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Regional Differences in the Impact of Energy Price Increases

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This Public Policy Brief presents estimates of the impact of price increases projected by the U.S. Department of Energy for the winter of 2004-5 on consumers in the nine Census divisions and selected metropolitan areas. It is based on materials presented in a briefing to the President of the Federal Reserve Bank of Boston in December 2004.

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The Energy Department is forecasting that energy prices will be considerably higher this winter (2004-05) than last winter (2003-04). Indeed, some prices are already (in December) noticeably higher. Rising energy prices have a differential impact across the country since energy use differs from region to region. The department's forecasts show especially large increases for heating oil, a fuel used much more extensively in New England than elsewhere in the country. Gasoline costs are also considerably higher now than a year ago, and driving costs loom larger in the market baskets of consumers outside the Northeast, on average. This brief estimates the impact of the Energy Department's projected energy price increases on consumers in the nine Census divisions and selected metropolitan areas. The estimates are based on the fuel mix used for heating and other residential energy use (lighting, water heating, air conditioning, appliances, etc.) across the divisions and on the relative importance of home energy use and motor fuel use in each area's consumer market basket.

New England faces the largest projected hit to consumer budgets this winter because of its reliance on heating oil (about half of New England households heat with fuel oil as compared with 6 percent in the rest of the country). The Midwest is also likely to see an above-average impact because the area depends more on natural gas than the South and West and also consumes slightly above-average amounts of motor fuel.

Data and Calculations

Figure 1 shows the Energy Department's forecasts of energy price increases from last winter (Q4 2003 and Q1 2004) to this winter (Q4 2004 and Q1 2005). The Energy Information Administration (EIA) expects #2 heating oil to see the steepest price increase (up 39 percent). EIA projects gasoline prices also to be up sharply (24 percent) and forecasts that natural gas will show a marked rise as well (13 percent).[1]

Figure 2 shows the mix of expenditures on residential energy sources in the nine Census divisions in 2001. New England is highest in the use of fuel oil, the Midwest (the East North

[1] Propane prices are also expected to rise steeply, but as Figure 2 indicates, propane represents a small share of household energy expenditures.

Central and West North Central divisions) relies heavily on natural gas, the southern states use mostly electricity, and the western states are somewhere between the latter two. These data refer to all residential use, whether owner-occupied or renter-occupied, and include air conditioning, water-heating, lighting, appliances, etc., as well as home heating.

Because of New England's heavy dependence on heating oil, the fuel facing the sharpest projected price increase, New England's residential energy costs are expected to rise the fastest among the nine Census divisions -- almost 15 percent from last winter to this winter.[2] See Figure 3. The next highest projected increase is in the Mid-Atlantic states, where heating oil is used by one-quarter of households and amounts to 10 percent of residential energy expenditure; the resulting projected average price increase for residential energy is 10 percent. The projected national average increase is 7.2 percent.

The U.S. Bureau of Labor Statistics reports the "relative importance" of various categories of spending in the market basket of goods used to compute consumer price indexes.[3] Here, relative-importance data as of December 2003 (the most recent data available) are used to estimate the impact on consumer budgets of the EIA-projected energy price increases, including the projected impact for gasoline. These estimates are computed for the nine Census divisions and for individual metropolitan areas, including Boston, using data for two energy components of the CPI-U. For the nine Census divisions, "relative importance" data for the four broad Census regions are used; for individual metropolitan areas, the appropriate figures for the specific metropolitan area are used. The relative importance figures are not season-specific; that is, they represent shares of annual consumption devoted to each type of purchase. Thus, while

[2] Before applying the price increase forecasts in Figure 1 to the mix-of-fuels data shown in Figure 2, the 2003 fuel expenditures for each division were estimated by applying actual price increases between 2001 and 2003 to each fuel. These calculations assume – as do the projections for this winter – that fuel consumption and fuel mix do not respond, within these time frames, to shifting relative prices for fuels. Because heating oil prices rose more over the 2001-03 period than did prices of other fuels, the relative expenditure share of fuel oil is slightly higher in the 2003 estimates than in Figure 2's 2001 data (Table 1).

[3] Document (pdf) obtained from the BLS website, "Relative importance of components in the Consumer Price Indexes" containing four tables: (1) U.S. city average, (2) and (3) selected metropolitan areas, and (4) the four Census regions.

the price increases analyzed are changes from last winter to this, the consumption impacts should be interpreted as annual averages.

Energy totals 7.1 percent of the U.S. CPI-U. The two energy components are the "fuels" element in housing expenditures and the "motor fuel" element in transportation. For the four broad Census regions, Figure 4 shows the share of the total market basket of expenditures accounted for by each of these components. The "importance" of both residential fuel use and motor fuel in the consumer's market basket is highest in the South and lowest in the West. However, part of the reason these shares are so high is that the South has below-average housing costs; housing represents only 30 percent of consumption in the South as compared with 35 percent in the West and 36 percent in the Northeast. Expressing the energy expenditure shares relative to the non-shelter consumer market basket, the motor fuel share in the West rises to equal that of the South (5.1 percent of non-shelter consumption). Similarly, the Northeast's residential energy share of non-shelter expenditures (6.3 percent) rises to equal that of the South. Presumably, residential fuel represents a larger share of budgets in the coldest and hottest climates than elsewhere in the nation because of heating or air conditioning costs. And driving is more important outside the densely settled Northeast.

Estimated Effects by Division

Under the assumption that consumers do not cut back or shift their mix of fuels in response to higher prices at least in the short run, the projected energy price increases can be applied to the base-year "relative importance" data and used to compute the increase in the share of total expenditures allocated to energy. As shown in Figure 5, New England's residential fuel "share" jumps by 0.6 percentage points – a much larger increase than for any other division. The surge is caused by the especially large price increases projected for fuel oil and the importance of this subcomponent in the region's energy mix. The EIA's projected gasoline price increase raises the motor fuel share by the most in the South – up 0.8 percentage points. Combining residential energy use and transportation motor fuel use, the share of total expenditures committed to energy would rise by 1.26 percentage points in New England, by more than 1.1 percentage points in the Midwest (East North Central and West North Central

divisions), and by 0.95 percentage points in the Pacific division, the area seeing the smallest increase.

An assumption that housing expenditures cannot adjust in the short run (that is, this winter) suggests an alternative way to scale these fuel cost increases: by expressing them relative to non-shelter, non-fuel consumption. The idea here is that the adjustments to energy price increases will have to be made in other elements of the consumer market basket. From this vantage point, non-shelter, non-fuel expenditures would have to fall by 2.2 percent in New England, 1.8 percent in the Middle Atlantic and across the Midwest, 1.7 percent in the South, and 1.6 percent in the West to offset the forecasted increases in fuel prices this winter (Figure 6). These estimates are upper bounds, since consumers could alternatively lower their thermostat settings or cut back on driving, even in the short run.

Estimated Effects for Metro Areas

The same analysis can be applied to individual metropolitan areas, using the metro-specific "relative importance" figures for fuel's role in local consumer budgets and assuming that the residential fuel mix of each division applies to every metro area within the division. Table 2 reports the share of consumer budgets taken up by the projected fuel cost increases in 25 of the 27 metropolitan areas for which the Census Bureau publishes a CPI.[4] Figure 7 displays the shares of non-shelter, non-fuel consumption that these increases represent.

The Boston metro area, which includes parts of Connecticut and New Hampshire as well as eastern Massachusetts, suffers the biggest projected hit to non-shelter, non-fuel consumption, totaling 2.4 percent. The substantial impact on Boston is largely because of New England's much-greater-than-average cost increase attributable to its use of home heating oil. Residents in and around Kansas City, Philadelphia, and Cleveland could also face cutbacks in other consumption in excess of 2 percent, and metro Atlanta almost 2 percent. Home fuel represents an above-average share of consumption in all of these metropolitan areas, and transportation

[4] Anchorage and Honolulu are the two metro areas not shown. Their climates and transportation situations are so unusual that it seemed inappropriate to assume their fuel mixes matched (or could even be approximated by) the Pacific division's average.

fuel shares are above the national average, whether calculated as a share of total consumption or of non-shelter consumption. Houston and Chicago, by contrast, might face above-average increases in home fuel costs, but more modest impacts from the increase in gasoline prices. Los Angeles has an above-average dependence on transportation fuel and hence an above-average impact of gasoline price increases, but this effect would be offset by below-average use of residential fuel.

Further Discussion

Changes in spending required by energy price increases such as those calculated above, while not huge, could still represent a noticeable hit to consumers' budgets. Furthermore, since the calculations yield average effects, some households in each region or metro area will face much bigger increases in costs and some, much smaller, depending on the individual fuels used and energy's share of the budget of each household.

The estimated regional impacts reported here are undoubtedly larger than those that might result from a full accounting of second-round responses of consumption patterns. That is, given more time, consumers undoubtedly substitute away from the highest-cost energy sources. However, while fuel oil prices have risen more steeply than prices of other residential fuels over the last few winters, relative prices may shift in a different direction next winter, reducing households' incentives to re-tool their heating systems to use an alternative fuel. And electricity prices are likely to respond with a lag to the recent increases in prices for some of the fuels used to generate electricity. Indeed, a recent report from the Federal Energy Regulatory Commission notes that electricity prices could rise sharply in New England because of the region's above-average dependence on natural gas for electricity generation and the possibility of gas shortages attributable to infrastructure weaknesses.[5]

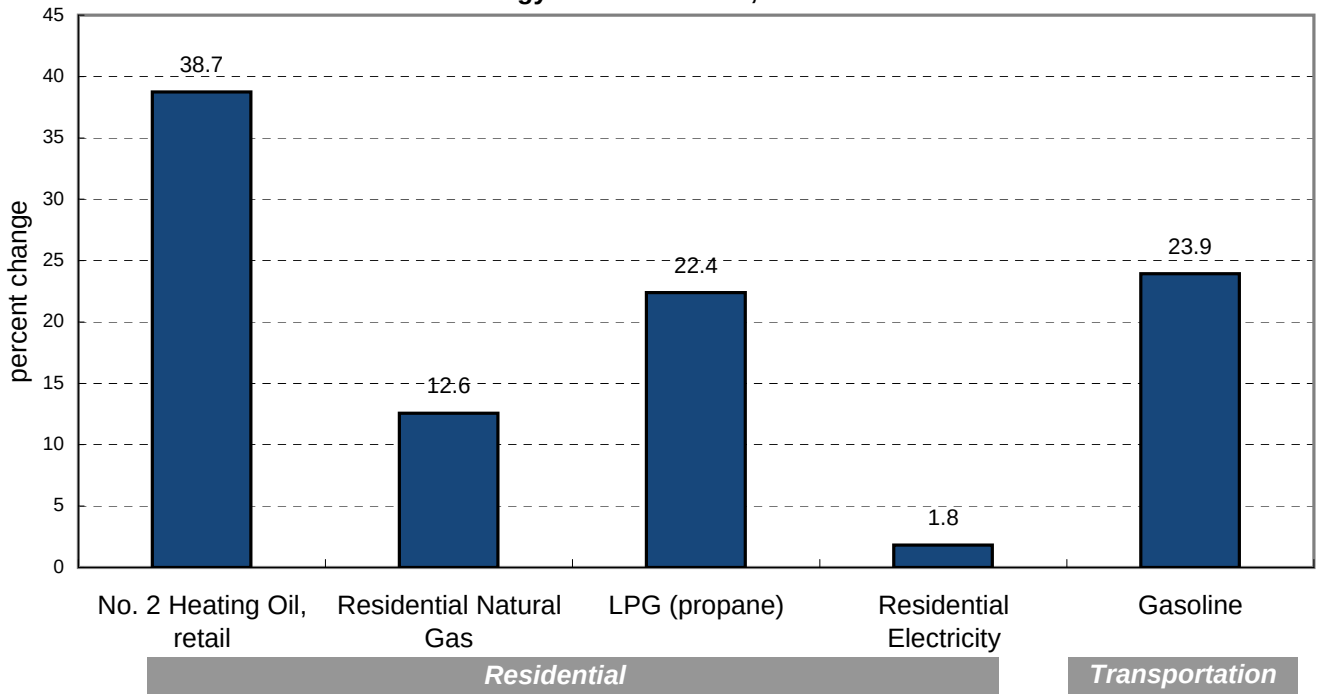
Furthermore, U.S. manufacturers and other producers also use various fuels. Thus, recent and projected increases in energy prices could have differential regional effects on employment, depending on the relative importance of energy-dependent industries. In

[5] Federal Energy Regulatory Commission, "2004/05 Winter Energy Market Assessment" November 18, 2004.

addition, regions that produce oil and natural gas benefit from these price increases on the production side, even as their consumers pay more for residential and transportation fuels. However, since much of U.S. oil and natural gas is imported (about 82 percent of final oil consumption and about 27 percent of natural gas consumption, according to the International Energy Agency), a substantial share of the blow to U.S. consumer and producer budgets is not balanced by increases in income anywhere within the United States.

Figure 1

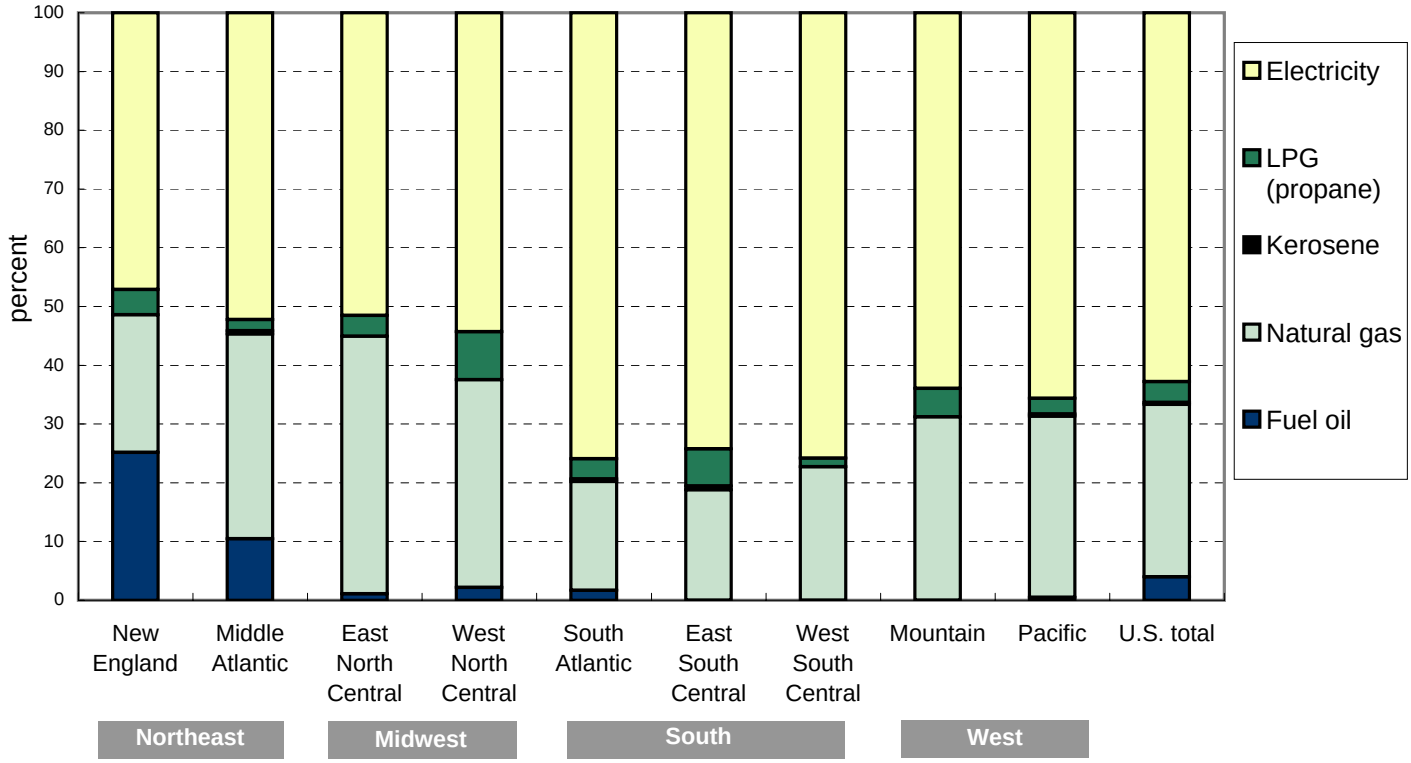
Forecasts of U.S. Energy Price Increases, Winter 2003/4 to Winter 2004/5



Source: Energy Information Administration, Short-Term Energy Outlook, November 2004.

Figure 2

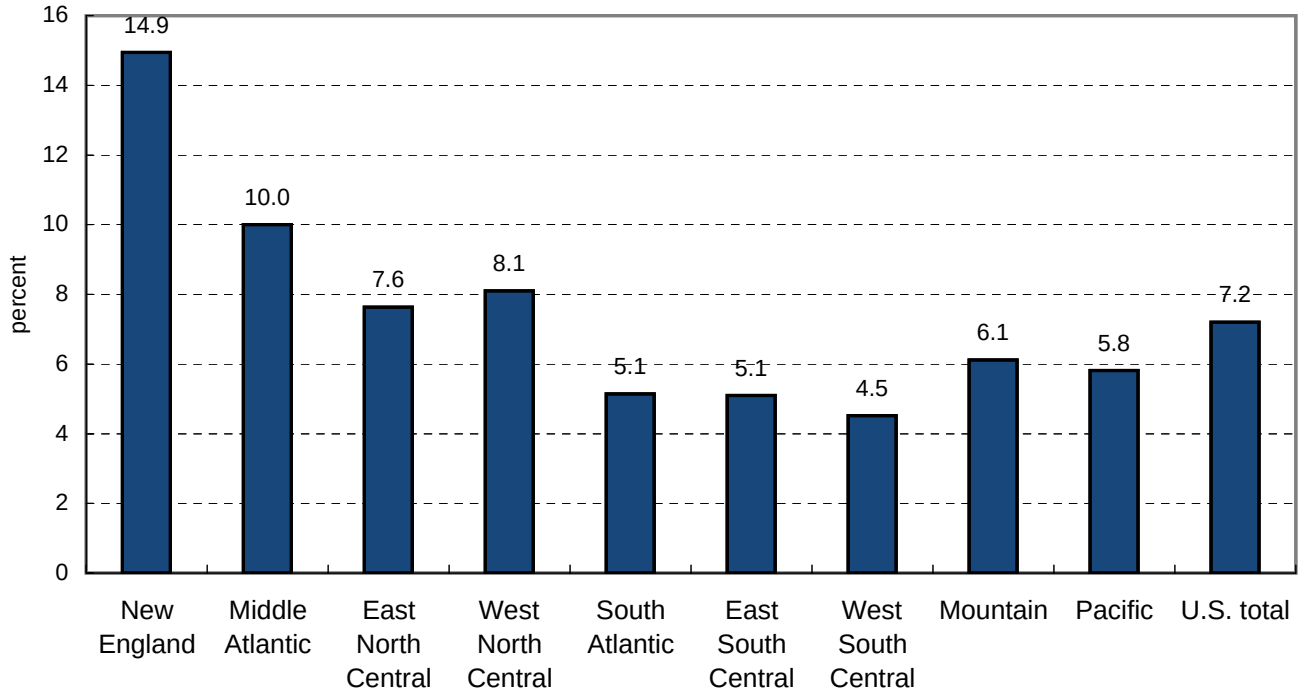
Residential Energy Mix by Census Division
(share of household energy expenditures, 2001)



Source: Energy Information Administration, 2001 Residential Energy Consumption Survey.

Figure 3

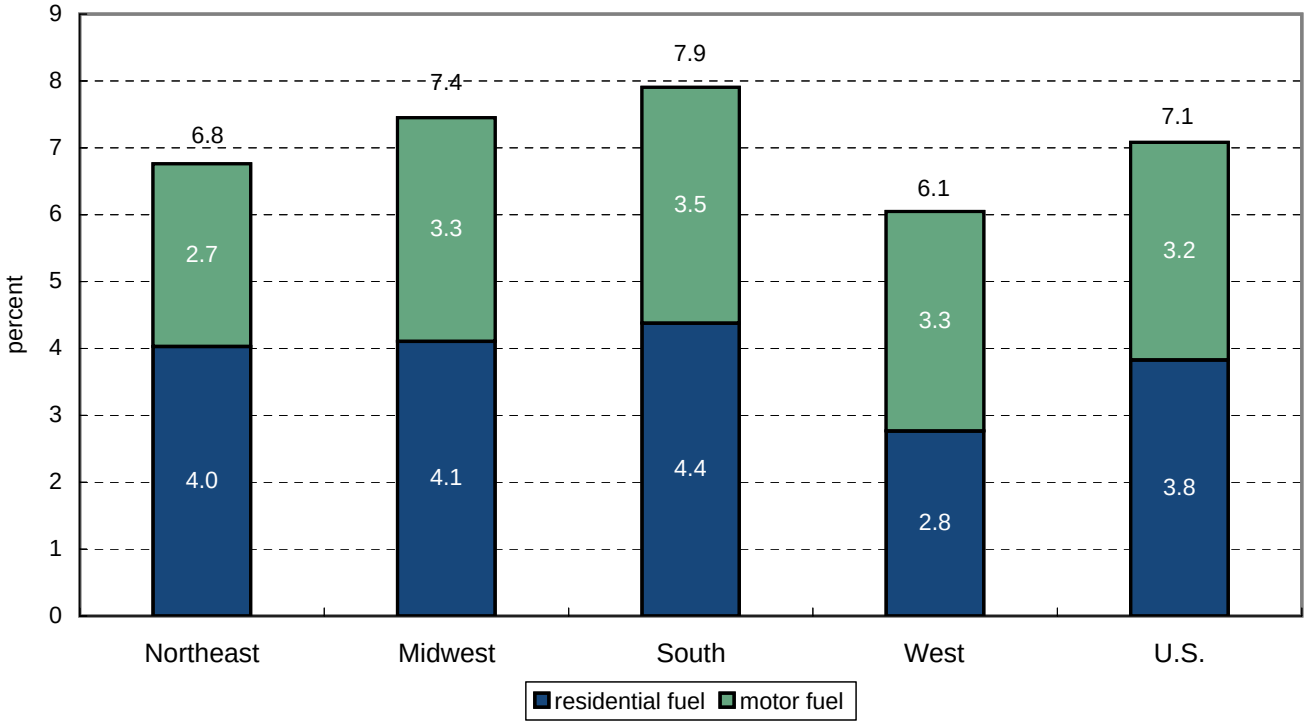
Projected Change in Average Residential Energy Cost, Winter 03/04 to Winter 04/05



Source: Author's calculations based on Energy Information Administration data shown in Figures 1 and 2 and calculations reported in Table 1.

Figure 4

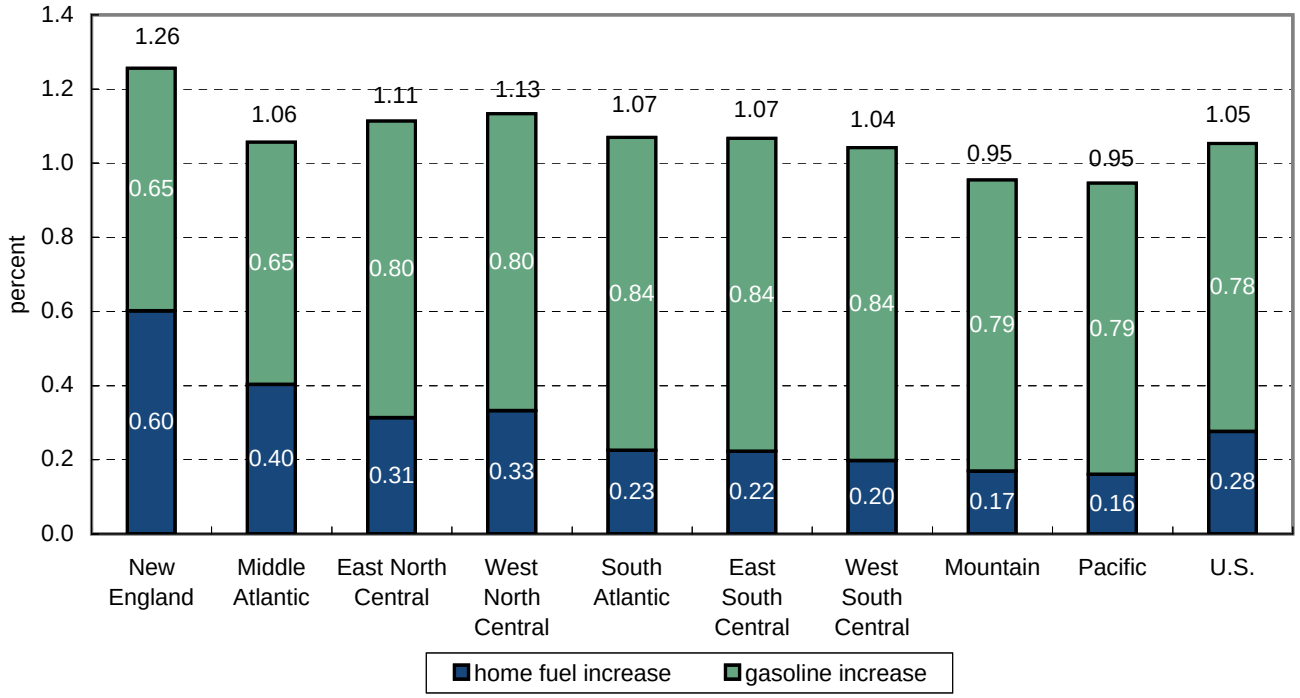
Share of Energy in Consumer Market Basket, December 2003



Source: U.S. Bureau of Labor Statistics, "Relative importance of components in the Consumer Price Indexes," (pdf from BLS website).

Figure 5

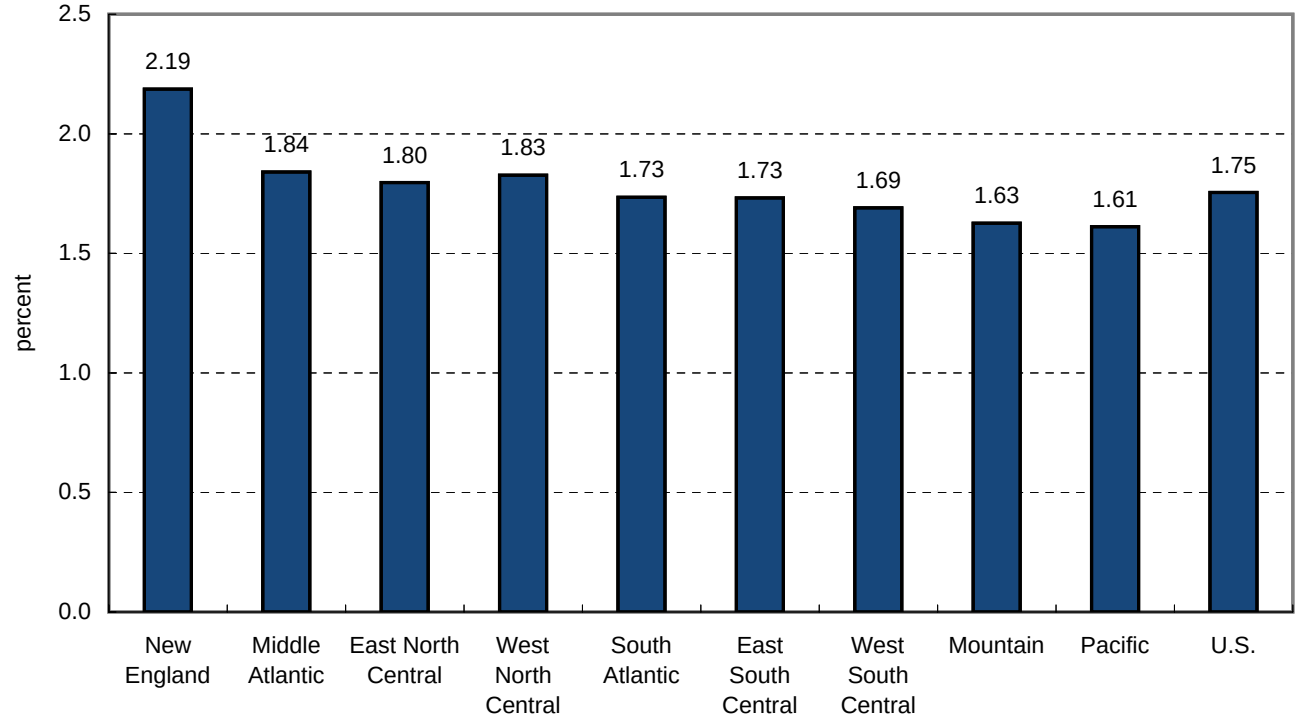
Projected Energy Cost Increases as Share of Consumer Spending, Winter 03/04 to Winter 04/05



Source: Author's calculations based on Energy Information Administration data shown in Figures 1 - 4 and Table 1.

Figure 6

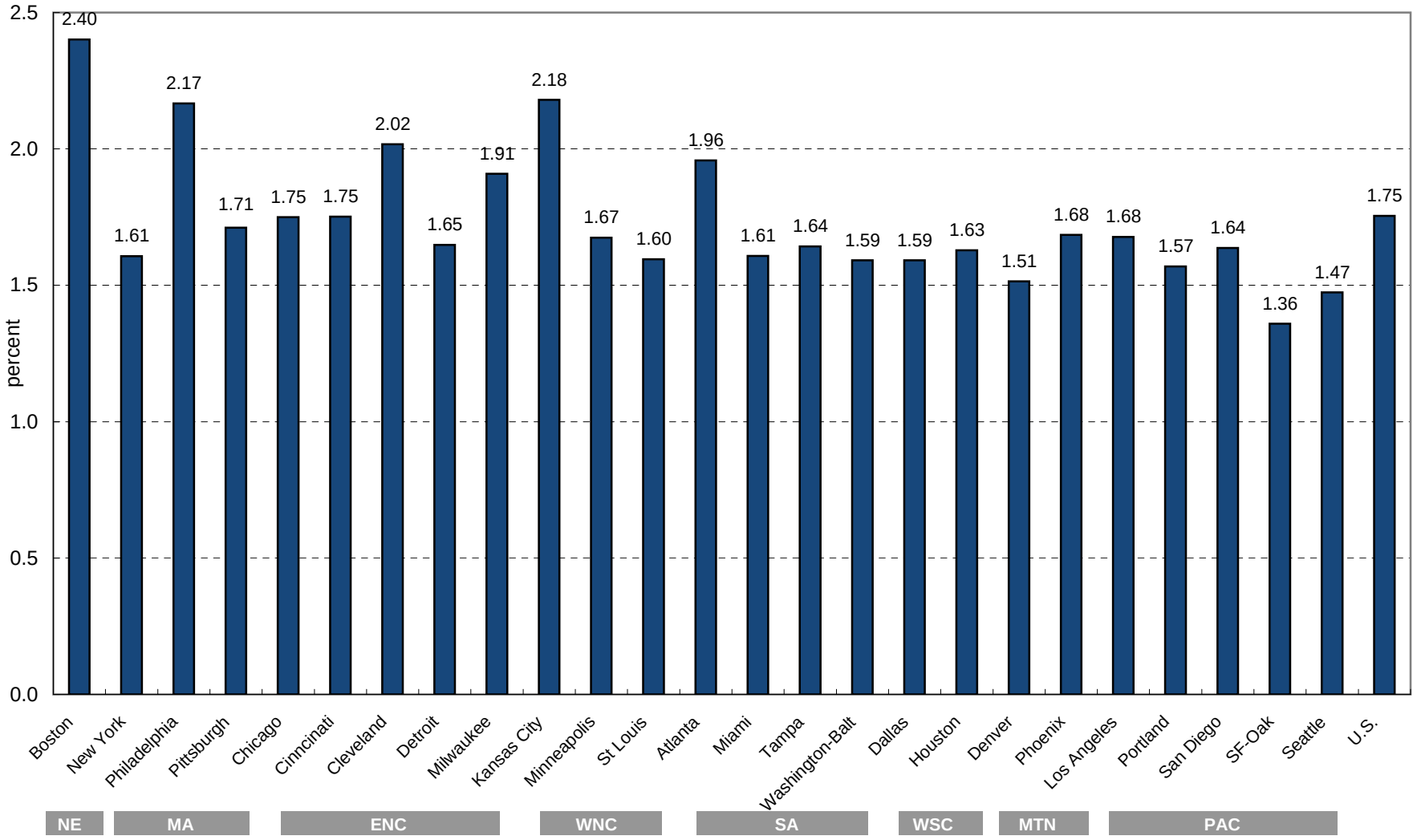
Projected Energy Cost Increases as Share of Non-Shelter, Non-Energy Consumer Spending, Winter 03/04 - Winter 04/05



Source: Author's calculations based on Energy Information Administration data shown in Figures 1 - 4 and Table 1.

Figure 7

Projected Energy Cost Increases as Share of Non-Shelter, Non-Energy Consumer Spending, Winter 03/04 - Winter 04/05



Note: The East South Central region contains no metropolitan areas with a consumer price index.
Source: Author's calculations based on sources of Figures 1 - 4 and Table 1.

Table 1. Fuel Use and Impact of Projected Price Increases on Consumer Budgets

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	U.S. total
2001 mix of residential fuels -- household expenditure shares (%) [1]										
Electricity	47.1	52.2	51.5	54.3	75.9	74.2	75.8	63.9	65.7	62.8
Natural gas	23.4	34.8	43.9	35.4	18.5	18.8	22.7	31.2	30.8	29.4
Fuel oil	25.2	10.5	1.1	2.2	1.7	0.0	0.0	0.0	0.5	3.9
Kerosene	0.0	0.6	0.0	0.0	0.4	0.6	0.0	0.0	0.4	0.3
LPG	4.3	1.9	3.6	8.2	3.4	6.4	1.5	4.8	2.7	3.5
Estimated 2003 mix of residential fuels (%) [2]										
Electricity	46.6	52.3	52.0	54.7	76.2	74.6	76.3	64.5	66.1	63.1
Natural gas	22.6	34.1	43.3	34.8	18.1	18.4	22.3	30.7	30.3	28.8
Fuel oil	26.6	11.2	1.2	2.3	1.8	0.0	0.0	0.0	0.5	4.2
Kerosene	0.0	0.5	0.0	0.0	0.4	0.6	0.0	0.0	0.4	0.3
LPG	4.2	1.9	3.5	8.1	3.4	6.3	1.5	4.8	2.7	3.5
Winter 2003-04 to Winter 2004-05 estimated change in average residential energy price [3]										
Percent change	14.9%	10.0%	7.6%	8.1%	5.1%	5.1%	4.5%	6.1%	5.8%	7.2%
Estimated change in share of consumption attributable to increase in prices (percentage points) [4]										
Home fuel	0.60	0.40	0.31	0.33	0.23	0.22	0.20	0.17	0.16	0.28
Gasoline	0.65	0.65	0.80	0.80	0.84	0.84	0.84	0.79	0.79	0.78
Total	1.26	1.06	1.11	1.13	1.07	1.07	1.04	0.95	0.95	1.05
Increase as share of nonshelter, non-fuel consumption (%)										
Home fuel	1.05	0.70	0.50	0.54	0.37	0.36	0.32	0.29	0.27	0.46
Gasoline	1.14	1.14	1.29	1.29	1.37	1.37	1.37	1.34	1.34	1.29
Total	2.19	1.84	1.80	1.83	1.73	1.73	1.69	1.63	1.61	1.75

[1] Source: EIA 2001 residential energy consumption survey Table CE1-9e.

[2] Calculated from 2001 mix and change in energy prices from 2001 to 2003, assuming consumption of energy does not respond to higher prices. Source of data on energy price increases, history and forecast, is Energy Information Administration, "Short Term Energy Outlook," November 2004.

[3] Calculated from 2003 mix (above) and EIA price increase forecasts shown in Figure 1.

[4] Based on "relative importance" of energy components of Consumer Price Indexes for four broad regions and Winter 2003-04 to Winter 2004-05 estimated change in price (above).

Table 2. Impact of Projected Fuel Cost Increases on Consumer Budgets, Winter 03/04 to Winter 04/05

	Increase as share of total consumption (percentage pts)			Increase as share of nonshelter, non-fuel consumption (%)		
	Home fuel	Gasoline	Total	Home fuel	Gasoline	Total
New England						
Boston-Brockton-Nashua, MA-NH-ME-CT	0.57	0.67	1.25	1.11	1.30	2.40
Middle Atlantic						
New York-Northern NJ-Long Island, NY-NJ-CT-PA	0.34	0.54	0.89	0.62	0.99	1.61
Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD	0.48	0.76	1.24	0.84	1.33	2.17
Pittsburgh, PA	0.44	0.71	1.14	0.65	1.06	1.71
East North Central						
Chicago-Gary-Kenosha, IL-IN-WI	0.31	0.72	1.02	0.52	1.23	1.75
Cincinnati-Hamilton, OH-KY-IN	0.30	0.82	1.12	0.47	1.29	1.75
Cleveland-Akron, OH	0.40	0.83	1.22	0.65	1.36	2.02
Detroit-Ann Arbor-Flint, MI	0.30	0.72	1.02	0.49	1.16	1.65
Milwaukee-Racine, WI	0.30	0.83	1.13	0.50	1.40	1.91
West North Central						
Kansas City, MO	0.38	0.95	1.32	0.62	1.56	2.18
Minneapolis-St. Paul, MN-WI	0.23	0.75	0.98	0.40	1.28	1.67
St Louis, MO-IL	0.29	0.72	1.02	0.46	1.14	1.60
South Atlantic						
Atlanta, GA	0.25	0.84	1.09	0.45	1.50	1.96
Miami-Fort Lauderdale, FL	0.19	0.76	0.94	0.32	1.29	1.61
Tampa-St. Petersburg-Clearwater, FL	0.20	0.79	0.99	0.34	1.31	1.64
Washington-Baltimore, DC-MD-VA-WV	0.17	0.72	0.88	0.30	1.29	1.59
West South Central						
Dallas-Fort Worth, TX	0.19	0.81	1.00	0.30	1.29	1.59
Houston-Galveston-Brazoria, TX	0.20	0.85	1.05	0.31	1.32	1.63
Mountain						
Denver-Boulder-Greeley, CO	0.18	0.71	0.89	0.31	1.21	1.51
Phoenix-Mesa, AZ	0.18	0.82	1.00	0.30	1.39	1.68
Pacific						
Los Angeles-Riverside-Orange County, CA	0.13	0.81	0.94	0.24	1.44	1.68
Portland-Salem, OR-WA	0.18	0.75	0.92	0.30	1.27	1.57
San Diego, CA	0.14	0.77	0.91	0.26	1.38	1.64
San Francisco-Oakland-San Jose, CA	0.13	0.61	0.74	0.23	1.13	1.36
Seattle-Tacoma-Bremerton, WA	0.15	0.76	0.91	0.24	1.23	1.47
U.S.	0.28	0.78	1.05	0.46	1.29	1.75

Sources: Metro changes based on fuel mix and price change data for nine divisions shown in Table 1, applied to "relative importance" of energy components of CPI for individual metro areas.

Note: The East South Central region contains no metropolitan statistical areas with a CPI.