http://clevelandfed.org/research/review/
Economic Review 2000 Q3

Will Electricity Deregulation Push Inflation Lower?

by Mark E. Schweitzer and Eric C. Thompson

Mark E. Schweitzer is an economist at the Federal Reserve Bank of Cleveland. Eric C. Thompson is the associate director of the Center for Business and Economic Research at the University of Kentucky.

Introduction

After thirty years' effort, deregulation has been achieved in key sectors of the U.S. economy—the transportation, telecommunications, financial, and natural gas industries. Deregulation has enhanced competition and efficiency and lowered prices in these industries. Moreover, because so many other industries and households utilize these services, successful deregulation also improves efficiency—and can reduce prices—throughout the economy.

One current focus of deregulation is the electric utility industry. Historically, regulated regional monopolies have generated, transmitted, and distributed electric power in the United States. In recent years, several states have acted to allow industrial, commercial, and even residential consumers to choose their power supplier, while many other states are considering similar measures. In addition, federal legislation has been proposed to help clear further hurdles.

How will such legislation affect the prices of electricity and other goods as well as the inflation rate? This paper uses two approaches to that question: a microeconomic analysis focused on existing electricity use and a macroeconomic study of past episodes of dramatic movement in energy prices.

I. Background

Every state in the Fourth Federal Reserve District has either proposed or passed legislation to deregulate electricity production. Ohio passed Senate Bill 3, which mandates more consumer choice and the unbundling of electricity services. This legislation will allow consumers to choose their electric power generator starting in 2001. It will also oblige generators to compete for customers on the basis of the price and reliability of the power they can supply. Local distribution of electric power, however, will remain a regulated monopoly, with distribution costs tacked onto whatever power charge a particular customer can negotiate.[1]

1 Distribution continues to be regulated because it is considered a natural monopoly, given the redundancy of having more than one firm maintain a system of power lines and poles in streets and neighborhoods throughout each region.

Generating facilities that become unprofitable or less profitable when competition is introduced are said to incur "stranded costs"; under Ohio's Senate Bill 3, these facilities are eligible for partial compensation. They may raise the money to cover some of their stranded costs by adding a surcharge per kilowatt-hour (kWh) to consumers' bills. Rates will be capped at current levels.

Ohio's action and similar initiatives throughout the region have been prompted by proposed federal legislation that would require (or at least strongly encourage) deregulation of electric power generators. A number of bills to increase competition in the industry have been proposed by both parties in Congress and by the Clinton administration.[2] These bills mandate (or strongly encourage) states to begin letting consumers choose their electric power generators within the next few years, but leave states to work out the specific details on issues such as beginning dates and compensation of stranded costs. The bills differ on whether they mandate or support generation of energy from renewable resources such as solar or wind power and whether they provide assistance to low-income consumers.

II. Deregulation and the Price of Electricity

As in most previous efforts in other industries, deregulation is expected to lower the price of electric power, partly because competition will cause generators to price electricity according to marginal costs (see Scott, Berger, and Thompson [1997], Maloney and McCormick [1996], and U.S. Department of Energy, Energy Information Administration [1997]). Under the current fair-rate-of-return system for setting regulated electricity prices, utilities are granted a fair rate of return to cover plant investment and operating costs. This practice allows firms to pass along the cost of regulator-approved investments to their customers as part of the price charged for electricity. Consumers must pay the full price of any poor investments their regional utility may have made in plants with high marginal production costs or excessive fixed costs.

Marginal-cost pricing implies that generating facilities facing competition must price electricity at or above the cost of operating the plant if they are to remain open. Pricing will not be affected by the cost of previous investments, which must be paid whether the plant operates or not, since electric generating facilities cannot as a rule be used for other purposes (Scott, Berger, and Thompson [1997]). Under this approach, if a power plant with a high marginal cost exits the market, consumers will not have to pay for their utility's earlier poor investment decisions. Prices will decline and efficiency will rise as a result. Further, as in most industries, owners of (or investors in) electric generating facilities that have high marginal costs or that cannot fund their sunk capital costs out of operating profits will see their value drop (Maloney and McCormick [1996]).

Consumer choice and competition will also lead to better investments and lower costs in the future. With no way to pass the cost of poor investments on to consumers, power generators will have a greater incentive to invest only in the most efficient plants. Prices need be just high enough to cover the low operating costs of these plants and a market rate of return on future capital investment.[3]

Beyond investment issues, a movement toward consumer choice and competition and away from fair-rate-of-return pricing should yield further efficiency gains and consequently lower prices. Competitive forces will encourage electricity generators to redouble cost-cutting efforts by operating their plants more efficiently and extending the lives of plants where operating costs are already low (Scott, Berger, and Thompson [1997]). Generators will also have an incentive to reduce excessive overhead costs such as redundant central-office staff (Maloney and McCormick [1996]). Further, a movement toward time-of-day pricing will encourage customers to shift consumption to lower-cost, off-peak periods, allowing capacity-utilization rates to rise and average prices to fall (Maloney and McCormick [1996]).

The changes just mentioned point to a substantial decline in long-term energy prices across the nation. But how quickly can the electric power generating industry make all these adjustments in a newly competitive environment? Near-term price declines will depend on how quickly electric power generators cut operating and overhead costs and how readily consumers shift their consumption to off-peak hours.

2 See http://www.naruc.org/Congressional/restructuringmatrix.htm for a description of this legislation.

3 Under competition, the number of poor investments should decline, allowing capital to be invested in electric generating facilities with a risk premium similar to that of other investments. This risk premium would be far less than the cost of paying for poor investments under the regulated, fair-rate-of-return price system.

Another factor affecting the near-term drop in electricity prices is the provision, already discussed briefly in section I, for stranded-cost recovery. This provision is designed to let utilities recover some or all of the losses incurred by generating facilities that become unprofitable or less profitable after the price declines that accompany deregulation. These would include facilities that cannot show operating profits at the new, unregulated market price or whose profits are too low to maintain the book value of their generating assets, so that the assets' value is lower than it was before deregulation (Scott, Berger, and Thompson [1997]). Ohio's legislation provides for a five-year period during which energy distribution companies (and consequently consumers) will pay an electricity-use surcharge that will raise funds to fully (or at least partially) compensate local utilities for losses associated with the transition to a deregulated environment. Naturally, the size of short-run price declines will be influenced by the extent to which this surcharge offsets utilities' losses. Because stranded-cost recovery is limited to a five-year transition period, it should not affect the long-run decline in electricity prices.

III. Empirical Estimates of Deregulated Electricity Prices

The U.S. Department of Energy's Energy Information Administration (1997), Scott, Berger, and Thompson (1997) of the University of Kentucky, and Maloney and McCormick (1996) for the Citizens for a Sound Economy Foundation have estimated the price declines that could result from deregulating electric utilities throughout the United States and particularly in the Midwest. These studies all show that competition will lower electric power prices substantially in the long term, but they differ as to the extent of near-term price declines. (The studies typically use "near-term" to describe price declines that are possible while existing generating facilities remain in use, so that no new capacity is assumed.)

The Energy Information Administration (1997) predicted that in the short run, electric power prices could fall to between 5.0 cents and 5.3 cents per kWh in the East Central Area Reliability Coordination Agreement region (the ECAR region), which includes Ohio and the entire Fourth Federal Reserve District. These prices represent a drop of between 1.0 cent and 1.3 cents per kWh in Ohio relative to the state's 1996 average of 6.3 cents per kWh (Energy Information Administration [1999]). The decline reflects lower labor costs in administration, operation, and maintenance, as well as more efficient machinery. It also reflects the introduction under competition of fuller time-of-day pricing policies, which would increase off-peak capacity utilization as demand shifts toward off-peak hours. The shift would allow a larger share of electricity to be sold at lower, off-peak prices, thus cutting the average price. Maloney and McCormick (1996) estimate the national price decline that would occur as competition substantially expands time-of-day and month-of-year pricing and increases off-peak capacity utilization, predicting a drop of 0.9 cent to 1.8 cents per kWh. Scott, Berger, and Thompson (1997) examine price changes in a 20-state area that includes the ECAR region as well as some southern states.[4] Their report assumes greater efficiency in maintenance, operation, and other production costs as well as higher capacity utilization. Under this model, electricity prices in Ohio would be expected to fall 2.2 cents per kWh (from 6.3 cents to 4.1 cents), based on the expected regional price and the current Ohio price. All these cuts assume that no surcharge is added to electricity prices to fund stranded-cost recovery. With a surcharge, the near-term price declines discussed above could be smaller, perhaps substantially so. These price declines are assumed to apply to all groups of customers, including residential, commercial, and industrial.[5]

■ **4** The states studied were Alabama, Arkansas, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Missouri, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia, and Wisconsin.

■ **5** Some have argued that the decline in energy prices will not be the same for all three major classes of customers: industrial, commercial, and residential. There is a belief in the industry that industrial customers currently subsidize residential ones. However, it is uncertain that this would occur with deregulation given that large industrial customers' location choice is often based partly on electric power costs in the service area, while this is not a major issue in residential location. As a consequence, industrial customers may already be in a much better position to negotiate lower costs for themselves, even in the current regulated pricing environment. A potentially more compelling explanation of why residential power costs may fall less is that residential customers may be less able to shift their consumption to off-peak hours. Regardless, Maloney and McCormick (1996) still favor an expectation that the price decline (in absolute, rather than percentage, terms) will be the same for industrial, commercial, and residential customers.

IV. Microeconomic Estimate of Deregulation's Impact on Consumer Prices

Consumers will be the ultimate beneficiaries of heightened competition, greater efficiency, and declining costs in the electric power generation industry, but it is difficult to predict how much they will save. They should benefit from lower electric power costs both directly (in their household electric bills) and indirectly (because prices for most goods and services will fall as the electric-power component of business costs shrinks). Further, these savings should grow over time as consumers and businesses adjust their consumption behavior to a lower-energy-cost regime. In particular, consumers who buy cheaper, less energy-efficient heating systems and appliances will realize greater savings.[6] Businesses that purchase cheaper, less energy-efficient equipment, heating, and lighting will be able to produce goods more cheaply or operate a store or office at a lower cost. These savings will eventually be passed on to consumers as additional price cuts in the full range of goods and services.

The difficulty stems from not knowing how much producers and consumers will alter their consumption behavior and equipment purchases in an environment with lower electricity prices. However, one approach to estimating near-term savings from energy price reductions is to look at savings given existing consumption behavior by households and businesses. This would provide a snapshot of the decline in the price of goods and services due to falling electric costs, but avoid trying to model consumer and technological responses fully. The resulting near-term savings estimate would probably be lower than the long-term savings estimate.

A first-cut measure of the decline in the price of goods and services resulting from lower electricity prices can be made using the *Benchmark Input–Output Accounts of the United States* (U.S. Department of Commerce, Bureau of Economic Analysis [1994]).[7] This matrix shows each industry's output and where it accrues in terms of intermediate product purchases and payments to factors of production like labor, benefits, capital consumption, and profits. In this sense, an industry's measured output is broken down into production costs, assuming that profits are viewed simply as the cost of the capital investment in the industry. Thus, the matrix can be used to calculate what share of each industry's production costs goes to purchase electricity. This information makes it possible to estimate how much a given energy price cut would lower an industry's overall production costs in the near term, according to the following simple formula:

(1) Percent change (production costs) = Percent change (electricity price) $*$ electricity's share of total production costs.

If competition forces businesses to pass along the entire drop in production costs to the consumer in the form of lower prices, then the percent change in production costs can be used to calculate the percent change in price for each industry.

We calculate the impact of electric-power-price declines under three alternative scenarios because of the uncertainty, already discussed, as to how much near-term electricity prices will drop when consumer choice and competition are introduced. The low price decline modeled will be a near-term drop of 0.9 cents per kWh, which was the lower-bound estimate in the reports of both the U.S. Department of Energy's Energy Information Administration (1997) and Maloney and McCormick (1996). The middle price decline will be a near-term drop of 1.8 cents per kWh, which was the upper-bound estimate from Maloney and McCormick (1996). The high price decline modeled will be a near-term drop of 2.2 cents per kWh, which was the estimate given by Scott, Berger, and Thompson (1997). Recall that these estimates all assume that no surcharge per kWh of electric power is imposed for stranded-cost recovery.

Household Electricity Prices

Lower electricity prices will affect consumers most directly in residential power prices, which will decline substantially in percentage terms. As of 1996, the average price of residential power in Ohio was 8.6 cents per kWh. From that level, a decline of 0.9 cent per kWh

6 The price declines above already reflect consumer responses to off-peak power consumption.

7 This approach naturally assumes that U.S. average shares for electricity are the same as Ohio companies' share.

TABLE 1

Average Household Savings in Residential Electric Power Bills under Consumer Choice (assuming constant consumption)

Electric power price-decline scenario	Estimated price decline for residential customers (percent)	Savings on electric power bill Per month	Per year
0.9 cent per kWh	10.5	$ 7.42	$ 89.02
1.8 cents per kWh	20.9	$14.88	$178.52
2.2 cents per kWh	25.6	$18.19	$218.29

SOURCE: Authors' calculations based on data from the U.S. Department of Energy, Energy Information Administration (1998).

would lead to a 10.5 percent decline in the price of residential power. A decline of 1.8 cents per kWh would lower the price 20.9 percent; and a drop of 2.2 cents per kWh would translate to a decline of 25.6 percent.

Prices of Other Goods

The price decline in other goods and services that utilize electric power will be more modest. Following equation (1), this decline equals the percent change in the price of electric power, multiplied by electric power's share of total production costs. Electricity's share of production costs in each industry was estimated using the *Benchmark Input–Output Accounts of the United States*, as described above. The percent change in the price of electric power varies by industry. The decline will be much greater for industrial customers, mostly in the mining and manufacturing industries, who paid an average price of 4.21 cents per kWh in 1996, compared to commercial customers, who paid an average price of 7.71 cents that year.

Average production-cost savings for each industry were calculated using equation (1). An average saving for all goods and services was estimated by calculating a weighted average decline in production costs, with each industry's share of total U.S. output serving as the weight.[8] Taking this approach, a decline of 0.9 cents per kWh in the price of electric power would translate into a 0.19 percent drop in the price of goods and services. A price cut of 1.8 cents per kWh would lead to a 0.39 percent decline in goods and services prices, while a 2.2 cents per kWh decline in electric power costs would lower prices 0.47 percent.

The modest nature of these declines shows that even such a key commodity as electric power has a limited effect on overall price levels. In the scenario featuring the largest price decline (2.2 cents per kWh), the aggregate impact on goods and services prices overall was estimated to be a .47 percent decline, which is slight compared to the typical annual inflation rate of 2.5 percent to 3.0 percent. This suggests that changes in the price of electric energy may not have a large effect on changes in the price level as a whole.

Overall Consumer Savings

From the viewpoint of individual households, however, the impact of energy price declines is substantial. Households will save in two ways: through lower costs for household electricity use and through lower costs on other goods and services. A large share of those savings will occur directly in household electric utility bills (see table 1). As indicated earlier, a price decline of 0.9 cents per kWh would amount to a 10.5 percent drop. Assuming constant consumption, this would mean a monthly reduction of $7.42 in electric power bills and an annual reduction of $89.02. Estimated savings would increase under more optimistic assumptions regarding near-term price declines. A decline of 1.8 cents per kWh would translate into a $14.88 decline in the average monthly bill (under constant consumption) and an annual saving of $178.52. A decline of 2.2 cents per kWh would result in savings of $18.19 monthly and $218.29 annually. Naturally, actual household energy bills would not decline this much, since some households would choose to consume more electric power if prices went down. Still, constant-consumption estimates provide a good measure of what households would save on their current expenditures. Again, each estimate assumes that consumers are not subject to extra charges on their utility bills for funding stranded-cost recovery.

8 The average reduction is weighted according to total output in each industry rather than each industry or good's share of the market basket in the Consumer Price Index.

TABLE 2

Average Household Savings in Other Goods and Services Purchases under Consumer Choice (assuming constant consumption)

Electric power price-decline scenario	Estimated price decline for other goods and services (percent)	1996 Current expenditures	1996 Estimated savings
0.9 cent per kWh	0.19	$29,244	$ 55.56
1.8 cents per kWh	0.39	$29,244	$114.05
2.2 cents per kWh	0.47	$29,244	$137.45

SOURCE: Authors' calculations based on data from the U.S. Department of Labor, Bureau of Labor Statistics (1996).

Lower electric power costs would also mean savings on existing household purchases. The savings can be calculated from the typical household's spending on goods and services and the average electricity price declines estimated above, which range from 0.19 percent to 0.47 percent, depending on the price-decline scenario. U.S. households' average annual expenditures minus pension and Social Security contributions, cash contributions, and electricity purchases came to $29,244 in 1996 (U.S. Department of Labor, Bureau of Labor Statistics [1998]). As table 2 shows, a 0.19 percent decline in the average price of goods and services would produce estimated annual savings of $55.56 in current expenditures. This is the savings in goods and services purchases that would result from a decline of 0.9 cents per kWh. With a decline 1.8 cents per kWh, the estimated annual savings would be $114.05. A decline of 2.2 cents per kWh would mean estimated savings of $137.45 annually. Note that these are savings on existing purchases only, and that consumers are likely to expand their buying in response to lower prices.

When savings on other goods and services are added to those on residential electric power, total annual savings range from about $140 to $350 per household under alternative scenarios. Direct savings on power purchases typically account for about 60 percent of households' total savings, while the other 40 percent results from price reductions in other goods and services. This contradicts the argument that price reductions resulting from electricity deregulation will accrue only to commercial and industrial customers, not to individual households. Even if this were so, consumers would continue to gain from deregulation as businesses' electricity savings were passed on in the form of lower costs for goods and services of all kinds.

V. Macroeconomic Dimension of Energy Prices

Estimating the effects of deregulation requires important assumptions at each step. Although the direct impacts on electricity prices are relatively straightforward to predict, they offer a range of alternatives. Evaluating electricity's effects on other prices requires the additional assumption that the economy's production and consumption patterns will not change if electricity prices drop.

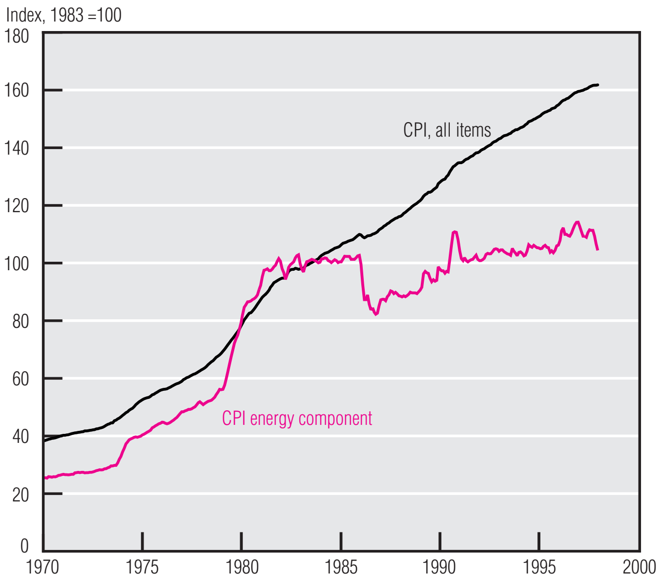
Analysis under these assumptions indicates that the decline in the general price level resulting from the anticipated fall in energy prices would be small (but still meaningful) compared to annual inflation rates. This suggests a limited effect on the overall price level. However, because the assumptions are restrictive, applying an alternative estimator (with its own assumptions) is warranted. Moreover, the analysis above does not allow for multiplier effects or anticipate how various market participants will react to reductions in the price of a general factor of production, nor does it consider the actions of the monetary authority. The analysis is best suited to providing a baseline for the price-level effects of the cost savings associated with electricity deregulation.

An alternative empirical analysis can utilize the fact that energy prices have a history of sharp changes. Several past occasions when sudden movements in energy prices were not quickly reversed should parallel the impacts of deregulation. Figure 1, which compares the annual rate of change in the energy component of the Consumer Price Index with the CPI as a whole, shows that energy prices have swung widely over the last 28 years.

Recent history contains four distinct episodes of sudden price movements. In 1973, an oil shock caused energy prices to rise very sharply at times (as much as 33 percent from the previous year) and then stabilize around a substantial rate of increase that typically exceeded the overall inflation rate. A second oil shock hit in 1979 and lasted about two years, boosting prices sharply. In its wake, the energy component of the CPI fluctuated around zero change, making this an interesting

FIGURE 1

Consumer Price Index versus CPI Energy Component



SOURCE: U.S. Department of Labor, Bureau of Labor Statistics.

case of a one-time price shock. In 1986, energy prices suddenly declined, only partially recovering during a brief bounce-back in 1987. Energy prices quickly rose and fell again in response to the Persian Gulf crisis in 1990. None of these episodes, however, originated in or focused on electricity; in every case, oil prices were the driving factor.

Are the prices of energy from other sources suitable for evaluating electricity deregulation's effects on the general price level? This issue can be separated into three more easily answered questions: 1) How big a price shock will electricity deregulation produce? 2) When utilities are deregulated, will other goods' prices react as they did to oil shocks? 3) Will changes in electricity prices be reflected in other energy prices? Answers to these questions are necessary to establish an a priori case for the tests used in this article and may limit our results' applicability.

Fortunately, the first question is the focus of the existing microeconomic analysis. We have three values to work with: 10.5 percent, 20.9 percent, and 25.6 percent. Oil shocks exceeded these values in the 1970s; in later episodes, the shocks were similar in size to these.

As to the second question, electricity prices represent 2.7 percent of the CPI based on households' average direct consumption; oil and motor fuels represent 3.2 percent. Of course, oil or electricity prices may be reflected in other goods and services according to the energy consumption of producers and even retailers. For these purposes, direct or indirect energy use is a better measure because households consume about two-thirds of gross domestic production. This more complete accounting shows that a substantial change in the price of electricity could be as significant as an oil shock.

Finally, other energy prices responded to oil prices because some users were able to substitute away from oil toward other sources. Many users, however, are limited to consuming a particular form of energy. After the first oil shock, petroleum products' share of U.S. energy consumption fell only slightly, from 46.9 percent in 1973 to 46.1 percent in 1974 and 46.4 percent in 1975. Consumers' ability to switch to electricity is difficult to measure, although there is certainly room for residential and some industrial substitution. Nonetheless, prices for other energy sources seem unlikely to change much because many of them are determined internationally.

Macroeconometric Tests

The first step in our econometric approach is to assess energy prices' effect on the inflation rate (both the overall rate and the core measures, on which energy prices have a smaller direct impact) by testing whether a change in energy prices imparts any information on the future inflation rate. This procedure, commonly called the Granger test of causality, provides a flexible evaluation of whether a statistical relationship exists, but may not represent clearly the process that links the variables being studied. The Federal Reserve's response, which could counteract energy shocks, is not specifically estimated. Several articles have explored this issue, but determining whether monetary policy reacts to energy prices requires specific assumptions and a more sophisticated model. Instead, this paper seeks evidence of energy price effects by including relative price effects because, even if the Federal Reserve chose to counteract shifts in the general price level, it would leave relative price shifts altered. Monetary policy applies to all prices equally.

TABLE 3

Granger Causality Tests on the Overall Inflation Rate

	Number of monthly lags			
	3	6	12	24
1957–99	No	No	No	Maybe (6.5%)
1970–80	No	Yes (2.4%)	Yes (1.4%)	No
1980–90	Yes (4.7%)	No	No	No
1988–99	Yes (0.2%)	Yes (0.0%)	Yes (0.4%)	Yes (3.6%)

SOURCE: Authors' calculations based on data from the U.S. Department of Labor, Bureau of Labor Statistics.

A critical element in the Granger test is the number of lags—including periods of older data—used to forecast the inflation rate. The same period of lagged information from both the predetermined inflation data and energy prices is used to provide two simulated forecasts of the current inflation rate. There are limited a priori grounds for believing that information is only relevant for a given length of time. On the other hand, there is little reason to consider the inflation increment from two years ago useful information, once last year's data have been included. In this paper, we report tests based on three, six, 12, and 24 months of lags. We include the shorter period because energy prices might have an immediate impact that is quickly incorporated into the overall inflation measure. Twelve months of lags allow for a fairly accurate prediction of monthly inflation increments, yet still permit additional information to play a role. Increasing the length of lags from three to 24 months raises the explanatory power of the regression. For example, the R^2 rises from 0.52 to 0.60 in regressions on inflation spanning 1957–99. The higher R^2 at the longer lag horizon implies that the regression yields predictions that mimic inflation trend movements over the period.

The first test is to see if energy prices are statistically useful in predicting the general inflation rate. Table 3 shows the results of these tests for three to 24 monthly lags. Beginning with the full period (1957–99), adding energy prices in the predictive equation did not significantly improve those predictions (in a statistical sense), except for a moderate influence at 24 lags. The probability values shown for the hypothesis that there was no predictive information in the energy component can be *rejected* at the 90 percent confidence level (when the probability value is less than 10 percent). This methodology is quite flexible in that it does not presuppose a structure of energy prices affecting inflation, but it does require that the effects be consistent throughout the estimation period. Given the distinct types of energy shocks and a potential break in monetary policy, this limitation may be excessive.

Focusing on three subperiods allow us to consider specific scenarios without constraining the parameters to be identical in another scenario. The time is divided roughly according to decade: 1970–80, 1980–90, and 1988–99. The first period has a generally accelerating inflation rate combined with rapid, sustained energy price increases. The second has declining inflation rates and the steep 1986 fall in energy prices, which recovered only partially in later years. The last 10 years combine a more stable (but typically declining) inflation rate and the Gulf War oil shock, which was fully reversed.

Each of these periods contains evidence that energy played a role in inflation trends beyond the information included in the inflation rate history. The lower rows of table 3 show the results of Granger causality tests in the subperiods. The timing of the estimated effects of the energy component varies between periods; 1970–80 shows the strongest association at a full year; for the 1980–90 period, the effects are only evident at three months. In the last 10 years, the relationship has been particularly clear. Because this period includes a rapid fall in the price of energy as well as stability in the conduct of monetary policy, it may be the most appropriate for investigating electricity deregulation. It is remarkable as a period when energy price changes affected the CPI. It doesn't matter how many lagged values are included in the 1990s, but the different results for earlier periods suggest considering both three-month and 12-month lags in the more detailed estimations.

TABLE 4

Granger Causality Tests on CPI Subcomponents, 12 Lags

	1957–99	1970–80	1980–90	1988–99
All items, mean	No	Yes (1.4%)	No	Yes (0.4%)
All items except energy	Yes (3.1%)	No	No	No
All items except food and energy	Yes (0.0%)	Yes (0.1%)	No	No
All items, median	Yes (0.5%)	Yes (0.5%)	No	No
Commodities	Yes (1.0%)	No	Maybe (5.8%)	Yes (0.4%)
Commodities except food and energy	Yes (0.2%)	Yes (0.2%)	No	No
Durable commodities	Yes (0.1%)	Yes (0.2%)	No	No
Nondurable commodities	Yes (0.0%)	No	Yes (0.3%)	Yes (0.0%)
Services	Yes (0.0%)	Maybe (7.8%)	No	No
Services except energy	Yes (0.8%)	Yes (2.0%)	No	No

SOURCE: Authors' calculations based on data from the U.S. Department of Labor, Bureau of Labor Statistics.

While energy prices may affect the prices of other products, this need not happen. One obvious distinction among episodes of energy price shocks is the stance of monetary policy.[9] The 1970s have been described as a decade in which U.S. monetary policy was unduly expansionary when challenged by oil shocks. Under the chairmanship of Paul Volcker, who was appointed in November 1979, monetary policy shifted, making disinflation its primary goal. An alternative possible explanation is that, without concern for the stance of monetary policy, energy prices don't feed through to enough other prices to matter (or at least to be identified using Granger causality tests). If this is the case, energy prices should not alter the CPI's subcomponents. Monetary policy cannot isolate specific components of the CPI from energy shocks, which are likely to have differential impacts on industries (based on their energy dependence) that would yield relative price responses.

Tables 4 and 5 apply the same techniques to major subcomponents of the price index, including or excluding energy where relevant. Table 4 shows the tests based on 12 months of lagged values, while table 5 shows three-month tests. The time period is again split into three separately estimated episodes. Both tables show a clear pattern:[10] In the 1970s, energy price changes fed into most major CPI components, even those that did not include energy directly. Indeed, the independent role of energy is rejected only in components that did include energy directly, possibly because energy is already too well reflected in the CPI component for energy prices on their own to add information. Since 1980, by contrast, there has been little evidence that energy prices altered components that exclude energy prices.

While we cannot rule out differences in either the nature of energy shocks or the relationship between prices, the likely explanation for these findings is a shift in monetary policy's response to energy shocks. The prices of energy relative to other goods adjust after 1980, but the relative energy price shock does not translate into inflation in other goods. This suggests that while deregulation of electricity prices would undoubtedly benefit consumers, it might have less effect on the overall inflation rate than the microeconomic analysis would indicate. Nonetheless, the consumer benefits shown in the microeconomic analysis are at least partially confirmed by the macroeconomic analysis because relative price shifts are identified and represent the source of consumer gains when an independent monetary authority can alter the price level.

■ **9** Identifying the reaction of monetary policy to energy shocks has been an active area of research. The present paper focuses more narrowly than this literature, which attempts to address the issue of whether monetary policy or energy shocks are associated with recessions, when the stance of monetary policy may depend on energy shocks. Bernanke, Gertler, and Watson (1997) conclude that "an important part of the effects of oil price shocks on the economy results not from the change in oil prices, per se, but from the resulting tightening of monetary policy." Brown and Yücel (1999) find that monetary policy was neutral in response to oil shocks, if neutrality is defined in terms of stable nominal GDP growth. In either case, monetary policy is important (if difficult to identify) in the macroeconomic response to oil shocks.

■ **10** Both tables are presented to demonstrate that these conclusions are not sensitive to the lag lengths used in the tests.

TABLE 5

Granger Causality Tests on CPI Subcomponents, Three Lags

	1957–99	1970–80	1980–90	1988–99
All items, mean	No	No	Yes (4.7%)	Yes (0.3%)
All items except energy	No	Maybe (6.0%)	No	No
All items except food and energy	Yes (0.9%)	Yes (0.3%)	No	No
All items, median	Yes (7.6%)	No	No	No
Commodities	Yes (0.7%)	No	No	Yes (1.0%)
Commodities except food and energy	Yes (1.7%)	Yes (0.7%)	No	No
Durable commodities	Yes (1.8%)	Yes (1.3%)	No	No
Nondurable commodities	Yes (1.9%)	No	No	No
Services	Yes (4.6%)	Yes (2.4%)	No	No
Services except energy	Maybe (7.5%)	Yes (0.2%)	No	No

SOURCE: Authors' calculations based on data from the U.S. Department of Labor, Bureau of Labor Statistics.

VI. Conclusion

Deregulated electricity generation can be expected to offer consumers many advantages, including dramatically lower energy costs. Electricity prices are interesting from a macroeconomic viewpoint because electricity is a major component of consumers' budgets (and thus of the CPI) and a large factor of production for many companies. This raises the possibility that electricity deregulation could create a substantial shock to the overall price trend, comparable to energy shocks in recent history.

Another key factor, on which this paper does not focus directly, is the price-setting environment. The Federal Reserve's behavior was probably a key factor in past episodes when energy prices moved dramatically. Historical accounts of the 1970s describe a Federal Reserve policy that attempted to smooth U.S. output in the face of oil shocks instead of focusing on inflation. In later periods our estimates, which show no feed-through from energy prices to inflation, may reflect the important shift of U.S. monetary policy after 1980. If policy follows roughly the course of the last 15 years, then electricity deregulation's effect on inflation (as measured by the CPI) is likely to be primarily a direct one. Some important relative shifts remain largely hidden by monetary policy, but are no less relevant. The benefits to consumers and producers identified in the microeconomic analyses strongly support legislative efforts to increase competition in one of the last bastions of regulated profits.

References

Bernanke, Ben S., Mark Gertler, and Mark Watson. "Systematic Monetary Policy and the Effects of Oil Price Shocks," *Brookings Papers on Economic Activity*, no. 1 (1997), pp. 91–142.

Brown, Stephen P.A., and Mine K. Yücel. "Oil Prices and U.S. Aggregate Economic Activity: A Question of Neutrality," Federal Reserve Bank of Dallas, *Economic and Financial Review* (1999 Quarter 2), pp. 16–23.

Maloney, Michael T., and Robert E. McCormick. *Customer Choice, Consumer Value: An Analysis of Retail Competition in America's Electric Industry.* Washington, D.C.: Citizens for a Sound Economy Foundation, 1996.

Scott, Frank A., Mark C. Berger, and Eric C. Thompson. *Competition and Customer Choice in Electric Power: An Analysis of Regulatory Reform in the Kentucky Electric Utility Industry.* Center for Business and Economic Research, University of Kentucky, October 1997.

U.S. Department of Commerce, Bureau of Economic Analysis. *Benchmark Input–Output Accounts of the United States, 1987.* Washington, D.C.: U.S. Government Printing Office, 1994.

U.S. Department of Energy, Energy Information Administration. *Electricity Prices in a Competitive Environment: Marginal Cost Pricing of Generation Services and Financial Status of Electric Utilities. A Preliminary Analysis through 2015.* (DOE/EIA-0614). Washington, D.C.: U.S. Government Printing Office, 1997.

________. *Electric Sales and Revenue 1998 Data Tables,* table 17, from <www.eia.doe.gov/cneaf/electricity/esr/esr_tabs.html>.

U.S. Department of Labor, Bureau of Labor Statistics. *Consumer Expenditure Survey All Consumer Units,* 1996, from <www.bls.gov/csxhome.htm>.