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DOCKET FILE COPY ORIGINAL

March 24, 1993

Ms. Donna R. Searcy
Secretary
Federal Communications Commission
1919 M Street, NW
Washington, DC 20554

RE: Ex Parte - MM Docket No. 92-266

Dear Ms. Searcy:

I am attaching for incorporation in the record of the above-captioned docket a recent Rand Journal of Economics article, *Market Power and Price Increases for Basic Cable Service Since Deregulation* by Robert Rubinovitz, which has been reproduced with permission of the publisher. This article provides an empirical analysis of cable rates since deregulation and finds that market power has been exercised. 43 percent of the inflation-adjusted price increases in basic cable rates during the period 1984 - 1990 was due to cable operators exercising this power (see page 13).

GTE recommends that the Commission consider using this statistic for establishing the benchmark GTE proposed in comments filed earlier in this proceeding. The Commission should require cable operators to roll back rate increases implemented since 1984 by 43 percent of the amount that exceeds inflation. To the extent that a cable operator believes that this rollback would cause a confiscation of capital, an opportunity for a cost based showing should be permitted. Alternatively, as proposed in comments by GTE, the Commission could impose an accounting order on existing cable rates pending its completion of a similar empirical analysis to determine initial benchmark rates.

Please let me know if you have any questions.

Sincerely,

Whitney Hatch

Attachment
c: Chairman James H. Quello
Commissioner Andrew C. Barrett
Commissioner Ervin S. Duggan
Commissioner Sherrie P. Marshall
Robert Pepper
Roy Stewart
Cheryl Tritt

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Market power and price increases for basic cable service since deregulation

Robert N. Rubinovitz*

Since the deregulation of rates for basic cable television service, increases in price have outpaced the rate of inflation. This article examines whether or not cable systems' increased market power, or their increased exercise of market power, explains these price increases. An estimated "quasi-supply" function for cable systems before and after deregulation implies that real basic cable prices increased 18% since deregulation, holding quality and other costs constant, accounting for 43% of the total real price increase. A demand equation is also estimated, and the estimated demand elasticity of basic cable does not change after deregulation, implying that this 18% real price increase is due to greater exercise of existing market power, made possible by the elimination of price regulation, rather than to an increase in market power caused by a change in the demand elasticity for cable.

1. Introduction

■ The Cable Act of 1984 permitted the deregulation of basic cable television rates in areas where cable faced "effective competition." As a result, basic cable rates were deregulated in virtually every franchise area in the United States. Since this deregulation, basic cable prices have increased at a rate that greatly exceeds the rate of inflation. Concerns have been raised that these large price increases are the result of cable systems exercising market power. This has led to calls for the reregulation of cable, and new federal legislation authorizing the reintroduction of limited price regulation has been passed. In addition, the Federal Communications Commission has changed the "effective competition" standard, in an attempt to curb cable systems' exercise of market power.

The cable system operators have maintained that they do not have market power, since they compete with other entertainment sources, especially over-the-air television. The operators argue that their price increases are justified because the quality of cable service has improved greatly since deregulation, and this higher quality can only be provided at a higher cost. Thus, higher prices for basic cable reflect cost increases due to quality improvements.

This article examines whether increased market power by cable systems, or greater exercise of existing market power, explains the price increases since deregulation. An esti-

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mated "quasi-supply" function for cable systems, using data from before and after deregulation, demonstrates the degree to which prices increased, on average, after deregulation, holding quality improvements and other cost changes constant. Using this method, real basic prices increased 18% since deregulation. This is about 43% of the total real price increase since deregulation. The remainder of the price increase is due to quality and cost changes.

However, this price increase could be attributable either to the ability of cable systems, after deregulation, to set price at the monopoly level, or to a change in the elasticity of demand for basic cable after deregulation. The demand equation estimated below shows no change in elasticity between the two time periods examined. Therefore, an increased exercise of market power, due to the change from a regulated to an unregulated environment, was responsible for about 43% of the total price increase since deregulation, while cost and quality improvements appear to explain the rest of the increase.

Section 2 discusses in more detail the changes that were brought about by the Cable Act of 1984 and examines the previous research on this subject. The basic empirical model is presented in Section 3, while Section 4 discusses the data used in this study and the results. Section 5 presents a conclusion and some suggestions for further research.

2. Background and previous research

■ The Cable Act of 1984 permitted the deregulation of basic cable rates in areas where cable faced "effective competition." [1] Congress left it to the Federal Communications Commission (FCC) to determine what constitutes effective competition. The FCC originally defined effective competition as the presence of three unduplicated over-the-air stations in the franchise area in which the cable system operated.[2] The result of this decision was that virtually all cable systems were deregulated. A General Accounting Office study indicates that at the end of 1989, 96% of all cable systems and 99% of all cable subscribers were not subject to local rate regulation. This compares to 20% of all systems and 17% of all subscribers that were not rate regulated at the end of 1984. (See General Accounting Office (1990).)

Between 1984, when the Cable Act was passed, and the end of 1989, the price of the most popular basic service increased 66%, on average, with most of this increase coming after 1986, when rates were fully deregulated. Deflating 1989 prices by the Consumer Price Index, the real increase in basic cable rates is 39%. Some franchise areas have seen nominal price increases on the order of 100% or more. For example, in Fairfax County, Virginia, rates increased from $4.95 in 1986 to $10.95 in 1989, a 121% increase. (See Fairfax County, Virginia (1990).) The response to these large rate increases has been calls for reregulation of rates and encouragement of more competition for cable through, for example, telephone company provision of cable services. The FCC, in response to concerns about these large price increases, investigated their causes and voted to change its effective competition standard. In addition, Congress recently passed legislation to alter the Cable Act of 1984, including the reintroduction of a limited degree of price regulation.

However, the cause of these price increases is not obvious. It has been argued by municipalities, competitors of cable, and some members of Congress that cable has market power and that the price increases since deregulation are the result of cable companies

[1] Local franchise authorities could regulate only the rates of "basic" cable service, if effective competition is not present. "Basic" cable service is defined as that group of programs offered by the cable operator, in a bundle at a given price, that includes the retransmission of the local broadcast television stations. It is often the case that this "basic" tier of programs includes additional channels that are received by the cable system via satellite. These channels include such networks as ESPN and CNN. However, it is not necessary for these satellite networks to be included in the basic tier.

[2] An over-the-air channel is considered to be in a cable system's franchise area if its "Grade B contour," a measure of the distance over which its signal is available at a given strength, overlaps the franchise area.

increasingly exercising this market power. Cable market power in basic service could come primarily from two sources. First, cable provides clear reception of over-the-air channels. Particularly in areas where over-the-air reception is poor, this could allow cable systems to charge more than the competitive price for this reception service because consumers would not have a good substitute available. In addition, cable systems generally offer a wider range of programming on their "basic" tier of programs than is available from other sources in their markets. Thus, if consumers value these programs and do not view other available alternatives as good substitutes, this could give cable systems market power.

The cable companies have maintained that prices have increased because they have improved the quality of the product they are offering.[3] This higher quality has led to higher costs for cable systems, which are recouped through higher prices. As an example of this higher quality, cable systems highlight the increase in the number of channels that are offered in the basic tier. In addition, existing cable networks have been investing more heavily in programming. If this translates into higher fees for carriage of programming networks by cable systems, this could also raise the operating costs of cable systems. These various rationales for basic cable price increases have been documented in, for example, Federal Communications Commission (1990).

The number of channels offered by cable systems has increased since rates were deregulated. The average number of basic cable networks available to a subscriber increased from 7.8 at the end of 1984 to 17.3 at the end of 1989. (See General Accounting Office (1990).) Not all of these may be highly valued by consumers, or costly enough to justify the price increases that accompanied the increase in programming, but the increase in channels is at least consistent with the cable companies' argument.

There is some evidence that cable systems exercised market power during this period. For example, there have been attempts to measure the "q ratio" for cable systems—the ratio of the market value of assets to the replacement cost of these assets. A q ratio greater than one may represent evidence of market power.[4] In comments filed by the United States Telephone Association, MacAvoy (1990) presents some estimates of q ratios for cable systems. He considers his most accurate estimate to be 4.3, though other estimates he presents range from 2.7 to 6.2. Q ratios are, of course, difficult to calculate and subject to many criticisms. (See, for example, Lindenberg and Ross (1981).) In addition, a ratio greater than one does not necessarily imply that a firm is exercising market power, since rents earned on intangible assets or other scarce resources can also push the ratio above one. Thus, evidence for q ratios of this magnitude is not conclusive regarding the issue of market power. In addition, this evidence says nothing about whether market power, or the exercise of market power, increased over time and can therefore explain the price increases after deregulation.

Jaffe and Kanter (1990) also examine the question of whether cable systems have exercised market power since deregulation. They examine sale prices of cable systems before and after deregulation, and find that the sale price of cable franchises increased significantly

The article by Jaffe and Kanter, however, does not address the quality issue, which could influence their results if systems in larger markets were more likely to invest in quality improvements before deregulation, while the systems in smaller markets waited until after deregulation to so invest. Moreover, their study may not use an appropriate time frame when it examines franchise values before and after deregulation. It is possible that the price of franchises in larger markets increased before the actual date of deregulation, because of an expectation that deregulation would most likely occur in these markets. If this is true, then comparing prices before and after 1984 instead of some other year might lead one to conclude that franchise values in larger markets were not affected by deregulation, when in fact the values were affected before 1984 in anticipation of deregulation.

Some indirect empirical evidence on the subject of market power has been presented in studies that examine whether or not broadcast television limits the prices charged by cable television. Three studies were presented to the FCC in response to its *Notice of Proposed Rulemaking* regarding the effective competition standard (MM Docket 90-4), each of which basically presents a reduced-form model where the price charged by cable systems for basic service is a function of, among other variables, the number of over-the-air channels available in the market. Dertouzos and Wildman (1990) find that the presence of at least five over-the-air channels leads to significantly lower prices in a market, but the presence of additional channels has no additional effect on price. Bykowsky and Sloan (1990) and Crandall (1990) present similar results, except that the former study finds that six stations are needed before a significant effect on price is found and the latter finds a significant, but decreasing, effect as the number of stations goes from one to five, with no significant effect with the addition of stations beyond five.

Certain methodological problems with these studies may limit their usefulness. For example, the Crandall study does not estimate a true reduced form. It includes the number of subscribers as one of the independent variables in the model, which introduces a potential simultaneous equation bias. These studies also do not address the question of quality improvements since deregulation as an alternative explanation for the price increases. Finally, the results of these studies are of somewhat limited relevance, since the fact that no additional effect on price is found beyond five or six stations is not equivalent to saying that cable systems are charging the competitive price in these markets. In other words, the presence of five or six over-the-air stations may constrain cable prices because, all else equal, the elasticity of demand is greater, in absolute value in these markets, but it may be that cable systems are still exercising market power and may have increased their exercise of market power since deregulation. Below I present a different approach to the problem of measuring market power of cable systems, one that addresses the flaws in these other studies.

3. The empirical model

■ Cable systems are, generally, monopolists that in theory had their prices constrained below monopoly levels under regulation, but that could set prices at the unconstrained monopoly level after deregulation. In either case, the elasticity of demand faced by cable systems, which may be influenced by competition from other entertainment sources, also affects prices. Therefore, I use the model specified below to determine if the price increases since deregulation were due to factors other than cost increases or quality improvements, recognizing that the increases could be influenced by both an increased exercise of market power, made possible by the elimination of price regulation, and a change in the elasticity of demand faced by cable systems.[5]

[5] The empirical model used in this article is related to the approach used, for example, in Baker (1989). Baker, however, examined the responses of an oligopoly to unexpected demand shocks. The model used here addresses a different set of issues.

This model starts with an inverse demand curve of the form

$$P = f(Q, \mathbf{Z}, \mathbf{Y}) + \epsilon, \tag{1}$$

where P is the market price, Q is the quantity demanded, $\mathbf{Z}$ is a vector of quality measures that can shift the demand curve, $\mathbf{Y}$ is a vector of exogenous factors that can also shift demand, and ϵ represents random fluctuations in demand. The marginal revenue curve can be derived from equation (1), by taking the derivative of (1) with respect to output:

$$MR = f(Q, \mathbf{Z}, \mathbf{Y}) + Qf_Q(Q, \mathbf{Z}, \mathbf{Y}) + \epsilon, \tag{2}$$

where f_Q is the partial derivative of the demand function with respect to quantity. Since there is only one cable company operating in each market, a "quasi-supply" curve for cable services is specified. This quasi-supply relation takes the form[6]

$$P = \Theta(P - MR) + c(\mathbf{Z}, \mathbf{W}) + \mu, \tag{3}$$

where $\Theta(P - MR)$ is a term representing the effectiveness of the regulation of the cable company,[7] $c(\mathbf{Z}, \mathbf{W})$ is the short-run marginal cost function, and μ is a random cost shock. A vector of exogenous factors that shift the cost function is represented by the vector $\mathbf{W}$, and $\mathbf{Z}$ represents a vector of endogenous quality factors that may also shift the cost function. By substituting equations (1) and (2) into equation (3), equation (3) becomes

$$P = -\Theta Qf_Q(Q, \mathbf{Z}, \mathbf{Y}) + c(\mathbf{Z}, \mathbf{W}) + \mu. \tag{4}$$

The marginal cost function is assumed independent of output, where output is the number of cable subscribers. For cable television, this is not an unrealistic assumption.[8] The marginal cost of serving another subscriber depends on, for example, the cost of buying programming to show that customer, billing the customer, and actually hooking up the customer to the system. These costs should not vary with the number of subscribers in the system. To verify this assumption, I also estimated the quasi-supply function with the number of subscribers included as an endogenous variable. However, it was not found to have a significant effect on price, so the quasi-supply functions estimated below exclude this measure of quantity.

The independence of marginal cost and output in this model allows cable market power to be empirically identified. This identification results from the fact that the most likely explanation for an increase in price when marginal cost is independent of output, and when it stays constant over time, is a decrease in the absolute value of the demand elasticity, while firms continue to exercise market power. (See, for example, Baker and Bresnahan (1992).) Therefore, the model estimated below explicitly examines whether a change in the demand elasticity for basic cable after deregulation had an effect on price, which would imply a change in market power. However, another explanation for the price increases since deregulation, which is incorporated in this model, is the possibility of an increase in the exercise of existing market power by cable firms once regulation is eliminated. This effect is captured by the Θ parameter,[9] which represents the degree to which regulation was effective

[6] It is very possible that this relationship would not hold during regulation, since regulators should be setting price equal to average cost, while unregulated firms would be setting price equal to a markup over marginal cost. This is discussed in more detail below.

[7] What is actually estimated is an average value of Θ for all cable systems in the sample. The true value of Θ for any given system could be greater or smaller than this estimated value.

[8] For example, Smiley (1986) discusses how variable costs in the operation of a cable system are roughly proportional to the number of subscribers.

[9] The markup parameter Θ, in similar models, generally reflects the degree to which market power is being exercised. (See Bresnahan (1982).) Under perfect competition, where a firm would set price equal to marginal cost, a value of Θ equal to zero would represent a competitive equilibrium. The monopoly outcome occurs when Θ equals one.

prior to 1984, and is assumed to be equal to one, after deregulation, when cable systems were free to set their profit-maximizing price.[10]

A priori predictions about the value of Θ prior to 1984 are difficult to make. Assuming where for simplicity Z and W are taken here to be scalars. Equation (10) is the primary equation of interest in this article, and it is estimated below. However, Θ, the primary parameter of interest, cannot be identified in this model. If it is hypothesized that the product of Θ and α_1 changes after deregulation, and equation (10) is estimated with data from before and after deregulation, then it is possible to identify the change in this product by estimating

$$\ln P = \beta_0 - \Theta\alpha_1 - (\Theta\alpha_1)^* DUMMY + \beta_1 \ln Z + \beta_2 \ln W + \mu, \qquad (10a)$$

where $DUMMY$ is a variable that takes on a value of one for postderegulation observations and zero for prederegulation observations, while $(\Theta\alpha_1)^*$ is the change in this product after deregulation. Estimating equation (10a) gives an estimate of the degree to which prices increased after deregulation, holding constant changes in cost and quality. However, as can be seen, this change is due to an interaction of an increase in the level of market power exercised and the demand elasticity faced by cable systems. If the elasticity change is at least partly responsible for the price increase, due to changes in the desirability of cable versus other entertainment sources, this has different welfare implications than if the price increase is due solely to the elimination of regulation. Thus, to examine these effects separately, it is also necessary to estimate a modified version of equation (5), which gives a value of both α_1 and the change in α_1 and allows the change in Θ to be identified.

Equation (10a) does not explicitly consider the possibility that the regulators would set price equal to average cost while, once rates were deregulated, cable firms would set rates according to the quasi-supply function in equation (10). To explicitly account for this possibility, I also estimate an expanded version of equation (10a). This expanded equation also includes a measure of average fixed cost, since this could have an effect on prices before deregulation. However, since the effect of average fixed costs should be different after deregulation, the measure of these costs is interacted with the dummy variable. Thus, in addition to equation (10a), the following equation is also estimated below:

$$\ln P = \beta_0 - \Theta\alpha_1 - (\Theta\alpha_1)^* DUMMY + \delta_1 FIXED + \delta_2 FIXDUM + \beta_1 \ln Z + \beta_2 \ln W + \mu, \qquad (10b)$$

where $FIXED$ is average fixed costs and $FIXDUM$ is $FIXED$ multiplied by $DUMMY$. The expectation is that δ_1 is equal to one, if regulators set prices equal to average costs, while the sum of δ_1 and δ_2 is equal to zero. If regulators did set prices equal to average costs, the value of Θ prior to deregulation should be zero. Thus, using the specification in (10b), evidence of a value of Θ greater than zero supports the hypothesis that prices were above average cost during the regulation period.[12]

Finally, the quality of the cable system is also an endogenous variable in this model. Therefore, an equation that explains the choice of quality for the cable system is specified and estimated. This equation takes the form

$$\ln Z = \phi_0 + \phi_1 \ln P + \phi_2 \ln Q + \phi_3 \ln \mathbf{V} + \tau, \qquad (11)$$

where $\mathbf{V}$ is a vector of exogenous variables that influences the choice of quality and τ represents random fluctuations in quality. The specific variables used in estimating equations (5), (10a), and (11) are described below.

4. Description of data and empirical results

■ **Description of data.** For this study, data were collected on cable systems throughout the country at two points in time, 1984 and 1990. These two years were chosen so that one set

[12] To the extent that the measure of average fixed costs used when estimating equation (10b) is an imperfect proxy for true average fixed costs, it is possible that the estimated value of Θ is biased.

of observations is before the deregulation of rates and the other set is as recent as was available. All data on the characteristics of cable systems were collected from the 1984 and 1990 editions of *Television and Cable Factbook: Cable and Services Volume.* The cable systems chosen for inclusion in the dataset are the ones in the major cities that are located in the Nielsen Station Index areas. These areas are used by the A.C. Nielsen Company to collect VCR penetration data. Thus, focusing on the franchises in these areas allows this information on VCR penetration to be incorporated into the analysis.[13] Where more than one city is obviously included in one of these Nielsen areas, the cable system for each of those cities is included separately in the sample. For example, one Nielsen area is Little Rock/Pine Bluff, Arkansas, so both Little Rock and Pine Bluff are included in the sample.

The information collected on the cable systems includes the monthly basic fee, the number of satellite channels available on the basic tier, the number of basic subscribers, the number of channels that are received over the air by the cable system, whether or not these over-the-air channels include an independent television station, the miles of plant of the system, the number of homes passed by the system, the channel capacity of the system, and the year the system started operation. Some systems in the sample also had an "expanded basic" tier, which is a tier of programming that includes neither over-the-air channels nor "premium" networks such as Home Box Office. For these systems, information on the satellite channels in this tier, the price of this tier, and the number of subscribers to this tier was also collected.[14]

In addition to the information on the cable systems, demographic information on the franchise area was also collected.[15] This information was collected to capture other influences on cost and demand that might not be reflected in the cable system information, or in the information regarding over-the-air options or VCR penetration. The demographic data included in this study are the per capita income in the relevant area, the percentage of the population between the ages of 25 and 54, and the population density.[16]

As it is restricted to franchises that correspond to the major cities in the Nielsen areas, the sample is not representative of cable systems as a whole. For example, the average number of basic subscribers in 1990, for systems in this sample, is about 52,000. (See Table 1.) The average number of subscribers for all cable systems is, by contrast, only 14,000. (See General Accounting Office (1990).) Thus, not surprisingly, the sample in this article has systems that are, on average, much larger than cable systems as a whole. This

[13] These Nielsen areas are larger than the franchise area for the cable systems in this study. Thus, the VCR penetration figures do not precisely measure the penetration in a cable system's franchise area. However, since the franchise areas examined in this study tend to be the larger cities in the Nielsen areas, the VCR figures should be somewhat representative of the VCR penetration in the franchise area.

[14] The basic analysis conducted below includes systems that had just a basic tier and those that had both a basic and expanded basic tier. As described below, the price, number of channels, and number of subscribers for these systems are calculated using a weighted average of the basic and expanded basic tier. However, when the equations discussed below were estimated using systems with only a basic tier, the results did not change significantly.

[15] The sources for this information are a number of publications of the U.S. Department of Commerce: *Survey of Current Business* for 1988 and 1990, *County and City Data Book* for 1988, and *Statistical Abstract of the United States* for 1986 and 1990. Whenever possible, this information was collected to correspond closely to the franchise area. However, in some instances, these data were collected for the relevant Metropolitan Statistical Area or county. In addition, some of this information is not for the exact year of interest. This obviously makes these measures imprecise, but they should capture, at least in relative terms, relevant information about the franchise area.

[16] Specifically, population density for the larger cities in the sample was collected from *Statistical Abstract of the United States* for 1984 and 1988, the most recent year available. For smaller cities, population density was available only for 1985, so this information was used for both 1984 and 1990 observations. This was obtained from *County and City Data Book*. Per capita income, by either Metropolitan Statistical Area or county, was obtained for the years 1988 and 1984 from *Survey of Current Business*. The percentage of the population between the ages of 25 and 54, either by city or county, only for the year 1985, was also obtained from *County and City Data Book*.

TABLE 1 **Descriptive Statistics**

		Mean	Standard Deviation	Minimum	Maximum
Basic fee	1990[a]	13.17	2.86	4.88	28.81
	1984	9.29	2.56	2.00	33.95
Basic subs	1990	51,739	47,335	1,553	292,113
	1984	33,357	28,569	1,281	235,200
Basic sat channels	1990	18.89	6.41	1.00	34.00
	1984	8.00	5.65	.00	25.00
Age	1990	21.03	8.33	7.00	39.00
	1984	15.03	8.36	1.00	33.00
Channel capacity	1990	39.07	11.11	12.00	104.00
	1984	30.30	15.98	12.00	164.00
Population density	1990	3,382	4,737	114	68,015
	1984	3,389	4,559	114	65,590
Per capita income	1990[a]	15,137	2,518	7,452	26,309
	1984	12,318	1,895	6,261	20,843
Over-the-air channels	1990	6.97	2.89	1.00	19.00
	1984	6.58	3.04	2.00	19.00

[a] Measured in 1984 dollars.
Number of observations: 251 (1990), 256 (1984).
Definition of variables: basic fee = monthly subscription fee for basic cable service; basic subs = number of basic cable subscribers; basic sat channels = number of satellite channels carried on basic tier; age = age of physical plant of cable system; channel capacity = number of channels available for use on cable system; population density = population density of metropolitan area in which system is located, for 1984 and 1988, except for smaller cities, where only 1985 data are available; per capita income = per capita income of metropolitan area, or county, in which system is located for 1984 and 1988; over-the-air channels = number of local, over-the-air channels retransmitted by cable system.

also results in a sample that has a relatively small number of systems but represents about 25% of all basic cable subscribers. However, the average basic fee in this sample in 1984, after correcting for inflation, is $9.29, while the average 1990 fee is $13.17, an increase of about 42%. (See Table 1.) For all cable systems, the increase in rates, correcting for inflation, between the end of 1984 and the end of 1989 is 39%, so the price increases in the sample used here are not unrepresentative. (See General Accounting Office (1990).)

Of course, the main concern about using this sample is whether or not it biases the results of interest, making it difficult to draw inferences about cable systems as a whole from the results in this article. Since the franchises examined are in larger cities on average, the main results could be biased downwards, as there might be more factors in these markets that serve to limit cable market power. However, the average number of over-the-air channels available to cable subscribers in the sample in this article is about seven, while the overall average is closer to eight, at least in 1989. (See General Accounting Office (1990).) If over-the-air stations are the primary limit on cable market power, the systems in this sample may have more market power on average than all cable systems, though this effect should be small. Therefore, it is necessary to be careful when making inferences from the results presented below.[17] To address this issue, the model below is estimated separately for the larger systems in the sample, to determine, at least within the sample examined here, whether larger systems behaved differently than smaller systems after deregulation.

□ **Estimation of empirical model.** As mentioned above, equations (10a) and (10b) are the main equations of interest. However, before focusing on the estimation of these equations,

[17] The results below, however, do not show much of an effect of over-the-air stations on market power, so the sample in this article may not be introducing a bias into the results, at least for this reason.

I shall present the full model and the variables used in the estimation of the model. As mentioned above, three equations make up the full model: the "quasi-supply" function, the demand function, and an equation that explains the choice of quality by the cable system. These three equations contain the following variables:

$$LBASFEE = F(DUMMY, LBASSAT, LPCMI, LPOPDEN, LAGE, LAGESQ) \quad (12)$$

$$LBASSUB = F(LBASFEE, LBASSAT, LCHANOA, LVCRPEN, LPCMI, LP2554, LAGE, LAGESQ, LHOMPA) \quad (13)$$

$$LBASSAT = F(LBASFEE, LBASSUB, LVCRPEN, LCHANOA, ONEIND, LPOPDEN, LP2554, LCAP, LPCMI). \quad (14)$$

All variables, except the dichotomous ones, are expressed in natural logs, and all equations are linear. *LBASFEE* is the natural log of the price charged by the cable system for its basic tier of programs, *LBASSUB* is the natural log of the number of subscribers to the basic tier, and *LBASSAT* is the number of distant satellite channels shown by the cable system and is the measure of quality used in this model.[18] For systems that have both a basic tier and an expanded basic tier, the values used for these variables are a weighted average of the values for the two tiers, where the weights are the percentage of subscribers that have just basic and those that subscribe to both tiers. I explain the other variables in more detail below. The equation that is estimated that corresponds to equation (10b) is the same as equation (12) above but includes the variables *FIXED* and *FIXDUM*, proxy measures for average fixed cost and average fixed cost interacted with a dummy variable equal to one for 1990 observations.

I estimate equation (10a) first, since it is easier to interpret than equation (10b). However, equation (10a) is just a special case of equation (10b), where equation (10a) assumes that δ_1 and δ_2 are both equal to zero. If average fixed costs are not correlated with market power, this should not bias the results of interest. However, equation (10b) is also estimated below, to see if including average fixed costs changes the results.

I use equation (12) to estimate equation (10a), where the natural log of the monthly fee for subscription to basic service is used as the dependent variable. For the vector of exogenous factors that affect marginal cost, **W**, four variables are used: *LPOPDEN*, the population density of the area where the franchise is located; *LPCMI*, the per capita income of the franchise area; *LAGE*, the age of the system; and *LAGESQ*, the square of the age of the system. More densely populated areas should have lower costs, so this variable should have a negative sign when equation (10a) is estimated. Per capita income is included as a proxy for factor costs in the area, which should have a positive effect on costs.

Older systems may have a different technology than newer systems and may need more maintenance, which could lead to higher costs for these systems. However, it is possible that systems that began operating longer ago may have recently replaced their physical plant. Thus, systems that are very new and systems that are very old, in terms of beginning operation date, may have similar technologies and costs, while systems in the middle may have higher costs. Since the only information available is the year the cable system began operating, both age and the square of age are included in the equation.

Equation (10a) also includes a dichotomous variable that is equal to one for 1990 observations, and zero otherwise, to capture the change in prices between 1984 and 1990

[18] Another quality measure, the number of top ten satellite networks shown in the basic tier, as measured by the number of systems on which the network is seen, was also considered. However, including this variable did not change the basic results. In addition, this variable had the wrong sign when included with the number of basic networks in the quasi-supply function, probably due to the high correlation between the two measures. Thus, the results reported here exclude this measure.

that is due to factors other than cost and quality changes. Finally, *LBASSAT* is included in the equation to control for changes in the quality of the system. If quality increased over time, and higher quality is more costly, then systems in 1990 should have higher costs and higher prices, without any change in the exercise of market power or demand elasticity. If a measure of quality is not included in the estimation of this equation, the dichotomous

TABLE 2 **Two-Stage Least Squares Estimates: Quasi-Supply Function Dependent Variable: *LBASFEE* (Standard errors in parentheses)**

	(1)	(2)	(3)
INTERCEPT	.18	−.11	.39
	(.86)	(.81)	(.84)
DUMMY	.18**	.23**	.35**
	(.08)	(.06)	(.03)
LAGE	.30**	.33**	.17
	(.12)	(.10)	(.11)
LAGESQ	−.06**	−.06**	−.04**
	(.02)	(.02)	(.02)
LPCMI	.16*	.17*	.20**
	(.09)	(.09)	(.09)
LPOPDEN	−.02	−.03*	−.03
	(.02)	(.02)	(.02)
LBASSAT	.15**	.05	—
	(.06)	(.06)	
LCAP	—	.15**	—
		(.06)	
N	489	489	490

* Significant at 10% level.
** Significant at 5% level.
Definition of variables: *LBASFEE* = natural log of basic fee; *DUMMY* = equal to one if 1990 observations, zero otherwise; *LAGE* = natural log of age of system; *LAGESQ* = (*LAGE*)∗(*LAGE*); *LPCMI* = natural log of per capita income; *LPOPDEN* = natural log of population density; *LBASSAT* = natural log, number of satellite channels on basic tier plus one; *LCAP* = natural log of channel capacity.

in this specification, the coefficient on *LBASSAT* becomes statistically insignificant, which is not surprising given the likely high correlation between channel capacity and number of satellite channels carried.

These coefficient estimates show that, controlling for cost and quality changes, prices were 18% to 23% higher after deregulation. Of course, this cannot necessarily be attributed solely to a change in the exercise of market power due to the elimination of regulation, since it can be seen in equation (10a) that the coefficient on *DUMMY* is equal to the change in the product of regulatory effectiveness and the elasticity of demand. A decrease in the absolute value of the elasticity of basic cable demand, perhaps due to a change in the relative attractiveness of cable and other entertainment sources, could increase the market power of cable systems and lead to higher prices. Thus, an estimate of the elasticity of demand and the change in the elasticity of demand is needed in order to separate the effects of regulatory effectiveness from the effects of changes in demand elasticity.

Thus, I estimate equation (13), a log-linear version of equation (5), with the number of basic subscribers as the dependent variable, while the right-hand-side variables include the price of basic, the same quality variable as in the quasi-supply equation, and exogenous variables such as per capita income, the number of over-the-air channels available in the market, the percentage of the population between the ages of 25 and 54, and VCR penetration. In addition, the price of basic is interacted with the *DUMMY* variable to determine if there was any change in the elasticity of demand between 1984 and 1990. This equation is also estimated using the method of two-stage least squares regression. Table 3 reports the results of the estimated demand equation. Generally, the results are consistent with prior expectations, though many of the coefficients are statistically insignificant.

TABLE 3 **Two-Stage Least Squares Estimates: Demand Equation Dependent Variable: *LBASSUB* (Standard errors in parentheses)**

INTERCEPT	.50
	(1.84)
LBASFEE	−1.46*
	(.84)
FEEDUM	.01
	(.08)
LBASSAT	.53**
	(.24)
LCHANOA	.05
	(.07)
LVCRPEN	−.04
	(.27)
LPCMI	.19
	(.18)
LP2554	.01
	(.40)
LAGE	1.43**
	(.46)
LAGESQ	−.22**
	(.08)
LHOMPA	.74**
	(.05)
N	489

* Significant at 10% level.
** Significant at 5% level.
Definition of variables: *LCHANOA* = natural log of number of over-the-air stations available; *LVCRPEN* = natural log of VCR penetration in Nielsen area where system located; *LP2554* = natural log of percentage of population aged 25–54; *LHOMPA* = natural log of number of homes passed by cable system; see Table 2 for other definitions.

The estimated elasticity from this demand equation is −1.5, which is roughly comparable to at least one previous estimate of the demand elasticity for basic cable.[24] However, the demand elasticity does not change significantly, in a statistical sense, between the two periods examined. Therefore, the 18% real increase in price after deregulation, holding cost and rates were probably not kept down to average cost levels.[25] The evidence on this issue, to date, has been mixed. A study by Zupan (1989a) presents evidence that regulators were successful in keeping rates down, at least below levels in unregulated markets. However, Prager (1990) finds no evidence that regulation was effective in controlling the frequency or magnitude of price increases. The evidence presented here is, therefore, more consistent with Zupan's results.

Though prices before deregulation appear to be below monopoly levels, and the price increases since 1984 were, in large part, due to the elimination of price regulation, it is possible that regulated prices were kept below average cost levels. This would imply that the price increases were necessary because of opportunism on the part of regulators, and would lead to a different interpretation of the results presented above. However, Zupan (1989b) finds little evidence of opportunism on the part of regulators, especially with regard to the price of basic service. In addition, Zupan (1989a) presents some evidence that, though regulators held prices below monopoly levels, regulated prices were above average cost levels. Finally, the results of the extended model presented below are also consistent with the hypothesis of prices above average cost prior to deregulation. Therefore, it appears unlikely that the price increases since deregulation were necessary to correct for opportunism on the part of regulators.

The welfare effects of this elimination of price regulation are difficult to assess, since the price increases that resulted were also accompanied by quality improvements, which may also have been due to the elimination of regulation. The welfare gains from such improvements, which would need to be distinguished from improvements that would have occurred anyway, are difficult to quantify. In addition, the magnitude of the costs of regulation, which is the benchmark against which a welfare loss due to a price increase should be compared, is also difficult to measure. However, we can obtain a rough estimate of the welfare loss attributable solely to the cable increases, using the figures for the price and quantity of an average system in the sample in Table 1 and the estimate of the elasticity of demand found in Table 3. Using these numbers, one can calculate a monthly deadweight loss of approximately \$16,500, which is about 2.4% of what consumers in this sample pay, on average, for basic cable service.[26] Further research is necessary, however, to determine if this is large relative to the costs of regulation.

Finally, for completeness, in column 3 of Table 2, the quality measure is eliminated from the equation. This specification is estimated using ordinary least squares, since there are no endogenous variables on the right-hand side of the equation. The point estimate of *DUMMY* increases to .35 when the quality measure is omitted, which is not surprising given the quality improvements that occurred since deregulation. This points out the importance of including quality changes when estimating the effectiveness of regulation and the change in the exercise of market power. If quality is not included, then more exercise of existing market power is attributed to cable systems than actually occurred.

□ **Extensions of the basic model.** As mentioned above, this model is a simplified version of how prices might actually have been set, since it does not explicitly recognize the fact that regulators, if they did an effective job, might constrain prices to average cost, not

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[25] A rough estimate of Θ in 1984 can be obtained by multiplying the coefficient on the *DUMMY* variable by the estimated demand elasticity and subtracting this product from one, the likely value of Θ in 1990, which would be equal to .73 in this case. Thus, prices were roughly, on average, 73% of monopoly levels prior to deregulation but were significantly above marginal cost. The relationship of these prices to average cost is discussed below.

[26] For an average system in the sample, with a basic price of \$13.17 in 1990, an 18% lower price level translates into a decrease of \$2.37, to \$10.80. With a demand elasticity of -1.5, an 18% decrease in price implies a 27% increase in quantity, which translates into almost 14,000 subscribers for the average system. Therefore, deadweight loss equals (.5)(2.37)(14,000), or \$16,590 per month. Monthly basic revenue for the average system is about \$681,000.

marginal cost, while unregulated cable firms would set price according to equation (10). Thus, one should explicitly consider average cost pricing when estimating the effectiveness of regulation and the increased exercise of market power that results from deregulation.

To explicitly consider average cost pricing, I estimate equation (10b). As mentioned above, the hypothesis for the coefficient on average fixed cost is that it should be equal to one, while the sum of the coefficients on these two variables should be zero. In other words, if the regulators in 1984 were pricing at average cost, then the price they set would go up one dollar for every dollar that average fixed cost increased. However, unregulated firms would be pricing according to the markup over marginal cost they could receive, as in equation (10a), so fixed cost should not affect their pricing decision.

Table 4 presents the estimated results for equation (10b). As a proxy variable for average fixed cost, I use the number of miles of plant in the cable system divided by the number of homes passed. This is a reasonable proxy for fixed costs, since miles of plant should be roughly proportional to true fixed costs. The sample used for this estimation includes systems with expanded basic tiers, with the prices and number of satellite channels for those systems weighted as described above. The results are qualitatively the same as those for the estimation of equation (10a). In particular, the coefficient on *DUMMY* is equal to .20, which is very similar to the estimated values already presented. Thus, the omission of fixed costs from equation (10a) is not introducing much bias to the estimated coefficient on *DUMMY*.

The coefficient on *FIXED*, the ratio of miles of plant to homes passed, is 0.59, which is not statistically different from one, the hypothesized value of this coefficient. However, it is also not significantly different from zero, indicating that the hypothesis test on this

TABLE 4 **Two-Stage Least Squares Estimates: Quasi-Supply Function, Including Average Fixed Costs, for Whole Sample, Including Systems with Expanded Basic Tiers (Standard errors in parentheses) Dependent variable: *LBASFEE***

INTERCEPT	.13
	(.79)
DUMMY	.20**
	(.08)
LAGE	.29**
	(.12)
LAGESQ	−.06**
	(.02)
LPCMI	.17*
	(.09)
LPOPDEN	−.02
	(.02)
LBASSAT	.14**
	(.06)
FIXED	.59
	(.68)
FIXDUM	−.45
	(1.93)
N	489

* Significant at 10% level.

** Significant at 5% level.

Definition of variables: *FIXED* = miles of plant/homes passed; *FIXDUM* = (*FIXED*)(*DUMMY*); see Table 2 for other definitions.

coefficient lacks sufficient power. The coefficient on *FIXDUM* is also not statistically significant, and the sum of the coefficients is not significantly different from zero. Again, the power of this test is limited. However, the results here are consistent with the previous results regarding regulatory effectiveness. In particular, they suggest that prices were above average cost under regulation, since average cost pricing, when the model includes fixed costs, would indicate a value of Θ in 1984 equal to zero, but these results suggest a value of Θ equal to .7—and this estimate of .7 is significantly different from zero. However, if *FIXED* is a poor proxy for average fixed costs, and any measurement error that exists is correlated with *DUMMY*, then this estimate would be biased. This potential bias would make it difficult to test the hypothesis that regulated prices were equal to average cost.

Table 5, column 1, has the estimated coefficients for equation (10a) when the sample is restricted to larger systems (with at least 50,000 subscribers). This is an indirect test of whether the overall sample in this study is biased, because it contains larger systems, on average, than exist in the population as a whole. The results using this subsample are not qualitatively different from the results presented in Table 2. In addition, there is no significant change in the elasticity of demand for this subsample, so the overall conclusions on the increased exercise of market power and the price changes since deregulation are similar to the conclusions reached from using the whole sample.[27] Though this does not conclusively rule out the fact that biases may be introduced by the sample used here, it suggests that the

TABLE 5 **Two-Stage Least Squares Estimates: Quasi-Supply Function, for Sample That Includes Systems with at Least 50,000 Subscribers, and for Systems in Markets with at Least Six Broadcast Channels (Standard errors in parentheses) Dependent variable: *LBASFEE***

	(1) At Least 50,000 Subscribers	(2) At Least Six Over-the-air Channels
INTERCEPT	−1.63	−.15
	(1.46)	(1.08)
DUMMY	.14	.19**
	(.09)	(.07)
LAGE	.55**	.33**
	(.25)	(.14)
LAGESQ	−.10**	−.07**
	(.05)	(.03)
LPCMI	.27*	.21*
	(.16)	(.13)
LPOPDEN	−.02	−.03
	(.03)	(.03)
LBASSAT	.21*	.14**
	(.11)	(.06)
N	127	300

* Significant at 10% level.
** Significant at 5% level.
Definition of variables: see Table 2.

[27] The point estimate for the demand elasticity for these larger systems is −2.4, which indicates that the demand is somewhat more elastic in these larger franchise areas, though this estimate is only significantly different

larger systems behave much like smaller systems and that any biases introduced by this sample are not likely to be significant.

I shall also briefly examine the role of over-the-air television in constraining prices of cable systems, an important issue in the FCC effective-competition proceedings. In the framework used above, over-the-air television might constrain cable prices by increasing, in absolute value, the elasticity of demand for cable. In addition, the effectiveness of regulation may have differed in these markets, which would lead to a greater or lesser role for an increased exercise of market power in explaining the increase in prices since deregulation.

To examine the role of over-the-air stations, I estimate equation (10a) using just those cable systems that are in markets with at least six over-the-air television stations. I choose six stations as the cutoff because the FCC cites it in its new effective-competition rules as the number that is necessary to have some constraining effect on cable rates. The results of estimating the model on this sample are reported in Table 5, column 2.

The estimated coefficient on *DUMMY* is .19, which is consistent with the other estimates presented above, and this coefficient is statistically significant. The elasticity of demand in these markets is estimated to be -1.51, with a standard error of .47. This is virtually the same as the estimated demand elasticity for all the systems in the sample. In addition, there is no significant change in elasticity between the two periods examined. Therefore, an increased exercise of market power after deregulation is responsible for a 19% price increase in markets where there are at least six over-the-air stations and regulation was slightly more effective in these markets relative to the whole sample, though the difference is minimal. Therefore, the presence of at least six over-the-air stations does not appear to change the overall results of the article.

5. Conclusion

■ Basic cable prices have increased at a rate much greater than the rate of inflation since they were deregulated by the Cable Act of 1984. The results presented above suggest that, on average, an increased exercise of market power, due to the elimination of regulation, can explain about 43% of this increase; changes in the elasticity of demand do not seem to have played a role in the price increases. These results hold under different assumptions about the form of the quasi-supply function for cable systems. Even if the function is changed to explicitly allow regulators to price at average cost before deregulation, while the cable systems price according to a markup over marginal cost after deregulation, the results are basically the same. Thus, although the cable systems may have some justification for their claim that cost increases are responsible for their price increases, it appears that an increased exercise of market power has also played a significant role.

There are a few obvious ways in which this approach could be extended, in order to insure that market power plays as large a role as these results indicate. A larger sample, one that included more systems in smaller population areas, would be useful to insure that the choice of the sample in this article is not biasing the results. An important improvement would be a refinement of the quality measures, particularly by taking into account the costs of carrying the same network over time. If there are cost increases that can be attributed to carrying the same network over time, then the results above may be biased upwards. In addition, the analysis of the welfare effects of deregulation should be expanded, to determine whether the reintroduction of price regulation is warranted or whether some other policy with regard to cable systems should be followed.

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