few workers later (when its annual cash OPEB obligation is large). Competition in the market--particularly entry from profit-seeking firms--drives prices towards economic costs which in turn forces high cost firms to leave the market. Thus, in competitive markets, the firm's supply curve--the amount of goods and services it is willing to produce for a given price--must reflect the economic cost of OPEBs regardless of their accounting treatment. A change to accrual accounting for OPEBs would have no effect on output prices in competitive markets: effectively, the accrual has already been recognized by the market and is reflected in the market price. A similar analysis shows that accounting changes would have no effect on non-competitive (but unregulated) markets.

In regulated markets, however, accounting changes can have significant effects on prices. The essence of the regulatory process is a connection between recognized or adopted accounting costs and prices paid by ratepayers. A rate-of-return regulated firm is entitled to an opportunity to recover its recognized accounting costs plus a fair return on its investment. In the interstate jurisdiction--and most other regulatory jurisdictions--cash accounting has been authorized by the Commission for OPEB expenses. In contrast with unregulated markets, there are no forces at work in regulated firms that require managers to recognize economic costs. Thus, the regulated prices which began the price cap regime for Pacific Bell were based on cash accounting for OPEBs.

However, Pacific Bell's liability for OPEB benefits was being created while employees worked, not when they retired--just as in unregulated markets. Cash accounting resulted in prices which were equal to a measure of cost of service which

understated the true current cost of using an employee to provide service. Only when that employee retired and began using benefits, would cash accounting begin to recognize those costs. Thus, the current cash accounting treatment for OPEBs leads to intertemporal inequities in regulated markets in which future ratepayers will pay a portion of the costs of providing current services.

Adopting FAS 106 and recognizing the difference in costs as an exogenous cost change would lead to the same price level that would have occurred if FAS 106 had been adopted before the beginning of price cap regulation. If FAS 106 had been adopted while the industry was subject to rate of return regulation, the initial levels of prices for price caps would have been set at a level to recover the amortization of the historical liability for OPEBs prior to 1993 and the ongoing expense for OPEB liability incurred in the current year. In addition, since earnings are measured with respect to accounting costs, if FAS 106 had been adopted before the beginning of price caps, measured earnings for sharing with ratepayers would reflect economic costs of OPEBs. Thus the prices (and measured costs) that would exist today if accrual accounting for OPEBs had predated price cap regulation can be attained by adopting an exogenous cost change for FAS 106.

In summary, competitive forces drive prices towards economic costs, but regulatory ratemaking sets prices using adopted accounting costs. In unregulated markets, prices already reflect accrual accounting costs for OPEBs because those are the actual economic costs. However, prices in regulated markets have been (and are currently) set to recover cash accounting costs for OPEBs, not accrual accounting costs. Prices of rate-of-return and price-cap regulated firms thus entail an intertemporal

misallocation of costs in which future ratepayers pay a portion of the economic costs of current services. To correct this inequity, the accounting costs of the regulated firm--and its prices--must be adjusted to recover each year's economic costs as they are incurred and to amortize as quickly as possible the accumulated liability for past years' OPEBs. For price-cap regulated firms, a Z-adjustment must be made to the price cap. Subsequent to adoption of accrual accounting by the FCC, if no price cap changes were allowed, (i) the intertemporal cost misallocation would continue, and (ii) the sharing mechanism would incorrectly transfer funds between shareholders and ratepayers. A Z-adjustment would also lead to the same level of prices that would prevail had accrual accounting for OPEBs been adopted prior to price cap regulation.

C. Exogenous Cost Changes in the Price Cap Formula

In its decision implementing price cap regulation, the FCC recognized the need to adjust the price cap to reflect exogenous cost changes.[13] The definition of an exogenous cost change was given in the decision:

> "Exogenous costs are in general those costs that are triggered by administrative, legislative or judicial action beyond the control of the carriers...These costs are created by such events as separations changes; USOA amendments; changes in transitional and long term support; the expiration of amortizations; and the reallocation of regulated and nonregulated costs."[14]

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[13]Federal Communications Commission, Second Report and Order, CC Docket 87-313, released October 4, 1990, pgh. 166.

[14]Ibid.

The adoption of FAS 106 is a change in accounting procedures, and the FCC price caps decision recognizes such changes as exogenous events:

> "Changes in LEC costs that are caused by changes in Part 32 of our Rules, the Uniform System of Accounts (USOA), will be considered exogenous. We make this classification on the basis that such changes are imposed by this Commission and are outside the control of carriers."[15]

From the perspective of an economist, a Z-adjustment that changes prices for price-cap regulated firms to reflect accrual accounting costs for OPEBs promotes economic efficiency because it moves prices towards economic costs. However, changes in wages (for example) for a regulated firm represent changes in economic costs, and yet few economists would recommend that wage changes be accorded Z factor treatment.[16] In what sense then is the cost change from adoption of FAS 106 different from the cost change from a (hypothetical) wage increase?

Like wages, OPEBs are an element of the compensation package for workers, and Pacific Bell has roughly the same ability to raise or lower OPEB expenses as it does to raise or lower wages.[17] What is beyond the control of the firm are (i) the change in accounting standards, and (ii) the build-up of an historical liability that has resulted from cash accounting in the past. Changes in accounting standards clearly have nothing to do with Pacific Bell management, and the historical liability represents deferred compensation earned by its employees for services rendered in the past.

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[15] Ibid. pgh. 168 [footnotes omitted].

[16] If changes in wages could be passed through to ratepayers by means of a Z-adjustment, the regulated firm would have little incentive to control the wages it pays.

[17] This ability is, of course, not unlimited. Pacific hires workers in competitive labor markets, and changes in OPEB benefits affect its ability to attract and maintain its workforce.

To understand how these accounting changes should be treated under price caps, it is useful to separate the OPEB expense under accrual accounting in any year into two parts:

1. the amortization of the embedded OPEB liability as of 1993, and

2. the on-going accrual associated with current year employees.

Thus the difference between expenses under accrual and cash accounting can be visualized as having two parts: the amortization of the embedded liability plus the difference between accrual expenses for current operations and cash-based accounting OPEB expenses.

The proposed 15 year amortization of the embedded liability can be correctly treated as a pair of Z-adjustments,[18] just like any other amortization (e.g., inside wire and the depreciation reserve deficiency in the FCC price cap plan). The costs in question have already been incurred, and the liability has been quantified.

The second component of the difference in expense streams can be calculated as the difference between OPEB costs associated with current operations and cash-based accounting OPEB expenses. By managing its operations prudently after the one-time 1993 Z factor adjustment, the firm can attempt to control the accrual for OPEBs--just as total OPEB expenses under cash accounting have been treated as endogenous expenditures under the price cap plan. If changes over time in this

[18]One Z-adjustment would be made in 1993, and an offsetting Z-adjustment would be made fifteen years later when the amortization expires.

difference were passed through as annual Z-adjustments, the firm's incentive to manage its OPEB costs prudently would be diminished.

The proposed Z-adjustment in the price cap aligns rates and costs as if price caps had been implemented with prices set using accrual accounting for OPEBs. That one-time change adjusts for the fact (recognized exogenously in FAS 106) that the prices under which price caps were implemented did not reflect the true economic cost of OPEBs offered to workers up until that time. After implementation of the Z factor adjustment, OPEB expenses would again be under management control just like wage expenses. Thus adoption of FAS 106 aligns accounting costs and economic costs, and Pacific's proposed Z-adjustment would align its initial prices with economic costs.

With initial rates set at their appropriate level, Pacific Bell's management would then have the incentive to manage OPEB expenses in the same manner as all other costs.[19] All else equal, if OPEB costs increase, Pacific Bell's earnings would decrease, and vice-versa. These are the same risks and incentives faced by firms in unregulated markets which compensate workers with similar packages of wages, pensions, and OPEBs. Z factor treatment for FAS 106 cost changes would not diminish the incentives of the firm to control its OPEB expenses. Thus, from an economist's point of view, FAS 106 cost changes meet the test for exogeneity as used in the theoretical derivation of the price cap formula.

[19]In this sense, FAS 106 cost changes are similar to separations cost changes, which are the prototype example of an exogenous cost change. Both types of changes are changes in accounting costs, not economic costs. In both cases, the firm can control future expenditures. Nonetheless, separations changes are treated as exogenous cost changes because they enable the regulator to change prices in different jurisdictions.

In this sense, FAS 106 cost changes are similar to separations cost changes, which are the prototype example of an exogenous cost change. Both types of changes are changes in accounting costs, not economic costs. In both cases, the firm retains some control over future expenditures. Nonetheless, separations changes are treated as exogenous cost changes precisely because they enable the regulator to change prices in different jurisdictions:

> "...we will require an exogenous cost adjustment for changes in interstate costs for LECs that are caused by changes in the Separations Manual. As we explained in the Second Further Notice, these changes are imposed by regulators and are outside the control of the carriers...Regulatory decisions that are designed to produce just and reasonable rates must affect the cap in order to ensure that the system results in rates that are just and reasonable."[20]

In the case of OPEBs, the FAS 106 accounting decision must affect the cap in order to ensure that the price cap is based on economic costs.

D. Applying the Price Cap Formula

How should the Z-adjustment for the change to accrual accounting for OPEBs be calculated in the price cap formula? For the regulated firm, the difference in 1993 expenses under FAS 106 and under cash accounting for OPEBs should be estimated and expressed as a fraction of the total annual revenue requirement. For the U.S. economy, a similar calculation should be made for those markets in which accounting cost changes will lead to price changes which, in turn, will affect the growth

[20] Second Report and Order, CC Docket 87-313, released October 4, 1990, pgh. 167.

of GNP-PI. The difference between these effects determines the 1993 Z-adjustment under price caps.

There are several ways in which this simple calculation may appear to overstate the price change required to pass through the cost changes stemming from the FAS 106 accounting changes. First, to the extent that FAS 106 changes affect all U.S. firms, there may be some change in the GNP-PI associated with FAS 106, and simply flowing through the firm's cost change would result in double-counting. The derivation of equation (4) presented above makes it clear that only the difference between the effect of FAS 106 on Pacific Bell costs and on U.S. average costs should be passed through as a Z-adjustment.[21] The rest of the cost change stemming from FAS 106 would be recovered from the assumed change in GNP-PI.[22]

A second apparent double-counting stems from the presence of prices of medical services as a component both of GNP-PI and of Z, the firm's expected change in costs stemming from FAS 106. If a Z-adjustment is made in 1993 (for example) so that the price cap reflects accrual accounting for OPEBs, that Z-adjustment will become part of the price cap that will be adjusted every year by GNP-PI - X. Since the OPEB Z-adjustment already includes expected medical inflation, one might think that the Z-adjustment should not be corrected in every future year for inflation. Possibly it should be isolated from the price cap index in the future, so that,

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[21] That is, if an exogenous event led to a 1 percent reduction in GNP-PI and a 4 percent reduction in telephone company costs, the appropriate Z-adjustment would be a 3 percent reduction in price.

[22] We showed above that the change to accrual accounting was already reflected in prices for competitive markets. The impact of FAS 106 on output prices in the economy will be approximately zero. Thus the appropriate Z-adjustment for the regulated firm will be approximately its increase in accounting expenses.

effectively, it would not be multiplied each year by [1 + GNP-PI - X]. But that would be wrong.

The actual OPEB cost incurred in 1993 is a function of future medical prices. If the OPEB Z-adjustment were made correctly in 1993, it would raise the price cap to the level it would have attained if Pacific Bell had been under accrual accounting for OPEBs all along.[23] Because the Z-adjusted price cap in 1993 represents actual costs in 1993, it follows from equation (4) that all parts of the 1993 price cap must be multiplied by [1 + GNP-PI - X] in 1994, or prices will no longer track costs, assuming that the productivity objective of X is met.

A common error is to examine the price cap adjustment formula and conclude that the GNP-PI term compensates the regulated firm for inflation in the price of its inputs, including medical services to retirees. If that were the case, then compensating the firm for inflation of its 1993 OPEB Z-adjustment might appear to be double-counting. However, the role of GNP-PI in the price cap adjustment formula is not to measure and compensate the firm for input price increases. Rather, GNP-PI is a measure of national output price increases, and the price cap adjustment equation assures us that if the firm meets its productivity target, its output price will have to be multiplied by [1 + GNP-PI - X] every year to keep prices equal to costs.

In summary, while compensating the regulated firm for changes in cost due to adoption of accrual accounting for OPEBs might at first give the appearance of double-counting in several ways, it does not.

[23]Apart from amortizing the historical liability.

1. The switch to accrual accounting will affect the GNP-PI, but we showed that the formula compensates the firm for the difference between the effect of the accounting change on its prices and the GNP-PI.

2. The Z-adjustment is based on forecasts of future medical inflation, so adjusting the OPEB Z-adjustment component of the price cap for inflation in future years may seem to be double-counting. However, we showed that this argument misinterprets the role of GNP-PI in the price cap formula, and adjusting the entire price cap by (GNP-PI - X) in subsequent years is necessary so that prices track costs.

IV. THE EFFECT OF FAS 106 ON PACIFIC BELL'S INTERSTATE PRICES

In this section, we combine the theory from the previous section with cost estimates for OPEB expenses obtained from Pacific Bell. We are informed that, as a result of adoption of accrual accounting for OPEBs in 1993, Pacific Bell's interstate revenue requirement (as if it were rate-of-return regulated) would increase by $29 million in 1993. We show that the effect of FAS 106 on the prices of other firms in the economy is small so that the effect of the change to accrual accounting on the growth of GNP-PI is very small (less than 0.12 percent). Thus Pacific Bell's price cap must also increase by close to $29 million (more than $27 million, as discussed below) so that its prices will cover its costs, and the intertemporal inequity by which future ratepayers pay for current services will be eliminated.

A. The Effect of FAS 106 on Pacific Bell Costs is Approximately 1.92 Percent

A shift to accrual accounting for OPEBs would lead to an increase in 1993 expenses, primarily because of the amortization of the historical OPEB liability. When the amortization expires after 2008, there will be a symmetric reduction in expenses under accrual accounting relative to cash accounting. For a rate-of-return-regulated firm, this shift in expenses would generate a similar shift in prices, reducing the inter-generation inequity. To insure that the change to accrual accounting for OPEBs also eliminates the inter-generation inequity for price-cap-regulated firms, we must pay special attention to how the annual Z factor adjustments are made.

The Z-adjustment to prices to account for FAS 106 should equal the change in expenses attributable to FAS 106. In turn, the change in 1993 expenses attributable to FAS 106 would equal the change in revenue requirements resulting from the change from cash to accrual accounting for OPEBs.[24] Specifically, let A_t be the incremental revenue requirement for OPEBs in year t under accrual accounting and C_t be the incremental OPEB revenue requirement under cash accounting. Then the 1993 proportional expense change ΔE_{1993} would be

$$\Delta E_{1993} = \frac{(A_{1993} - C_{1993})}{(Total\ Revenue\ Requirement)_{1993}} . \quad (5)$$

[24]Pacific Bell's interstate expenses for OPEBs reflect partial implementation of accrual accounting in that Pacific Bell is currently using tax-deductible funding vehicles for OPEBs. Thus, the change in expenses represents the effects of full implementation of accrual accounting.

In accordance with the accounting requirements under FAS 106, Pacific Bell has estimated the expenses that would be incurred under cash and accrual accounting for OPEBs.[25] For the interstate jurisdiction, OPEB revenue requirements under accrual accounting would be $59 million in 1993 compared with cash accounting expenses of $30 million. Therefore, Pacific's revenue would have to increase by $29 million in 1993 in order for the company's revenue to match what its 1993 expenses would have been had the FCC adopted accrual accounting for OPEBs before price caps were begun. This increase represents a price increase of about 1.92 percent, based on an estimated Pacific Bell 1993 interstate revenue billing base of about $1,493 million.[26] Assuming the 1993 interstate revenue requirement is about $1,493 million, application of equation (5) would produce a price increase of about 1.92 percent (relative to prices under continued cash accounting for OPEBs) in the first year.[27]

B. The Effect of FAS 106 on the GNP-PI is Less Than 0.12 Percent

Under price caps, a utility's exogenous cost changes will be fully recovered through changes in the GNP-PI if (i) they are of the same relative size as for a typical firm in the U.S. economy, and (ii) the typical firm will pass through the

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[25]As we understand it, Pacific's estimate of expenses under accrual accounting is based on an Accumulated Post-retirement Benefit Obligation that has been reduced by the amount of the tax free funding Pacific has already incurred. Without this funding before the start of FAS 106 requirements, the OPEB expenses under accrual accounting for 1993 would be greater.

[26]This estimate is conservative (high) because it includes anticipated revenues before sharing. Revenues that just matched the benchmark rate of return of 11.25 percent would be lower, thus increasing the percentage increase in exogenous expenses.

[27][$59 - $30]/$1,493 = 1.92%.

exogenous cost change in higher prices. For the adoption of FAS 106, we have shown that, in theory, the historical liability for post-retirement benefits would logically already have been captured in the output prices of firms in unregulated markets. To a first approximation, since most of American GNP is produced by firms whose prices reflect economic costs, the accounting change required by FAS 106 will result in no contemporaneous change in the GNP-PI.

Historical experience also suggests that accounting changes have negligible effects on prices in unregulated markets and in the U.S. economy as a whole.[28] In 1987, the FASB changed the method of accrual accounting for pension benefits, a change which is similar in principle to the change contemplated in FAS 106, though smaller in magnitude. A search of the empirical literature reveals two studies of the effects of these accounting changes which both show no relationship between accounting changes and stock prices.[29] Assuming that (i) changes in stock prices reflect changes in anticipated profits and (ii) changes in accounting costs do not change economic

[28]Modern finance theory as well as practicing financial analysts recognize that accounting changes do not change the underlying economic reality. For example, in discussing the ramifications of FAS 106, Solomon Samson of Standard & Poor observed, "The realities do not change simply because someone puts down a different number. Part of our trade is adjusting published numbers to reflect economic realities." (BNA Pensions and Benefits Daily, September 27, 1991.)

[29]NERA undertook A DIALOG Database system search of the relevant literature, including the Economic Literature Index (1969-present), the Academic Index (1976-present), the Conference Papers Index (1973-present), Management Contents (1974-present), and Dissertation Abstracts (1961-present). These databases were searched using as keywords: "FASB," "Financial Accounting Standards Board," "Statement 87," "87," "pensions," and "economic". Fifteen publications were identified and two were relevant: (i) Sheree S. Ma, "An Empirical Examination of the Stock Market's Reaction to the Pension Accounting Deliberations of the Financial Accounting Standards Board," Doctoral Dissertation, University of Alabama, 1989, and (ii) Samuel S. Tung, "Stock Market Reactions to Mandatory Changes in Accounting for Pensions," Doctoral Dissertation, University of Wisconsin, 1987. Both works showed that no changes in stock prices could be attributed to the 1987 pension accounting changes.

costs, the fact that accounting changes do not affect stock prices implies that accounting changes do not affect output prices.[30]

To refine this approximation somewhat, we observe that prices of some goods and services will change when FAS 106 is implemented in 1993: notably (i) regulated public utility services and (ii) certain government purchases of services under contracts which historically covered only pay-as-you-go costs and prospectively allow FAS 106 accruals. In 1987, regulated public utilities produced approximately 6.13 percent of U.S. GNP. Total government contract purchases (not just cost-plus contract purchases) were 4.36 percent of GNP in 1987.[31] In total, what might be called the "cost-plus" sector of the economy produced less than 10.49 percent of GNP in 1987. We use 1987 for comparison because the 1987 government contract data is the latest available. Note that these proportions do not change much over time; Table 1 shows these proportions for 1980 and 1987.[32] If all firms experienced the same expense change from FAS 106 in 1993 as Pacific Bell and if prices in the unregulated economy already reflect OPEB costs measured on an economic basis, then the overall price level in the U.S. would increase by less than 0.20 percent in 1993 when accrual accounting is

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[30]This follows from the observations that (i) profits represent the difference between output prices and costs and (ii) accounting changes affect neither profits nor costs.

[31]A GSA report tracks the annual value of Federal Government contracts issued in each year: see General Services Administration, Federal Procurement Data System Standard Report. For 1987, the amount of Federal contracts issued was $197.3 billion which represents an update (obtained by telephone from the Federal Procurement Data Center) of the published figure.

[32]Regulated public utilities include railroad transportation, local and interurban passenger transportation, pipelines other than gas, telecommunications, and electric, gas, and sanitary services. See U.S. Bureau of the Census, Statistical Abstract of the United States: 1990, (110th edition), Washington, D.C., 1990, pp. 425-426. We include data for 1980 to show that the industry components of GNP are reasonably stable over time.

Table 1.
Relative Size of the Cost-Plus Sector

	GNP by Industry current $ billion 1980		GNP by Industry current $ billion 1987	
GNP	$2,732.0	(percent)	$4,526.7	(percent)
Railroad	$20.8		$19.6	
Passenger transit	$5.4		$8.1	
Non-gas pipelines	$4.7		$5.3	
Telecommunications	$60.2		$108.3	
Electric, gas, sewer	$68.4		$136.4	
TOTAL UTILITIES	$159.5	5.84%	$277.7	6.13%
GOVERNMENT CONTRACTS			$197.3	4.36%
TOTAL COST-PLUS SECTOR			$475.0	10.49%

implemented.[33] Under these assumptions, less than 10.49 percent of Pacific Bell's exogenous cost change would be accounted for in the GNP-PI, and the required Z factor would exceed 89.51 percent of the exogenous cost change.[34] This estimate is unrealistic because all U.S. firms have not used OPEBs to the extent that Pacific Bell has.

An additional refinement to this upper bound would recognize that the effect of FAS 106 on Pacific Bell is far greater than on the typical firm in the U.S.

[33]Pacific Bell expenses will increase 1.92 percent. If all cost-plus firms have the same proportional OPEB liability as Pacific Bell, the average liability will be a weighted average of 1.92 percent in the cost-plus sector and 0 elsewhere. Thus (1.92 * 0.1049) + (0.0 * 0.8951) = 0.20. Recall that this estimate is an upper bound because (i) all government contract purchases are included in the cost-plus sector, not just government purchases under cost-plus contracts, and (ii) the impact of FAS 106 on Pacific Bell is greater than on an average firm.

[34]10.49 percent equals 0.20/1.92; and 89.51 percent equals 1.72/1.92.

economy. In order to understand what the important differences are, we engaged William M. Mercer, a leading employee benefits consulting firm, to develop and analyze basic facts about post-retirement benefits other than pensions. The most important differences between Pacific Bell and a typical firm appear to be the following:

1. Coverage: Pacific Bell provides post-retirement benefits to its entire pension-qualified labor force. In contrast, only about 40 percent of private sector workers are employed by firms that offer post-retirement health benefits.[35]

2. Historical liability: Pacific Bell estimates that its accumulated historical postretirement benefit obligation will be about $0.5 billion in 1993 in the interstate jurisdiction. This amount is about 33 percent of Pacific's annual interstate revenues, about 21 percent of Pacific's interstate net rate base, and about 37 percent of the equity component of the net rate base. In contrast, the accumulated historical liability for the U.S. economy is estimated at about $300 billion.[36] This amount represents about five percent of U.S. GNP and on the order of 7 to 10 percent of corporate equity.[37]

U.S. OPEB expenses are estimated to be about $13 billion in 1993 on a cash accounting basis compared with about $82 billion on an accrual basis in 1993.[38] The

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[35]United States General Accounting Office, "Extent of Companies' Retiree Health Coverage," Prepared for Congress, March 1990 (GAO-1990).

[36]Statement of Gregory J. McDonald, United States General Accounting Office, Before the Subcommittee of Health, Ways and Means Committee of the House of Representatives, May 6, 1991.

[37]U.S. General Accounting Office, "Companies' Retiree Health Liabilities Large, Advance Funding Costly," Report to Congress, June 1989 (GAO-1989). Mark Warshawsky, "The Uncertain Promise of Retiree Health Benefits: An Evaluation of Corporate Obligations," Retiree Health Benefits Seminar, American Enterprise Institute, Washington, D.C., April 9, 1991.

[38]Mercer first evaluated a number of existing studies of corporate obligations for OPEBs and concluded that the GAO-1991 study was the most reliable in terms of credibility and methodology. This study produced an estimate of $42 billion for accrual accounting expenses under FAS 106 procedures in 1991. Mercer then modified a number of assumptions to conform more closely with FAS 106 requirements and carried the calculations forward to 1993, in the process producing the higher figure.

change is thus $69 billion out of an estimated GNP of $6,260 billion, or 1.10 percent.[39] Since the incidence of OPEBs appear to be uniformly distributed across industries, it is reasonable to assume that firms in the cost-plus sector increase prices by 1.10 percent in response to FAS 106.[40] Firms in the rest of the economy have already reflected accrual accounting in their prices, so the net effect of FAS 106 on the GNP-PI would be less than 0.12 percent (twelve-hundredths of one percent) instead of the 0.20 percent bound calculated above.[41] Thus, if cost-plus firms experience the U.S. average OPEB expense increase (1.10 percent) instead of the Pacific Bell increase (1.92 percent), GNP-PI would increase by less than 0.12 percent and the required Z factor would exceed 1.80 percent. Thus, less than 6.26 percent of the exogenous cost change is reflected in the GNP-PI, leaving more than 93.74 percent to be recovered through the Z factor.[42]

This estimate of the effect of FAS 106 on the GNP-PI is an upper bound for several reasons. First, we have overstated the size of the cost-plus sector of the economy by assuming that all public utility prices are set using accounting costs and treating all government contracts as cost-plus contracts with accounting change escalators. Second, this calculation ignores second-order effects that would lower the impact on national output prices. As prices rise in the cost-plus sector, for example,

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[39]The 1993 GNP forecast was downloaded from Data Resources, Inc.

[40]A GAO survey in 1990 compared health coverage of retirees by type of industry and concluded that there was "little variation among companies with retiree health benefits when comparing companies by industry group," GAO-1990 Report, pp. 6-7. Thus the impact of FAS 106 on expenses for firms in the cost-plus sector should be roughly the same as the U.S. average of 1.10 percent.

[41]Thus (1.10 * 0.1049) + (0.0 * 0.8951) = 0.12 percent.

[42]Because [1.92 - 0.12]/1.92 = 93.74 percent and 0.12/1.92 = 6.26 percent.

consumers substitute away from these goods and services which reduces the net effect of the price increase in the cost-plus sector on overall inflation. Finally, the calculation ignores second-order macroeconomic responses to the change in output prices through changes in government expenditure, interest rates and the money supply.

A summary of these calculations may be useful. Recall that we wish to increase Pacific Bell's price cap by 1.92 percent which represents the change in expenses due to the shift from cash to accrual accounting for OPEBs in 1993. Some of this increase will be accounted for by the change in inflation; the rest must be supplied through the Z-adjustment we are calculating. The increase in inflation due to FAS 106 is measured in two steps: (i) we calculate the effect of FAS 106 on the expenses of an average firm to be 1.10 percent, and (ii) we calculate the fraction of GNP produced by firms whose prices do not already reflect accrual accounting for OPEBs to be less than 10.49 percent. Since the incidence of OPEBs across industries is roughly constant, we estimate that the prices at which less than 10.49 percent of GNP is sold will increase by 1.10 percent, so that the increase in GNP-PI, averaged over all firms, will be less than 0.12 percent. Using this bound as an estimate, Pacific Bell's 1.92 percent price increase would thus consist of a 0.12 percent increase in GNP-PI and a 1.80 percent Z-adjustment. The required Z-adjustment (net of the change in GNP-PI) is thus at least 93.74 percent of the $29 million change in expenses, or at least $27 million.

These results are stable with respect to the various assumptions and forecasts that we have made. In Table 2, we summarize our previous results and provide new estimates assuming (i) a 100 percent increase in the effect of FAS 106 on an average

Table 2
Summary of Results
and
Sensitivity Analysis

	BASE CASE	NATIONAL FAS EFFECT IS 100% LARGER	COST-PLUS SECTOR IS 100% LARGER	PB REVENUE FORECAST IS 10% LARGER
PAC BELL FAS EFFECT	1.92%	1.92%	1.92%	1.74%
GNP-PI EFFECT	0.12%	0.23%	0.23%	0.12%
Z-ADJUSTMENT	1.80%	1.69%	1.69%	1.62%
% FAS IN GNP-PI	6.26%	12.01%	12.01%	6.89%
% FAS IN Z	93.74%	87.99%	87.99%	93.11%
Z	$26,808	$25,166	$25,166	$26,629

U.S. firm, (ii) a 100 percent increase in the cost-plus proportion of the U.S. economy, and (iii) a 10 percent increase in our forecast of Pacific Bell's 1993 revenues. Clearly, the results are insensitive to the assumptions.

APPENDIX

In this Appendix, we provide the details of the derivation of the price cap annual adjustment formula. The logic follows that of Dr. Schankerman, whose presentation of the price cap formula formed the basis of the California price cap plan.[43]

A. The Relationship Among TFP, Input Price, and Output Price Growth

Consider a multiproduct firm having N outputs (Q_i^o, i=1,...,N) and M inputs (Q_j^I, j=1,...,M). We wish to calculate X and Z so that in all periods, economic profits are identically zero, i.e., that the value of total inputs (including a normal return on capital) equals the value of total output. The identity can be written as

$$\sum_{i=1}^{N} p_i Q_i^o = \sum_{j=1}^{M} w_j Q_j^I ,$$

where p_i and w_j denote output and input prices respectively. Differentiating this identity with respect to time yields

$$\sum_{i=1}^{N} \dot{p}_i Q_i^o + \sum_{i=1}^{N} p_i \dot{Q}_i^o = \sum_{j=1}^{M} \dot{w}_j Q_j^I + \sum_{j=1}^{M} w_j \dot{Q}_j^I ,$$

[43]Testimony of Mark Schankerman on behalf of GTE California Incorporated, Docket I. 87-11-033, Technical Appendix, pp. 1-3.

where a dot indicates a derivative with respect to time. Dividing both sides of the equation by the value of output $R = \sum_i p_i Q_i^o$ or $C = \sum_j w_j Q_j^I$, we obtain

$$\sum \dot{p}_i \left(\frac{Q_i^o}{R} \right) + \sum \dot{Q}_i^o \left(\frac{p_i}{R} \right) = \sum \dot{w}_j \left(\frac{Q_j^I}{C} \right) + \sum \dot{Q}_j^I \left(\frac{w_j}{C} \right),$$

where **R** and **C** denote revenue and cost. If $\mathbf{r}_i$ denotes the revenue share of output **i** and $\mathbf{c}_j$ denotes the cost share of input **j**, then

$$\sum_i r_i \, dp_i = \sum_j c_j \, dw_j - \left[\sum_i r_i \, dQ_i^o - \sum_j c_j \, dQ_j^I \right],$$

where **d** denotes a percentage growth rate: $dp_i = \dot{p}_i / p_i$. The first term in the above equation is the revenue weighted average of the rates of growth of output prices, and the second is the cost-weighted average of the rates of growth of input prices. The term in brackets is the difference between the rates of growth of weighted averages of outputs and inputs and is thus the change in TFP. We can write the equation as

$$dp = dw - dTFP.$$

Thus the growth in input prices less the growth in output prices is equal to the change in TFP. This result requires only that excess profits are zero in every period. It does not require cost minimization, profit maximization, marginal cost pricing, or constant returns to scale.

B. The Price Cap Adjustment Equation

We begin with equation (3) from the text:

(6) $$dp = dp^N - [\, dTFP - dTFP^N + dw - dw^N \,] + [\, Z^* - Z^{*N} \,].$$

If we measure national output price inflation by the change in GNP-PI, we obtain

(7) $$dp = GNP\text{-}PI - X + Z'$$

where $X = [\, dTFP - dTFP^N \,] + [\, dw - dw^N \,]$ and $Z' = Z^* - Z^{*N}$. Since the percentage change in the regulated firm's output price between years t-1 and t is just $[p_t - p_{t-1}] / p_{t-1}$, we can write equation (7) as

$$\frac{p_t - p_{t-1}}{p_{t-1}} = GNP\text{-}PI - X + Z'$$

so

$$p_t - p_{t-1} = p_{t-1} \times [\, GNP\text{-}PI - X + Z' \,]$$

which simplifies to

(8) $$p_t = p_{t-1} \times [\, 1 + GNP\text{-}PI - X + Z' \,].$$

Since revenue equals price times quantity, the revenue change associated with the price change in equation (8) is obtained by multiplying both sides of the equation by the fixed amount of quantity demanded:

$$q_{t-1} \times p_t = q_{t-1} \times p_{t-1} \times [\, 1 + GNP\text{-}PI - X + Z' \,]$$

or

(9) $$R_t = R_{t-1} \times [\, 1 + GNP\text{-}PI - X \,] + Z$$

where Z represents the total dollar value of the exogenous cost change rather than the unit cost change.

Appendix 2

SFAS-106 Costs by year

Part A

Pacific Bell

PACIFIC BELL
POSTRETIREMENT BENEFITS OTHER THAN PENSIONS
INTERSTATE IMPACT OF SFAS 106
1993 - 1996

(Dollars In Millions)

	1993	1994	1995	1996
1) SFAS 106 Accrual	$59.5	$59.4	$59.8	$60.1
2) OPEB Cost Cost Recovery -- Current Methodology	$30.1	$30.1	$30.1	$30.3
3) SFAS 106 Incremental Rate Base Impact	$0.6	$1.1	$1.6	$2.2
4) Net Increase (L1 - L2 - L3)	$28.8	$28.2	$28.0	$27.7
5) GNP-PI Effect (6.26%* X L4)	1.8	1.8	1.8	1.7
6) Total Z Factor Adjustment (L4 - L5)	$27.0	$26.5	$26.2	$25.9
7) Billing And Collection Allocation#	1.6	1.6	1.6	1.6
8) Net Price Cap Adjustment (L6 - L7)	$25.4	$24.9	$24.6	$24.3

* Per NERA Study, Page 32

\# Per Transmittal Letter No. 1579, Work Paper II

Appendix 2