

**NATURAL GAS PRICING POLICIES:
IMPLICATIONS FOR THE FEDERAL BUDGET**

The Congress of the United States
Congressional Budget Office

NOTE

Unless otherwise noted, all dollar figures in this report are expressed in nominal (current dollar) terms and thus include the assumed effects of inflation.

PREFACE

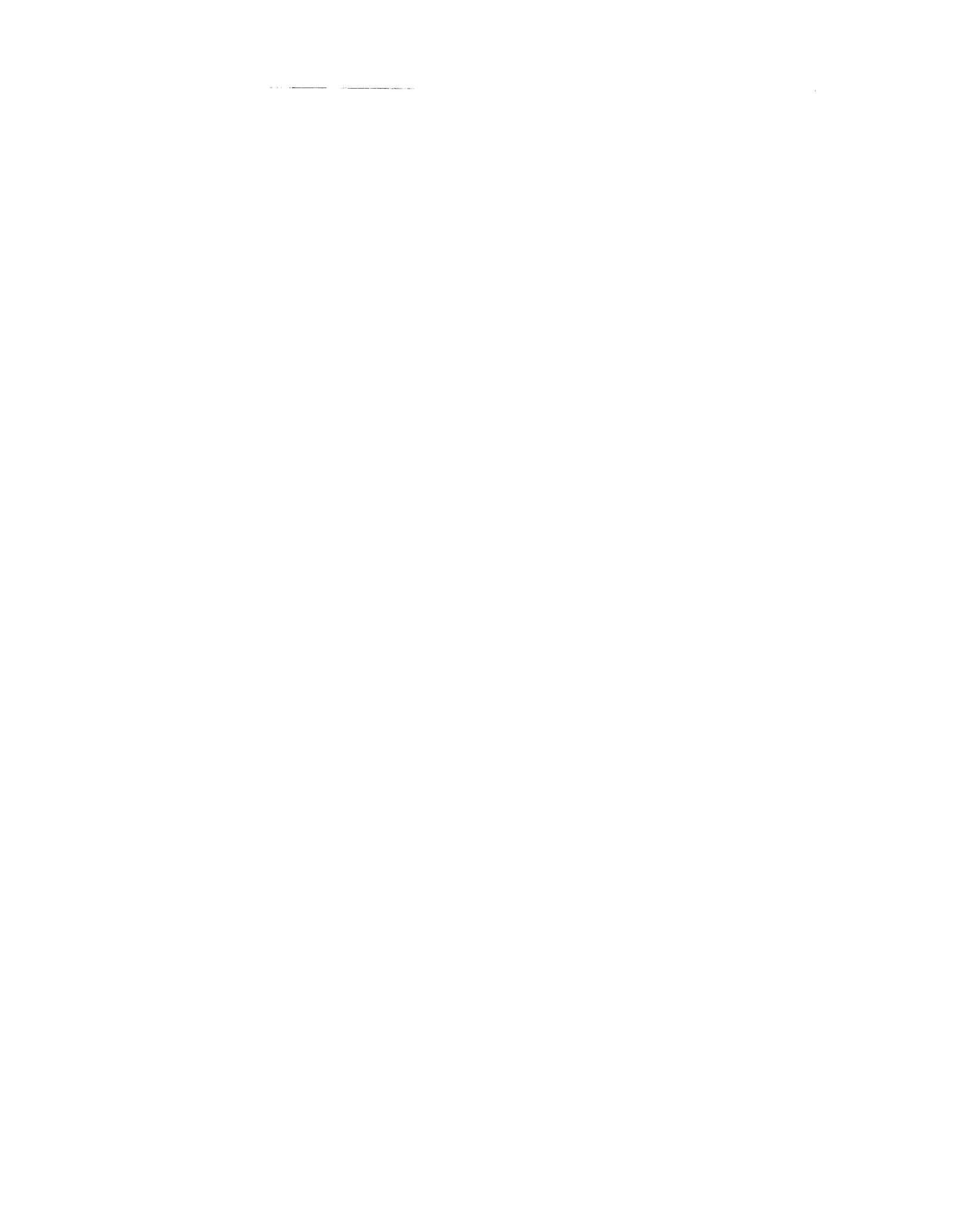
A wellhead pricing policy for natural gas is an important element of U.S. energy policy. In order to raise the wellhead prices of natural gas to achieve a balance between supply and demand in 1985, the Natural Gas Policy Act of 1978 specified gradual price increases for various categories of gas, based on a projected price of oil that is considerably lower than current oil prices. This price disparity has introduced more inefficiency in the natural gas market and could, depending on oil prices and contract provisions, lead to a sharp increase in average wellhead prices in 1985. Consequently, alternative natural gas pricing policies have been suggested to facilitate the transition to a deregulated market.

At the request of the Senate Budget Committee, this paper analyzes the macroeconomic and budgetary effects of alternative natural gas wellhead pricing policies. In keeping with CBO's mandate to provide objective analysis, the report makes no recommendations.

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SUMMARY

In the Natural Gas Policy Act (NGPA) of 1978, the Congress sought to decontrol gradually the wellhead price of most natural gas, thereby providing incentives for a more efficient gas industry. But events that were not envisioned by the framers of the NGPA--the 1979-1980 oil price shock and contract provisions peculiar to the gas industry--have disrupted the smooth transition to decontrol contemplated in the NGPA. These conditions have led many in the Congress to reconsider the nation's long-term pricing policy for natural gas.

While the decontrol of natural gas is a major issue in formulating U.S. energy policy, this report examines natural gas pricing policies from the perspective of the federal budget. The higher gas prices resulting from decontrol would have significant macroeconomic repercussions. In turn, these economic responses would ultimately change budgetary outlays and, especially, revenues.

This report discusses three approaches to wellhead price decontrol, including complete decontrol on January 1, 1984. Assuming moderate increases in the price of oil between 1982 and 1985 and an accommodative set of fiscal and monetary policies, the resulting budgetary effects would be small under any alternative, both in comparison with the federal deficit and in comparison with the other policy instruments that affect the budget. The complete decontrol of all natural gas on January 1, 1984, for example, would reduce the fiscal year 1984 federal deficit by \$3.6 billion when compared to the budget with the NGPA assumed to remain in force. The cumulative effect over fiscal years 1984-1987 would be a \$5.0 billion reduction in the deficit.

If oil prices rose to a higher level, the fiscal year 1984 deficit would be reduced by \$7.0 billion under complete decontrol. Under a low oil price scenario, complete decontrol would reduce the deficit by only \$1.4 billion. Under complete decontrol, a nonaccommodative monetary policy combined with a fiscal policy that restricted federal discretionary spending would reduce the deficit by \$4.6 billion in fiscal year 1984. These restrictive policy assumptions magnify the output losses under decontrol and lead to a \$1.8 billion increase in the 1985 deficit.

NATURAL GAS POLICY, THE ECONOMY, AND THE FEDERAL BUDGET

Changes in natural gas pricing policy would set in motion economic events that pull the federal deficit in opposite directions. Higher natural gas prices would result immediately in increased corporate taxes from the gas industry and higher royalty payments from gas produced on federal lands. But macroeconomic adjustments to higher prices might offset these revenue gains. To the extent that the adjustment to higher gas prices resulted in a temporary reduction in economic growth and employment, taxes paid elsewhere in the economy could decline, and expenditures for federal transfer payment programs would increase. If gas decontrol raised the rate of inflation, expenditures on indexed payment programs (such as Social Security) would also rise. Expenditures for discretionary programs would either have to be increased or a lower real level of services accepted.

In the long run, natural gas decontrol could result in economic gains, as a less-constrained gas market allowed firms and consumers to use energy more efficiently. But in the short term, the economy would undergo a period of dislocation, adjustment, and reduced economic growth as higher gas prices led to significant changes throughout the economy. Consumers would reduce their consumption of nonenergy goods as higher gas prices eroded their purchasing power. Firms would adjust their production by substituting other fuels for higher priced gas or adjusting their utilization of capital or employment of workers. These adjustments would eventually generate the economic benefits associated with decontrol, but they would take time since prices and wages do not respond rapidly to changed circumstances.

The budgetary effects of alternative natural gas pricing policies would depend strongly on how these changes would affect the economy. Unfortunately, most current macroeconomic models are not designed to represent the effects of such policy alternatives. They do not deal explicitly with the central factors linking natural gas policy with the economy--how consumers reduce their consumption of nonenergy goods and how firms substitute other fuels and factors of production for natural gas when its price rises. It is essential to understand the duration and strength of these adjustments and their interim impact on employment and prices.

This report addresses these issues using an economic model especially designed to deal with these effects.¹ The model generally produces results that are within the range of other large macroeconomic models, but has the

1. This analysis is described in Congressional Budget Office, An Empirical Analysis of Energy-Economy Interactions (forthcoming).

advantage of specifically representing the effects of higher energy prices, gas prices in particular. The intent of this analysis is not to predict the future but rather to suggest the magnitude and the direction of the economic and budgetary effects resulting from alternative natural gas policies.

The Policy Options and Assumptions

Three gas pricing policy options are examined in this report:

- o Complete decontrol of all wellhead natural gas prices on January 1, 1984;
- o Advancing the partial decontrol found in the NGPA by one year, to January 1, 1984; and
- o Administrative decontrol in which prices for some older categories of gas would be raised to the higher levels allowed for new gas on January 1, 1983.

The budgetary effects of these options are presented in terms of changes from the CBO budget baseline, which includes NGPA. ²

Two sets of assumptions are central to estimating the budgetary effects of natural gas price decontrol. The first concerns oil prices, which play a large part in determining how high decontrolled gas prices would rise--first, because oil is the primary fuel with which gas competes and, second, because many gas contracts directly and indirectly tie the price of decontrolled gas to the price of oil. Oil prices are assumed to rise from \$34.00 per barrel in 1983 to about \$39.00 per barrel in 1985 in nominal dollars.

The second set of assumptions involves the conduct of fiscal and monetary policies during the period of adjustment following decontrol. Discretionary federal spending is assumed to increase in response to inflation, so that it remains constant in real terms. Monetary policy is assumed to be accommodative, in that the money supply is allowed to expand to finance the higher natural gas prices that decontrol would bring. The effects of different assumptions about oil prices and fiscal and monetary policies are also examined.

2. Congressional Budget Office, Economic and Budget Outlook: An Update (September 1982).

The level of natural gas prices under NGPA and the three policy options would depend on oil prices and contract provisions between producers and purchasers not commonly found in other markets. The contract provisions are important since they will largely determine the amount of gas that would reach oil prices. The average wellhead natural gas price would be a weighted average of gas that is priced at or near oil prices and gas with prices below oil prices. Under NGPA, average wellhead natural gas prices will increase 23 percent in 1985 from their 1984 levels to \$3.83 per thousand cubic feet. If complete decontrol was adopted on January 1, 1984, then gas prices would increase 49 percent in that year to \$4.10 per thousand cubic feet. A partial decontrol of gas prices in 1984 would increase wellhead prices about 25 percent. Finally, administrative decontrol in 1983 would cause a 19.1 percent increase in average wellhead prices from their 1982 levels contrasted with a 14.1 percent increase under NGPA.

MACROECONOMIC AND BUDGETARY EFFECTS

Effects under the Base Assumptions

A comparison of the macroeconomic and budgetary effects of the three policy options under the base assumptions is presented in the Summary Table. Complete decontrol of wellhead gas prices on January 1, 1984, would lower gross domestic product by 0.3 percent in that year, raise inflation by 1.1 percent, and reduce the fiscal year 1984 budget deficit by \$3.6 billion.³ Federal revenues and royalties would rise by \$6.9 billion in fiscal year 1984, about half of which would come from higher personal income tax receipts as inflation pushed taxpayers into higher tax brackets (bracket creep). These higher revenues, however, would be somewhat offset by increased federal expenditures of \$3.3 billion, of which about \$0.9 billion resulted from higher benefit payments made to individuals. Beyond 1985 inflation would subside and output increase and the net effect would be a slight reduction in the federal deficit over the levels that would have occurred under NGPA. These small reductions reflect increases in benefit payments to individuals and the indexing of the personal income tax in 1985, which will eliminate the bracket creep additions to individual income tax revenues. Thus, over fiscal

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3. Gross domestic product (GDP) is a national income concept based on production within the geographic borders of a country. Gross national product (GNP) covers production by and incomes to citizens of a country no matter where they live. GDP is used in this report because changes in gas prices would not appreciably affect income earned from foreign sources.

SUMMARY TABLE. A COMPARISON OF THE MACROECONOMIC AND BUDGETARY EFFECTS OF THREE NATURAL GAS POLICY OPTIONS; CHANGES FROM THE NGPA BASE CASE (By calendar year)

Variable	1983	1984	1985	1986	1987
Real Gross Domestic Product (GDP) (percent change)					
Complete decontrol	0.00	-0.30	0.01	0.04	0.03
Partial decontrol	0.00	-0.10	0.05	0.03	0.00
Administrative decontrol	-0.05	-0.03	0.03	0.02	0.00
GDP Deflator (rate of change)					
Complete decontrol	0.00	1.10	-0.40	0.00	0.00
Partial decontrol	0.00	0.40	-0.30	0.00	0.00
Administrative decontrol	0.20	0.00	-0.20	0.00	0.00
Net Budgetary Effect (by fiscal year, in billions of dollars) ^a					
Complete decontrol	0.00	3.60	0.70	0.20	0.50
Partial decontrol	0.00	1.10	-0.50	-0.50	-0.30
Administrative decontrol	0.40	0.30	-0.50	-0.40	-0.20
Nominal Wellhead Natural Gas Prices (percent change)					
Complete decontrol	0.00	31.80	14.40	14.40	14.40
Partial decontrol	0.00	10.30	0.00	0.00	0.00
Administrative decontrol	4.40	4.20	0.00	0.00	0.00

a. Positive numbers indicate a reduction in the deficit; negative numbers indicate an increase.

years 1984 to 1987, the cumulative reduction in the federal deficit resulting from complete decontrol is only \$5.0 billion.

Since the average gas price increase would be smaller under partial decontrol, its revenue-generating effects would be reduced, but so would the macroeconomic adjustment costs in terms of inflation and lost output. Partial decontrol on January 1, 1984 would reduce the fiscal year 1984 budget deficit by \$1.1 billion. Federal revenues and royalties would rise by

\$2.2 billion, of which half would come from higher personal income taxes. These revenues would be offset by \$1.1 billion in higher federal expenditures, of which one-third would come from nondiscretionary and two-thirds from discretionary spending programs. Beyond 1984, the pattern would reverse itself, and the net budgetary effect would be an increase in the deficit, unlike the decrease under the complete decontrol option which would raise more revenues. For fiscal years 1984 through 1987, the cumulative net budget effect would be insignificant, however--a deficit increase of \$0.2 billion.

Administrative decontrol would cause the least economic dislocation of the three policy options, and, therefore, would have the smallest budgetary impact. Administrative decontrol on January 1, 1983, would reduce the fiscal year 1984 budget deficit by \$0.3 billion.

Effects Under Different Oil Price Assumptions

The effects described above depend on the assumption that oil prices will rise to about \$39.00 in nominal dollars in 1985. To examine the sensitivity of these results to this assumption, two alternative oil price paths were assumed. A low oil price path assumes that prices will drop to \$28.00 per barrel by 1985, and an alternative high price path projects oil prices of \$44.00 per barrel in that year (all figures in 1985 dollars).

Different oil price assumptions not only change the budgetary effects of gas decontrol when measured from the CBO baseline; they also change the baseline itself. Assuming the NGPA remained in force, the high oil price path would reduce the fiscal year 1984 deficit by \$3.3 billion, primarily because of higher personal and gas industry taxes.

When measured against this higher NGPA base case, complete decontrol of gas on January 1, 1984, would result in a \$7.0 billion reduction in the 1984 deficit. Again, the pattern of this increase would include higher personal income taxes, social insurance taxes, and taxes paid by the gas industry, with offsetting outlays from higher expenditures on nondiscretionary and discretionary spending. The net cumulative budgetary effect would be smaller over fiscal years 1985-1987, as scheduled indexing in 1985 restricted increases in personal taxes and nondiscretionary benefit payments increased. Most of the revenue effects of decontrol would have been realized anyway under the NGPA's 1985 partial deregulation. Using the higher oil price assumption, partial deregulation would lower the fiscal year 1984 deficit by \$2.8 billion.

The lower oil price path would increase the NGPA base case budget deficit, since lower oil prices would reduce the windfall profits tax and

personal income tax receipts caused by bracket creep. Assuming the NGPA remained in force, the lower oil price path would add \$10.0 billion to the fiscal year 1984 deficit. Compared to the low oil NGPA base, complete decontrol in 1984 would reduce the fiscal year 1984 deficit by \$1.4 billion and the outyear deficits only moderately. The cumulative change in the budget deficit for fiscal years 1984-1987 would be \$2.0 billion. Partial decontrol under the low oil price path would reduce the fiscal year 1984 federal deficit by \$0.4 billion and would lead to a cumulative reduction in the federal deficit of \$0.5 billion for fiscal years 1984-1987.

Effects Under Different Monetary and Fiscal Policy Assumptions

Assumptions regarding the conduct of fiscal and monetary policies during the adjustment to decontrolled gas prices are also pivotal. In response to higher gas prices, consumers and firms could increase their demands for money to finance transactions. If the Federal Reserve Bank did not allow the supply of money to expand to accommodate these demands, interest rates would rise. Thus, a nonaccommodative monetary policy would result in slower growth and more unemployment, but less inflation than the accommodative monetary policy first assumed in this analysis.

Moreover, the initial estimates assumed that discretionary federal spending would be increased to account for any added inflation resulting from gas decontrol. With current and projected large deficits, such an assumption may be unrealistic. An alternative assumption, therefore, is that discretionary spending would not increase to reflect higher rates of inflation. These two alternative policy assumptions--the erosion of discretionary spending and a nonaccommodative monetary policy--were combined to form an alternative set of policy assumptions under which the budgetary effects of decontrol could be examined.

Using these more restrictive assumptions, complete decontrol of natural gas prices on January 1, 1984, would lead to a reduction in the federal deficit of \$4.6 billion in fiscal year 1984. In addition, the output losses under complete decontrol would be larger and more prolonged than those found under base case assumptions. This greater reduction in economic growth would lead to larger increases in nondiscretionary federal spending, greater reductions in taxes paid outside the energy sector, and an increase in the deficit in 1985. The cumulative effect, however, would be a \$7.7 billion reduction in the deficit over the fiscal year 1984-1987 period. This reduction would be greater than the net budgetary effect under the base case assumptions because of restricted discretionary spending. Under these alternative policy assumptions, partial decontrol would reduce the federal budget deficit a mere \$1.4 billion in fiscal year 1984. Over fiscal years 1984-1987, the net cumulative deficit reduction would be \$3.7 billion.

CONCLUSION

Natural gas decontrol would generate new tax revenues from the gas-producing industry, but these revenue increases would be offset by higher levels of federal spending caused by higher inflation and unemployment. As a result, the effect of decontrol on the deficit, even under a range of different oil price and monetary and fiscal policy assumptions, would be small compared to projected budget deficits. Thus, in the absence of any special taxes on new profits accruing to the gas industry, the decontrol of natural gas prices at the wellhead would not appreciably change the federal budget deficit.

CHAPTER I. INTRODUCTION

Some portion of the natural gas market has been regulated since 1938. Over the years, additional regulation and the growth of a body of transactions and contract provisions peculiar to this market produced a growing imbalance between supply and demand.¹ This imbalance was especially acute in the interstate gas market in which lower, controlled prices created shortages during the mid-1970s.²

In response to these conditions, the Congress passed the Natural Gas Policy Act (NGPA) of 1978 to provide incentives for new production through higher prices while limiting prices for gas already in production. In order to raise the wellhead prices of natural gas to achieve a balance between supply and demand in 1985, the legislation specified gradual price increases for various categories of gas, based on a projected price of oil that today is considerably lower than current oil prices. This price disparity has promoted new inefficiencies in the allocation and consumption of natural gas and could, depending on oil prices and gas contract provisions, lead to a sharp increase in average wellhead prices in 1985. Thus, the smooth transition to a deregulated market envisioned by the framers of the Act may not occur. These problems have led many to propose alternative natural gas policies, ranging from outright decontrol to revision of pricing rules under NGPA.

This paper addresses the budgetary implications of alternative natural gas pricing policies. While other criteria for evaluation, such as energy policy and equity between consumers and producers are important, they are not the focus here. The effects of these natural gas policies on the federal budget are inextricably linked to their macroeconomic consequences. The economy's response to higher natural gas prices ultimately would change budget revenues and outlays. For example, inflation caused by higher prices

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1. The regulatory history and market characteristics of natural gas are discussed in Appendix A.
 2. Interstate gas is produced in one state and sold in another. Intrastate gas is both produced and sold within the same state. Since regulation was first introduced in the gas market to control monopolistic interstate pipeline practices, the preponderance of regulation has grown in the interstate market.

would lead to higher individual income taxes by pushing taxpayers into higher tax brackets.³ Higher prices would generate more revenues for natural gas producers, who consequently would pay higher royalties and income taxes. On the other hand, government outlays would increase because of inflationary effects on cost-of-living adjustments in benefit payments to individuals and increases in unemployment compensation. Hence, the budgetary effects of alternative natural gas policies would reflect the automatic adjustments built into federal spending and revenue policies. The Congress would either have to increase discretionary spending to offset the effects of inflation or allow its real level to fall.

While the effects of higher natural gas prices on federal spending and revenues would be sizable, these changes would offset each other to a degree. For example, complete decontrol on January 1, 1984, would reduce the fiscal year 1984 federal deficit by \$3.6 billion. The impact on the economy, however, would be much more pervasive. For instance, complete decontrol would increase the average wellhead price of natural gas by about \$1.00 per thousand cubic feet. This would result in a redirection of income that would be about half as large as the third year tax reduction enacted in the Economic Recovery Tax Act of 1981. Furthermore, gas price increases would alter relative prices throughout the economy and lead to additional effects on real spending and production activities. Thus, significant changes in natural gas policies could have macroeconomic effects that are comparable to those of a major fiscal program.

Chapter II discusses the relationship between gas pricing policy changes, the economy, and the budget. Estimates of the budgetary effects of natural gas decontrol are then presented. But these budgetary effects rely on a set of assumptions regarding oil prices, which play a large role in determining gas prices, and the conduct of monetary and fiscal policies during the transition to a decontrolled gas market. In Chapter III, these budgetary effects are examined under alternative oil price assumptions. In Chapter IV, they are measured under alternative assumptions regarding the conduct of fiscal and monetary policies.

3. Under current law, this "bracket creep" would continue until 1985 when the indexing of individual income taxes is scheduled to take effect.

CHAPTER II. BUDGETARY EFFECTS OF NATURAL GAS
 PRICE DECONTROL

Changes in natural gas pricing policy would affect the federal budget in a variety of ways. Since higher natural gas prices would translate into increased revenues for gas producers, they would immediately raise royalties from federally owned gas-producing properties and generate higher tax receipts from gas producers. As higher natural gas prices led to greater inflation, unemployment, or both, tax revenues from other sectors of the economy, personal income taxes, and nondiscretionary federal programs would be affected. Thus, the budgetary impact of natural gas decontrol is rooted in the economy's response to higher gas prices and the ways in which the federal budget reflects changed economic conditions.

This chapter discusses these relationships and presents a methodology for analyzing these competing effects. It then estimates the effects of gas decontrol on the budget under a set of assumptions about oil prices (which set a benchmark for gas prices) and the conduct of fiscal and monetary policies during the transition to a decontrolled gas market. Under these assumptions, complete decontrol of natural gas at the wellhead on January 1, 1984 would reduce the fiscal year 1984 budget deficit by \$3.6 billion.

ECONOMIC ADJUSTMENT PROCESS UNDER HIGHER
NATURAL GAS PRICES

The adjustment of the economy to natural gas price increases is the result of several competing factors. The level and rate of increase in natural gas prices eventually would influence all consumption and production decisions through their effects on purchasing power and by changing the relative prices of energy and other goods. Higher natural gas prices would lower consumer discretionary income and, unless offset by price reductions for other items, would reduce the amount consumers could spend on nonenergy goods. These reductions in consumption expenditures would translate into lower business receipts and subsequently limit the ability of nonenergy goods producers to employ workers, purchase energy and materials, and pay returns on capital investments. In addition, producers of non-energy goods and services that use natural gas would have to readjust their fuel and other input use in order to minimize costs. In contrast, gas producers would recirculate their additional revenues in the form of higher taxes, payrolls, or investment. The key economic question is whether this additional spending would offset output losses elsewhere in the economy.

These consumption and production adjustments eventually would lead to a different mix of economic activities and a more efficient use of resources. For example, higher natural gas prices would encourage reductions in gas use among existing users and thereby permit new gas users to substitute newly available decontrolled gas for the more expensive alternatives currently in use, such as electricity and home heating oil. This would eventually lower production costs and prices for finished goods. Furthermore, if price differentials among various categories of gas under NGPA were eliminated as a result of complete decontrol in the near term or the long-run exhaustion of gas in the regulated categories, then gas producers would allocate capital more efficiently by reducing capital expenditures on new, high-cost gas wells and increasing capital outlays to develop low-cost, old gas fields. This shift might reduce the total cost of producing natural gas.

The realization of these gains would depend on macroeconomic adjustments. Higher gas prices would generate additional revenues in the gas industry that could be used to increase gas production by hiring more capital, labor, and other productive resources, just as higher oil prices have stimulated investment and employment in the oil industry. If prices and wages fully and instantaneously adjusted to levels that equate supply with demand, then this shift in the relative importance of various economic sectors would not have to cause lower levels of output and employment. But a time lag would occur because the economy's resources are not perfectly flexible. Wages and prices do not move downward quickly in response to short-term market pressures. These short-term rigidities, combined with higher energy prices, would cause reductions in output and employment.

Natural Gas Prices and the Federal Budget

The interactions between the economy, natural gas markets, and the budget are the focal point of this analysis. These interactions are critical for several reasons. First, in the short term, the demand for energy is more sensitive to the level of income and output in the economy than to changes in energy prices. For example, the current low level of oil demand is partially the result of the recession. Second, the line of the causation between economic activity and energy demand is not one way. In other words, energy prices can have a substantial impact on economic activity. They are now recognized by many as one of the more important factors

influencing macroeconomic activity since 1973.¹ The macroeconomic consequences of alternative gas pricing policies, in turn, change revenues and expenditures in the federal budget. This analysis reports changes in revenues and expenditures that result from gas pricing policy, rather than absolute levels. These changes, however, can be applied to CBO's five-year budget projections, which serve as a baseline, in order to find the absolute levels.²

The sensitivity of the budget to individual changes in economic conditions can be summarized as follows:³

- o Lower real economic growth or higher unemployment leads to a reduction in revenues, an increase in outlays, and an increase in the deficit.
- o Higher inflation causes an increase in revenues that exceeds the increase in outlays and, hence, a smaller deficit.
- o Higher interest rates lead to a small increase in revenues and a relatively larger increase in outlays and a higher deficit.

Since the effects of higher natural gas prices on interest rates are unresolved, the interest rate sensitivity of the budget is not considered in this chapter. To the extent that monetary authorities restricted the money supply in response to inflationary pressures from higher gas prices, higher interest rates might indeed result with substantial repercussions on the budget. If higher gas prices caused a greater demand for money, additional pressures on interest rates might result. This report initially assumes a completely accommodative monetary policy for the pricing alternatives considered in this paper. This assumption is varied in Chapter IV.

While the above rules of thumb are helpful guidelines, they are not adequate for this analysis. Changes in economic conditions do not occur in

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1. See, for example, Robert J. Gordon, Alternative Responses of Policy to External Supply Shocks, Brookings Papers on Economic Activity, 1, (1975), pp. 183-204; and M. Bruno and J. Sacks, Input Price Shocks and the Slowdown in Economic Growth, Working Paper No. 851, National Bureau of Economic Research, Inc. (February 1982).
 2. Congressional Budget Office, The Economic and Budget Outlook: An Update (September 1982).
 3. *Ibid.*, Appendix B.

isolation, particularly in the case of energy. Higher energy prices affect inflation and output at the same time. Hence, methods that capture the interactions between energy, the economy, and the budget are used here in lieu of these rules of thumb.

The net change in federal tax revenues induced by natural gas price increases would primarily depend on the balancing of two effects. First, natural gas price increases would generate some additional inflation and, as a result, expand the corporate tax base and push individual taxpayers into higher tax brackets until indexing is adopted in 1985, after which only real individual income increases will be taxed. Royalty and corporate taxes paid by natural gas producers would also increase. The size of these increases would depend on the size of the natural gas price increases and any resulting demand reduction. The second effect would offset the first, as lower real growth associated with the adjustment to higher gas prices lowered employment and profit margins, thus reducing the nation's tax base.

On the outlay side of the budget, government expenditures on goods and services would increase because of the inflationary effects of higher natural gas prices. Outlays for direct payments to individuals would also increase because of cost-of-living adjustments in Social Security and other benefit programs. If lower growth induced by higher energy prices resulted in higher unemployment, then outlays for unemployment compensation would also rise.

METHODOLOGY

The analysis presented in this study consists of two principal steps. First, natural gas prices under three policy options--complete, partial, and administrative decontrol--are estimated. Then, based on these estimates, the macroeconomic and budgetary effects are calculated.

In the first year of any decontrol option, this study assumes that natural gas prices will be determined by contract provisions and oil prices. Since most gas is sold under long-term contracts that tie prices either to oil prices or to the rate of inflation, future gas price increases are preordained regardless of natural gas supply and demand conditions. Hence, for this analysis, natural gas prices are assumed to increase at the rate of oil price inflation after the initial year of decontrol. In the long run, gas prices will be affected by the supply and demand for gas, the price of alternative fuels, and the economy's adjustment to decontrol.

The second step of the analysis involves an examination of energy-economy interactions. Most previous work has used one of two major approaches to analyze these interactions. The first has examined the

effects of energy prices using existing macroeconomic models.⁴ A major problem with this method is that most macroeconomic models do not realistically measure energy substitution possibilities and how these substitutions influence spending patterns and income flows in the economy. This could result in overestimation of the inflationary effects of decontrol that would, in turn, introduce an upward bias in tax revenue calculations.

The other major approach involves the examination of energy price changes in the context of long-term economic growth.⁵ Unlike the major macroeconomic models, this method does not consider unemployment and price-wage rigidities. An additional problem is that the role of price expectations are not adequately considered. This approach could lead to an underestimation of the initial output losses associated with decontrol since price and wage rigidities and the gradual response of consumers and producers to higher gas prices are at the heart of the macroeconomic adjustment problem.

The analysis in this study combines aspects of both approaches.⁶ Its main feature is the explicit linkage of energy demand relationships with macroeconomic aggregates. In other words, the demands for fuels are determined simultaneously with income, employment, and output, reflecting their interdependence. Substitution possibilities among fuels used by consumers and among energy and other inputs used by nonenergy producers are explicitly measured. This formulation permits a more accurate measurement of energy producer revenues and of how the economy would adjust to higher gas prices and the respending of gas revenues by energy producers. The effects of relative price changes on the composition of gross domestic product,⁷ which are the focus of the second approach mentioned above, are

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4. The Wharton and Data Resources, Inc. models are two examples.
 5. See, for example, E.A. Hudson, and D.W. Jorgenson, "U.S. Energy Policy and Economic Growth, 1975-2000," Bell Journal of Economics, vol. 5, no. 2 (Autumn 1974).
 6. A detailed description of the analysis is presented in Congressional Budget Office, An Empirical Analysis of Energy-Economy Interactions (forthcoming).
 7. Gross domestic product (GDP) is a national income concept based on production within the geographic borders of a country. Gross national product (GNP) covers production by and incomes to citizens of a country no matter where they live. GDP is used in this report because changes in gas prices would not appreciably affect income earned from foreign sources.

explicitly considered through the measurement of labor, capital, material, and fuel substitution possibilities in the production of goods and services. This analysis also considers traditional demand side effects, such as income effects on consumption and output effects on investment that are measured in major macroeconomic models. 8

In theory, macroeconomic modeling resembles a science, but in practice it is more of an art and, thus, less precise. Hence, results obtained from different econometric models will differ as do the models themselves. Consequently, the estimates of the macroeconomic and budgetary effects presented in this report should not be construed as definitive and unerring statements. They do, however, strongly indicate the magnitude and direction of these effects.

ASSUMPTIONS

The results presented in this report are sensitive to underlying assumptions regarding oil prices and the conduct of fiscal and monetary policies. The assumptions used in this analysis are discussed in the following sections.

Oil and Other Energy Price Assumptions

Oil prices determine, in large part, the level to which deregulated gas prices would rise. Oil is the fuel with which gas competes in most of its applications, either as distillate fuel (heating oil) in household use or as residual oil in industrial uses. Moreover, many long-term gas contracts set the price of their gas, upon decontrol, according to a formula based on the price of oil. For the purposes of this analysis, the price of oil is assumed to rise to about \$39.00 per barrel in 1985 (in 1985 dollars) and increase at an assumed 7 percent annual rate of inflation thereafter. Alternative oil price paths are examined in Chapter III.

Besides wellhead oil and natural gas prices, growth rates for other nominal energy prices must also be assumed for this analysis. Prices for refined oil products are assumed to increase with wellhead oil price increases. Similarly, natural gas prices for residential, commercial, industrial, and electric utility customers move with wellhead natural gas prices

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8. Key concepts and assumptions used to calculate macroeconomic and budgetary adjustments induced by higher gas prices are described in Appendix B.