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Climate Policy and Labor Markets

Olivier Deschênes

2.1 Introduction

An important component of the debate surrounding climate legislation in the United States is its potential impact on labor markets. A main concern is the displacement of jobs from the United States to countries without carbon pricing, especially for energy-intensive industries facing import pressure from nonregulated countries. These concerns are rooted in the long-standing debate on the effects of domestic environmental regulations on US industries, although the empirical evidence regarding those effects is mixed (see, for example, Jaffe et al. 1995; Berman and Bui 2001; Greenstone 2002).

While concerns that higher energy prices will depress labor demand have received much attention in this debate, theoretically the connection is ambiguous and depends on the sign of cross-elasticity of labor demand with respect to energy prices, which is a priori unknown.[1] Evidence from studies conducted in the 1970s and 1980s indicates that energy and labor are *p*-substitutes, albeit weakly, suggesting that increases in energy prices lead to small *increases* in labor demand (see, for example, Hamermesh [1993] and references therein).[2] Therefore, credible empirical estimates of the short-run

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1. This presumes firms use other inputs in additional to labor and energy.

2. Two inputs are said to be *p*-substitutes (*p*-complements) when their cross-partial elasticity of factor demand is positive (negative). So in the case of *p*-substitute inputs, an increase in the price of one input leads to an increase in the demand for the other.

and long-run cross-elasticities of labor demand with respect to energy prices are the key statistics required to assess the employment effects of climate policies that lead to increases in energy prices. This chapter provides some new evidence on this question.[3]

To date, most of the research on the potential effects of carbon pricing on employment has been conducted using computable general equilibrium models. The approach typically combines various aggregate data sets with sophisticated models of the US economy and simulates the short-run and long-run effects of setting a price on carbon. For example, Ho, Morgenstern, and Shih (2008) find that the employment effects of a ten dollars per ton carbon tax decline over time as the economy adjusts to the new energy prices. Taken as a whole, their analysis suggests employment effects ranging from –1 to –2 percent, although declines in some sectors are larger.

An alternative approach is to estimate the relationship between measures of economic activity (such as production and employment) and energy prices using historical data, and use these estimates to predict the impact of a carbon price. In this vein, Aldy and Pizer (2009) use annual industry-level data on output, employment, and electricity prices to assess the effects of a ten dollars per ton tax on carbon. The advantage of this approach is that it is more transparent and does not hinge on particular assumptions about intersectoral and intertemporal elasticities. Its main disadvantage is that it ignores general equilibrium effects. The findings of Aldy and Pizer suggest overall modest effects of this carbon tax, although some electricity-intensive manufacturing sectors are more severely affected.

This chapter provides new estimates of the relationship between real electricity prices and indicators of labor market activity using data for 1976 to 2007. While the prices of all energy sources are predicted to increase in proportion to their carbon content under carbon-pricing policy, in this short chapter I focus only on electricity because it is the largest energy expenditure in most sectors of the economy. For example, in the retail trade sector, electricity purchases correspond to roughly 2 percent of total production costs, but 80 percent of total energy costs. Thus in principle, a first-order impact channel of climate policy on the labor market will be through its effect on electricity prices.

The chapter contributes to the literature in two important ways. First, it relies primarily on within-state variation in electricity prices for the period 1976 to 2007. This extends the analysis of Aldy and Pizer (2009), who utilized aggregate electricity prices for the period 1986 to 1994. Second, I consider all sectors of the US economy (which I classify in twelve categories)

3. There is also a long-standing macroeconomic literature on the effect of energy, and especially oil prices on economic activity (see Hamilton [2008] and Killian [2008] for recent surveys).

rather than focusing only on the manufacturing sector. This distinction is important since the manufacturing sector now represents less than 20 percent of total employment in the United States. The resulting cross-sectional and time-series variation allows me to control for unrestricted year, state, and industry shocks, as well as allowing for differential time trends across states or industry. This modeling effort is made in an attempt to minimize the confounding effects of industry-specific or state-specific permanent and/or transitory shocks that may be correlated with electricity prices. It also implicitly controls for state-specific labor demand shocks (as long they evolve smoothly over time) or arbitrary year-specific shocks to labor demand (perhaps because of changes in determinants of international trade such as tariffs).

The main finding is that employment rates are negatively related to real electricity prices and that the relationship is relatively weak. The cross-elasticity of full-time equivalent (FTE) employment with respect to electricity prices ranges from –0.10 to –0.16 percent. By comparison, the average annual change in FTE employment (normalized by population) over the sample period is about 1.5 percent, so the fluctuations in employment caused by electricity price shocks are well within the range of the normal historical variation. The estimated elasticities are precise with confidence intervals that rule out large short-run declines in employment. Although not reported in detail here, an industry-level analysis also reveals that employment in some industries (agriculture, transportation, finance, insurance, and real estate) is more responsive to changes in electricity prices. Notably these industries only make up 15 percent of total employment.

I then interpret these estimates in the context of predicted increases in electricity prices that are consistent with H.R. 2454, the American Clean Energy and Security Act of 2009. To this end, I use the empirical estimates to simulate the short-run employment response to higher electricity prices. The preferred estimates in this chapter suggest that in the short run, an increase in electricity price of 4 percent would lead to a reduction in aggregate FTE employment of about 460,000 or 0.6 percent.

There are several caveats to this research and its results that need to be emphasized. First, since the analysis is based on annual variation in electricity prices, it is only relevant for evaluating the short-run employment effects of a possible carbon policy. These short-run effects will be important determinants of the initial transition costs associated with a climate policy. However, the short-run response to a permanent change in electricity price caused by a carbon-pricing policy will likely differ from the short-run response to transitory changes in electricity price that are measured in this chapter. In addition, the long-run effects will presumably be smaller in magnitude once all the adjustments to the capital stock are made and the sectoral reallocation of labor takes place. Second, estimates based on historical data are dependent on the set of events, institutions, and regulations that applied during the period observed. As such, these estimates may not be applicable to the new economic environment that would follow climate legislation. Third, the observed historical variation in electricity prices may not overlap with the higher energy prices caused by a specific carbon-pricing policy, and so prediction of its effects may depend on functional form projections. Finally, this analysis does not quantify the effect of the policy incentives that could increase employment in "green" sectors. In addition, many climate legislation proposals, such as H.R. 2454, contain provisions for job assistance programs aimed at workers displaced by the policy, and industry-specific subsidies designed to counter some of the added costs imposed by the policy. It is possible that such provisions will cause increases in labor demand in some sectors and this possibility is not accounted for in this analysis.

2.2 Conceptual Framework

A natural starting point to conceptualize the effect of energy prices on labor markets is the neoclassical theory of labor demand. In a model where labor and energy are factors of production (along with other factors), the cross-elasticity of labor demand with respect to energy prices is given by $\eta_{LE} = s_E \times [\sigma_{LE} - \rho/(\rho - \theta)]$ where s_E is the share of energy in total production costs, σ_{LE} is the partial elasticity of substitution between labor and energy, ρ is a measure of market power of the firm (= 1 if the firm is a price-taker in the product market, and > 1 if the firm is a price-maker), and θ measures the degree of homogeneity of the production function (see Cahuc and Zylberberg [2004] for derivations). The first term in the parentheses is the substitution effect (which may be positive or negative in this case) and the second term is the scale effect (which declines in magnitude as the degree of market power increases). This formula has two key implications: (a) the cross-elasticity of labor demand with respect to energy prices is likely to be small since S_E is small for most industries, and (b) the sign of η_{LE} will depend on whether the substitution or the scale effect dominates.

The previous expression also highlights three key sources of variation in the cross-elasticity of labor demand to energy price across industries. First, there are differences in energy intensity (i.e., S_E) across industries. Second, there may be differences in market power across industries that determine the degree to which firms in a sector can pass the extra costs associated with the policy to the buyers of their products (either as intermediary inputs, or as final demand). For example, sectors producing goods that face low import pressure are less likely to be affected by carbon pricing, at least in the short run. Finally, differences in the production technology (i.e., σ_{LE}) across sectors will also contribute to differences in the responsiveness of labor demand to shocks to energy prices.

2.3 Data Sources and Preliminary Analysis

2.3.1 Data

The primary data for this chapter are taken from the 1977 to 2008 March Current Population Surveys (CPS), and covers calendar years 1976 to 2007.[4] Importantly, the March CPS contains information about labor force outcomes (employment status, hours worked, weeks worked in the last year), as well as information on industry affiliation at the three-digit level. Starting in 1976, weeks of work are reported continuously, which explains the choice of the sample period. In addition, the March CPS contains demographic information including state of residence, age, gender, race, education, and so forth. The state of residence information will be used in conjunction with the survey year to link the CPS with the electricity price data.

The annual worker-level data are then combined with retail electricity prices from the State Energy Data System (SEDS) maintained by the Energy Information Administration. The SEDS data is detailed, and contains prices and expenditures for a dozen primary energy sources (i.e., coal, natural gas, etc.), as well as "transformed" energy sources, such as retail electricity and total energy at the state-year level. The retail electricity price data from SEDS are then merged with the microlevel CPS data by year and state of residence to construct the final samples used in the analysis.

2.3.2 Sample Construction and Key Variables

For the purpose of this analysis, I consider individuals aged sixteen to sixty-five, working for pay (i.e., not self-employed), and residing in the continental United States. I then use the micro data to derive the number of full-time equivalent (FTE) workers. The approach could be extended to other measures of labor supply, such as total hours worked, number of part-time workers, and so forth. In practice there is a tradeoff between a fine industry classification (which provides a better characterization of the production technology in which a worker is employed) and statistical precision (because of empty or small cells) and so for this chapter, I consider a twelve-industry classification.[5] Full-time equivalent employment is obtained by summing annual hours worked in each state-year-industry cell, and then dividing by 2,080 (40 hours per week * 52 weeks per year). In all cases, I use the CPS person weight (perwt) variable for these calculations.

4. These data were accessed through IPUMS (http://cps.ipums.org/cps/).

5. The industry classification are Agriculture & Natural Resources, Mining, Construction, Durable Goods, Non-Durable Goods, Transportation, Utilities, Wholesale Trade, Retail Trade, Finance, Insurance and Real Estate (FIRE), Services, and Public Administration.

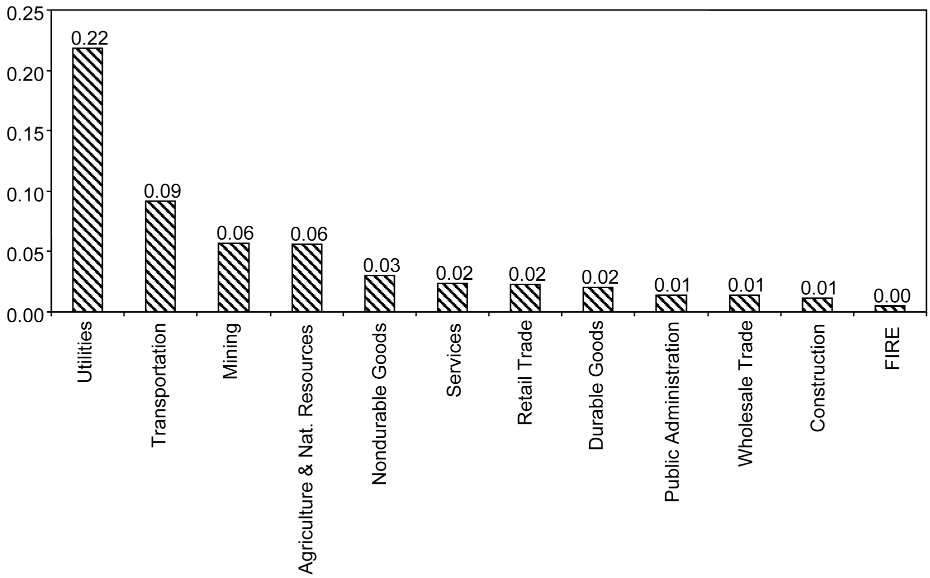

Fig. 2.1 Share of energy in total production costs, 2002

Notes: Tabulations from the Bureau of Economic Analysis "Industry Economic Accounts" for 2002. See the text for more details.

2.3.3 Preliminary Analysis

The formula for the cross-elasticity of labor demand with respect to energy price highlights that a mandated carbon price is likely to have differential effects across industries, reflecting in part differences in energy intensity. Unfortunately there are no comprehensive and comparable sources of data on electricity intensity available for each sector of the economy.[6] Instead, I report energy shares (defined as the ratio of the value of energy inputs over the value of all intermediate inputs and employee compensation) from the Bureau of Economic Analysis 2002 Industry Accounts data.

Figure 2.1 reports the energy shares for each of the twelve industry categories considered in the empirical analysis.[7] While there are evident differences in energy shares across sectors (ranging from less than 1 percent in the Finance, insurance, and real estate (FIRE) sector to 22 percent in the utility

6. For example, the Manufacturing Energy Consumption Survey (MECS) contains detailed information on electricity consumption in the manufacturing sector, but by definition this covers only roughly 20 percent of the US workforce. Similarly, the Survey of Business Expenses omits the agricultural, utilities, and public administration sectors.

7. The BEA data appears to slightly undercount energy inputs in some of the durable and nondurable manufacturing sectors. For these two sectors I use instead energy shares computed from the 2002 MECS data.

sector), for most sectors, and most of the employment, the energy share is 3 percent or less. In fact, the FTE weighted share across the twelve sectors is 2.6 percent. And since electricity is one of many possible sectoral energy inputs, these shares are upper bounds on the actual electricity shares (S_E). As such, this evidence, in connection with the previous theoretical formula, foreshadows that the cross-elasticity of employment with respect to electricity price is likely to be small.

Figure 2.2 presents a first look at the connection between real electricity prices and FTE employment over the period 1976 to 2007. The full line shows the yearly average of residuals from a regression of real electricity prices (in $2005 per kWh) on a quadratic time trend and unrestricted state effects. Similarly, the dashed line displays the yearly average of residuals from a regression of log FTE employment on a quadratic time trend and unrestricted state effects. The connection is remarkable: each period of higher than average electricity prices is accompanied by lower than average employment, especially in the early 1980s and late 1990s. In fact, the raw correlation between the two series is –0.77. This evidence clearly suggests the existence of a relationship between FTE employment and electricity prices. The following regression analysis will quantify and refine the magnitude of relationship by including more variables in order to control for unobserved shocks correlated with electricity price and labor demand.

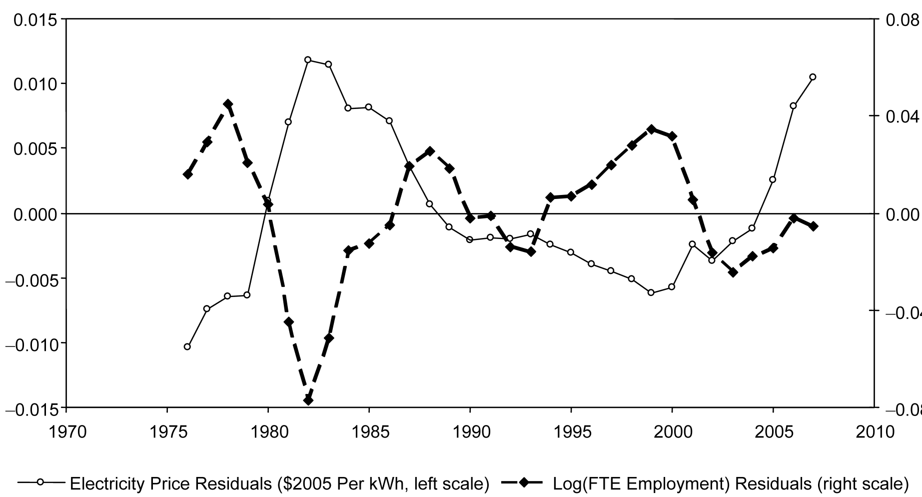

Fig. 2.2 Residual relationship between real electricity prices and full-time equivalent (FTE) employment

Notes: Residuals from regressions based on 1,568 state * year observations. Each model controls for a quadratic in year and state fixed effects. Reported in the figure are the yearly averages of the residuals from the regressions. See the text for more details.

2.4 Regression Analysis

In order to estimate the cross-elasticity of labor demand with respect to electricity prices I consider group-level regression models of the form:

$$\text{(1)} \qquad \text{Log}(Y_{st}) = \alpha_s + \alpha_t + \beta \text{Log}(P_{st}) + X_{st}\gamma + \varepsilon_{st},$$

where Y_{st} represents employment in state s and observed in year t. The parameters α_s and α_t are fixed effects for state (s) and year (t). In some models, these fixed effects are also augmented by state-specific time trends. The key variable is P_{st}, the average retail electricity price in dollar per kWh in state s and year t (deflated to 2005 dollars). Variable β is the parameter of central interest in this chapter: it measures the percentage change in employment associated with a 1 percent change in real electricity prices. Table 2.1 reports estimates of this cross-elasticity for various specifications. The vector X_{st} contains the control variables, most importantly the size of the sixteen to sixty-five population in the relevant cell. In addition to the specification in equation (1), I also consider alternative models where the year effects are replaced with a quadratic time trend and where industry fixed effects and industry-specific time trends are included. The last term in equation (1), ε_{st}

Table 2.1 Estimates of cross-elasticity of full-time equivalent (FTE) employment with respect to real electricity prices

	(1)	(2)	(3)
A. Based on state * year cells			
cross-elasticity of FTE employment	–0.147	–0.096	–0.132
	(0.031)	(0.036)	(0.032)
B. Based on state * year * 12 industry cells			
cross-elasticity of FTE employment	–0.156	–0.097	–0.119
	(0.039)	(0.052)	(0.064)
C. Predicted FTE employment effect of 4% increase in electricity prices (based on estimates in panel A).	–512,513 (108,081)	–334,702 (125,513)	–460,215 (111,567)
Quadratic in year	yes	no	no
Year fixed effects	no	yes	yes
State fixed effects	yes	yes	yes
State-specific time trends	no	no	yes
Industry fixed effects (panel B only)	no	no	yes
Industry-specific time trends (panel B only)	no	no	yes

Notes: Cross-elasticity estimates are from models based on 1,568 state * year cells (row A) and 18,471 state * year * industry cells (row B). Each model controls for the log of sixteen to sixty-five population in addition to the variables listed at the bottom of the table. Predicted FTE employment effects assume a 4 percent increase in electricity prices are evaluated at the sample average of aggregate FTE employment in the sample period (87,162,000). The standard errors in parentheses are corrected for within-state serial correlation. See the text for more details.

is an error term. Throughout the chapter the standard errors are corrected to allow for arbitrary within-state serial correlation.

Once the cross-elasticity of employment with respect to electricity price is estimated from equation (1), we can predict the impact of a particular climate policy on employment by multiplying the β coefficient by the predicted increase in electricity price. For example, the predicted change in FTE employment would be calculated as follows:

$$\%\Delta FTE \approx \hat{\beta}_{FTE} \times \Delta P. \quad (2)$$

The credibility of this approach depends on the assumption that the estimation of equation (1) will produce unbiased estimates of the β parameter. The key assumption is that there are no residual labor demand shocks that are correlated with electricity price once we control for year, state, and industry fixed effects as well as industry-specific and state-specific time trends. This is a strong assumption; for example, it rules out state-specific labor demand shocks that do not evolve smoothly over time. Following, I further discuss the limitations of the empirical estimates produced by this analysis.

2.4.1 Cross-Elasticity of FTE Employment with Respect to Real Electricity Prices

Table 2.1 reports empirical estimates of the coefficient β in equation (1). In all models FTE employment and electricity prices are expressed in logs, so the reported coefficients correspond to the effect of a 1 percent change in electricity price on %FTE employment. Row A is based on state * year cells and ignores the variation in employment due to differences across states (and/or over time) in industry composition. Estimates in column (1) are based on models including a quadratic time trend and state fixed effects, column (2) replaces the quadratic time trend with year fixed effects and column (3) adds state-specific time trends to the specification. It is the more general model considered, and allows for differential shocks to labor demand in each state, provided that these shocks evolve smoothly enough. Estimates in row B are based on state * year * industry cells, but restrict the impact of electricity price on employment to be the same across industries. The specification of the models in columns (1), (2), and (3) of row B remains the same, with the exception that industry fixed effects are included in all specifications, and industry-specific time trends are added to the models in column (3).

The estimates are negative in all specifications and statistically significant in most. This indicates that increases in electricity prices lead to reductions in FTE employment and suggest that labor and electricity prices are *p*-complement. However, the cross-elasticities are relatively small: The largest point estimate in absolute magnitude is –0.156 and its 95 percent confidence interval ranges from –0.234 to –0.078. The preferred estimates in column (3) indicate that a 1 percent change in electricity price will lead to a –0.13 percent to –0.12 percent reduction in FTE employment. By comparison, the average annual change in FTE employment (normalized by population) over the sample period is about 1.5 percent, so the fluctuations in employment caused by electricity price shocks are well within the range of the normal historical variation.

Although not reported in table 2.1, I also estimated the impact of electricity prices on FTE employment separately for each of the twelve industry categories considered. With the caveat that this analysis lacks the statistical precision of table 2.1, it is notable that higher electricity prices lead to a reduction in FTE employment in most industries. The most affected industries are agriculture, transportation, and FIRE. The cross-elasticities for those three sectors are –0.426, –0.385, and –0.291, respectively, and are statistically significant at the conventional level. However these are smaller industries in terms of overall employment, representing about 15 percent of total employment in the United States over the sample period. There is a positive correlation between electricity prices and FTE employment in the mining and utilities sector, although the point estimates are not statistically significant.

Although not reported here, I have also considered alternative specifications of equation (1), notably to allow for nonlinearities and lagged effects of electricity prices on employment. In general, these considerations did not alter the main results significantly.[8] It is also worth noting that the analysis presented in table 2.1 could be extended to provide information about the "incidence" of electricity price shocks by examining responses specific to demographic groups or geographical areas.

2.4.2 Implication for Climate Policy

While the estimated cross-elasticities appear small, their implications on the possible aggregate employment effects of a climate policy may be more sizable. To put this in context, I evaluate the predicted aggregate employment effects associated with an increase in electricity price similar to the increase that would be caused by a climate policy like H.R. 2454, the American Clean Energy and Security Act of 2009.

To this end, I use the estimated cross-elasticities in row A of table 2.1 to simulate the short-run employment response to an increase in electricity price of 4 percent. This price increase is consistent with the projections from the Energy Information Administration (2009) about future electricity prices under H.R. 2454. The resulting predicted changes in FTE employment are reported in row C of table 2.1. Across the three specifications the estimates range from reductions of 510,000 to 335,000 in FTE employment. By comparison, the average aggregate FTE employment in the sample is about

8. Blanchard and Gali (2007) report that the effect of oil prices on aggregate employment has declined over time.

eighty-seven million. The preferred estimate in column (3) is –460,215 with a standard error of 111,567. It is worth noting that the predicted employment effects are a linear function of the estimated cross-elasticity and therefore could be implemented for alternative scenarios regarding future electricity prices under any specific climate policy.

2.4.3 Possible Sources of Bias in Cross-Elasticity Estimates

It is possible that the estimates reported in table 2.1 are biased if there are omitted factors in the regression models that are correlated with both electricity prices and labor demand. This bias would invalidate the results of this analysis, including the employment projections associated with specific climate policies.

A key issue is that within-state variation in electricity price provides the key identifying variation for the empirical analysis, and within-state electricity price changes are likely to be caused by many factors, including changes in regulator behavior, capacity constraints, changes in the relative price of primary energy inputs, and so forth. As such, these price shocks may be caused in part by factors related to labor demand in a way that is not controlled for by the year fixed effects and state-specific time trends included in the empirical models. This could occur if the electricity-pricing rule used by the utility regulators sets prices to equate average costs to average revenues. Since revenues depend on electricity sales, which may in turn depend on labor market conditions, this pricing rule may imply a reverse causality relationship from employment to electricity prices. As a consequence, this would lead to biased estimates of the cross-elasticity of employment with respect to electricity prices, and this bias is difficult to sign a priori.

A common solution to this problem is to rely on instrumental variables that are correlated with electricity prices but otherwise uncorrelated with labor demand. One possibility would be to use changes in relative prices of primary energy inputs used in producing electricity interacted with physical production capacity by fuel type in each state as instrumental variables for electricity prices. While a complete implementation is beyond the scope of this chapter, it is an approach I am undertaking in continuing work.

2.5 Implications and Concluding Remarks

Taken literally, the preferred estimates in this chapter suggest that in the short run, an increase in electricity price of 4 percent would lead to a reduction in aggregate FTE employment of about 460,000 or 0.6 percent. This estimate corresponds to the first-year response to higher electricity prices assuming firms did not anticipate the rise in electricity costs and that no production subsidies are given to sectors most affected by the introduction of a price on carbon. In reality, it is probable that a carbon-pricing policy will be phased in gradually and accompanied with subsidies to selected sectors. Such adjustment mechanisms should reduce some of the employment loss predicted by the approach in this chapter.

By comparison, the important recession that started in December of 2007 caused the number employed nationally to decline by 3.1 million between December 2007 and 2008.[9] Using this recent experience as a benchmark, it appears that climate policies that lead to increases to electricity price of 3 to 4 percent will lead to significant but not unprecedented employment loss.

There are many limitations to this research and its results need to be interpreted with caution. In my view the most significant limitation is that the approach taken here is only informative about the short-run effect of transitory shocks to electricity prices, and so ignores general equilibrium effects. Information about the differential dynamic adjustment paths across industries is essential to evaluate the full extent of the implications of climate legislation on labor markets. Insights into this question can be obtained by considering dynamic general equilibrium models.

References

Aldy, J., and W. Pizer. 2009. *The Competitiveness Impacts of Climate Change Mitigation Policies.* Pew Center on Global Climate Change. Available at http://www.cfr.org/climate-change/pew-center-competiveness-impacts-climate-change-mitigation-policies.

Berman, E., and L. Bui. 2001. "Environmental Regulation and Labor Demand: Evidence from the South Coast Air Basin." *Journal of Public Economics* 79: 265–95.

Blanchard, O. J., and J. Galí. 2007. "The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so different from the 1970s?" In *International Dimensions of Monetary Policy,* edited by Jordi Galí and Mark Gertler, 373–421. Chicago: University of Chicago Press.

Cahue, P., and A. Zylberberg. 2004. *Labor Economics.* Cambridge, MA: MIT Press.

Energy Information Administration. 2009. *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009.* Washington, DC: EIA.

Greenstone, M. 2002. "The Impacts of Environmental Regulations on Industrial Activity: Evidence from the 1970 and 1977 Clean Air Act Amendments and the Census of Manufactures." *Journal of Political Economy* 110 (6): 1175–219.

Hamermesh, D. 1993. *Labor Demand.* Princeton, NJ: Princeton University Press.

Hamilton, J. 2008. "Oil and the Macroeconomy." In *The New Palgrave Dictionary of Economics,* 2nd ed., edited by S. Durlauf and L. Blume. New York: Palgrave Macmillan.

Ho, M., R. Morgenstern, and J. Shih. 2008. "Impact of Carbon Price Policies on U.S. Industry." Resources for the Future. Discussion Paper no. 08-37.

9. Laura A. Kelter (2009).

Jaffe, A., S. Peterson, P. Portney, and R. Stavins. 1995. "Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?" *Journal of Economic Literature* 33 (1): 132–63.
Kelter, Laura A. 2009. "Substantial Job Losses in 2008: Weakness Broadens and Deepens across Industries." *Monthly Labor Review* 132 (3): 20–33.
Killian, L. 2008. "The Economic Effects of Energy Price Shocks." *Journal of Economic Literature* 46 (4): 871–909.

Comment Matthew E. Kahn

This impressive chapter utilizes a state-level panel data set covering the years 1976 to 2007 to provide new estimates of the relationship between retail electricity prices and state employment activity. Based on an estimation strategy that controls for state and year fixed effects, this chapter exploits within-state variation in electricity prices. A key finding is that the electricity price elasticity is roughly –.12. Deschênes uses this estimate to predict the likely employment effects of a federal carbon mitigation policy. If such a policy would raise electricity prices by 4 percent, then he predicts that aggregate US employment would decline by 460,000. In absolute terms, this would appear to be a very large unintended regulatory effect, while relative to the nation's total workforce this effect is small.

In the summer of 2009, the House of Representatives barely passed the American Clean Energy and Security Act. In the summer of 2010, the Senate chose not to vote on that bill. The Congress' tepid efforts to battle climate change indicate that its members believe that such long-run regulation must have significant short-run costs. How do such senators know this? They are unlikely to have general equilibrium modelers on their staff. The Deschênes estimates offer credible evidence and represent a key "missing link" in public policy discussions. Combining state-specific predictions for how carbon regulation will affect state electricity prices with the Deschênes estimates would yield an expected job incidence measure that could help to predict congressional voting patterns on carbon mitigation legislation.

This chapter focuses on the short-run effects of electricity prices on employment. In the medium term, higher energy prices will induce some firms to innovate to economize on energy consumption (Popp 2002). Such nimble firms will be less likely to shut down or reduce employment when future electricity price increases take place. In contrast, there will be other

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