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Effects of Natural Gas Deregulation on the Distribution of Income

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The rapid escalation of energy prices since the 1973 oil embargo has generated political pressure to keep the retail prices of oil and natural gas from rising as much as market forces might dictate. Shortages of natural gas in the middle 1970's and attempts to reduce dependence on oil imports, however, have led to policies of phased deregulation for oil and gas. Wellhead prices of oil were completely deregulated in 1981 by President Reagan, and natural gas price ceilings are being phased out under the Natural Gas Policy Act of 1978 (NGPA).

Under NGPA, a limited amount of gas is exempt from price controls. For the remaining gas, price ceilings are raised each month to adjust for inflation. Most of this gas is scheduled for complete decontrol between 1985 and 1987. "Old gas," which is gas placed under contract before 1978, will not be deregulated under NGPA. Current debate about natural gas pricing policies, therefore, is concerned with whether price regulation should be lifted earlier than planned under NGPA, whether old gas should also be decontrolled, or whether regulation should be extended beyond 1985.

The primary argument for continued price regulation is that the increase in prices accompanying deregulation would not reflect higher costs of providing the resource and would simply transfer income from consumers to producers and from energy-consuming states to energy-producing states. Furthermore, because lower income groups tend to spend a larger share of their budgets on energy than higher income groups, increases in energy prices are assumed to be regressive: they have a larger impact on low-income classes than on high-income classes.[1]

This argument, however, focuses attention on only one aspect of the relationship between energy price increases and the relative well-being of different income groups. Estimates of the changes in expenditures on energy generally capture only the

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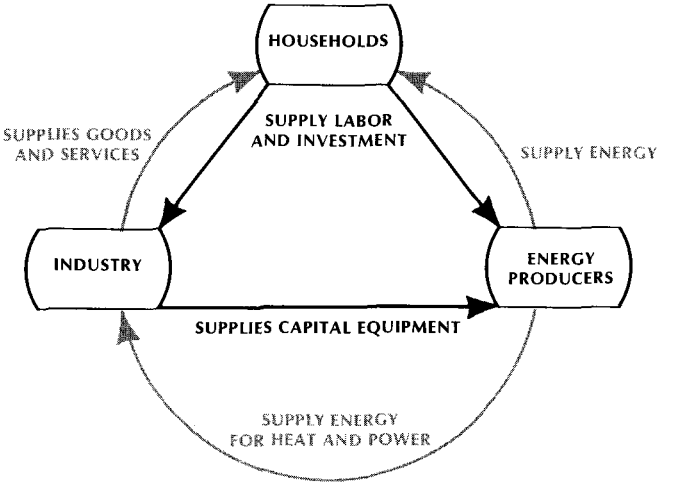
1. Jorgenson, Lau, and Stoker estimated that a standardized family with an income of $5,000 (in 1972 dollars) would spend 1.58 times more of its total expenditures on energy than a similar family with $35,000. See Dale W. Jorgenson, Lawrence J. Lau, and Thomas M. Stoker, "The Transcendental Logarithmic Model of Aggregate Consumer Behavior," in *Advances in Econometrics*, ed. R. L. Basmann and George F. Rhodes, Jr., vol. 1 (Greenwich, Conn.: JAI Press, 1982), 224.

Chart 1

Interactions Between Households, Industry, and Energy Producers



first-round, direct effects of a price increase. Energy prices also influence the level and distribution of income through their effects on employment, profits, production, and the prices of final goods other than energy.

Both the direct and the indirect effects of deregulating energy prices are important to consider. The purpose of this study is to estimate the possible effects of natural gas deregulation on households at different points along the income scale. Because there is a large set of alternative plans for changing NGPA, this article focuses on only two cases: a regulation scenario, where no modifications of the NGPA or existing contracts between pipelines and gas producers occur, and a deregulation scenario, where all gas is sold in a free market from the beginning of 1983.

These cases provide some indication of the relative importance of the indirect effects of deregulation on the real income of different households. Results from a simulation model for the two scenarios suggest that including the indirect effects of deregulation strengthens the case for deregulation. Immediate deregulation of natural gas is found to produce a very small increase in income inequality before 1985 but actually results in slightly higher income equality beginning in 1985, with all income groups enjoying a small increase in real income after 1985.

Theoretical implications of deregulation

The relationship between energy policies and the distribution of income can be seen by dividing the private economy into three major sectors: households, industry, and energy producers. As shown in Chart 1, changes in energy prices affect households directly through the energy-household channel and indirectly through the effects energy prices and quantities have on the industrial sector. To understand these interactions, it is useful to begin by sketching the general nature of the decisions made by each sector and the linkages between sectors.

Households obtain income from labor, investments, and transfer payments. The income is then used for purchasing energy, goods, and services. Unspent income is saved for future consumption. The composition of income and expenditures varies

along the income scale. This variation is what generates changes in income distribution from changes in energy prices.

Each industry within the industrial sector uses energy inputs, labor, capital equipment, and materials from other industries to manufacture final goods and services for households and energy producers. Changes in the rate of production or the level and mix of input purchases arising from a change in an energy price have repercussions on the distribution and level of real income to the extent that labor or investment income is changed.

Energy producers supply fuel from proved reserves to households and industry for heat and power. They augment their reserves by exploration and development. Based on expectations about future energy prices, producers choose a production plan to maximize profits from the reserves over time. Energy producers purchase labor from households and equipment from industry. They also generate profits for the household sector.

To demonstrate the channels through which the distribution and level of income are likely to be linked to energy price shocks, it is useful to trace the effects of an increase in natural gas prices caused by deregulation. In the next four sections the short-run and long-run direct and indirect effects are described.

Short-run direct effects. Opposition to decontrol is often based on two direct short-run effects.[2] First, an increase in natural gas prices reduces the real purchasing power of all users of natural gas. Households that have a relatively high and inelastic demand for gas face a reduction in their income compared with households having more elastic demands or lower consumption levels. To the extent that low-income households spend a larger share of their budgets on gas, inequality in purchasing power is increased.

A second direct short-run effect is an increase in profits to gas producers. Because investment income tends to be more heavily concentrated in the higher income brackets, an increase in profits is likely to raise income inequality.

Short-run indirect effects. Deregulation is also likely to have short-run indirect effects on households through the linkages between households and the industrial sector. If an increase in the price of gas reduces the demand for labor, unemployment rises and total labor income falls.[3] The income of low-income households declines relative to that of high-income households because the incidence of unemployment is higher among the low-income groups.

Investment income, too, is affected indirectly by increases in gas prices. Industry profits are likely to fall if the additional production costs cannot be passed on to consumers in the form of higher output prices. If profits fall, the distribution of income is made more equal because the higher income groups are affected disproportionately. Any short-run reduction in industry profits, though, needs to be compared with increases in short-run profits of gas producers.

Household expenditures are affected indirectly in the short run by these changes in income and prices. Adjustments in the prices of final goods are likely to occur under deregulation, with energy-intensive products reflecting larger cost increases than other products. These changes in the prices of goods affect the distribution of purchasing power of households by decreasing the real purchasing power of consumers who allocate a comparatively large share of their expenditures to energy-intensive goods.

Long-run direct effects. Increases in natural gas prices trigger long-run adjustments by both households and energy producers. Households respond directly through energy conservation and conversion to alternative sources of heat and power. This direct effect differs among households, depending on their relative long-run price elasticities of demand for gas. If these elasticities differ across income groups, the distribution of real income shifts.

A second direct effect works on the other side of the market. Higher gas prices encourage exploration for and development of gas and gas substitutes.[4]

2. See Energy Action Educational Foundation, *The Decontrol of Natural Gas Prices: A Price Americans Can't Afford* (Washington, D.C.: Energy Action Educational Foundation, February 1981).

3. This analysis assumes that wages are fixed by contracts and are less flexible than labor demand. Changes in demand, therefore, alter employment without directly altering nominal wages.

4. This effect is emphasized in the arguments of deregulation's advocates. See, for example, Edward W. Erickson, *Natural Gas and the Natural Gas Policy Act: A Pragmatic Analysis* (Washington, D.C.: Natural Gas Supply Association, 1981).

This supply response slows the growth rate of energy prices in the future by generating new supplies of energy. With the additions to supply, the upward trend in gas prices from the depletion of reserves is flattened.

Long-run indirect effects. Higher gas prices create long-run indirect responses through the industry-energy channel. The primary force leading to changes in the long run is the accumulation of capital by industry. To use less energy-intensive production techniques, firms adjust their capital stock as a result of higher energy costs.

Changes in the capital stock and the output of different industries resulting from higher gas prices have two long-run indirect effects on households. First, household income is affected by changes in labor and investment income. The demand for labor is a function of the capital stock in place and the level of production. If higher energy prices change the capital stock and production, labor income is changed as well. If deregulation of the natural gas industry causes an improvement in economic efficiency and, in turn, an expansion in economic activity, investment income is likely to rise in the long run.

Second, the households' uses of income are indirectly affected in the long run. Because long-run price elasticities of demand are usually larger than short-run elasticities, households shift away from energy-intensive products in the long run.

The direction of both of these indirect effects is positive from the perspective of the households. Economic theory suggests that distortions in the market create production inefficiencies. When the price of gas is kept below market prices, distortions are introduced that lead to inefficient use of gas. Deregulation, by removing the source of inefficiency, should increase economic growth in the long run.

An energy policy simulation model

To gain a better understanding of the relative importance and implications of these direct and indirect, short-run and long-run effects from increases in energy prices, an annual model of the U.S. economy has been constructed for use in policy simulations for the period from 1983 to 1994. The structure of the economy, designed to capture the major channels described above between households, industry, and the energy sector, is outlined in Chart 2.

The model traces the sources and uses of income of five representative households from different points along the distribution of income.[5] Each household obtains income from labor and investments. Labor income is determined by the total demand for and supply of labor, with the incidence of unemployment falling disproportionately on the lowest income groups.[6] Because the supply of labor is assumed to grow exogenously, changes in the demand for labor affect the level of income by altering the total wage bill and the distribution of income by altering the unemployment rate.

Because labor income and investment income have had a relatively stable relationship as shares of total income over time, the model calculates investment income as a markup over labor income.[7] The markups are largest for the highest income bracket (reflecting investment income), although the markup for the lowest is higher than for the other three income brackets (reflecting transfer payments and social security).

Disposable income is used by each household for saving and expenditures on three composite goods: durables, nondurables, and services.[8] Aggregate

5. The households were selected to represent typical households at the 10, 30, 50, 70, and 90 percentiles of the distribution of before-tax income of "families and unrelated individuals." Demographic characteristics for these five groups were obtained from U.S. Bureau of the Census, *Current Population Reports*, Series P-60, no. 123 (Washington, D.C., 1980).

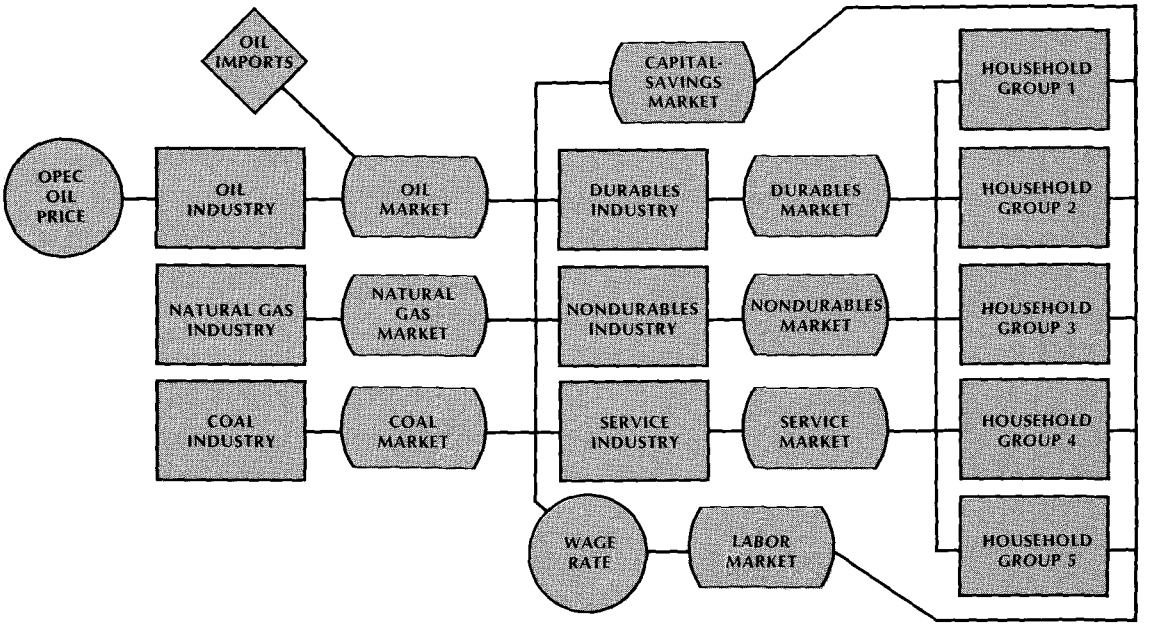
6. Estimates of the shares of unemployment attributed to each group were obtained using data from the *Current Population Reports* covering 1960 through 1970. Parameters for labor income equations for the different households were estimated to calculate (1) the share of employment allocated to each household and (2) the effect of changes in unemployment on those shares. Resulting estimates found that with an increase of 1 percentage point in the unemployment rate, the lowest income group's share of aggregate employment would be adjusted downward by 0.0018, and the derived parameter for the highest income group's share would be adjusted upward by 0.0023. (Adjustment parameters for the five household groups sum to zero.)

7. The wage markup factors were obtained from Richard A. Musgrave and Peggy B. Musgrave, *Public Finance in Theory and Practice*, 3d ed. (New York: McGraw-Hill Book Company, 1980), 344.

8. Disposable income is obtained from total income, using exogenous tax rates for the five household groups. A brief discussion of the industrial sector, as well as the energy sector, of the simulation model is presented in the Appendix.

Chart 2

An Income Distribution Simulation Model for Energy Policy



saving is determined by the level of income and the interest rate, with the interest rate supplied exogenously. Total saving is then split among consumers, based on historical shares.[9] Remaining income is allocated among the three consumption goods according to budget-share equations that are determined by output prices, individual income, and demographic characteristics.[10]

The model outlined in Chart 2 captures many of the general-equilibrium effects of an energy price change on the distribution and level of income. The model does not directly calculate the effects on residential gas consumption, but they may be approximated by examining changes in gas prices and making additional assumptions about total household demand for gas over time. The bulk of the model, however, is designed to capture the indirect effects of changing energy prices.

An application to natural gas deregulation

Using the model just described, simulation experiments were conducted to determine the effects of natural gas deregulation on the five household groups. To simplify the discussion, only two scenarios were considered: the status quo and immediate deregulation.

The regulation scenario assumes that the Natural Gas Policy Act is allowed to run its course without any further Government intervention. The NGPA established a tiered structure of price ceilings for

9. Saving shares were obtained from the 1972-73 Consumer Expenditure Survey (conducted by the Census Bureau for the U.S. Bureau of Labor Statistics). The shares for the groups were −0.0962, 0.0108, 0.1265, 0.2678, and 0.6911 for the lowest to highest incomes. The negative saving share for the lowest group reflects dissaving by that class.

10. Demographic characteristics included family size, age of head of household, race, region, and urban-rural status. Coefficients for the budget shares were obtained from Jorgenson, Lau, and Stoker, "Transcendental Logarithmic Model of Aggregate Consumer Behavior."

different categories of gas based on the age of the well, the market the gas was sold in before 1978, and the difficulty of extraction. Three major categories have been identified: old gas, which sells for as little as 30 cents per thousand cubic feet (Mcf); new gas, which sells for around $3 per Mcf; and high-cost gas (including gas below 15,000 feet), which has sold for as much as $10 per Mcf.

The NGPA permits ceiling prices for old gas to rise at the rate of inflation, but it does not remove the ceilings at any time in the future. Prices of new gas are allowed to rise by more than the inflation rate and are scheduled to be deregulated between 1985 and 1987, depending on the particular subcategory. High-cost gas is virtually deregulated now; deep gas was deregulated in 1979, and other incentive categories currently sell below ceiling prices. By 1985, approximately 60 percent of all gas will be decontrolled under NGPA. The cost of gas to pipeline companies is determined by a weighted average of these prices.

The deregulation scenario, on the other hand, treats all sources of gas alike and relies on a single upward sloping supply curve for gas. The price is determined at the margin, where supply and demand coincide.

The second major difference between the scenarios concerns assumptions about contract provisions. Unless changes are legislated, provisions written into many existing contracts for gas between pipeline companies and gas producers could lead to prices above market-clearing prices in 1985. "Indefinite escalator" and "most-favored-nation" clauses have been included in a large number of gas contracts. These clauses, written to protect the interests of gas producers, often state that in the event of deregulation, the price of previously regulated gas is to be set at a rate based on the highest prices in the producing region.

Because deep gas (from below 15,000 feet) has sold for as much as three times the price of new gas, it is possible that in 1985 the price of all newly deregulated gas could rise dramatically under such contract provisions. Old gas will remain regulated at very low prices in 1985, lowering the average price of gas, but the net effect of the contracts could be to raise the prices as much as 30 percent. A rise of this magnitude would result in prices well above free-market levels.

The regulation scenario allows the average price in 1985 to rise dramatically. The price of all new gas under contract rises to the equivalent of the price of residual fuel oil forecast for 1985. In the deregulation scenario the assumption is that all contracts are renegotiated in 1983 to reflect equilibrium market prices. A more detailed description of price determination in the regulation scenario is provided in the Appendix.

In keeping with the discussion above, differences in the two scenarios are divided into short-run direct effects, short-run indirect effects, long-run direct effects, and long-run indirect effects. The "short run" is defined to be the first year of immediate deregulation. The period starting with 1984 is considered to be the "long run" because adjustments in capital and gas production begin to appear in response to the changes in gas prices.

Before turning to a discussion of these effects on households, it is useful to examine the results of the simulation on gas prices. Price paths from the simulation experiments are shown in Chart 3 for 1983 through 1994, in 1982 dollars. Prices are higher under deregulation than under regulation—by 3 percent in 1983, by 5 percent in 1984, and between 1 and 3 percent after 1985. In 1985, however, the regulation scenario generates a 26-percent increase in gas prices over the deregulated price as a result of the contract provisions.[11]

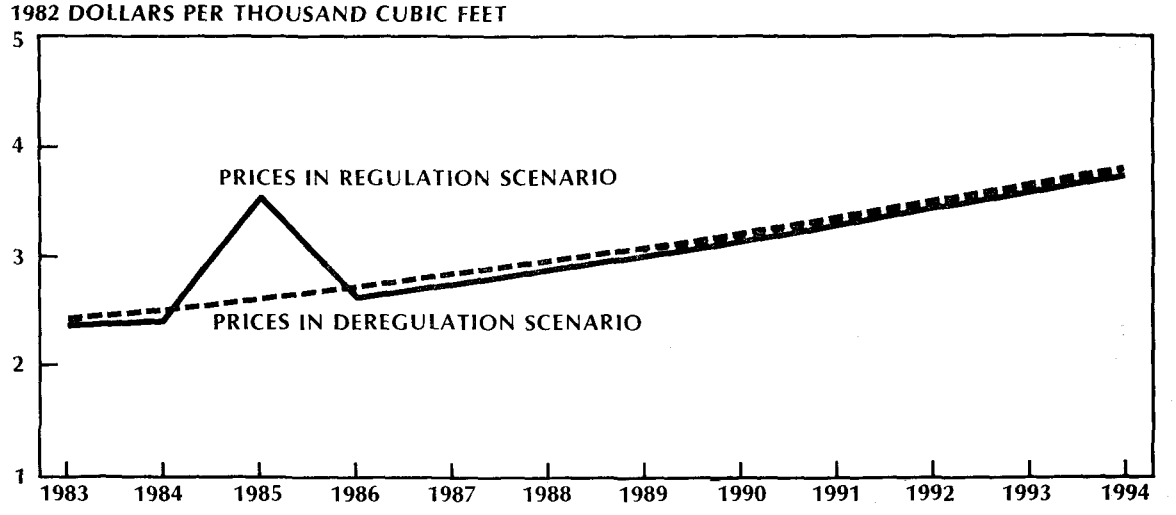
Prices are higher under deregulation in the first two years. Because the average cost curve lies below the marginal cost curve, deregulation raises the price in the short run by shifting to the marginal cost schedule from the average cost schedule. The price spike in 1985 boosts the regulated price above the deregulated price because prices for all "new gas" increase to the equivalent of residual fuel oil prices, which lie above the deregulated price of gas.

After 1985 the price is slightly higher under deregulation. The higher price, however, is the result of an outward shift in the demand curve for gas, caused by increased economic activity in the

11. This pattern of price increases is consistent with the results of other studies. In particular, see Charles J. Cicchetti, Robert H. Haveman, Mark Lowry, Mitchell Post, and Ronald Schmidt, *The Economic Effects of Deregulating Natural Gas*, vol. 1 (Madison, Wis.: Madison Consulting Group, 1982), and Richard N. Cooper, "A Note on Deregulation of Natural Gas Prices," *Brookings Papers on Economic Activity*, 1982, no. 2:371-88.

Chart 3

Natural Gas Prices With and Without Deregulation



deregulation scenario. The difference between the price paths diminishes steadily after 1985.

Short-run direct effects. A measure of the short-run direct effect of deregulation on households is not determined endogenously in the model. (Gas demand is included in nondurables consumption.) Nevertheless, it is possible to calculate a rough estimate of the effect. Because there is little evidence on the current income elasticity of gas demand, the discussion is restricted to aggregate estimates of increases in gas bills.[12]

Assuming that household gas consumption is approximately 7 trillion cubic feet per year, a rough calculation of the change in gas bills is possible. (The model does not estimate a separate demand for residential consumption of gas.) The ratio in 1982 between the average cost to residential consumers and the average wellhead price paid to gas producers was estimated to be 2.07. Using this markup, the difference between wellhead gas prices in 1983 generated by the model, and a consumption level of 7 trillion cubic feet per year, gas bills are $1.075 billion higher in 1983 because of deregulation.

This short-run increase in gas expenditures is likely to raise income inequality. Compared with high-income households, low-income households spend a larger share of their budgets on gas and receive a smaller share of profits from gas, so their real income declines by a larger percentage. For example, taking the extreme position that the income elasticity of gas expenditures is zero (implying that low- and high-income households consume the same quantity of gas), the additional cost of gas to low-income households represents 0.41 percent of their real income in 1983, versus 0.03 percent of the real income of the highest income group. The short-run direct effects on the distribution of income, therefore, are likely to be minor, especially because

12. The budget-share figures cited in footnote 1 indicate that lower income groups spend a larger share of their budgets on gas. The evidence presented by Jorgenson, Lau, and Stoker ("Transcendental Logarithmic Model of Aggregate Consumer Behavior"), however, is based on expenditures in 1972. Because energy prices have escalated dramatically since 1972, the current elasticities are probably different. A recent survey of studies estimating price and income elasticities of natural gas demand has reported estimates ranging from 2.18 to zero for long-run income elasticities. See Douglas R. Bohi, *Analyzing Demand Behavior: A Study of Energy Elasticities* (Baltimore: Johns Hopkins University Press for Resources for the Future, 1981), 94-95.

the income elasticity will probably be greater than zero, which would reduce the cost estimate for low-income households at the expense of the high-income households.

Short-run indirect effects. Deregulation increases income inequality in 1983 through indirect channels also. The simulations indicate that nominal income is lower for all households than it would have been under continued regulation, but the percentage difference is largest for the lowest income group. The effects are very small, however, with the lowest income group having 0.2 percent less nominal income and the highest income group having only 0.01 percent less income. The indirect effects result in a decline of $594 million in disposable nominal income in 1983 with the deregulation scenario.[13]

The declines in nominal income are caused by changes in the demand for labor. Higher natural gas prices generate 0.06 percent more employment in the durables industry, but they generate 0.13 percent less labor demand in the nondurables industry and 0.05 percent less in the service industry.

These differences in labor demand across industries result from the different uses for gas. Gas can be used for heat and air conditioning, in which case the demand for labor will fall with a decline in the quantity of gas demanded. When gas is used for power, however, the demand for labor increases if additional workers are needed to operate the machinery or decreases if less labor-intensive techniques are used. In the cases of services and nondurables, the complementary uses outweigh the substitution effects, while the reverse happens for the durables industry. In all cases, though, the percentage changes are very small.

Long-run direct effects. The simulation model does not provide estimates of the long-run direct effects. Residential demand for gas will undoubtedly change in the period between 1983 and 1994. The magnitude and direction of the change, however, cannot be predicted. Population growth and improvement in the availability of gas supplies may increase gas demand. At the same time, conservation and conversion to other fuel sources may reduce demand. To avoid making any judgment about the likely demand for gas, the calculation of long-run changes in gas expenditures assumes a constant consumption level of 7 trillion cubic feet per year. The resulting estimate, therefore, should be interpreted with this limitation in mind.

EFFECT OF DEREGULATION ON HOUSEHOLD EXPENDITURES FOR NATURAL GAS

(Calculated in billions of 1983 dollars)

Year	Additional gas cost with deregulation	Present value of cost difference between scenarios[1]	
		Annual	Cumulative
1983	$1.075	$1.075	$1.075
1984	1.711	1.630	2.705
1985	-13.498	-12.243	-9.538
1986	1.088	.940	-8.598
1987	1.469	1.208	-7.390
1988	1.352	1.059	-6.331
1989	1.208	.901	-5.430
1990	1.076	.765	-4.665
1991	.954	.646	-4.019
1992	.846	.545	-3.474
1993	.746	.458	-3.016
1994	.655	.383	-2.633

1. Using a real discount rate of 5 percent.

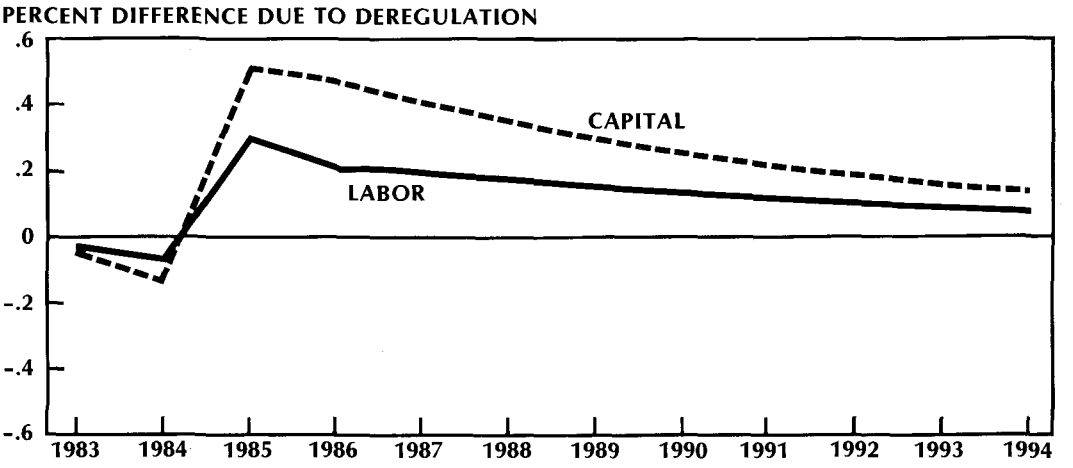
Using the assumption that the markup for residential prices over wellhead prices remains 2.07, calculations of the change in gas expenditures are presented in the table. The most dramatic effect on gas expenditures occurs in 1985 under regulation. If the regulated price rises to the level projected in the model, gas expenditures in 1985 will be $13.5 billion more than if deregulation occurred in 1983. In all other years, gas expenditures will be higher in the deregulation scenario but by a much smaller amount.

The present value of the difference in gas bills between the two scenarios and the cumulative pres-

13. The effect of deregulation on the distribution of real income is slightly smaller. A measure of real income is obtained by deflating the nominal income of each household group by a price index constructed using its 1982 consumption bundle. By this measure, 1983 real income for the lowest income group is 0.15 percent less under deregulation. The real income of the other income groups is slightly higher under deregulation in 1983; the difference for the highest income group is 0.016 percent.

Chart 4

Labor and Capital Demand: Differences Between Deregulation and Regulation Scenarios



ent value, using a real discount rate of 5 percent, are also shown in the table. Before 1985 the present value of gas expenditures is $2.7 billion higher for households in the deregulation scenario. This would lead to a less equal distribution of income because low-income households are assumed to have a more inelastic demand for gas than high-income households. The increase in profits to gas producers from the higher prices should also benefit the higher income groups.

After 1985 the cumulative present value of the difference in gas expenditures is lower for households than in the regulation scenario. Using the same argument outlined above, the reduction in cumulative expenditures in the deregulation scenario lessens income inequality. In present-value terms, these direct gains from deregulation begin to diminish after 1985, reflecting the effect on the price of gas of the lower level of economic activity in the regulation scenario.

The calculations presented in the table indicate that the increases in gas expenditures are on the order of $1 billion per year in the first two years. Furthermore, the dominant factor in determining the eventual effect on gas bills is the possibility of a price spike under NGPA in 1985.[14]

Long-run indirect effects. Deregulation influences the level and distribution of income indirectly through its effect on industry's demand for labor.[15] As shown in Chart 4, employment is lower initially in the deregulation scenario as a result of the higher deregulated gas prices. Capital investment is also lower in percentage terms because of the joint reduction in gas and labor inputs. In 1985, though, the lower price of gas in the deregulation scenario generates higher employment. The greater use of both gas and labor in 1985 under decontrol leads to

14. The effect of deregulation on additions to gas reserves did not have an important role in the analysis because the differences in prices were very small. Additions were slightly higher in the period except for 1985. The strong price boost in 1985 led to higher additions in the regulation scenario in 1986.

15. Total employment in the model differs across scenarios as a result of differences in gas prices and in the capital stock. Employment is negatively affected by increases in gas prices and positively affected by increases in capital. Investment in capital, in turn, is negatively affected by decreases in natural gas use and positively affected by increases in employment. As shown in Chart 4, differences in employment and capital move together.

Chart 5

Nominal Income of Selected Households: Differences Between Deregulation and Regulation Scenarios

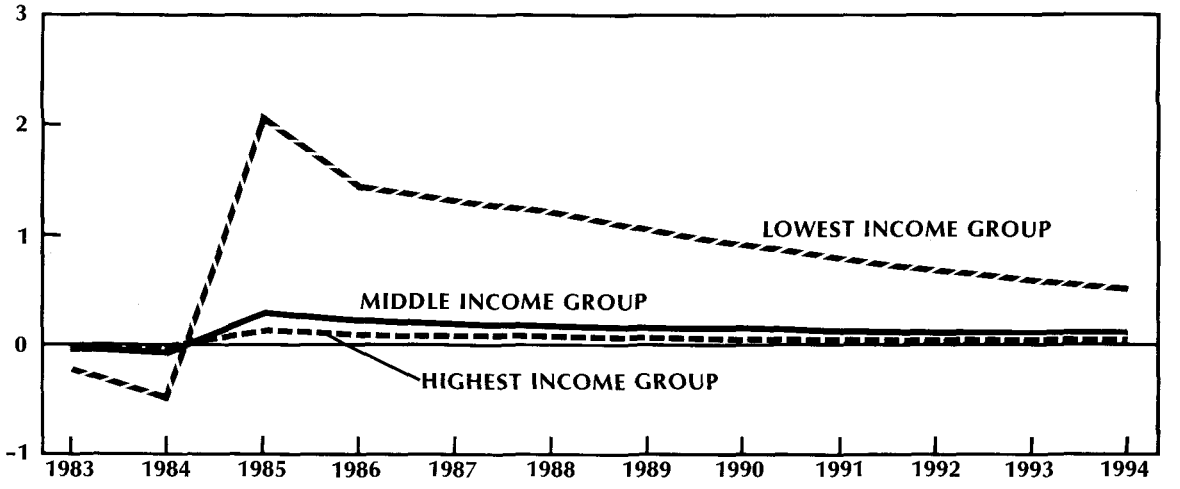
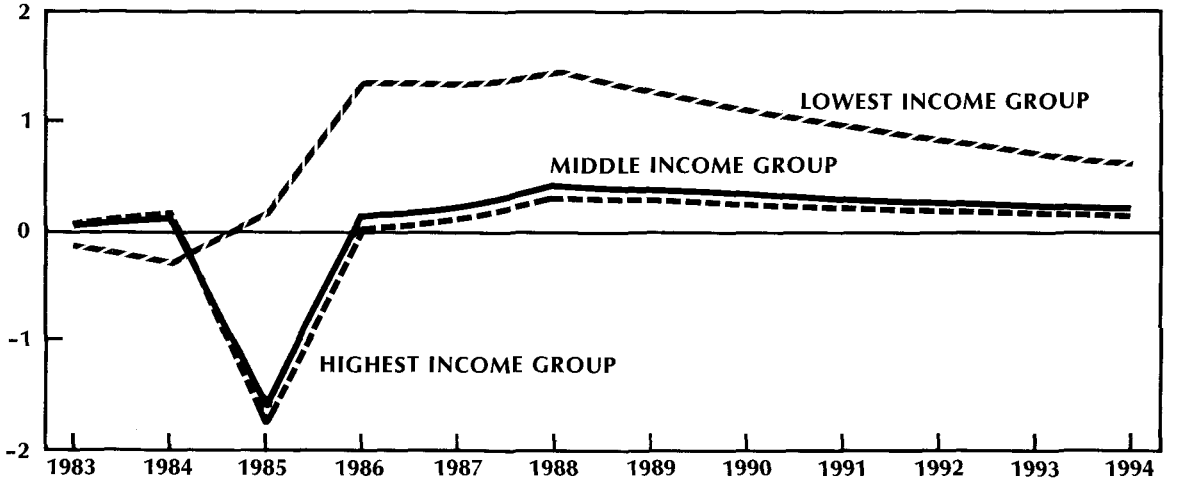


Chart 6

Real Income of Selected Households: Differences Between Deregulation and Regulation Scenarios



more capital investment. After 1985, therefore, employment remains higher in the deregulation scenario because the capital stock is larger.

The effects of these differences in labor demand on the distribution and level of nominal income can be seen in Chart 5. Lower employment in the deregulation scenario in 1983 and 1984 leads to lower nominal income for all households. Because most of this difference is reflected in the earnings of the lowest income group, it has the largest percentage difference in nominal income of any of the household groups. As a result, the distribution of income becomes less equal. On the other hand, the higher level of employment beginning in 1985 under the deregulation scenario presents the lowest income group with the largest percentage gain, reversing the reduction in income equality experienced in 1983-84.

A comparison of differences in nominal income generated by deregulation over time, however, fails to capture the effects of differences in output prices on the real income of households across scenarios. Real income is calculated for each household group by using a price deflator based on its 1982 consumption bundle.

As shown in Chart 6, differences in real income follow a similar pattern to that exhibited by nominal income. The lower income groups are hardest hit by deregulation in the first two years and benefit the most later in relative terms. All households are better off by 1986 in the deregulation scenario. Furthermore, as was the case with nominal income, percentage differences in real income across scenarios are small. The present value of the difference between scenarios in aggregate real income (using a real discount rate of 5 percent) indicates a net gain to the economy of $12.09 billion, in 1982 dollars, by 1994.[16]

Conclusions

The results of this study lend support, at least in part, to both advocates and critics of natural gas deregulation. The evidence supports the views of the critics in the short run because households, especially low-income households, appear to be worse off under deregulation in the first two years.

In the longer run, though, the results support the case of the advocates of deregulation. Both direct and indirect effects lead to higher real income for all households and lower gas expenditures, with low-income households benefiting the most. Beginning in 1985, employment, real income, and production are higher in the deregulation scenario.

The two most striking results of the simulations, however, are the impact of the price spike and the magnitude of the differences generated by deregulation. The major threat to low-income households from gas policy is the possibility that NGPA will lead to an abrupt increase in prices in 1985 because of existing contract provisions. If the political price of eliminating these contract provisions requires a compromise in the form of immediate deregulation, the study results indicate that all households would benefit.

Of equal importance, the effects in all cases were small. Given the degree of concern expressed by critics and advocates about the possible consequences of decontrol, the magnitude of the effects was surprisingly minor. Price differences between scenarios were minimal, with the exception of the price spike.

The small effects reported here are especially interesting because the two scenarios use some rather extreme assumptions. Compared with the regulation scenario, legislation proposed by the Reagan Administration would probably have a smaller effect on the economy than the deregulation scenario used in this study. Furthermore, even in the absence of new legislation, the price spike in the regulation scenario is likely to be reduced. The decline in gas demand resulting from a dramatic price increase would encourage pipeline companies and gas producers to renegotiate contracts to preserve future sales. The effect of most deregulation proposals on income inequality, therefore, is likely to be very small.

16. Given the assumptions underlying the income equations, this estimate is probably overly conservative. As shown in Chart 6, real income is actually higher in 1983-84 for the higher income groups and lower in 1985 in the regulation scenario. The reason for this result is the assumption that nominal wages do not vary in response to changes in unemployment. Therefore, real wages can differ across scenarios. In the model, higher employment generates greater demand for goods, resulting in increases in the price level and lower real wages. In 1985 the positive effect of an increase in employment is overpowered for higher income groups by a decrease in the real wage rate caused by higher inflation. Assuming that wages increase more in periods of high inflation, real income of these groups is unlikely to be higher in the regulation scenario in 1985, as projected by the model.

Appendix

Energy Input Supply and Demand

The industry-energy channel of the model is used to determine the prices and quantities of oil, gas, and coal. A general description of the decisions made by each industry and energy producer is provided in this appendix. The process used to calculate gas prices in the regulation and deregulation scenarios is also described.

The industrial sector of the economy is composed of durables, nondurables, and service industries.[1] Each industry is assumed to use labor, capital, oil, natural gas, and coal to produce final output. Demands for labor, oil, natural gas, and coal are determined by the price of each input (deflated by the output price) and the capital stock available at the beginning of each period. Investment in capital—assumed to be installed in the next period—is then based on the stocks of inputs used in the current period. Next, production functions are used to calculate the units of output.

The energy sector supplies coal, oil, and gas production, but the production of coal is considered to be exogenous for the purposes of this study. The price of oil is determined outside the model by the Organization of Petroleum Exporting Countries, and at that price, OPEC meets any oil demand that is not satisfied by domestic production. Domestic oil and gas production is assumed to be positively related to the wellhead prices received (which may be regulated in the case of natural gas) and the quantity of proved reserves. Reserves, in turn, are augmented over time by exploration and development. Additions to reserves of both oil and gas are assumed to respond positively to increases in the prices of oil and gas. To capture the assumption of increasing extraction costs, additions to reserves are assumed to be negatively related to cumulative additions.

In the regulation scenario the supply of natural gas is determined sequentially from three sources. First, pipelines are assumed to take high-cost gas in amounts determined by past purchases. Prices for this gas are set at an equivalent of residual fuel oil prices. Next, new gas equal to purchases in 1982 is taken by pipelines at prices determined by the Natural Gas Policy Act of 1978. Third, old gas is added into the supply at its ceiling price.[2] If demand for gas exceeds the amount contracted, additional offerings of new gas are then rolled in. If demand rises sufficiently to create excess demand that cannot be met by previously committed gas and new gas, pipelines meet the shortage with additional supplies of high-cost gas.

After 1985, high-cost gas is assumed to be indistinguishable from other gas, and new gas is free to receive market prices. Pipelines continue to practice average cost pricing, however, with low-cost old gas bringing down the average price. Beyond 1987, only new gas is consumed, with its supply determined by prices and available reserves.

To capture the effect of a price spike, all new gas is assumed to receive a price equivalent to the price for residual fuel oil in 1985. Average prices are then determined by a weighted average of the new gas and the old gas, which is still regulated. This assumption, it should be emphasized, provides an extreme case for the price increase because not all new gas is likely to fly up to the oil price equivalent.

In the deregulation scenario, all gas is assumed to be deregulated in 1983, with all contracts renegotiated. Both the supply of gas and the price are determined by market forces. As is also the case with the regulation scenario, the supply is positively related to the price of gas and the quantity of proved reserves. Additions to reserves are positively affected by increases in the prices of oil or gas and are inversely related to cumulative discoveries of gas.

1. The durables industry consists of nonfuel mining, construction, and durable manufacturing. The nondurables industry covers agriculture as well as nondurable manufacturing. Remaining Standard Industrial Classification codes have been aggregated into services.

2. Estimates of prices and quantities of gas, by NGPA category, were taken from Charles J. Cicchetti, Robert H. Haveman, Mark Lowry, Mitchell Post, and Ronald Schmidt, *The Economic Effects of Deregulating Natural Gas*, vol. 1 (Madison, Wis.: Madison Consulting Group, 1982).

Economic Determinants of Illegal Mexican Immigration to the U.S.

*By Alberto E. Davila**

Immigration policy has typically overlooked the economic developments in Mexico that "push" undocumented Mexicans into the United States. Traditionally, the focus has been on U.S. economic determinants—"pull" forces—that draw Mexicans into this country. This narrow view has failed to take account of human migration research showing that migrants respond to economic conditions in both the sending and the receiving regions.[1]

This article examines the contention that push forces are an economic determinant of illegal Mexican immigration.[2] The evidence here, as in much research on illegal migration from Mexico, is drawn from analysis based on apprehensions of undocumented Mexicans. First, therefore, this study discusses the use of apprehensions as an adequate proxy for net illegal Mexican immigration. Push and pull forces are then considered as economic determinants of such immigration. The major pull variable is U.S. demand for agricultural labor. But the rate of apprehensions is more sensitive to the push variable—the ratio of employment to population in Mexico. The relationship between apprehensions and the push variable holds for both male and female Mexicans.

These results are consistent with recent studies that have found push forces to be primarily responsible for variations in illegal Mexican immigration.[3]

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1. For an overview of the migration literature, see Michael J. Greenwood, "Research on Internal Migration in the United States: A Survey," *Journal of Economic Literature* 13 (June 1975): 397-433. For a recent article supporting the view that migration is affected by home economic conditions, see Alan M. Schlottmann and Henry W. Herzog, Jr., "Home Economic Conditions and the Decision to Migrate: New Evidence for the U.S. Labor Force," *Southern Economic Journal* 48 (April 1982): 950-61.

2. This study is concerned primarily with the economic forces behind illegal Mexican immigration. Mitchell A. Seligson and Edward J. Williams, however, have found that noneconomic forces are also important in the Mexican migration decision (*Maquiladoras and Migration Workers in the Mexico-United States Border Industrialization Program* [Austin: Mexico-United States Border Research Program, University of Texas at Austin, 1981], 99).

3. See Mario I. Blejer, Harry G. Johnson, and Arturo C. Porzecanski, "Un análisis de los determinantes económicos de la migración mexicana legal e ilegal hacia los Estados

Table 1
APPREHENSIONS OF UNDOCUMENTED MEXICANS IN THE UNITED STATES AND ENFORCEMENT EFFORTS

Year	Apprehensions			Authorized force[2]
	Total	Expected change[1]	Actual change	
1973 . . .	576,823	—	—	3,247
1974 . . .	709,959	Increase	Increase	3,465
1975 . . .	680,392	Increase	Decrease	3,525
1976 . . .	781,474	Increase	Increase	3,767
1977 . . .	954,778	Increase	Increase	3,787
1978 . . .	976,667	Increase	Increase	3,840
1979 . . .	998,830	Increase	Increase	3,951
1980 . . .	817,479	Increase	Decrease[3]	4,017
1981 . . .	900,612	Decrease	Increase	3,924
1982 . . .	[4]915,169	Increase	Increase	3,940

1. Due to enforcement changes.
2. For border patrol and for investigations.
3. Reflects termination of INS worksite inspections.
4. Estimated, based on monthly data through October. The estimate takes into account the increase in apprehensions after the August peso devaluation.

SOURCE: U.S. Immigration and Naturalization Service.

The studies, however, have attached less importance to pull forces. This study elaborates on previous analysis by using quarterly data for apprehensions instead of annual data. Using quarterly data permitted the analysis of within-year variations in apprehensions due to seasonal changes in U.S. agricultural labor demand, revealing the importance of the demand for agricultural labor as a pull force. Quarterly data were also used here to estimate separate equations for apprehensions of males and females, an analysis that is absent in other work.

The policy implications from these results are discussed in the final section of the article. Current proposed legislation designed to stem undocumented Mexican immigration does not address push determinants of illegal Mexican immigration. The Simpson-Mazzoli bill is typical in its focus on discouraging American employers from hiring undocumented Mexicans. If, as the evidence in this and other research suggests, Mexican immigration is more sensitive to push forces than pull forces, such proposals may not be as effective as those that help increase employment opportunities in Mexico.

Apprehensions are an adequate proxy for immigration flows

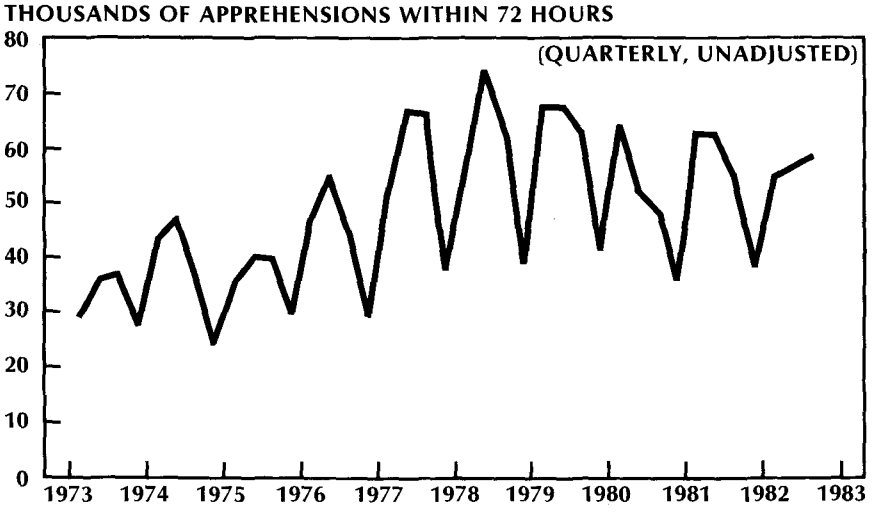
Interest in illegal immigration arises from its effect on the population and labor supply of the United States. Consequently, the ideal series to examine in a study of illegal Mexican immigration is net immigration, which is the difference between migration to and migration from a region. The apprehensions series, however, is probably more highly correlated with gross immigration.

Many of the Mexicans who illegally cross the border return to their country after working in the United States for a few weeks or months. In some cases, such journeys for temporary jobs are undertaken regularly to take advantage of seasonal in-

Unidos," *Demografía y economía* 11, no. 3 (1977): 326-40, and Walter Fogel, "Twentieth-Century Mexican Migration to the United States," in *The Gateway: U.S. Immigration Issues and Policies*, ed. Barry R. Chiswick (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1982), 210-14.

Chart 1

Total Apprehensions of Undocumented Mexican Workers in the United States



SOURCE OF PRIMARY DATA: U.S. Immigration and Naturalization Service.

creases in labor demand. Under these conditions, gross illegal immigration would overstate net immigration and, therefore, actual increases in the population and labor force.

Theoretically, however, the same economic forces inducing Mexican migration to the United States serve to delay Mexican return migration. A widening in the gap in employment opportunities between Mexico and the United States, for example, is likely to drive jobseekers into this country and also discourage Mexican aliens from returning to Mexico. The sensitivities of both net and gross immigration to changes in economic conditions are, consequently, likely to be comparable.

Unfortunately, data on actual gross or net Mexican immigration are not available. Instead, this analysis uses monthly data, from the U.S. Immigration and Naturalization Service (INS), on the number of apprehended aliens, by nationality and sex. These data are an imperfect measure of actual gross, and hence net, immigration flows. They reflect repeat crossings, depend on the level of border patrol enforcement, and represent but a fraction of actual entries. These deficiencies, however, do not rule out the use of apprehensions as a proxy for net illegal immigration, as contended below.

First, repeat crossings are also related to economic forces. Residents of Mexico, in deciding whether to attempt an additional crossing, must weigh the benefits and costs of undertaking this venture. It can be argued that these benefits and costs are determined largely by labor market conditions in Mexico and the United States. Second, the number of apprehensions, albeit a smaller count than actual entries, is likely correlated with crossings. The primary purpose here is to identify determinants of changes in migration flows, not to measure the magnitude of those flows.

Finally, changes in apprehensions do not appear to be strongly affected by changing enforcement patterns. Between 1973 and 1982, for example, there are two years in which annual apprehensions are negatively related to changes in enforcement (Table 1). A stronger argument can be made by investigating quarterly patterns in apprehensions of Mexicans. Variance in apprehensions is highly seasonal and is apparently related to the demand for agricultural labor in the United States (Chart 1). Ap-

prehensions generally peak between March and July and hit their lowest point in December, even though the annual authorized border patrol force remains virtually unchanged. The number of U.S. wage and salary farm workers follows this same pattern.

Push forces found to affect illegal immigration . . .

The discussion above suggests that changes in economic conditions in Mexico and the United States lead to changes in the amount of illegal immigration and, hence, the number of apprehended Mexicans. The surge in apprehensions of Mexicans after the 1976 peso devaluation supports this economic argument. The peso declined 45 percent, on a direct-quote basis, in 1976, after being stable for 22 years. This change in the exchange rate lowered the real wage rate in Mexico relative to the real wage rate in the United States. In 1976, apprehensions totaled 781,474; by 1977 they had increased to 954,778. This increase is statistically significant and was likely attributable to the resulting widening differential between income in Mexico and income in the United States. (See the Appendix for details.)

Further evidence on the role of economic forces can be obtained through regression analysis. To estimate the strength of the relationship between economic variables and illegal Mexican immigration, apprehensions were regressed on selected "push" and "pull" variables. The apprehensions measure covers only those individuals captured within 72 hours of the initial border crossing.

The coefficients for the pull variables indicate the response of Mexican immigration to variations in U.S. labor demand. U.S. agricultural employment was chosen as a proxy for agricultural labor demand because the majority of Mexicans apprehended while working are agricultural workers. Employment in construction and manufacturing industries in Texas, New Mexico, Arizona, and California was added to form a proxy for nonagricultural labor demand. Many believe that these states and industries are targets of illegal Mexican immigrants.

The push variable measures the correspondence between illegal immigration and the demand for labor in Mexico. As demand south of the border weakens, Mexicans are pushed to the United States. The push variable is the ratio of employed individuals to the relevant population. Undocumented Mexicans are typically young; therefore, the ratio includes only the 20–34 age group.[4] The ratio was constructed by adding employment and population data for the three largest metropolitan areas in Mexico: Mexico City, Guadalajara, and Monterrey. Data covering the entire country are not available, but these areas likely reflect the health of the Mexican economy.[5]

The data contain 24 quarterly observations spanning the period from 1973 to 1978. All the variables were detrended.[6] Preliminary regression results were little affected by changes in functional form. Estimates using a double-log functional form are reported in Table 2. The coefficients of the variables can be interpreted as elasticities.

The regression results show both push and pull forces to be determinants of illegal Mexican immigration. In all cases except one, the pull elasticities are positive, as expected.[7] But agricultural employment, despite being smaller (in some instances) in absolute value than nonagricultural employment, is the only statistically significant pull variable. The significance of this variable supports the view that some of the migration is

4. In the empirical analysis, a ratio of the Mexican and U.S. minimum wages was used to capture the effect of income differentials on the Mexican migration decision. The ratio was generally of the wrong sign and statistically insignificant. (This finding, however, is consistent with that of other studies. See, for example, the above-cited study by Blejer, Johnson, and Porzecanski and the Fogel study.) Mexican workers could be displaced by legislated increases in Mexican wages, which would narrow the U.S.-Mexico wage gap and lead to an upsurge in illegal immigration to the United States. The devaluation, on the other hand, widened income differentials by changing the dollar-peso exchange rate and probably had little effect on Mexican labor displacement.

5. The employment and population data for the three areas were obtained from quarterly figures in *Encuesta continua de mano de obra* for 1973 through the first quarter of 1977 and in *Encuesta continua sobre ocupación* for the other three quarters of 1977 and for 1978. Both reports were published by the Secretaría de Programación y Presupuesto, Coordinación General del Sistema Nacional de Información (Mexico City).

6. The log of each variable was regressed on a constant and time. See the Appendix for the effects of the 1976 peso devaluation on illegal immigration where the apprehensions series was not detrended.

7. The U.S. employment data were obtained from publications of the Bureau of Labor Statistics. For both agricultural and nonagricultural employment, monthly figures (not seasonally adjusted) were transformed into quarterly figures.

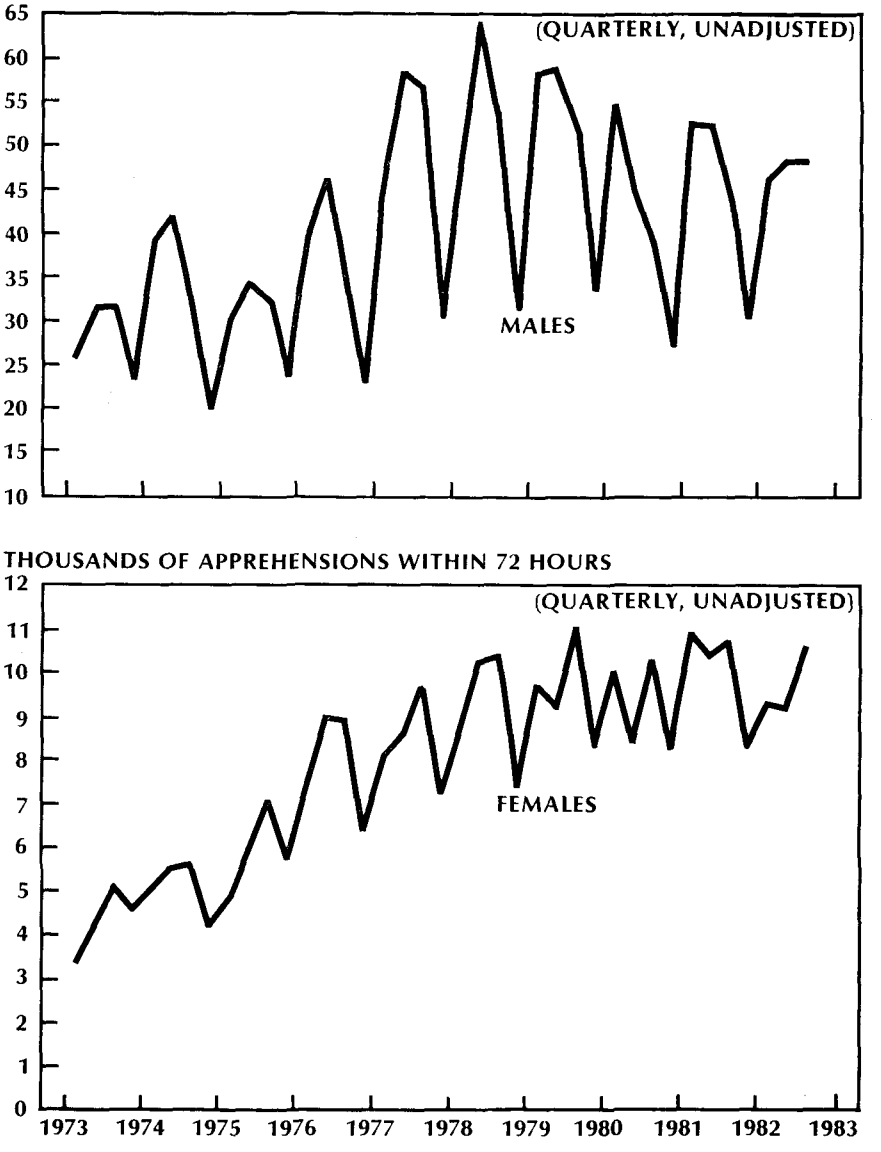
Table 2
PUSH-PULL FORCES AFFECTING ILLEGAL MEXICAN MIGRATION TO THE UNITED STATES, 1973:Q1-1978:Q4
(Dependent variable = apprehensions of undocumented Mexicans within 72 hours)

Variable	Both males and females			Males			Females		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	Regression coefficients								
Push forces									
Employment opportunities in Mexico[1]	-12.40	-12.28	-13.77	-13.75	-13.64	-15.12	-3.19	-3.02	-2.34
	(-2.53)	(-2.75)	(-2.75)	(-2.50)	(-2.72)	(-2.72)	(-2.38)	(-2.20)	(-1.35)
Pull forces									
Demand in the United States									
For agricultural labor	.72	.74		.72	.74		.92	.73	
	(1.60)	(2.32)		(1.44)	(2.07)		(4.16)	(4.57)	
For nonagricultural labor	.14		2.55	.11		2.57	-1.19		1.71
	(.06)		(1.65)	(.05)		(1.49)	(-1.20)		(1.90)
Devaluation effects[2]									
$(D \times T)$	.02	.02	.07	.02	.18	.07	.04	.07	.09
	(.46)	(.82)	(1.62)	(.33)	(.60)	(1.39)	(1.65)	(3.39)	(2.99)
$(D \times T)^2$	-.001	-.001	-.003	-.001	-.001	-.003	-.002	-.003	-.004
	(-.46)	(-.84)	(-1.63)	(-.34)	(-.62)	(-1.40)	(-1.66)	(-3.44)	(-3.01)
Regression intercept	-.11	-.09	-.32	-.09	-.07	-.31	-.19	-.28	-.39
	(-.37)	(-.58)	(-1.30)	(-.27)	(-.43)	(-1.11)	(-1.31)	(-2.61)	(-2.40)
R^2	.32	.32	.25	.30	.30	.25	.58	.56	.28
Autocorrelation coefficient	.02	.02	-.05	.03	.03	-.03	.08	.07	.05
	(.10)	(.10)	(-.25)	(.15)	(.15)	(-.15)	(.39)	(.34)	(.25)

1. Employment-population ratio.
2. D = a binary variable equal to 1 if the quarter is after the fourth quarter of 1976; zero otherwise. T = time.
NOTE: All variables were detrended using the following equation: $\ln(A) = a_0 + a_1(T)$.
Estimates were corrected for autocorrelation.
Figures in parentheses are t statistics of the regression coefficients.
SOURCES OF PRIMARY DATA: Secretaría de Programación y Presupuesto.
U.S. Bureau of Labor Statistics.
U.S. Immigration and Naturalization Service.

Chart 2

Apprehensions of Undocumented Mexican Workers in the United States, by Sex



SOURCE OF PRIMARY DATA: U.S. Immigration and Naturalization Service.

Table 3
UNDOCUMENTED MEXICANS APPREHENDED WHILE WORKING IN THE UNITED STATES

	Type of employment					
	Agricultural		Industrial and other		Totals	
Year	Males	Females	Males	Females	Males	Females
1973 . . .	103,433	3,839	71,138	12,808	174,571	16,647
1974 . . .	110,529	5,600	71,963	11,365	182,492	16,965
1975 . . .	114,536	6,323	68,767	16,154	183,303	22,477
1976 . . .	114,882	7,107	66,867	17,670	181,749	24,777
1977 . . .	109,691	7,257	86,023	23,620	195,714	30,877
1978 . . .	101,935	5,958	78,917	15,609	180,852	21,567
1979 . . .	108,214	5,372	82,463	11,111	190,677	16,483
1980[1] . . .	54,755	2,920	49,593	7,673	104,348	10,593
1981 . . .	95,585	5,625	65,192	9,514	160,777	15,139
1982[2] . . .	90,954	5,982	71,644	14,863	162,598	20,845

1. Decreases in apprehensions reflect termination of INS worksite inspections.
2. Figures are annual rates based on January-June data.
SOURCE OF PRIMARY DATA: U.S. Immigration and Naturalization Service.

seasonal. Regression results also reveal multicollinearity between the two pull variables; no additional variation is explained by the nonagricultural employment variable. Therefore, the following discussion is based primarily on Model 2, which considers only agricultural employment.

A negative and significant coefficient for the push variable indicates that Mexican economic conditions also affect the migration decision of undocumented Mexican workers. Moreover, comparing the absolute magnitude of this variable with that of the pull variables suggests that push forces outweigh pull forces in explaining variation in Mexican migration to the United States.

An alternative possibility, however, is that the Mexican employment-population ratio is a better push proxy than are the proxies for the two pull variables. This possibility reduces the confidence that may be attached to conclusions about the relative magnitudes of the push and pull elasticities. Interpretation of the relative sensitivity of immigration to push over pull variables can, therefore, only be tentative. Still, these results *are* consistent with those of other studies. More important, the results in Table 2 provide evidence of the sensitivity of immigration rates to push factors.

. . . of both male and female Mexicans

The analysis above was expanded to test for differences in responses of males and females to push-pull economic forces.[8] The relevance of this test stems from two major considerations. First, apprehensions of Mexican females have grown at a faster pace than apprehensions of males (Chart 2). In 1973, females accounted for 10 percent of total apprehensions, but their share increased to 16 percent by 1982. Second, females are apparently more concentrated in nonagricultural occupations than are males (Table 3). Between 1973 and 1982, females apprehended in industry outnumbered those apprehended in agriculture. Apprehensions of males in agriculture, on the other hand, were greater than apprehensions in industry in every year in that period.

These additional tests were conducted by

8. The INS reports on deportable aliens found in the United States give data for adult Mexican males and for Mexican females and children. It is assumed here that adult females compose most of the second group.

estimating separate equations for males and females. The female employment-population ratio was used for the regression analysis for females; the total employment-population ratio was used for males. The specifications were derived from preliminary tests indicating that these variables worked best for the two groups. The specifications are also consistent with theory. In making their decision to migrate illegally to the United States, males probably respond to total labor market forces, while females most likely consider labor market conditions for women.

According to the statistical results, U.S. agricultural labor demand is the major economic force "pulling" both groups into this country, while U.S. nonagricultural labor demand has an insignificant effect. Likewise, employment opportunities in Mexico are an economic force "pushing" both groups into the United States. The push variables are larger in absolute value than the pull variables for both sexes. The only major difference between males and females in the estimation results is in the relative magnitude of the push elasticity. Males are more responsive to Mexican employment conditions than are females.

Illegal immigration a major U.S. issue

The steady growth of apprehensions, together with high U.S. unemployment, has led to public concern in the United States about the effect of the influx of Mexican workers on wages, employment, and public resources. In 1978, Congress established the Select Commission on Immigration and Refugee Policy. It was the task of this commission to study existing immigration policies and report recommendations for their improvement. Among the 67 recommendations in its March 1981 report, the commission advised that further study on international migration was needed.[9] Such a recommendation highlights the importance of a better understanding of the forces behind illegal immigration in order to deal with the problem effectively.

Congress is currently considering legislation geared to reducing illegal immigration.[10] Through the Simpson-Mazzoli bill, Congress has combined recommendations from the Reagan Administration and the Select Commission on Immigration and Refugee Policy into a proposal to stem the Mexican inflow into this country.

This bill proposes a mixture of programs involving amnesty, temporary workers, and employer sanctions. Amnesty would be given to millions of undocumented workers, depending on the length of their stay in the United States. The bill also provides for a worker identification system and a revision of an existing temporary-worker program. These two arrangements would at least result in useful information on the count of aliens in this country.

Of greatest interest, however, is the bill's proposal to stem illegal immigration by means of employer sanctions. This bill provides for fines ranging up to $2,000 per alien for employers who knowingly hire illegal aliens. This part of the bill has social, political, and economic drawbacks.

The social and political drawbacks have recently been discussed in the press. Fines are likely to discourage employers from hiring individuals who appear to be aliens, leading to discontent among minority groups. Enforcement problems will probably arise, considering the many employers who hire undocumented workers. In addition, the Mexican government has recently attacked the bill, resulting in political strains between Mexico and the United States.[11]

Even with these problems, the legislation, if passed as proposed, would likely lead to less illegal Mexican immigration. This proposition is partially supported by the findings in this paper that illegal Mexican immigration does respond to changes in demand on the U.S. side of the border. The proposition is also supported by recent experience. In the 1973-75 recession, slack labor market conditions apparently discouraged Mexican aliens from seeking U.S. employment, resulting in a decline in apprehensions in 1975. Similarly, apprehensions for the first half of 1982 were below a year earlier, reflecting the latest U.S. recession.

Nonetheless, the bill's major economic drawback

9. For a review of the findings of this commission, see Philip L. Martin, "Select Commission Suggests Changes in Immigration Policy—A Review Essay," *Monthly Labor Review*, February 1982, 31-37.

10. On May 18, 1983, the Senate passed a version of the Simpson-Mazzoli bill. A slightly different version has already cleared the House Judiciary Committee.

11. For an example of how these issues have received coverage from the press, see "Mexico: Bridling at a U.S. Immigration Bill," *Business Week*, 28 February 1983, 43-44.

is failure to address another determinant of illegal Mexican immigration—the weakness of the Mexican economy. This study shows that illegal Mexican immigration is sensitive to changes in the ability of the Mexican economy to absorb the country's growing, economically active population. This finding is consistent with the recent surge in apprehensions resulting from the deterioration of the Mexican economy in early 1982. Immigration has increased despite record-high unemployment rates in the United States. The increase highlights the importance of push forces behind illegal Mexican immigration.

To summarize, then, the proposed legislation fails to account for empirical evidence suggesting that illegal Mexican immigration is sensitive to push forces. Furthermore, the results from this and other studies suggest that the employer sanctions program proposed by the Simpson-Mazzoli bill may not be as effective as measures leading to a stronger economy in Mexico. These findings should not be dismissed on the grounds of data limitations. Instead, the findings should signal that much work still needs to be done to arrive at an effective immigration policy.

Appendix

Impact of 1976 Peso Devaluation on Illegal Mexican Immigration

One of the effects of the 1976 peso devaluation was the widening of income differentials between U.S. and Mexican residents. An increase in apprehensions of undocumented Mexicans after this devaluation supports the view that Mexicans migrated to the United States to take advantage of the higher U.S. wages.

Estimates of the devaluation effect are presented in Table 2. The devaluation coefficients are statistically significant only in the regression for apprehensions of females. But the estimates are sensitive to the equation's functional form.

When the labor market variables are dropped,

$$\ln(A) = a_0 + a_1(D \times T) + a_2(D \times T)^2.$$

When the data are not detrended and the sample is extended through 1982,[1] the following results are obtained:

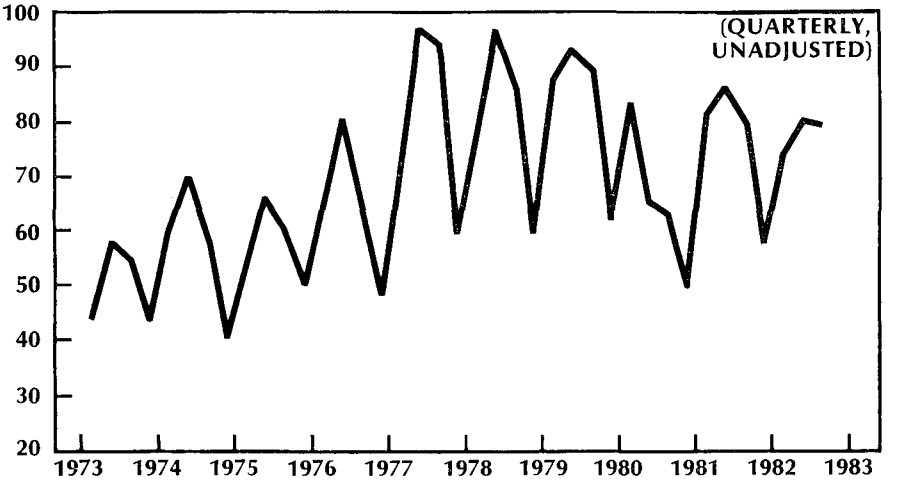
$$\ln(A) = 10.48 + .03\,(D \times T) - .0003\,(D \times T)^2.$$
$$(116.66)\ \ (2.05)\qquad (-1.62)$$
$$R^2 = .15.$$

(The coefficients were corrected for autocorrelation. Figures in parentheses are t statistics of the regression

1. At the time of the study, figures for the labor market variables were not readily available beyond 1978.

Chart A

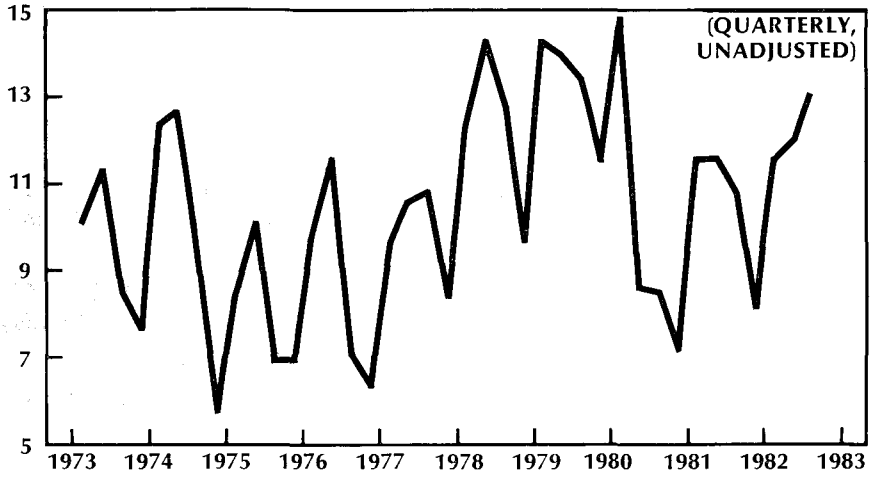
Undocumented Mexican Workers Apprehended Between the Pacific Coast and Del Rio, Texas



SOURCE OF PRIMARY DATA: U.S. Immigration and Naturalization Service.

Chart B

Undocumented Mexican Workers Apprehended from Del Rio, Texas, to the Texas Gulf Coast



SOURCE OF PRIMARY DATA: U.S. Immigration and Naturalization Service.

coefficients.)

The statistical significance of the linear devaluation term suggests that the widening of the income gap created by the devaluation led to an increase in apprehensions. Furthermore, the negative coefficient of the quadratic term suggests that this impact diminished over time, perhaps reflecting the rapid expansion in the Mexican economy that began in 1978.

The increase in apprehensions varied across regions. The region between the Pacific Coast and Del Rio, Texas, had an observable rise in apprehensions after the 1976 peso devaluation, but the region from Del Rio to the Texas Gulf Coast experienced little or no change.

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