the entry of competitive access providers), etc., etc.¹⁸

Figure 1 depicts the evolution of the states' regulatory environment. The figure shows for each regulatory policy the number of states that have implemented those types of policies. We observe an upward trend in the implementation of all those regulatory policies. Indeed, by all measures, the states' competitive environment is much more intense and their regulatory policies

¹⁸ See, Huber et al (1993) for a description of the variety of regulatory instruments at the state level.

are much more flexible in 1993 than a decade ago. For example, while in 1984 only ten states allowed intraLATA competition, by 1993 almost forty states allow it. Similarly, by 1993 thirty states had introduced policies to liberalize services deemed competitive. The figure also shows the spread of competitive access providers, with almost twenty states allowing such entry by 1993. The movement towards a more competitive environment is accompanied by a trend towards more flexible regulatory schemes. Thus, while in 1984 there was no state that had introduced an incentive regulation plan, by 1993 approximately twenty states had introduced some type of price regulation and almost thirty had introduced earnings sharing schemes.

These numbers, however, disguise the fact that state Commissions do not implement their flexible regulatory schemes throughout their respective states, but rather that they are implemented on a firm by firm basis. Indeed, only a handful of states (e.g., Nebraska in 1986) have taken a state wide approach to regulatory reform. Figures 2 and 3 provide a graphic proof of the state of incentive regulation across the country in 1991. The figures show that price regulation and earnings sharing schemes were implemented on a firm by firm basis. Indeed, they show also that in most cases, flexible regulatory schemes were introduced only for the dominant firm, as GTE and the other large independent companies seldom were the beneficiaries of major regulatory reforms.^{19,20}

¹⁹ Several states, however, undertook special regulatory reform for small telecommunications firms. For example, a 1988 Indiana law allows for price deregulation of local exchange companies with less than 6,000 lines. Similarly, in 1987 the South Dakota legislature deregulated all cooperatives and LECs with less than 10,000 lines. In this paper, however, we focus on the large LECS, those with sales of \$100 million or more per year.