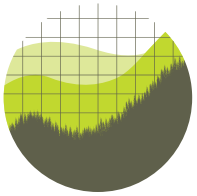
The Regulatory Red Herring

The Role of Job Impact Analyses in Environmental Policy Debates



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Executive Summary

Recent policy debates about environmental regulation have focused on how those rules will affect the labor market. Opponents of regulation argue that increasing production costs will lead to layoffs, while proponents of stronger protections counter that new rules can result in businesses hiring new workers to reduce their environmental impact.

To bolster these competing claims, advocates on both sides have promoted economic studies that purport to examine the employment effects of environmental protection. These job impact analyses are extremely sensitive to data and model structure, but in policy discussions the underlying assumptions and limitations of models are inconsistently reported and too often ignored. In an advocacy context, job impact analyses can tell very different stories, often depending on the narrator. In one revealing example, the American Coalition for Clean Coal Electricity estimated that two EPA rules on power plant emissions would trigger a 1.4 million job *loss*; meanwhile, using a different model and different assumptions, the Political Economy Research Institute predicted the same two rules would generate a 1.4 million job *gain*.

Job impact analysis can and should be used by policymakers when weighing the costs and benefits of a rule. But it should not serve as a trump card. Rather, the positive and negative effects of environmental protection on employment can be used as one of the inputs to a rulemaking's cost-benefit analysis, with the consequences of joblessness evaluated using standard economic techniques. Perhaps most importantly, analysts and policymakers must recognize that even the most sophisticated job impact analyses have only limited predictive power in our complex and dynamic economy. While research should be carried out to refine and improve these models, the degree of uncertainty associated with estimates of employment impacts should be acknowledged.

This report examines the use of job impact analysis by the federal government and advocacy groups, discussing how cost-benefit analysis can incorporate regulatory effects on layoffs and hiring, and how job impact models can be used and misused in the public policy debate. On the basis of this analysis, several recommendations are offered:

1. Job impact analysis is not an alternative to, or substitute for, cost-benefit analysis. Rather, employment effects should be incorporated into cost-benefit analysis on the basis of traditional economic principles.

2. The difference between short-term and long-term unemployment should be taken into account when determining the economic costs of layoffs.

3. The potential for regulations to positively and negatively affect workers should be recognized.

4. Economic models used to predict employment effects should be well suited to the type of regulatory effect being estimated (e.g., regional versus nationwide and multi-sector versus single industry).

5. Uncertainty surrounding model predictions should be acknowledged by analysts and policymakers, and all assumptions and modeling choices should be disclosed.

Part One

Jobs, Politics, and Environmental Policy

The attentions of President Obama, Congress, the media, and the public continue to focus on jobs. While the high unemployment rate—currently at around 8.3%[1]—certainly provides good reason for that focus, too much of the rhetoric and activity on this issue have concentrated on the alleged connection between environmental regulations and unemployment. Environmental regulations have been attacked without consideration of the benefits of regulation, the rigorous process used to develop rules, or crucial distinctions between job losses and unemployment as well as between short-term and long-term unemployment. By better understanding what unemployment means and how consideration of jobs fits into the analysis of regulations, the attentions of the public, press, and politicians can be redirected more productively.

Political Attempts to Link Environmental Protection to Employment

Claims that environmental regulations cause unemployment have been a staple of political discourse for decades.[2] But as the American economy continues to struggle in the aftermath of the 2008 recession, assertions about the negative employment impacts of environmental regulations have resurfaced with increasing volume and frequency. During roughly the first twenty days the 112th U.S. House of Representatives sat in session, congressional committees scheduled at least twenty separate hearings on the purported link between regulations and the nation's job woes[3] From 2007 to 2011, the phrase "job-killing regulations" underwent a 17,550% increase in usage in U.S. newspapers (from just four appearances in 2007 to over seven hundred in 2011).[4]

Representative Fred Upton—a Republican Congressman from Michigan and Chair of the House Energy and Commerce Committee—provides an example of how this rhetoric has been deployed most aggressively to target environmental regulations. In a 2010 opinion piece, Upton "declar[ed] war on the regulatory state" and singled out for special condemnation "a handful of job-killing regulations the EPA is finalizing."[5] When EPA announced a few months later that it would delay updating its ozone regulations, Upton pressured the agency to curtail regulatory activity even more drastically: "At a time of near double-digit unemployment, the EPA should stand down altogether from any action that will further hamstring our fragile economy."[6]

Since the 112th Congress was gaveled into session in January 2011, numerous bills have been introduced to directly or indirectly weaken EPA's regulatory authority, in the name of job protection. In fact, there are so many pending bills that House Majority Leader Eric Cantor created a website, *Jobs Legislation Tracker*, to keep tabs on the multiple proposals aimed at "remov[ing] onerous regulations that . . . impede private sector growth and job creation."[7] Adding more reviews, analyses, and audits to the rulemaking process in order to "reduce regulatory burdens" is page one of the *House Republican Plan for America's Job Creators*.[8]

Nearly two dozen bills introduced or drafted directly target EPA regulations, seeking to delay implementation of rules or to strip EPA's regulatory authority entirely,[9] with the impact on jobs as a

leading justification.[10] At least a few bills introduced would take the even more draconian measure of imposing across-the-board moratoria on rulemakings.[11] Multiple other bills have sought to add new procedural constraints to the regulatory process. At least nine bills have proposed new impact analysis requirements for rulemakings, including general mandates for job impact statements and additional analysis on cumulative costs, energy prices, and jobs.[12] Another nine bills have proposed modifying or expanding existing regulatory analysis and review processes.[13] Finally, at least four bills would create new congressional regulatory approval mechanisms.[14] These legislative proposals would add requirements on top of the extensive economic analysis and regulatory review procedures already in place.

Even without passing legislation, Congress has a variety of means to apply political pressure, such as committee hearings and public statements.[15] For example, in late 2010, over 150 Members of Congress signed letters urging EPA to balance environmental protections with job preservation, and specifically to scale back its proposed controls for hazardous air pollutants from industrial boilers (the "Boiler MACT Rule").[16] They were spurred to action in part by economic analyses released by industry groups, predicting that the Boiler MACT Rule would jeopardize tens of thousands of jobs.[17] In March 2011, EPA issued a final rule, having scaled back its proposed standards;[18] a few months later, EPA suspended the rule's effective date,[19] and the agency proposed even further modifications in December 2011.[20] Similarly, last summer, thirty-four Senators circulated a letter claiming that EPA's proposed revisions to the standards for ozone pollution would threaten tens of thousands of jobs.[21] Again, interest groups' dire job predictions played a key role in attracting congressional attention.[22] In August 2011, the White House Office of Information and Regulatory Affairs refused to grant EPA's proposal the green light, explaining that the President "does not support finalizing the rule at this time."[23]

More recently, the Keystone XL oil pipeline has been a flashpoint in the debate over jobs and the environment. Though the State Department estimates the pipeline would only create a few thousand temporary construction jobs and "would not have a significant impact on long-term unemployment,"[24] supporters of the pipeline insist over 100,000 direct and indirect jobs would result from the project.[25] Representative Upton sharply criticized the President's decision in January 2012 to not approve the pipeline, saying "the American people should not have to keep waiting for jobs and energy security. If President Obama cannot say yes to jobs, Congress will."[26] Sean Sweeney of Cornell's Global Labor Institute reported that the pipeline's backers are inflating job numbers: "The problem is that this is being depicted as an economic game changer, as a get-America-back-to-work project that has an almost miraculous capacity to fight our employment problem."[27]

Supporters of environmental policies have also capitalized on job impact arguments to bolster their agenda. President Obama has frequently placed green jobs at the center of his economy recovery plan, arguing "the country that leads in clean energy and energy efficiency, I'm absolutely convinced, is going to lead the global economy tomorrow."[28] Much attention has focused on stimulus spending,[29] but promoting new regulations is also part of the strategy. Pro-biofuel rules from EPA and Agriculture were released in 2010 as part of a green jobs package.[30] When EPA took its first steps to regulate greenhouse gases, Administrator Jackson promised "this pollution problem has a solution—one that will create millions of green jobs."[31]

Congress has also touted the employment benefits of environmental protections, perhaps increasingly so since 2009, when the Senate created a subcommittee specifically on "Green Jobs and the New Economy."[32] In congressional debates over EPA regulations, supporters are quick to cite studies from academic and environmental groups estimating hundreds of thousands of new "American jobs in manufacturing, installing and operating modern pollution control technology and producing clean energy."[33] Employment benefits were a central argument during the Democrats' pushes to pass Renewable Electricity Standards and climate legislation.[34] More recently, everything from e-waste recycling bills[35] to renewable fuel tax incentives[36] have been cited as job creators.

Unfortunately, when politicians or policy advocates remark on how new EPA regulations are fueling the rising unemployment rates[37] or how climate legislation will "significantly lower the national unemployment rate,"[38] their rhetoric often clouds the discussion. To understand whether and how job impact analysis can inform environmental policymaking, it is important to understand some basics about dynamic labor markets, and how job impacts differ from traditional costs and benefits.

The Difference between Job Loss, Short-Term, and Long-Term Unemployment

The labor market is dynamic. When the U.S. Department of Labor measures unemployment, it is taking a snapshot of a constantly changing, cyclical process. The Department surveys a sample of U.S. households and counts the number of adults trying to find employment who, at that instant, are not employed. At any given moment, the stock of unemployed individuals includes not only those individuals who have been laid off, but also new entrants (e.g., young workers and college graduates), re-entrants (e.g., older workers coming out of retirement or individuals returning from time spent caring for family members), and workers who quit jobs without finding new employment first.[39] In short, job loss contributes to—but is not the same as—unemployment.

In a dynamic economy, workers flow into and out of the stock of unemployed individuals. During a period of economic downturn, the flow of people into unemployment exceeds the flow of people out of unemployment, and so the stock of unemployed individuals increases. During an economic expansion, the flow of people coming out of unemployment exceeds the flow of people into unemployment, and the stock of unemployed people decreases.

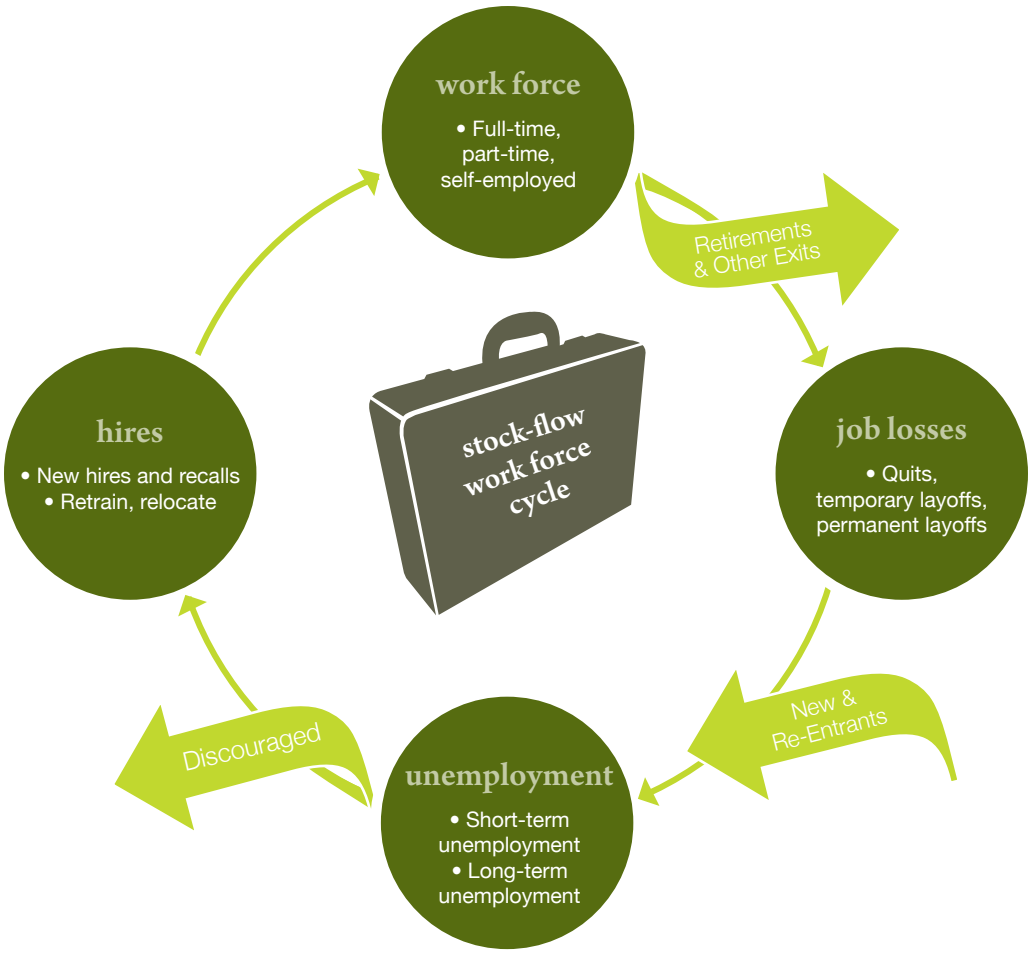
Even during economic booms, unemployment exists. The unemployment rate during economic expansions is typically between five and six percent in the United States.[40] Indeed, some temporary unemployment is part of a healthy economy, as new entrants join the workplace, individuals choose to exit current positions to seek different or better-paying work, and businesses shift their labor needs in response to market demands—all causing individuals to join the stock of unemployed people for at least short periods of time.

Quite often, large numbers of unemployed individuals and job vacancies coexist.[41] Unemployed individuals may be viewed as available workers moving through the labor market on their way to job vacancies. But they need time to search for a new job and to be selected by a new employer; some new positions will also require retraining or relocation.

Not only is "unemployment" therefore too broad a term for debating the nation's current employment problems, it is also too narrow. It omits important categories of individuals: discouraged workers (those who would be unemployed but have given up looking for work), the underemployed (those who have a job, but would prefer to work more hours), and the inadequately employed (those whose skills exceed what is required for the job they hold and who are therefore not as productive as they could otherwise be).[42]

Another key distinction is between short-term and long-term unemployment, which have very different consequences. Some short-term unemployment is inevitable. In a dynamic economy, people may switch jobs, and employers' demand for labor may expand or contract. Owing to imperfect information, it can take time for available workers to find appropriate jobs and for employers to interview and hire workers. Workers do not have complete and perfect information about the benefits and responsibilities of all job openings across the country; employers do not have complete and perfect information about the skills and qualifications of all job seekers. These factors are referred to as "friction" in the labor market, and result in some level of unemployment.[43]

FIGURE 1. Flow of Workers through the Dynamic U.S. Labor Market



Long-term unemployment, by contrast, results when labor supply persistently exceeds labor demand in at least some regions or sectors of the economy. It can be driven by a number of factors, including inflexible wage rates,[44] technological change,[45] and foreign competition.[46] Potential causes for the nation's current unemployment troubles include the immobility of the workforce across sectors and geographic regions as the composition of labor demand shifted; long-term structural changes to the U.S. economy associated with technological advances and globalization; and the prolonged reduction in consumer demand during the recent economic recession.[47]

Classic economic theory indicates that if labor were perfectly mobile, workers would relocate or retrain until wage differences among sectors and regions exactly offset the costs to the worker of relocating.[48] Real world imperfections in the inter-sectoral mobility of labor occur for a number of reasons. For example, relocation costs money and time, which workers may be hesitant to invest for uncertain returns.[49] Individuals who are laid off from one industry may not be able to fill positions in another industry (even if that sector is actively hiring workers) because they do not have the necessary skills.[50] These individuals will require training, which is also costly, takes time, and has uncertain returns.

Laid-off workers also cannot easily relocate their housing and other immobile region-specific assets, notably social and family groups. Relocation costs therefore include the costs of cutting social and psychological ties to the current geographical location.[51] While certain regions may be hiring, laid-off

workers may not want to move there because of the costs involved, especially if they are carrying large mortgages during a time of falling housing prices or have children in school.

The effort necessary to find new employment depends in part on the distance required for relocation.[52] If relocation costs are high, then unemployed individuals are unlikely to relocate to obtain new employment. Empirical studies show that there is a negative relationship between search intensity and distance to jobs—that is, the further the position is away from a worker's current location, the less likely a worker is to find it, which may increase the duration of unemployment.[53]

Long-term unemployment tends to be higher during periods of economic contraction.[54] Low aggregate demand for goods and services reduces production. When production drops, it lowers the demand for labor. Employers may respond in several ways, including by reducing wages, reducing hours, or incentivizing early retirement, but layoffs are also likely. Even if wages can be reduced (minimum wage laws or union contracts may prevent salary cuts), employers may fear that reducing wages or cutting hours will adversely affect employee morale and productivity.[55] As such, employers tend to lay off workers when aggregate marketplace demand is low. Unfortunately, because total demand for labor has fallen, it is difficult for these laid off workers to find new jobs, which means that they are more likely to transition from short-term to long-term unemployment. In other words, if an environmental regulation does cause some layoffs, during an economic downturn the negative consequences are likely to be greater because those workers will probably face additional difficulties finding new employment.

On the other hand, during an economic downturn, regulated industries may hire otherwise unemployed workers to design, fabricate, and install the necessary pollution control equipment.[56] Typically when firms hire new workers to comply with regulations, the new wages paid are calculated as a cost of the regulation, because those workers could have been allocated in other productive functions in the economy. However, during periods of high unemployment, those workers may otherwise remain jobless, meaning their opportunity costs are very low. In such cases, concentrating just on wages paid may overstate the overall social costs, because otherwise idle workers are being put back into the productive workforce.

If the regulatory costs are higher in some respects and lower in others during an economic downturn, the net effect is ambiguous. Whether or not a rule should be delayed during a period of unemployment, then, is highly contingent on the specific circumstances of the rule. While delaying a rule until employment levels recover may decrease some costs associated with production-related layoffs, it may also increase other costs associated with new compliance-driven hiring. And, of course, delaying implementation of a rule foregoes the net social benefits it would have generated in the meantime by improving environmental quality.

Long-term unemployment imposes greater economic costs than temporary layoffs. As the duration of unemployment increases, individuals become less attractive to employers.[57] Any loss of skills or productivity during periods of unemployment may result in lower wages once work is found. The longer an individual remains unemployed (without training or the acquisition of skills that employers value), the greater the likelihood that he will be eligible for only low-skilled, low-wage employment.[58] The long-term unemployed may need to attend training or education programs to increase their marketability. The largest costs from job loss tend to be experienced by older workers, who may have acquired considerable seniority with employers, and may be viewed as more difficult to train or costly to hire.[59]

Unemployment insurance, Social Security, private pensions, and other sources of household income may mitigate the individual harms associated with job loss. To the extent that laid-off workers may not be able to find full-time employment, but rather must accept part-time or temporary employment, household income will likely fall. Empirical analysis of the income effects of layoffs is mixed, but there does appear

to be consensus that the costs of unemployment increase as the length of unemployment increases, and are likely to be lower for individuals who have skills that can be transferred across industries, sectors, or geographic regions.[60] In addition to earnings losses, laid-off workers may experience a range of social-psychological problems, including reduced health, loss of self-confidence, depression and alcoholism. The likelihood of such consequences again tends to increase with duration of unemployment.[61]

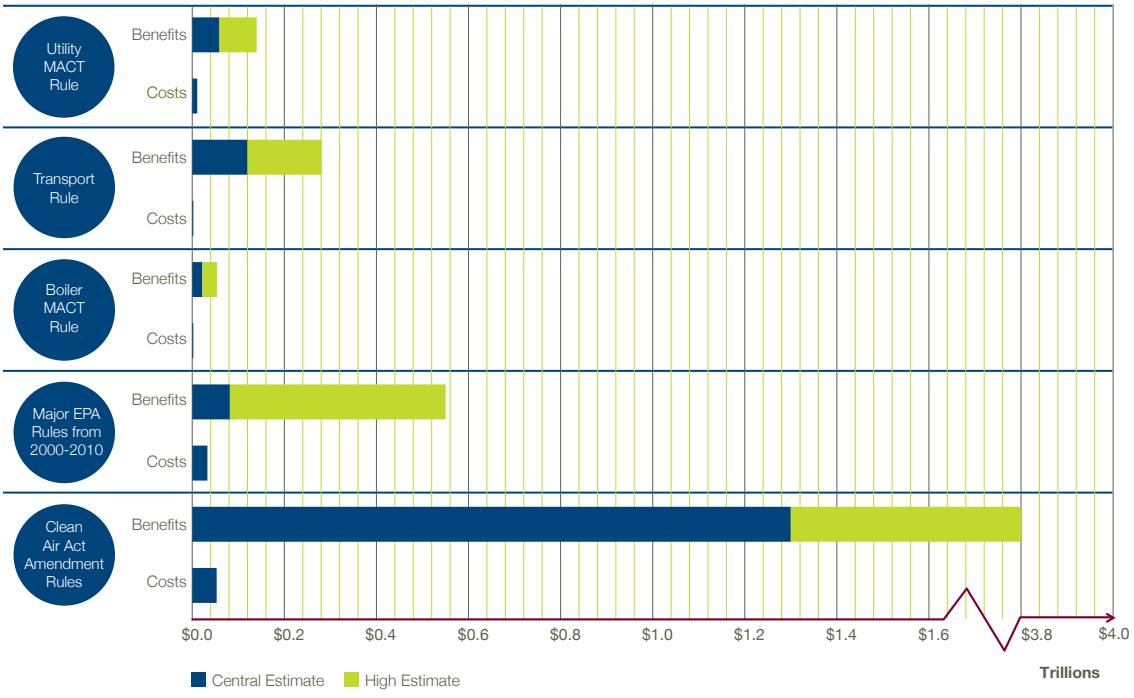
To summarize, job loss and unemployment are related, but are different phenomena. In addition, long-term unemployment and short-term employment have different causes and effects. How job loss or creation may contribute to the redistribution of the workforce, and how long-term unemployment may generate significant costs, are both factors that policymakers may want to consider in their decisions on environmental regulation. However, such considerations need to be properly incorporated into the broader, existing mandates for regulatory impact analysis.

Existing Regulatory Impact Requirements and the Role of Jobs Analysis

When a federal agency proposes a new regulation, it is because a statute passed by Congress authorized it to do so. Often, at that point, many of the broad policy considerations have already been debated by Congress; it is then left to the agency to implement that decision in the best possible manner. Under executive orders in place since the presidency of Ronald Reagan, federal agencies are required to exercise their regulatory discretion by studying a range of alternative actions, considering the costs and benefits of each, and selecting the most efficient option that will maximize net social benefits.[62]

EPA's recent regulations, which have come under attack for "killing jobs," have all gone through economic analysis and have been vetted by the White House Office of Information and Regulatory Affairs. For example, the Boiler MACT Rule discussed above is estimated to deliver between $22.2 billion and $54.5 billion in benefits per year, including the avoidance of thousands of premature deaths and cardiopulmonary illnesses annually (as well as significant, non-monetized ecosystem and mercury reduction benefits); by comparison, only about $1.9 billion in costs are expected.[63]

Figure 2: Annual Costs and Benefits of Sample EPA Regulations



Besides a cost-benefit analysis and White House review, the Boiler MACT rule—like all significant environmental rules—was also subject to a small business impact analysis, an unfunded mandates assessment, a review of the impacts to children's health, an energy effect statement, and an environmental justice review.[64] The presidential orders on regulatory review also mention consideration of job impacts,[65] and in light of the current economic downturn, job effects are particularly salient.[66] EPA has therefore been including job impact analyses in its most recent significant environmental regulations.[67] These additional impact analyses are done separately from the cost-benefit analysis conducted by the agency.

EPA's job impact analyses attempt to forecast the effect of a rule on layoffs and hiring in the regulated industry. To conduct these analyses, EPA employs a type of forecasting model, which is discussed in the following section. The agency sometimes uses the results of its job impact analyses in its feasibility analyses, attempting to determine if the job losses associated with a regulation are too high.[68] This practice has been criticized as inconsistent with the goals of maximizing economic efficiency, because job losses are not compared to the regulatory benefits that are forgone when the regulation is adjusted.[69]

Jobs created or lost are often not considered in standard cost-benefit analysis,[70] based on the assumption that labor markets are relatively efficient, meaning the costs associated with layoffs should be transitory.[71] If labor markets operate smoothly, workers laid off as a result of a regulation will obtain employment elsewhere. Under this assumption, regulation results in reallocation of labor, rather than a benefit or cost.

The traditional view is captured by the example of a broken window's effects on spending and economic activity. Imagine an errant baseball flies through the window of a local storekeeper. The storekeeper must now bear the cost of the necessary labor and materials to repair her damaged storefront. It is tempting to argue that this financial loss is balanced out by a corresponding benefit. Indeed, the baseball mishap has created a day's worth of work for the window repairman: he now stays employed, collects wages, and spends those wages on more goods and services, with positive effects rippling through the economy. The fallacy, however, is to think that the broken window has produced a gain, while in reality it has only resulted in a redistribution of money. If the batter had instead struck out, the storekeeper may not have hired the repairman, but she would have put that money to some use—a different business improvement, perhaps, or a personal purchase, which also would have generated positive ripple effects through the economy. If she chose to save the money, then it would add to the capital pool available for borrowers to engage in consumption or investment. In any case, just as much money would be available to circulate through the economy and generate employment whether or not the window is broken: the broken window merely determines who will benefit (namely, the repairman); it does not create any net benefit. Indeed, by forcing the business owner to reallocate resources from some other welfare-enhancing use (like a necessary home improvement) to window repairs for her store, the batter's foul ball has reduced the storekeeper's overall well-being.

Compare these labor effects to more standard costs and benefits. If a regulation reduces the air pollution from an industrial boiler, the resulting cleaner air delivers health and environmental benefits, such as fewer cardiopulmonary ailments and less acid rain. Those benefits come at a cost: the industry must install pollution control technologies or processes, and the government must administer the regulation. If the positive consequences outweigh the negative consequences, then the rule is cost-benefit justified. The labor costs associated with installing those control technologies are typically treated as costs, not as beneficial job creation, for the reason discussed above—the new employment is created by a reallocation of labor resources from other uses.

If workers are displaced by regulation (for example, if a factory closes as a result of a pollution control requirement), neoclassical economic theory predicts that in a flexible labor market, they will move from one firm or sector of the economy to another in response to job openings, and wages will adjust to restore employment levels. If this assumption holds and workers are quickly hired by another firm or industry,

then the costs associated with the labor reallocation caused by the regulation are nonexistent or minimal.

On the other hand, if the classical assumption of rapid rehiring does not hold, and workers have difficulty finding replacement employment, then the transition costs associated with layoffs—including psychological, emotional, relocation and training costs—may be considerable.[72] As the duration of unemployment increases, loss of skills or productivity may result in lower future wages and a decrease in lifetime earnings. Being out of work for a substantial amount of time also increases risk of serious social-psychological problems, including health impacts, loss of self-confidence, depression, and alcoholism. Importantly, long-term unemployment tends to be higher during periods of economic contraction, such as the country has experienced since 2008.[73]

There are good reasons to be concerned that, in reality, labor markets do not always operate smoothly and that, therefore, cost-benefit analysis should take employment effects into account. Workers who are laid off cannot easily relocate their housing and other region-specific assets like social and family groups. Information barriers to identifying open positions in unfamiliar geographic regions or economic sectors, as well as skill barriers to transitioning into a new field of employment, may further inhibit workers' ability to quickly and easily find new jobs.

The efficiency consequences of employment impacts are easily incorporated directly into cost-benefit analysis. The transition costs associated with a rule are, ultimately, costs. Though cost-benefit analyses in the past have rarely examined the reallocation of labor, the standard methodology has the tools to do so. The transition costs that cost-benefit analysis could reflect include relocation or retraining costs, long-term productivity effects, and any negative effects on psychological or physical health resulting from long-term unemployment. If these transition costs are substantial, they may be enough to raise total costs above benefits, making the rule inefficient. On the other hand, if net benefits remain positive, that means that any negative impact from layoffs and associated transition costs are outweighed by other social benefits.

At the same time, transition benefits could be associated with environmental regulation. Regulation can spur demand in a local labor market by, for example, requiring facilities to retrofit pollution control technology. If that market had recently experienced a labor demand shock resulting in a substantial number of underutilized workers, then increased hiring could cause an important sector- or region-specific welfare gain. Even if aggregate, economy-wide demand for labor is not increased by the rule, expanding employment opportunities in specific markets may have particularly significant consequences for workers—especially in areas in which the regional or local economy is depressed.

If the assumption of well-functioning labor markets is relaxed for the purpose of calculating transition costs associated with layoffs, the same should hold true for determining transition benefits associated with hiring. Examining only one type of transition effect in a cost-benefit analysis would create an unjustified anti-regulatory bias. If currently underutilized workers are hired into new positions with higher productivity because of a rule, this fact should be reflected in the analysis. The best way to do so would be to calculate compliance costs on the basis of the opportunity costs of the workers who are hired in order to comply with a regulation. A standard assumption is that those opportunity costs are exactly equal to the wage paid for the workers, but in imperfect labor markets, this may not always be the case. If a worker is currently unemployed, then the opportunity costs associated with allocating that person to a new position are low, because unemployed workers generate very little productivity. Wages could come down in times of high unemployment to reflect this reality, but in the real world, wages are slow to adjust to change in labor demand. Because the social cost of allocating unemployed workers to a new position is low, compliance costs from a social perspective are lower than the wages that are paid.

There are also distributional effects related to employment that may be important for policymakers to

consider. For example, a rule may help relatively affluent customers but harm low-skill, low-income workers. So long as the aggregate benefits outweigh the harms, standard cost-benefit analysis would show such a rule to be efficient. Only a subsequent distributional analysis would scrutinize exactly who benefits and who is burdened. Policymakers may then choose to leave such considerations to the political process or may try to adjust the regulation to minimize or offset the unbalanced distributive effects.

If the negative employment effects are mostly distributional, it is not clear that altering or revoking the rule is the optimal response. Rather, direct compensation for disproportionate regulatory costs may be a more desirable way to achieve distributional goals.[74] There are, however, important practical and political limitations to such compensation schemes. In those cases where compensation for non-wage losses from unemployment—like lost skills and psychological harms—is difficult, altering a rule to reduce labor transition costs may be the best option.

These are complex considerations, which require good analysis. The risk is that policymakers, in a bid to minimize the transition costs of a regulation, may change the rule in a way that causes even larger unintended efficiency losses. Indeed, the most significant past attempt to reduce transition costs associated with environmental protection—the grandfathering of existing, coal-fired power plants under Clean Air Act regulations—has resulted in massive inefficiencies that were not anticipated at the time the policy was made.[75] This is why the vast majority of economists now prefer flexible, market-based regulatory tools with compensation for distributional effects, rather than command-and-control regulation with transitional regulatory relief. Market-based regulations allow firms to respond in the most efficient manner, minimize the administrative burden on government, and often simplify compensation schemes for any negative distributive effects.[76]

To conclude, the labor effects of rules are sometimes important, and examination of the costs and benefits associated with layoffs and hiring can play a useful role in regulatory impact analyses. Cost-benefit analysis is already a complex and time-consuming task: cost estimates require engineering analyses and technology forecasts; benefit estimates require detailed scientific models, dose-response curves, and careful surveys of the value of health or environmental gains. Adding an examination of secondary effects on labor markets—dynamic, complex systems that are extremely difficult to model—will increase the analytic burden faced by agencies, but can also generate valuable information that should be considered by policymakers. To ensure that this kind of analysis actually helps improve regulatory decisionmaking, careful attention must be paid to the nature of the labor market, and especially the welfare effects associated with different potential jobs effects of regulation. In other words, if employment effects are to be taken into consideration when setting regulatory policy, then the accuracy, transparency, and potential limitations of the economic models used to estimate employment effects matter.

Part Two

The Limitations of Employment Models for Setting Environmental Policy

All of the models used to estimate the effect of environmental regulations on layoffs, hiring, and overall employment have limitations, which means that the picture they provide is necessarily incomplete. Currently, most models are best able to examine only part of the picture—like layoffs or hiring in a particular sector—and cannot accurately model the dynamic, economy-wide effects of a policy on aggregate employment levels. Because overall employment responds to large, macroeconomic factors, individual environmental regulations will rarely have lasting effects on aggregate employment. Environmental regulations that do not affect marginal labor productivity in the general economy are more likely to influence only the geographic or sectoral distribution of employment opportunities, rather than national employment levels. Current employment models are better suited to measuring these effects than forecasting economy-wide consequences. While this information may be useful for policymakers, especially when designing mechanisms to reduce transition costs and protect against long-term unemployment, it should not be mistaken for an accurate picture of the net effects of an environmental policy on employment in the economy as a whole.

Overview of Model Varieties

Multiple frameworks can analyze employment effects—from simplistic supply-and-demand curve analysis to complex computable general equilibrium models. Each technique has its own strengths and weaknesses; therefore, particular models may not be ideal for analyzing certain public policies.

Single Market Supply-and-Demand Analysis: If a policy has only small effects on a single market, analysts can turn to the most elementary of economic tools and plot the supply and demand curves.[77] This approach has the advantage of being inexpensive and fast. Assuming the regulation causes production costs to increase, the higher price may then be passed on to consumers, some of whom may decrease their demand. By assuming a drop in consumer demand for a good or service decreases output, which in turn triggers a proportional drop in labor demand, basic job impacts can be estimated. Of course, the simplicity of this analysis is also its shortcoming: by ignoring all but a single market, the technique overlooks the possibility of simultaneous job creation in other sectors, either because regulatory compliance requires new goods and services, or because consumers seek out substitute goods as they lower their demand for the regulated product.[78] Consequently, this kind of analysis is really only suitable for "very small-scale regulations,"[79] and even then can only offer an incomplete estimate of total employment effects. To capture more complex market interactions requires, at minimum, a multiple-market partial equilibrium analysis.

Multiple-Market Partial Equilibrium Analysis: A strictly partial equilibrium analysis studies only one market, holding the prices and quantities of goods and services in other markets constant. A multiple-market partial equilibrium analysis, however, can capture a finite set of important linkages between several markets, while still assuming the absence of broader effects to the general economy.[80] By assessing a few closely related markets for substitutes and complementary goods, multiple-market partial equilibrium analysis can paint a clearer picture of the effects of certain regulations; it can be especially

useful to evaluate policies that change the relative price of a specific good.[81] But for regulations with economy-wide impacts, this approach cannot capture the complex interactions between various markets, and an economy-wide general equilibrium model is necessary.

Fixed-Price General Equilibrium Simulations (I-O Models): Fixed-price simulations are the most widely used tool to assess the employment effects of environmental policies.[82] These models hold prices constant, which, though unrealistic, allows researchers to easily estimate economy-wide effects and break down results by sector or region. These simulations are designed to focus on impacts to specific sectors of the economy, while still estimating how changes in the demand for goods and services ripple through the entire economy.

These models are built around input-output (I-O) tables, which are essentially accounting matrices that show the flow of goods and services through the economy: the output of one sector is the input for another. The tables are ideally built from data derived from detailed surveys of manufacturers;[83] however, sometimes surveys may prove too costly, and I-O table may instead be built around shortcuts, which undermines their reliability.[84] From these tables, I-O analysis derives "multipliers" that indicate how an increase or decrease in activity in one industry affects business activity and jobs at all other industries.[85]

I-O simulations have important limitations. It is more difficult to model policies that change supply compared to policies that change demand. These simulations also cannot reflect long-term, structural changes to the economy, like globalization and industrialization. Moreover, because these models require constant prices, there is no room for price adjustments, and so they cannot account for substitution between goods and services consumed. As a result, I-O models tend to overstate employment effects.[86]

Some examples of popular fixed-price models are IMPLAN (IMpact analysis for PLANning, created by MIG, Inc. using data from federal government sources)[87] and RIMS-II (Regional Input-output Modeling System, developed by the U.S. Bureau of Economic Analysis).[88] Such models may provide good estimates for the short-run effects of policies in small economies; but for policies with a large enough impact to affect relative prices, a more sophisticated approach is likely required. For example, the RIMS website cautions that "RIMS multipliers are best suited for estimating the impact of small changes on a regional economy,"[89] and some analysts have advised that since it cannot capture changes over time, "IMPLAN is not readily suitable for forecasting the effects of public policy changes."[90] In particular, for "policies that have large, widespread impacts, like carbon taxes to address global warming, the [assumptions about] prices implicit in the linear model can lead to significant inaccuracy in policy analysis."[91]

Computable General Equilibrium (CGE) Simulations: Computable General Equilibrium models use the same data as I-O analysis, but CGEs permit for fluctuating prices and more complex interactions among economic sectors.[92] In particular, CGEs allow for substitution of goods and services, creating a more realistic picture of employment—and "less extreme assessments of employment impacts."[93]

CGEs first emerged in the 1960s, and by the 1980s they had gained widespread use among analysts seeking more powerful, sophisticated tools to estimate economic impacts.[94] Common CGEs include REMI (Regional Economic Models, Inc.)[95] and Global Insight (developed by IHS, Inc.).[96]

Unfortunately, the main strength of CGE models—complexity—is also their chief disadvantage. A CGE model is composed of multiple equations solved simultaneously;[97] the more sophisticated the CGE model, the greater the number of equations to be estimated and the greater the degree of model calibration required. They are therefore more expensive to purchase or construct; they require more data and more analysis; and their complexity makes them less transparent to a lay or policy audience.[98]

In particular, hidden within the CGE's structure are multiple decisions about the correct values for additional terms, decisions typically left up to the modelers' judgment.[99] Often the values of key

parameters amount to guesstimates about the rate of substitution between goods or the development of technology,[100] raising concerns about consistency and accuracy.[101] Since CGEs often do not explicitly define all their assumptions, the models are frequently characterized as "black boxes"[102]—though some argue that the chief problem with CGEs is not their inherent complexity or hidden assumptions, but rather a miscommunication of the models' structures and results to policy audiences.[103]

Because CGEs are focused on large, economy-wide effects, only policies with impacts on the scale of $100 million or more can be accurately assessed using such models. CGEs work especially well for policies that change tax rates or the use of technology (like adding new emissions controls to smokestacks).[104]

Despite their sophistication, standard CGE models are still static models, meaning they assume all economic activity occurs at a fixed point in time, and they cannot capture changes in variables over time. They are typically built around macroeconomic data from a single reference year, making it difficult for the model to capture major economic fluctuations, dynamic economic components like changes in investment and savings, or effects of financial and monetary policies.[105] Dynamic CGE models, by contrast, can reflect changes to the population and capital stock to simulate long-run equilibria. For dynamic CGE models there is a tradeoff between the length of time that the model covers and the degree of sector-specific detail that may be incorporated into the model.[106] To more directly analyze how variables move over time, a different approach may be required.

Econometric Estimation of Adjustment (Time-Series Models): For long-run relationships among employment in various sectors, time-series analysis may be appropriate. Whether linear or non-linear, simulated models do just that: they simulate, rather than directly estimate, economic variables. By contrast, time-series models allow for direct estimation of long-run relationships, based on data like historical monthly employment rates. But again, there is a tradeoff between the time horizon covered and the number of sectors that can be studied, due to data and computational limits,[107] and any increase in model detail or the time horizon will increase the complexity and potential for errors. Many economists have argued that forecasting models should not be used in policy analysis because the results are highly sensitive to the model's structure, such as how it responds to economic shocks.[108] In general, forecasting models should be regarded with caution, and time-series analysis should typically only be a supplement to other types of employment estimates.[109]

Case Studies on Employment Estimate Models in Environmental Policy Debates

Nearly every controversial environmental policy proposed during the last several years has featured a debate over the possible employment effects. Unfortunately, few of the studies used to support either side in these debates meet the criteria for well-executed models, and even less frequently do the political debates mention the potential limitations of the results. A few case studies will illustrate how very different estimates can be generated for similar policies or interventions. The purpose of these case studies is not to pick out which estimates may be more reliable and which may be more suspect, nor is the purpose to criticize the authors of any of the studies included, who may have clearly stated the assumptions used and limitations of the results. This report takes no position on the validity of the studies discussed below. And the fact that the models can produce a wide range of outcomes does not mean they have no place in legitimate policy debates. Rather, the point is to caution anyone who would use a single study or model as definitive proof of the aggregate employment effects of a regulation or investment—rules can often have contradictory effects on demand for labor that will interact in complex ways. Models that cannot accurately account for these opposing tendencies risk overstating or understating net effects.

Figure 3 provides a brief summary of several recent analyses of the effect of environmental policies on labor markets, and the case studies that follow summarize the role that these analyses played in the policy discourse on these subjects.[110]

Figure 3: Case Studies on the Limitations of Employment Models

	Research Team	Year	Policy Scenario	Model Type	Estimated Employment Effects	Assumptions Disclosed?	Sensitivity Analysis?
CASE STUDY #1: RENEWABLE ELECTRICITY STANDARD	Management Information Services (for the American Solar Energy Society)	2008	Renewable portfolio standard, tax incentives, research & development, and other federal and state energy initiatives	I-O model (RIMS II and Management Information Services, Inc. model)	Under "advanced" scenario, by 2030, 15 million net energy efficiency jobs gained and 6 million net renewable energy jobs gained	No	No
	Center for American Progress & Political Economy Research Institute (PERI), University of Massachusetts, Amherst	2009	$150 billion in new national clean energy investment from stimulus, renewable electricity standard, and carbon cap bills	I-O model (IMPLAN)	1.7 million net new jobs; net decrease in unemployment rate of 1%	Yes	Partial: sensitivity to industry weights
	Union of Concerned Scientists	2009	Renewable electricity standard of 25% by 2025	EIA National Energy Modeling System (NEMS, modified version)	202,000 net job gain by 2025	Partial	No
	Heritage Center for Data Analysis	2010	Renewable electricity standard (minimum 37.5% by 2035)	CGE model (IHS Global Insight)	Job loss of 330,000 by 2012, reaching a peak loss of 1.3 million jobs by 2032	Partial	No
	University of Tennessee (for 25 by 25 Alliance)	2010	Renewable fuel standard plus a renewable electricity standard of 25% by 2025	I-O Model (IMPLAN), plus POLYSYS simulation model for agricultural effects	723,000 new jobs in 2025 (compared to only implementing the Energy Independence and Security Act)	Yes	No
	Navigant Consulting (for RES Alliance for Jobs)	2010	Renewable electrictiy standard of 25% by 2025	I-O model (Unspecified)	274,000 new jobs	No	No

	Research Team	Year	Policy Scenario	Model Type	Estimated Employment Effects	Assumptions Disclosed?	Sensitivity Analysis?
CASE STUDY #2: TRANSPORT RULE AND/OR UTILITY MACT RULE	EPA	2011	Transport Rule	I-O model (Integrated Planning Model), plus Morgenstern et al. estimation approach	2,230 jobs gained in environmental protection sector in 2014, and about 700 jobs gained each year in the utility sector	Yes	No
	EPA	2011	Utility MACT	I-O model (Integrated Planning Model), plus Morgenstern et al. estimation approach	Central estimate of about 8,000 jobs gained in utility sector, and about 46,000 job-years gained in environmental protection	Yes	No
	Navigant Consulting (for Clean Air Council)	2011	Utility MACT	I-O model (modifying EPA's findings with RIMS II multipliers)	115,520 jobs more than estimated by EPA	Partial	No
	Economic Policy Institute	2011	Utility MACT	Modifying EPA's findings with multipliers from the Bureau of Labor Statistics employment requirement matrix	28,000 to 158,000 jobs created by 2015	Partial	Partial: sensitivity check using information from the Census of Construction
	CERES & Political Economy Research Institute (PERI), University of Massachusetts, Amherst	2011	Transport Rule + Utility MACT	I-O model (IMPLAN 3.0) and the North American Electricity and Environment Model (NEEM)	1.46 million jobs gained over 5 years	Partial	No
	NERA (for American Coalition for Clean Coal Electricity)	2011	Transport Rule + Utility MACT	EIA National Energy Modeling System (NEMS) and CGE model (REMI)	1.44 million jobs lost over 7 years	Yes	No

	Research Team	Year	Policy Scenario	Model Type	Estimated Employment Effects	Assumptions Disclosed?	Sensitivity Analysis?
CASE STUDY #3: FEDERAL AND STATE CLIMATE LEGISLATION	Heritage Center for Data Analysis	2008	Lieberman-Warner Climate Change Legislation (America's Climate Security Act)	CGE model (IHS Global Insight)	Annual losses as high as 907,000 jobs per year in 2017, falling to between 431,000 and 461,000 jobs lost in 2030	Partial	Partial: sensitivity to assumptions about technology
	Heritage Center for Data Analysis	2009	American Clean Energy and Security Act of 2009	CGE model (IHS Global Insight)	Average of 1.14 million jobs lost per year from 2012 to 2035	Partial	No
	Brookings Institution	2009	Emissions reductions broadly consistent with proposals by President Obama, Representatives Waxman and Markey, along with two cost-minimizing paths	Dynamic CGE model (G-Cubed)	Reduce employment levels by 0.5% in the first decade	Partial	No
	CRA International (for National Black Chamber of Commerce)	2009	American Clean Energy and Security Act of 2009	Dynamic CGE model (MRN-NEEM and MS-MRT modeling systems)	Net reduction in U.S. employment of 1.5 million job-equivalents in 2015, increasing to 2.2 million in 2030 and 3.6 million in 2050	Partial	Partial: sensitivity to cost projections
	CRA International (for Coalition for Affordable American Energy, CAAE)	2009	Climate provisions contained in the Obama Administration's FY 2010 Budget Proposal	Dynamic CGE model (MRN-NEEM and MS-MRT modeling systems)	Net job loss of 800,000 in 2015, increasing to 1.9 million by 2020 and 3.2 million total by 2025	Partial	No
	UC Berkeley	2009	American Clean Energy and Security Act of 2009 and the Clean Energy Jobs and American Power Act	Forecasting model based on IMPLAN (Environmental Assessment in General Equilibrium (EAGLE) model)	918,000 to 1,894,000 jobs gained by 2020 (0.4 to 0.9% increase in employment)	No	No
	UC Berkeley	2009	American Clean Energy and Security Act of 2009	Dynamic CGE model (Berkeley Energy and Resource (BEAR) model)	Employment declines 0.2% to 0.3% in Florida by 2025	Yes	Partial: sensitivity to allowance price
	Center for Energy Economics (for Texas Comptroller)	2009	American Clean Energy and Security Act of 2009	CGE model (REMI-Policy Insight)	Employment declines 1.4% by 2030 nationwide, with about 173,000 jobs lost in Texas alone	No	Partial: sensitivity to allowance price
	American Council for Capital Formation (ACCF) & National Association of Manufacturers (NAM)	2009	American Clean Energy and Security Act of 2009	EIA National Energy Modeling System (version NEMS/ACCF-NAM 2)	1.79 million to 2.44 million jobs lost by 2030 (1.1% to 1.5% reduction in employment)	Yes	Partial: sensitivity to cost projections
	U. S. Energy Information Administration (EIA)	2010	Kerry-Graham-Lieberman American Power Act of 2010	EIA National Energy Modeling System (NEMS)	Employment losses of 0.1 to 0.2% relative to reference case	Partial	Partial: sensitivity to cost, technology, and natural gas projections
	Apollo Alliance	2010	American Clean Energy and Security Act of 2009	No independent research; results generated by EIA	320,000 new manufacturing jobs	No	No
	Political Economy Research Institute (PERI), University of Massachusetts, Amherst	2011	Carbon Limits and Energy for America's Renewal (CLEAR) Act	I-O model (IMPLAN)	360,000 jobs gained	Partial	No
STATE LEGISLATION	UC Berkeley	2009	California Climate Law AB 32, combined with 33% Renewable Portfolio Standard (RPS) for California electric power utilities	Dynamic CGE model (Berkeley Energy and Resources (BEAR) model)	Net employment gain in California, by mitigating 352,000 jobs that would have been lost due to fossil fuel costs	Yes	Partial: sensitivity to technology costs
	UC Berkeley	2009	Various efficiency and renewable fuel requirements possible under California climate laws like AB 32	Dynamic CGE model (Berkeley Energy and Resources (BEAR) model)	14,335 to 420,747 net increase in California jobs by 2050	Yes	No

Case Study #1: Renewable Electricity Standards

A national Renewable Electricity Standard (RES, also known as the Renewable Portfolio Standard or, more recently, the Clean Energy Standard) would require that electricity suppliers include a certain fraction of their electricity from renewable energy sources like solar generators or wind farms. Though several states have their own RES programs, there is currently no federal RES (even though each House of Congress has individually passed several versions, no single bill has ever passed both chambers).[111] A federal RES has been proposed for years, with President Obama most recently calling for 80% clean energy generation (including renewables, but also natural gas, nuclear power, and coal accompanied by carbon capture and storage) by 2035.[112]

Claims about job impacts have featured prominently in the RES debates. While most studies predict job growth from a federal RES, at least one study—by the Heritage Foundation—estimates significant job losses. That Heritage Foundation study has been cited in the Republican Staff Commentary of the U.S. Congressional Joint Economic Committee[113] and presented in testimony before the U.S. House Committee on Oversight and Government Reform.[114] On the other side of the debate, various groups have produced positive but still highly variable reports, even when using similar models to analyze the same underlying policy. Several of these findings were included in Senate Majority Leader Harry Reid's report on "Job Growth from Investment in Renewable Energy."[115] In all cases, on both sides of the debate, the results were reported as definitive, raw numbers, with no discussion of methodology, assumptions, or limitations.

Case Study #2: Transport Rule and Utility MACT Rule

To address the serious problem of upwind states contributing to the poor air quality in downwind states, EPA proposed the "Transport Rule" in 2010 under statutory direction from the Clean Air Act; the rule was finalized in 2011.[116] Under similar statutory direction, EPA proposed the "Utility MACT Rule" in 2011 to regulate hazardous air pollutants (like mercury) from utilities.[117] Together, EPA estimates that these two rules will deliver annual net benefits of $166-407 billion, including up to 51,000 avoided premature deaths per year.[118]

Though there have been few estimates of the job impacts of these two rules, the reports that exist are surprisingly inconsistent. EPA, for example, predicts low potential impacts: in the range of about 2,200 one-time jobs and 700 annual jobs created by the Transport Rule,[119] and for the Utility MACT rule a one-time gain of about 46,000 jobs, with another 8,000 jobs created annually.[120] Other estimates, however, are less modest. In particular, a report commissioned by the American Coalition for Clean Coal Electricity estimates that the two combined rules will generate a 1.4 million job *loss*, while a Political Economy Research Institute study predicts the same two rules will trigger a 1.4 million job *gain*.[121]

Senator James Inhofe has cited the American Coalition for Clean Coal Electricity's pessimistic report when opposing the EPA's Transport Rule and pledging to "keep a close eye" on developments.[122] The same study is also being circulated by utility lobbyists, who have encouraged lawmakers like Representative Ed Whitfield to draft legislation seeking to block both the Transport Rule and the Utility MACT Rule; one lobbyist gave his political pitch as: "The notion that a very expensive rule is a great way to create jobs—give me that money and I will create far more jobs."[123] Proponents of the rules are just as quick to cite only the studies that most support their position.[124]

Case Study #3: Federal and State Climate Legislation

As passage of federal climate legislation seemingly grew more likely in 2009 and 2010 (before abruptly running off the rails in late 2010),[125] a myriad of reports on job impacts came out. Though none of the various legislative proposals became law, the range of job estimates still demonstrates the wildly

contradictory results that different models can generate when analyzing the same underlying policy. For example, for one legislative proposal—the American Clean Energy and Security Act (ACES, also known as the Waxman-Markey bill, which passed the House in 2009 but stalled out in the Senate)[126]—everything from a 3.6 million job loss to a 1.9 million job gain has been predicted.[127] These reports were frequently cited and debated at congressional hearings and were often featured in media reports on the fate of the climate legislation.[128] Perhaps unsurprisingly, each side of the debate tended to rely exclusively on the analyses that supported their positions.

A similar debate played out in California over the implementation of its climate law, A.B. 32. One team from the University of California-Berkeley used the same model to generate two different results, but both studies generally predicted job gains. The studies were "cited repeatedly" by opponents of the climate law, who backed a proposition seeking to suspend the law's implementation until unemployment dropped below 5.5%, and who used the Berkeley studies to claim that the climate legislation would hurt employment.[129] The studies' authors took to the local editorial pages to set the record straight: "They claim that our study says A.B. 32 will 'threaten' more than 3 million jobs in California, but the report says no such thing. In fact, it shows that A.B. 32 will generate enormous opportunities for California."[130]

The proposition to overturn A.B. 32 failed at the polls, but the debate continued over jobs and the state's efforts to curb greenhouse gas emissions. California's Air Resources Board predicted a 120,000 job gain by 2020, only to have their results called in to question by a report from the state's non-partisan Legislative Analysts Office—whose findings were in turn dismissed by Governor Schwarzenegger. In defense of the law, Schwarzenegger announced he was "absolutely convinced [A.B. 32] will create jobs more than kill jobs," explaining that "[u]nlike others that only have theoretical opinions, I travel up and down the state to see first-hand."[131]

Toward a More Productive Use of Employment Models in Environmental Policy Debates

Not all models are created equal, and the various models available can be used in more or less informative ways. To ensure that employment forecasting models play a productive role in policymaking, there are several steps that analysts can take, from model selection to results communication, that will help produce more reliable estimates and reduce the risks of confusion. Using the right models in the right ways to report appropriately limited results can help inform public debate and decisionmaking. But the wrong models, used to answer the wrong questions, reported without caveat, will only obscure the important tradeoffs at stake in environmental policymaking.

Ideally, analysts should simply choose the best tool for the question they are trying to answer, matching the type and scale of the policy under evaluation to the appropriate model as closely as possible.[132] For example, because CGE models are focused on large, economy-wide effects, they are well suited to analyze policies with national, annual impacts on the scale of $100 million or more. CGEs work especially well for policies that will lead to a change in taxes or in the use of technology (like adding new emissions controls to smokestacks).[133] By contrast, both the makers and users of fixed-price models caution that these tools are best suited to estimating regional impacts and have limited application to policies with large, widespread effects.[134]

Unfortunately, cost, time, and analytical skill are often the driving factors in model selection.[135] For example, CGE models are costly, either to purchase off the shelf or to build from scratch; they are also time-consuming to run and may require special training to adjust and interpret the model. Input-output models are therefore sometimes seen as the more affordable choice, even though they may be less robust.[136]

The choice of model, assumptions, and data is crucial.[137] For example, a 1996 study for the California Energy Commission looked at a hypothetical policy (a 40% cut in federal defense spending in the state) under three models that differed only in their treatment of which variables were explained by the model and which were treated as a given. Under the model variation that most operated like a classic CGE model, the study predicted no change in gross state product and little effect on wages; under the model that most operated like an input-output analysis, however, the study predicted a 9-12% drop in employment across all classes; and under the model most like an econometric forecasting approach, the study predicted a 2.4% employment gain in some sectors and a 6% decrease in others.[138] Clearly, model choice matters.

All models are subject to limitations, and it is extremely important to communicate those limitations to policymakers in a transparent fashion when reporting model results. Analysts should disclose all their assumptions and data sources, including a description of how realistic the assumptions are and how complete and accurate the data is. Reports should also include a sensitivity analysis, to identify how sensitive the results are to changes in the underlying assumptions and structure of the model. All final results should be accompanied by a clear indication of the limitations of the model, any weaknesses in the results, and any other relevant caveats. Policymakers should rely only on studies that meet these criteria, and even then should only do so after fully acknowledging all the studies' potential limitations. Modelers, politicians, and commentators should all avoid translating the complex model outputs into a single, often very misleading, sound bite about "jobs" that could be created or lost by a policy choice.

Unfortunately, the way employment models are cited in political debates about environmental regulations is often not particularly illuminating—each side simply picks the study that justifies the position it already supports. Though practical and political obstacles may get in the way, in theory this problem has a straightforward solution: choose the right model for the job; disclose the assumptions and limitations of the model selected; and acknowledge any reliable, conflicting estimates.

Particularly problematic has been the use of models best suited for understanding regional or sector-specific impacts to make predictions about the nationwide, aggregate effects of regulations on employment. These models are poorly suited to making these kinds of predictions, because they do not take into account the primary factors that drive national employment levels, like aggregate demand or wage price rigidity. When they attempt to extrapolate regional and sector-specific estimates to the economy as a whole, they run up against the reality that dynamic market forces interact in complex ways that make predictions of aggregate effects extremely difficult. It is unsurprising that employment models using different assumptions and methodologies can predict both job losses and new hiring: both effects may simultaneously be caused by an environmental policy. Yet so long as the environmental policy does not fundamentally alter labor supply or demand at the national level—which will rarely be the case—the net effects on employment are likely to largely cancel each other out, or to be corrected by monetary and fiscal policy. Unless employment models can take these factors into account, they will be ill suited to predicting economy-wide effects, and their use to estimate large-scale job losses or gains is inappropriate.

The employment models that currently exist can continue to play a useful role in examining environmental policy, primarily to estimate regional or sector-specific impacts on hiring and layoffs. This information can help to determine what policies, if any, are appropriate to facilitate labor market transitions (like helping workers move or retrain to prepare for a new job in a new region or sector) or to craft effective distributional policies. Labor transition costs can and should be incorporated into cost-benefit analysis using standard economic principles, and the relationship between economy-wide unemployment on those costs (both positive and negative) should be taken into account. But if used improperly, these models can easily lead to misunderstanding. In all cases, analysts have to be especially careful to acknowledge their model limitations, and policymakers and advocates should be sure to use their findings with caution and in a responsible manner.

Recommendations

Federal agencies are beginning to rethink the place of job effects in regulatory impact analysis, prompted by executive order, congressional pressure, public interest, and their own reevaluations. At the same time—and likely for at least as long as unemployment levels remain elevated—both the opponents and the proponents of environmental regulations will continue to commission and publicize studies estimating job losses or gains as part of their advocacy strategies. Job impact analysis can and should be used by policymakers and advocates when weighing the costs and benefits of a rule. But it should not serve as a trump card, and both policymakers and advocates must recognize that even the most sophisticated job impact analyses have only limited predictive power in our complex and dynamic economy.

If job impact analyses are to play a useful role in regulatory decisionmaking, then analysts, advocates, and policymakers should adhere to the following recommendations for best practices:

1. Job impact analysis is not an alternative to or substitute for cost-benefit analysis. Rather, employment effects should be incorporated into cost-benefit analysis on the basis of traditional economic principles. If a regulation causes labor transitions resulting in layoffs, any costs of relocation or retraining, long-term productivity effects, and negative health effects associated with unemployment should be calculated. Likewise, if labor transitions result in hiring, especially of underutilized workers, this should be factored into estimates of regulatory costs. Crucially, these employment-related costs and benefits will be just one input into the broader cost-benefit analysis, to be weighed against all traditional compliance costs and the full range of environmental, health, and safety benefits. Employment-related distributional effects may need to be analyzed separately along with other distributional effects.

2. The difference between short-term and long-term unemployment should be taken into account when determining the economic costs of layoffs. Short-term unemployment may entail relatively minor costs for job search, relocation, and retraining. Long-term unemployment, by contrast, may entail more substantive costs, such as more intense retraining, long-term income and productivity effects, and negative health consequences. Conflating these two distinct types of consequences in a job impact analysis leads to incorrect cost calculations and misleading rhetoric.

3. The potential for regulations to positively and negatively affect workers should be recognized. In our dynamic labor market, regulations may produce multiple effects simultaneously. Layoffs in one sector or region may be accompanied by hiring in another sector or region. Analysts, as well as advocates on both sides of the debate, should be careful to look at the whole picture and not cherry-pick data or results.

4. Economic models used to predict employment effects should be well suited to the type of regulatory effect being estimated. Some models are better suited to estimating effects in a single region or industry, while others can better handle multi-sector or nationwide analysis. While a model less suited to the regulatory effect in question may be appealing as a cheaper or less time-consuming option, analysts should strive to select the best tool for the task.

5. Uncertainty surrounding model predictions should be acknowledged by analysts and policymakers, and all assumptions and modeling choices should be disclosed. Far too often, data sources and model assumptions are buried in an economic report, or not disclosed at all. Sensitivity analyses are conducted and disclosed inconsistently at best. Advocates then tend to discuss only those studies that most support their positions, without reference to the study's limitations, uncertainty, or the existence of other reliable but contradictory results. For job impact analysis to play a useful role in policy debates, more transparency and disclosure is necessary.

One final recommendation should be directed to government officials and academic scholars: more research is needed to refine and improve the models for measuring employment effects, as well as to develop the techniques for incorporating those effects into cost-benefit analysis.

If employment analyses and policy debates remain on their current trajectories, job impact analyses will continue to conflate short-term and long-term unemployment, to ignore either a policy's positive or negative employment effects, to select the wrong model for the task, to report results without disclosure of assumptions or limitations, and to encourage the use of results as a trump card against cost-benefit analysis. If analysts and advocates cannot reverse course, then the use of job impact analyses will remain a misleading distraction—nothing more than a red herring. But by following the simple recommendations listed above, we can begin to put job impact analysis into its proper context in the debate over environmental protection and employment.

Notes

1 *See* Bureau of Labor Statistics, USDL-12-0402, News Release, *The Employment Situation—February 2012* (Mar. 9, 2012), *available at* http://www.bls.gov/news.release/pdf/empsit.pdf (last visited Mar. 9, 2012).

2 *See, e.g.*, Letter from Rep. David Stockman (1981), *cited in* Marissa Martino Golden, What Motivates Bureaucrats?: Politics and Administration During the Reagan Years 118 (2000) ("EPA and its minions in the press and the professional environmental lobbies have assumed an absolute monopoly right to flood the American economy with regulations, litigation, and compliance costs . . . [that] bleed American industry of scarce funds needed for investment, modernization, and job creation."). Stockman later went on to serve as director of the Office of Management and Budget under President Reagan.

3 The following hearings took place during roughly the first twenty legislative days in 2011:

- House Appropriations Comm., *Budget Hearing-Environmental Protection Agency* (March 3), http://appropriations.house.gov/Calendar/?EventTypeID=316 (last visited July 1, 2011).
- House Energy & Commerce Comm., *The Views of the Administration on Regulatory Reform* (January 26); *Energy Tax Prevention Act of 2011* (February 9); *Environmental Regulations, the Economy, and Jobs* (February 15); *Network Neutrality and Internet Regulations: Warranted or More Economic Harm than Good?* (February 16); *Impact of Medical Device Regulation on Jobs and Patients* (February 17); *EPA's Greenhouse Gas Regulations and Their Effect on American Jobs* (March 1), http://energycommerce.house.gov/hearings/default.aspx (last visited July 1, 2011).
- House Education & Workforce Comm., *State of the American Workforce* (January 26); *Impact of the Health Care Law on the Economy, Employers, and the Workforce* (February 9); *Investigating OSHA's Regulatory Agenda and Its Impact on Job Creation* (February 15), http://edworkforce.house.gov/Calendar/List.aspx?EventTypeID=189 (last visited July 1, 2011).
- House Financial Services Comm., *Promoting Economic Recovery and Job Creation: The Road Forward* (January 26), http://financialservices.house.gov/Calendar/?EventTypeID=309 (last visited July 1, 2011).
- House Judiciary Comm., *The REINS Act: Promoting Jobs and Expanding Freedom by Reducing Needless Regulations* (January 24); *Regulatory Flexibility Improvement Act of 2011—Unleashing Small Business to Create Jobs* (February 10); *The APA at 65—Is Reform Needed to Create Jobs, Promote Economic Growth, and Reduce Costs* (February 28), http://judiciary.house.gov/hearings/hearing112.html (last visited July 1, 2011).
- House Natural Resources Comm., *Impact of the Administration's Wild Lands Order on Jobs and Economic Growth* (March 1), http://naturalresources.house.gov/Calendar/List.aspx?EventTypeID=264 (last visited July 1, 2011).
- House Oversight & Government Reform Comm., *Regulatory Impediments to Job Creation* (February 10), http://oversight.house.gov/index.php?option=com_content&view=article&id=1089&Itemid=20 (last visited July 1, 2011).
- House Rules Comm., *H. Res. 72—Directing… committees to… review existing… regulations… particularly with respect to their effect on jobs and economic growth* (February 3), http://www.rules.house.gov/Legislation/Hearings.aspx (last visited July 1, 2011).
- House Small Business Comm., *Putting Americans Back to Work: The State of the Small Business Economy* (February 16), http://smallbusiness.house.gov/Calendar/List.aspx?EventTypeID=253 (last visited July 1, 2011).
- House Transportation Comm., *FY 2012 Budget and Priorities of the EPA: Impacts on Jobs, Liberty, and the Economy* (March 2), http://transportation.house.gov/hearings/ (last visited July 1, 2011).

- House Ways & Means Comm., *Health Care Law's Impact on Jobs, Employers, and the Economy* (January 26), http://waysandmeans.house.gov/Calendar/ (last visited July 1, 2011).

4 Results were calculated by a LexisNexis search of U.S. newspapers and wires. The search term "job-killing w/1 (regulation! or rule!)" was entered for each year, with a duplication filter eliminating highly-similar results. In 2007, the phrase appeared 4 times. In 2008, the count was at 17. By 2009, it had more than doubled, to 38. The frequency of use increased dramatically in 2010, to 206 times, and then again in 2011, to 706 times. As of March 8, 2012, the phrase has appeared 78 times already this year. *See also* Steven Pearlstein, *'Job-killing' regulation? 'Job-killing' spending? Let's kill this GOP canard*, Wash. Post, Jan. 6, 2011 (calculating that the more generic phrase "job-killing" appeared over 11,000 times in news articles from 2009-2010).

5 Rep. Fred Upton, *Declaring War on the Regulatory State*, Wash. Times, Oct. 18, 2010.

6 Rep. Fred Upton, Press Release, *Upton Comments on EPA Delay of Devastating Ozone Regulations*, Dec. 8, 2010.

7 Rep. Eric Cantor, Jobs Legislation Tracker, http://majorityleader.gov/jobstracker/ (last visited Mar. 9, 2012).

8 House Republican Conf., The House Republican Plan for America's Job Creators 1 (2011), *available at* http://www.gop.gov/resources/library/documents/jobs/theplan.pdf.

9 For example, the following bills were proposed during 2011 by the 112th Congress: H.R. 1 (a continuing appropriations resolution for FY2011, which passed the House in February, containing more than twenty riders restricting or prohibiting the use of funds to implement various regulatory activities under EPA's jurisdiction); H.R. 199, Protect America's Energy and Manufacturing Jobs Act of 2011 (proposing a two-year suspension of climate rules); H.R. 457, H.R. 517, H.R. 2018, & S. 272 (to modify EPA's authority under the Clean Water Act); H.R. 750 & S. 228, Defending America's Affordable Energy and Jobs Act (preempting any regulation to mitigate climate change); H.R. 872, Reducing Regulatory Burdens Act of 2011 (amending the Clean Water Act and FIFRA to alter EPA regulation of pesticide discharge into water); H.R. 910, Energy Tax Prevention Act (to prevent greenhouse gas regulations under the Clean Air Act); H.R. 960 & S. 468, Mining Jobs Protection Act (amending EPA's consultation procedure under the Clean Water Act); H.R. 1391, Recycling Coal Combustion Residuals Accessibility Act of 2011, & H.R. 1405 (prohibiting coal ash from being regulated under Subtitle C of RCRA); H.R. 2021, Jobs and Energy Permitting Act of 2011 (amending the Clean Air Act to change permitting of offshore sources); H.R. 2250 & S. 1392, EPA Regulatory Relief Act of 2011 (to delay the Boiler MACT rules); H.R. 2584 (an appropriations bill with various riders); H.R. 2681, Cement Sector Regulatory Relief Act (to delay the Cement MACT rules); H.R. 3400 & S. 1720, Jobs Through Growth Act (incorporating several of the above restrictions on EPA authority); and S.J. Res. 27 (a resolution to disapprove EPA's cross-state air pollution rule).

10 As just one example, when Senator Susan Collins drafted legislation to delay regulation of hazardous air pollution, she said, "To impose that kind of costs on manufacturing at a time when the economy is very fragile would cost us thousands of jobs." Jean Chemnick, *Sen. Collins to Offer Bill to Delay "Boiler MACT,"* E&E Daily, July 19, 2011. Many of the titles of the legislation listed *supra* note 9 explicitly try to convey a direct link between jobs and environmental regulation.

11 In January 2011, Representative Don Young proposed the Regulation Audit Revive Economy (RARE) Act of 2011, H.R. 213, seeking to create a two-year moratorium on rulemakings. Senator Ron Johnson introduced the Regulation Moratorium and Jobs Preservation Act of 2011, S. 1438, which would prevent agencies from taking any significant regulatory action until the national unemployment rate drops below 7.7%. Senator Warner has also started drafting a "regulatory paygo" bill, which would require that for every new regulation an agency wants to propose, it first must eliminate one existing regulation with similar economic impacts. Luke Burns, *PAYGO Proposed to Manage Agency Regulations*, RegBlog, May 5, 2011, http://www.law.upenn.edu/blogs/regblog/2011/05/paygo-proposed-to-manage-agency-regulations.html; Emily Yehle, *Democratic Senator Offers Sweeping Regulatory Reform Proposal*, E&E Daily, Feb. 16, 2012.

12 The following bills were proposed during 2011 by the 112th Congress: H.R. 1049, Regulatory Openness, Accountability, and Disclosure to Jobs Act of 2011 (requiring CEQ to report on the number of permits not issued because an environmental impact statement has not been completed, including the economic impact of not issuing those permits); H.R. 1705 & H.R. 2401, Transparency in Regulatory Analysis of Impacts on the Nation Act (TRAIN) of 2011 (requiring new impact analyses for about a dozen specifically listed EPA rules, focusing on cumulative costs and benefits, energy prices, and job impacts); H.R. 1872 & S. 1292, Employment Protection Act of 2011 (requiring EPA to consider the impact on employment levels and economic activity prior to issuing a regulation, policy statement, guidance, or other requirement; implementing any new or substantially altered program; or issuing or denying any clean water or other permit); H.R. 2204 & S. 1219, Employment Impact Act (requiring agencies to complete jobs impact statement); S. 609, Comprehensive Assessment of Regulations on the Economy Act of 2011 (directing the Department of Commerce to form a panel to review the cumulative energy and economic impacts of specific rules proposed or finalized by EPA or expected soon); and S. 1720, Jobs Through Growth Act (incorporating several of the above provisions).

13 The following bills were proposed during 2011 by the 112th Congress: S. 128, Small Business Paperwork Relief Act; S. 358, Regulatory Responsibility for our Economy Act of 2011 (codifying and modifying Executive Order 12,866); S. 474, Small Business Regulatory Freedom Act of 2011 (expanding the Regulatory Flexibility Act); S. 602, Clearing Unnecessary Regulatory Burdens (CURB) Act (largely codifying Executive Order 12,866); S. 817 (expanding the Unfunded Mandates Reform Act to cover independent agencies); S. 1030, Freedom from Restrictive Excessive Executive Demands and Onerous Mandates (FREEDOM) Act of 2011, (expanding the Regulatory Flexibility Act); S. 1189, Unfunded Mandates Accountability Act (requiring impact analyses for major rules); and S. 1606 & H.R. 3010, Regulatory Accountability Act of 2011 (codifying Executive Order 12,866, adding judicial review for cost-benefit analysis, and adding special hearings for "high-impact," billion-dollar rules).

14 For example, the following bills were proposed during 2011 by the 112th Congress: H.R. 10 & S. 299, Regulations from the Executive in Need of Scrutiny (REINS) Act (requiring congressional approval of all major rules); H.R. 214, Congressional Office of Regulatory Analysis Creation and Sunset and Review Act of 201 (creating a new congressional office to analyze and report on the costs and benefits of rules, as well as a new sunset review process for agencies to examine the ongoing necessity of their existing rules); and H. Res. 72 (requiring various congressional committees to review and report on all regulations, particularly with respect to their effects on jobs and economic growth).

15 *See* Mathew D. McCubbins, Roger G. Noll & Barry R. Weingast, *Administrative Procedures as Instruments of Political Control*, 3 J.L. Econ. & Org. 243 (1987).

16 *See*, Letter from Various Senators to Lisa Jackson, EPA Admin., Sept. 24, 2010, *available at* http://www.afandpa.org/Temp/Newsreleases/Senate_Boiler_MACT_Letter_to_EPA_with_signatures.pdf; Letter from Various Representatives to Lisa Jackson, EPA Admin., Aug. 2, 2010, *available at* http://www.washingtonpost.com/wp-srv/politics/documents/boilerletter.pdf. Rep. Upton in particular called the Boiler MACT Rule part of a "regulatory train wreck" that was stifling economy recovery. Gabriel Nelson, *How EPA's Regulatory Surge Missed a Primary Target*, Greenwire, Dec. 8, 2010.

17 *See* IHS & Council of Industrial Boiler Owners, *The Economic Impact of Proposed EPA Boiler/Process Heater MACT Rule* (2010), *available at* http://www.cibo.org/pubs/boilermact_jobsstudy.pdf; Fisher Int'l & American Forest & Paper Assoc., *Economic Impact of Pending Air Regulations on the U.S. Pulp and Paper Industry* (2011, updating an Aug. 2010 version), *available at* http://www.afandpa.org/Temp/Docs/FinalCumulativeAirBurdenEconomicImpactSummary.pdf. The Council of Industrial Boiler Owners won considerable press attention for its job impact estimate, and the American Forest and Paper Association met with the head of EPA's air office, Gina McCarthy, after issuing its own report. Gabriel Nelson, *18 Senate Dems Join GOP in Assault on EPA's Boiler Proposal*, Greenwire, Sept. 28, 2010; *see also* Olga Belogolova, *Clean Air or Jobs Debate Dominates House Hearing*, National Journal, Sept. 8, 2011 (noting citation to both studies in House hearing the rule). Those studies were also regularly cited by the Members of Congress opposing the rule. *E.g.*, Senator James Inhofe, EPA's Anti-Industrial Policy: Threatening Jobs and America's Manufacturing Base 4 (2010) (citing Council of Industrial Boiler Owner's study). Environmental groups have attacked these studies as being "fundamentally flawed." Natural Resources Defense Council, Press Release, *Economists Grade Reports*, Oct. 26, 2010 (citing evaluations by Jason F. Shogren and Charles D. Kolstad, giving these reports D's and F's). The limitations of such economic models are discussed, *infra* Part Two.

18 Notice of Reconsideration of Final Rule, National Emission Standards for Hazardous Air Pollutants, 76 Fed. Reg. 15,266, 15,266 (Mar. 21, 2011).

19 Delay of Effective Dates, Industrial, Commercial, and Institutional Boilers and Process Heaters and Commercial and Industrial Solid Waste Incineration Units, 76 Fed. Reg. 28,662, 28,662 (May 18, 2011); *see also* Gabriel Nelson, *EPA Sets New Schedule for Controversial Boiler Rule*, Greenwire, June 24, 2011.

20 Proposed Rule and Reconsideration of Final Rule, National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters, 76 Fed. Reg. 80,598 (Dec. 23, 2011).

21 Gabriel Nelson, *Ozone Decision Waits as Senators, Businesses Pressure EPA,* Greenwire, July 26, 2011. Senator Barrasso in particular has criticized the ozone proposal by claiming, "This administration ought to take this 9.2% unemployment a lot more seriously." Jean Chemnick, *Barrasso Calls EPA Ozone Rule "Most Expensive" in History*, E&E News PM, July 19, 2011.

22 The Manufacturers' Alliance released a report predicting millions of jobs lost by 2020. Donald A. Norman, MAPI & Manufacturers Alliance, ER-707, Economic Implications of EPA's Proposed Ozone Standards (2010). Subsequently, the *Wall Street Journal* published an opinion piece from the Business Roundtable, calling the ozone rule the "latest job killer." John Engler, Opinion, *The Latest Job Killer from the EPA*, Wall Street Journal, July 26, 2011; *see also* Gabriel Nelson, *Businesses Groups Decry "Job-Killing" Smog Crackdown*, Greenwire, July 19, 2011. Environmental groups have attacked this study as "fundamentally flawed." Natural Resources Defense Council, Press Release, *Economists Grade Reports*, Oct. 26, 2010 (citing an evaluation by Richard B. Howarth, giving the report a "incomplete" grade). The limitations of such economic models are discussed, *infra* Part Two.

23 Letter from Cass Sunstein, OIRA Admin., to Lisa Jackson, EPA Admin., Sept. 2, 2011, *available at* http://content.govdelivery.com/attachments/USEOPWHPO/2011/09/02/file_attachments/56091/Letter.pdf.

24 Elana Schor, *Obama's Denial Opens New Chapter in Keystone XL Drama*, Greenwire, Jan. 19, 2012 (quoting a State Department report).

25 *Id.*; Christa Marshall, *State Department Retracts Job Number Figure for Keystone XL*, ClimateWire, Jan. 27, 2012.

26 Elana Schor, *Obama Rejects Pipeline, Blames Republicans*, E&E PM, Jan. 18, 2012.

27 Christa Marshall, *Keystone XL Supporters Are Inflating Job Numbers -- report*, ClimateWire, Sept. 29, 2011.

28 President Barack Obama, Remarks on Clean Energy Jobs, Mar. 5, 2010, http://www.whitehouse.gov/the-press-office/remarks-president-clean-energy-jobs.

29 *E.g.*, Michael Burnham, *Obama Admin. Announces $500M Grants for "Green" Jobs*, Greenwire, June, 25, 2009.

30 *See* EPA, News Release, *Obama Announces Steps to Boost Biofuels, Clean Coal*, Feb. 3, 2010, http://yosemite.epa.gov/opa/admpress.nsf/0/3a91d20f44b4b2d2852576bf00711782?OpenDocument.

31 Robin Bravender, *EPA Sets Stage for Regulation of Greenhouse Gases*, Greenwire, Apr. 17, 2009.

32 Katherine Boyle, *EPW Panel Reveals New Subcommittee Members, Outlines Priorities*, E&E Daily, Feb. 13, 2009; U.S. Senate Comm. on Env't & Pub. Works, Subcommittees, http://epw.senate.gov/public/index.cfm?FuseAction=Subcommittees.Subcommittees (last visited Mar. 1, 2012).

33 *See* Gabriel Nelson, *With Toxics Rule Expected, EPW Panel to Probe Clean Air Act's Job Effects*, E&E Daily, Mar. 14, 2011 (quoting Sen. Tom Carper); Sen. Tom Carper, Press Release, *Sen. Carper Reacts to "New Jobs-Cleaner Air: Employment Effects under Planned Changes to EPA's Air Pollution Rules" Report*, Feb. 8, 2011 (reacting to job impact report released by Ceres).

34 See case studies *infra* Part Two.

35 Elana Schor, *Major Electronics Companies Back E-Waste Bill*, E&E Daily, Oct. 10, 2010 (quoting Rep. Gene Green, "It's a green jobs bill.").

36 H.R. 851, 112th Cong., Clean Energy Jobs Act (2011).

37 For example, Rep. Marsha Blackburn of Tennessee said that new regulations from EPA and other agencies were "killing the growth of jobs. The [new unemployment] figures this morning attest to that." Gabriel Nelson, *GOP Hammers Jobs Numbers as Sunstein Defends Red Tape Review*, E&E News PM, June 3, 2011.

38 *See* Natural Resources Defense Council, Press Release, *Clean-Energy Investment Provides Economic Boost, More Jobs, and Expanded Opportunities*, June 18, 2009, http://www.nrdc.org/media/2009/090618.asp (linking climate legislation with clean energy investment and a "significantly lower national unemployment rate").

39 Bureau of Labor Statistics, U.S. Dept. of Labor, How the Government Measures Unemployment (2009), *available at* http://www.bls.gov/cps/cps_htgm.pdf; *see also* N. Gregory Mankiw, Principles of Economics 614-15 (2008, 5th ed.).

40 *See* Bureau of Labor Statistics, Household Data Annual Averages: Employment Status of the Civilian Noninstitutional Population, 1940 to Date (2012), *available at* http://www.bls.gov/cps/cpsaat01.pdf.

41 *See* Bureau of Labor Statistics, News Release, USDL-11-1304, *Job Openings and Labor Turnover—July 2011*, Sept. 7, 2011, http://www.bls.gov/news.release/archives/jolts_09072011.pdf (noting 3.2 million job openings in July 2011, even as unemployment stayed above 9% that month); Mankiw, *supra* note 39, at 620-24; Daron Acemoglu & Robert Shimer, *Efficient Unemployment Insurance* at 4 (NBER Working Paper 6686, 1998) ("Standard matching frictions ensure that within an individual labor market, unemployment and vacancies coexist.").

42 *See* Steven E. Haugen, Bureau of Labor Statistics, Measures of Labor Underutilization from the Current Population Survey (BLS Working Paper 424, Mar. 2009), http://www.bls.gov/osmr/pdf/ec090020.pdf.

43 Mankiw, *supra* note 39, at 623-24; Don Bellante & Mark Jackson, Labor Economics: Choice in Labor

Markets (1979); Robert E. Hall, *Why is the Unemployment Rate So High at Full Employment?*, 1 Brookings Papers on Economic Activity 369, 388 (1970) ("Economists have generally recognized that a certain amount of unemployment will always arise in the normal operation of a labor market.").

44 Traditionally, both minimum wage legislation and collective bargaining have been understood to contribute to unemployment, by setting wage rates above the market equilibrium level. When individuals are willing to remain in the labor force to gain access to jobs with above-market wages, rather than accepting lower paid jobs or exiting the labor force, the excess supply of labor contributes to unemployment. However, even in the absence of interventions, employers may set wages above the equilibrium level. Companies may hope to increase labor productivity by increasing the wage rate above the equilibrium level. Above-market wages may raise labor productivity by reducing the probability that employees shirk their duties, because they fear being laid off and losing the higher wage. Employees may have an incentive to work harder, as a means of cooperating with the employer in return for treating them fairly. To the extent that increased revenues from this additional labor productivity exceed the costs of higher wages, it is in the best interests of a profit-maximizing firm to pay such above-market wages, even though they contribute to unemployment. *See* Lloyd G. Reynolds, Stanley H. Masters & Colletta H. Moser, Labor Economics and Labor Relations (1998).

45 If technological change results in the mechanization of work, then labor demand can decrease. *See id.*; Edward E. Leamer, *Wage Inequality from International Competition and Technological Change: Theory and Country Experience*, 86 Am. Econ. Rev. 309 (1996); National Research Council Center for Education, Research on Future Skill Demands: A Workshop Summary at Chapter Two: Labor Market Trends: A Loss of Middle-Class Jobs? (2008), *available at* http://www.ncbi.nlm.nih.gov/books/NBK4064 (last visited Sept. 1, 2011) (reporting David Autor's findings that "[c]ompared with 1960, jobs requiring high levels of abstract tasks have increased, jobs compromised mostly of routine tasks have decreased, and jobs including many manual tasks initially decreased but then leveled off"). On the other hand, if technological change increases marginal productivity per hour worked, demand for labor may increase as a result. The advent of new technology might replace certain mid-level positions, but it also might increase productivity at the higher and lower ends of the labor market. *See id.*; David Autor, *Technological Change and Job Polarization: Implications for Skill Demand and Wage Inequality* (presented at the Nat'l Acad. Workshop on Research Evidence Related to Future Skill Demands, 2007), http://www7.nationalacademies.org/cfe/Future_Skill_Demands_Presentations.html.

46 If the productivity of certain industries is higher in foreign countries and relative wages in the United States do not adjust to offset these differences in productivity, then the price of imports (for those industry) will be lower than the price of domestic output. In the absence of import restrictions, demand for the cheaper imports will rise, the domestic products will lose market share, output by domestic industry will fall, and this will result in less labor demand in that industry. Consider the textiles, apparel, and shoe industries, which employ low-skilled individuals, but must pay higher wages in the United States than overseas. Foreign competition in the textiles, apparel, and shoe industries has driven down demand for labor in these industries in the United States. *See* Timothy J. Minchin, *The Decline of the U.S. Textile Industry*, 50 Labor History 287 (2009); Cynthia D. Anderson et al., *Globalization and Uncertainty: The Restructuring of Southern Textiles*, 48 Social Problems 478 (2001); *see also* Council on Foreign Relations, Independent Task Force Report No. 67, U.S. Trade and Investment Policy 22 (2011).

47 *See* Christina D. Romer, *Jobless Rate is Not the New Normal*, N.Y. Times, Apr. 9, 2011; Christina D. Romer, Speech at Washington University, *The Continuing Unemployment Crisis: Causes, Cures, and Questions for Further Study*, Apr. 12, 2011, http://elsa.berkeley.edu/~cromer/Washington%20University%20final.pdf; Lawrence F. Katz, *Long-Term Unemployment in the Great Recession*, Testimony for the Joint Economic Comm. of the U.S. Congress, *Hearing on Long-Term Unemployment: Causes, Consequences, and Solutions* (Apr. 29, 2010), *available at* http://www.economics.harvard.edu/faculty/katz/files/jec_testimony_katz_042910.pdf; Paul Krugman, *Degrees and Dollars*, N.Y. Times, Mar. 6, 2011; Robert B. Reich, *How to End the Great Recession*, N.Y. Times, Sept. 2, 2010; Serge L. Wind, *Unemployment: Structural vs. Cyclical—and Globalization's Adverse Impact* (Working Paper, May 9, 2011), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1838365.

48 *See* Reynolds, Masters & Moser, *supra* note 44.

49 Etienne Wasmer & Yves Zenou, *Equilibrium Search Unemployment with Explicit Spatial Frictions*, 13 Labor Econ. 143 (2006); Yves Zenou, *Urban Search Models under High-Relocation Costs: Theory and Application to Spatial Mismatch*, 16 Labor Econ. 534 (2009).

50 Reynolds, Masters & Moser, *supra* note 44.

51 Zenou, *Urban Search Models under High-Relocation Costs*, *supra* note 49.

52 To read further on unemployment and the costs of relocation, see Lawrence A. Leger & James D. Gaisford, *Imperfect Intersectoral Labor Mobility and Welfare in International Trade*, 15 J. Econ. Surveys 463 (2001); Jos Van Ommeren & Piet Ri-

etveld, *Commuting and Reimbursement of Residential Relocation Costs*, 41 J. Transport Econ. & Pol'y 51 (2007); Wasmer & Zenou, *Equilibrium Search Unemployment with Explicit Spatial Frictions*, *supra* note 49; Zenou, *Urban Search Models under High-Relocation Costs*, *supra* note 49.

53 Zenou, *Urban Search Models under High-Relocation Costs*, *supra* note 49.

54 Reynolds, Masters & Moser, *supra* note 44.

55 *Id.*

56 *See* Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone, 76 Fed. Reg. 48,208, 48,318 (Aug. 8, 2011).

57 *See* Louis Jacobson, Robert LaLonde & Daniel Sullivan, *The Costs of Worker Dislocation* (W.E. Upjohn Institute for Employment Research, 1993); Louis Jacobson, Robert LaLonde & Daniel Sullivan, *Earnings Losses of Displaced Workers*, 83 Am. Econ. Rev. 685 (1993).

58 Tom Krebs, *Job Displacement and the Cost of Business Cycles*, 97 Am. Econ. Rev. 664 (2007).

59 *Id.*

60 See *id.* for a review of the empirical literature on the long-term income and welfare effects of job loss. According to empirical studies, the long-term earnings losses for high-tenure workers may be as much as 25 percent of earnings prior to job loss, while the earnings losses for low-tenure workers average 10 percent of earnings prior to job loss. Those studies that do not separate out low- and high-tenure workers find that the average earnings losses are 13 percent of earnings prior to job loss. These negative income shocks are higher when the economy is in a recession.

Further research has shown that the income effects of job loss are higher in depressed geographic areas, in which there are few employment alternatives. *See* Jacobson, LaLonde & Sullivan, *The Costs of Worker Dislocation*, *supra* note 57; Jacobson, LaLonde & Sullivan, *Earnings Losses of Displaced Workers*, *supra* note 57.

A 1989 study of job loss costs found that the median reemployed worker (who was previously employed for at least three years and was laid off because of slack work, elimination of the job, or plant closure) likely experienced a 5 to 15 percent decrease in earnings. See Daniel S. Hamermesh, *What Do We Know About Worker Displacement in the U.S.?*, 28 Industrial Relations 51 (1989).

Interestingly, an Austrian study has shown that while the reduction in employment rates for blue-collar workers immediately following job loss is higher than for white-collar workers, employment rates for laid-off blue-collar workers increase much faster. Within six years the employment rate for these laid-off workers was only slightly lower than for blue-collar workers who were not laid off. Earnings losses are also higher for white-collar workers than for blue-collar workers in both the short and the long run. *See* Guido Schwerdt et al., *Does the Color of the Collar Matter? Employment and Earnings After Plant Closure*, 108 Econ. Letters 137 (2010).

61 Daniel Sullivan & Till von Wachter, *Mortality, Mass-Layoffs, and Career Outcomes: An Analysis Using Administrative Data* (National Bureau of Economic Research Working Paper 13,626, 2007).

62 For the currently operational executive orders, *see* Exec. Order 12,866, 58 Fed. Reg. 51,735 (Sept. 30, 1993); Exec. Order 13,563, 76 Fed. Reg. 3,821 (Jan. 21, 2011).

63 EPA, Fact Sheets on Final Air Toxics Standards for Industrial, Commercial, and Institutional Boilers at Major and Area Source Facilities (2011), http://www.epa.gov/ttn/atw/boiler/major_final_fs.pdf and http://www.epa.gov/ttn/atw/boiler/area_final_fs.pdf.

Sources for Figure 2: EPA, Regulatory Impact Analysis of the Proposed Toxics Rule: Final Report (2011), http://www.epa.gov/ttn/atw/utility/ria_toxics_rule.pdf [hereinafter "Final Utility MACT RIA"]; Office of Air and Radiation, EPA, Regulatory Impact Analysis for the Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone in 27 States (2011) [hereinafter "Final Transport RIA"]; Fact Sheets on Final Air Toxics Standards for Industrial, Commercial, and Institutional Boilers, *supra* note 63; Office of Information & Regulatory Affairs, 2011 Report to Congress on the Benefits and Costs of Federal Regulations and Unfunded Mandates, at 13 (2011); Office of Air and Radiation, EPA, The Benefits and Costs of the Clean Air Act from 1990 to 2020, tbl. on Estimated Monetized Benefits and Costs of the 1990 Clean Air Act Amendments (2011).

64 National Emissions Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters: Final Rule, 76 Fed. Reg. 15,608, 15,655, 15,658, 15,659, 15,662 (Mar. 21, 2011).

65 *See* Exec. Order 12,866 §§ 3(f)(1), 6(a)(3)(C), 58 Fed. Reg. 51,735 (Sept. 30, 1993) (noting that an adverse impact on jobs makes a rule "significant," and requiring an assessment of adverse effects on employment); Exec. Order 13,563 § 1, 76 Fed. Reg. 3,821 (Jan. 21, 2011) (calling for the regulatory system to protect job creation).

66 Final Transport RIA, *supra* note 63, at 286 ("such an analysis is of particular concern in the current economic climate").

67 *Id.*; Final Utility MACT RIA, *supra* note 63.

68 *See* David M. Driesen, *Two Cheers for Feasible Regulation*, 35 Harvard Envtl. L. Rev. 313, 331 (2011); David M. Driesen, *Distributing the Costs of Environmental, Health, and Safety Protection: The Feasibility Principle, Cost-Benefit Analysis, and Regulatory Reform*, 32 B.C. Envtl. Affairs L. Rev. 1 (2005).

69 *See* Jonathan S. Masur & Eric A. Posner, *Against Feasibility Analysis*, 77 U. Chi. L. Rev. 657 (2010).

70 *See* Jonathan S. Masur & Eric A. Posner, *Regulation, Unemployment, and Cost-Benefit Analysis* (U. of Chi. Law School, John M. Olin Law & Economics Working Paper No. 571, 2011); Final Transport RIA, *supra* note 63, at 286 ("a standalone analysis of employment impacts is not included in a standard cost-benefit analysis").

71 Nat'l Ctr. for Envtl. Econ., EPA, Guidelines for Preparing Economic Analysis at 8-6 to 8-7, 9-8 (2010).

72 *See generally* Masur & Posner, *Regulation, Unemployment, and Cost-Benefit Analysis*, *supra* note 70; Robert H. Haveman & Scott Farrow, *Labor Expenditures and Benefit-Cost Accounting in Times of Unemployment*, J. Benefit-Cost Analysis, vol. 2, iss. 2 (2011).

73 *See generally* Masur & Posner, *Regulation, Unemployment, and Cost-Benefit Analysis*, *supra* note 70; *see also supra* Part I(B).

74 Redistribution through regulatory policy can distort labor-leisure tradeoffs in the economy (similar to the income tax) and also reduces efficiency in the regulated market. *See* Louis Kaplow & Steven Shavell, *Why the Legal System is Less Efficient than the Income Tax in Redistributing Income*, 23 J. Legal Stud. 667 (1994).

75 *See* Richard Revesz & Allison Kong, *Regulatory Change and Optimal Transition Relief*, 105 Nw. U. L. Rev. 1581 (2011).

76 *See, e.g.*, Inimai Chettiar & Jason Schwartz, *The Road Ahead: EPA's Options and Obligations for Regulating Greenhouse Gases* 61-64 (Policy Integrity Report No. 3, 2009) (discussing the efficiency, workability, and fairness of cap-and-trade systems and citing the relevant economic literature).

77 *See* Martin Ross et al., *Assessing the Economy-Wide Effects of the PSA Program*, in EcoMarkets: Costa Rica's Experience with Payments for Environmental Services 2 (Gunars Platais & Stefano Pagiola, eds., World Bank Report, 2007); Peter Berck & Sandra Hoffman, *Assessing the Employment Impacts of Environmental and Natural Resource Policy*, 22 Env't & Res. Econ. 133, 136 (2002).

78 A second step can be added to compensate, by calculating the increased output and related job gains in the sector that supplies products for regulatory compliance. But even this more advanced analysis cannot fully reflect the possibility that consumers may find substitute products.

79 Berck & Hoffman, *supra* note 77, at 136.

80 Air Economics Group, EPA, Alternative Approaches for Economic Impact Analysis, http://www.epa.gov/ttnecas1/econdata/Rmanual2/5.1.html (last visited Mar. 1, 2012).

81 Jehan Arulpragasam & Patrick Conway, *Partial Equilibrium Multi-Market Analysis*, *in* Tool Kit for Evaluating the Poverty and Distributional Impact of Economic Policies at 12-2 (World Bank, 2003); *see also* Berck & Hoffman, *supra* note 77, at 136-37.

82 Berck & Hoffman, *supra* note 77, at 137.

83 *Id.* at 140.

84 *See* Harry W. Richardson, *Input-Output and Economic Base Multipliers: Looking Backward and Forward*, 25 J. Regional Sci. 607 (1985).

85 Social accounting matrix (SAM) multiplier analysis builds off of I-O tables by including more detailed disaggregation of households (by income or demographics) and institutions (like level of government). SAM models also tend to treat more terms as endogenous than I-O models do (endogenous variables are the interconnected values that the model is trying to estimate; exogenous variable are independent terms that the model takes as a given). As a result "there is more money circulating in a SAM model of a region's economy than in an I-O model . . . [and] SAM [employment] multipliers tend to be slightly larger than I-O multipliers." Berck & Hoffman, *supra* note 77, at 138, 143. This distinction shows how sensitive employment estimates are to model assumptions like the endogeneity of variables.

86 *Id.* at 144-45.

87 MIG, Inc., About Us, http://implan.com/V4/index.php (last visited Sept. 1, 2011). IMPLAN originally built off resources from USDA Forest Service and FEMA, *id.*, and now uses data from the U.S. Bureaus of Labor Statistics and Economic Analysis. Jonathan Q. Morgan, *Analyzing the Costs and Benefits of Economic Development Projects*, UNC School of Government Community & Economic Development Bulletin No. 7, p.4 (2010).

88 U.S. Bureau of Economic Analysis, Regional Multipliers from the Regional Input-Output Modeling System (RIMS-II): A Brief Description, http://www.bea.gov/regional/rims/brfdesc.cfm (last visited Sept. 1, 2011).

89 *Id.*

90 Morgan, *supra* note 87, at 5.

91 Berck & Hoffman, *supra* note 77, at 145.

92 Xie and Saltzman describe four major features of a typical CGE model: (1) prices are endogenous to the model and determined by the market; (2) supply and demand for goods or production factors are determined by adjusting prices based on Walrasian general equilibrium theory; (3) supply and demand functions are derived from profit/utility maximizing producers/consumers; and (4) the model is multi-sectorial and non-linear, containing resource constraints. J. Xie & S. Saltzman, *Environmental Policy Analysis: An Environmental Computable General Equilibrium Approach for Developing Countries*, 22 J. Pol'y Modelling 453 (2000).

93 Berck & Hoffman, *supra* note 77, at 146. Some CGEs would follow perfect neoclassical assumptions and predict no aggregate employment changes: under the neoclassical assumption of no barriers to labor movement, wages, demand, and supply will all adjust to each other, and any workers laid off will be quickly hired in other jobs. But migration and labor force participation equations can be added to the model, thereby generating employment change estimates based on wage impacts. *Id.* at 135.

94 *See* Ricardo Teixeira & Tiago Domingos, *Computable General Equilibrium Models and the Environment: Framework and Application to Agricultural Policies* 2 (AERNA Conference Paper, 2006), *available at* http://aerna2006.de.iscte.pt/papers/S4C_Teixeira.pdf.

95 REMI.com says the model "can be variously referred to as an econometric model, an input-output model, or even a computable general equilibrium model." REMI, Overview, http://www.remi.com/the-remi-model/overview (last visited Mar. 9, 2012).

96 IHS Global Insight, http://www.ihs.com/products/global-insight/index.aspx (last visited Mar. 9, 2012); *see* Dept. of Transportation, *Guide to Quantifying the Economic Impacts of Federal Investment in Large-Scale Freight Transportation Projects* (2006), *available at* http://www.dot.gov/freight/guide061018/sect06.htm (discussing the more well-known CGE models used in the United States).

97 The underlying database for the model includes tables of transaction values (in the form of an input-output table or a social accounting matrix) and elasticities that capture how changes in economic conditions change behavior (e.g., substitution between inputs to production and income-based changes to demand).

98 *See* Frank Ackerman et al., *The Limits of Economic Modeling in the FTAA Environmental Review* 5-6 (Tufts University Globalization and Sustainable Development Program Background Paper, 2001), *available at* http://ase.tufts.edu/gdae/policy_research/USTRComments&Summary.pdf.

99 Berck & Hoffman, *supra* note 77, at 146.

100 *See* Lars Bergman & Magnus Henrekson, *CGE Modeling of Environmental Policy and Resource Management*, *in* Handbook of Environmental Economics (Karl-Goran Maler & Jeffrey Vincent eds., 2005).

101 For an overview of the evolution of CGE models and criticisms of these models, *see* Jayatilleke S. Bandara, *Computable General Equilibrium Models for Development Policy Analysis in LDCs*, 5 J. Econ. Surveys 3 (1991); *see also id.* at 31 ("The values of major parameters in many CGE models are little more than best guesses.").

102 For this reason, sensitivity analysis is especially important for CGE models. *See* Teixeira & Domingos, *supra* note 94, at 3 (listing sensitivity analysis as the last required step in the process of using a CGE model); Arvind Panagariya & Rupa Duttagupta, *The 'Gains' from Preferential Trade Liberalization in the CGE Model: Where Do They Come From?* 3 (Working Paper, 2001), http://www.columbia.edu/~ap2231/technical%20papers/cge-critique.pdf (noting that in the context of trade liberalization, "Unearthing the features of CGE models that drive [their results] is often a time-consuming exercise. This is because their sheer size, facilitated by recent advances in computer technology, makes it difficult to pinpoint the precise source of a particular result. They often remain a black box. Indeed, frequently, authors are themselves unable to explain their results intuitively and, when pressed, resort to uninformative answers."); C. Böhringer, T. Rutherford & W. Wiegard, *Computable General Equilibrium Analysis: Opening a Black Box* (Centre for European Economic Research Discussion Paper No. 03-56, 2003).

103 Ian Sue Wang, *Computable General Equilibrium Models and Their Uses in Economy-Wide Policy Analysis: Everything You Ever Wanted to Know (But Were Afraid to Ask)* 3 (MIT Joint Program on the Science and Policy of Global Change Technical Note 6, 2004).

104 Berck & Hoffman, *supra* note 77, at 146, 154.

105 Nobuhiro Hosoe, Kenji Gasawa & Hideo Hashimoto, Textbook of Computable General Equilibrium Modelling: Programming and Simulations (2010).

106 *See* Sergey Paltsev, *Moving from Static to Dynamic General Equilibrium Economic Models* 14 (MIT Science and Policy of Global Change, Technical Note No. 4, 2004) ("We cannot solve numerically for an infinite number of periods.").

107 *See* Jorgen Dejgard Jensen et al., *A Regional Econometric Sector Model for Danish Agriculture* 23 (Statens Jordbrugs-og Fiskeriokonomiske Institut, Report No. 129, 2001) ("[T]he model can only be validated within the data intervals spanned by the historical observations. Thus, applying an econometric model for analysing changes beyond historical variations is always problematic. Another limitation to the econometric approach is that econometric estimation is restricted by the amount of available data.").

108 For an overview of the potential limitations of forecasting models, see Christopher A. Sims, *Are Forecasting Models Usable for Policy Analysis*, Federal Reserve Bank of Minneapolis Quarterly Review 2 (1986); Christopher A. Sims, Stephen M. Goldfeld & Jeffrey D. Sachs, *Policy Analysis with Econometric Models*, 1982 Brookings Papers on Economic Activity 107 (1982); *see also* Dan Rickman, *Modern Macroeconomics and Regional Economic Modeling*, 50 J. Regional Sci. 23 (2010), http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9787.2009.00647.x/pdf; David F. Hendry & Neil R. Ericsson, Understanding Economic Forecasts (2001).

109 Berck & Hoffman, *supra* note 77, at 150.

110 Sources for Figure 3:

- Case Study #1 (Renewable Electricity Standard):MGMT. Info. Serv. & Am. Solar Energy Society, Defining, Estimating, and Forecasting the Renewable Energy and Energy Efficiency Industries in the U.S. and in Colorado (2008); Roger H. Bezdek, MGMT. Info. Serv. & Am. Solar Energy Society, Green Collar Jobs in the U.S. and Colorado (2009), *available at* http://www.misi-net.com/publications/ASES-JobsRpt09.pdf; Robert Pollin et al., Pol. Econ. Res. Inst. & Ctr. for Am. Progress, The Economic Benefits of Investing in Clean Energy (2009); Union of Concerned Scientists, Green Jobs: A National Renewable Electricity Standard Will Boost the Economy and Protect the Environment (2009); David W. Kreutzer et al., Heritage Ctr. for Data Analysis, A Renewable Electricity Standard: What It Will Really Cost Americans (2010); Burton C. English et al., Bio-Based Energy Analysis Group at Univ. of Tenn. & 25x25 Alliance, Implications of Energy and Carbon Policies for the Agriculture and Forestry Sectors (2010); and Navigant Consulting, Jobs Impact of a National Renewable Electricity Standard (2010).

- Case Study #2 (Transport Rule and Utility MACT Rule): Final Transport RIA, *supra* note 63; Utility Mact

RIA, *supra* note 63; Charles J. Cicchetti, Navigant Consulting Inc. & Clean Air Council, Why EPA's Mercury and Air Toxics Rule is Good for the Economy and America's Workforce (2011); Josh Bivens, Econ. Policy Inst., A Lifesaver, Not a Job Killer: EPA's Proposed "Air Toxics Rule" Is No Threat to Job Growth (EPI Briefing Paper No. 312, 2011); James Heintz et al., Pol. Econ. Res. Inst. & Ceres, New Jobs—Cleaner Air: Employment Effects under Planned Changes to the EPA's Air Pollution Rules (2011); and NERA Econ. Consulting & Am. Coalition for Clean Coal Electricity, Proposed CATR + MACT (2011).

- Case Study #3 (Federal and State Climate Legislation): William W. Beach et al., Heritage Ctr. for Data Analysis, The Economic Costs of the Lieberman-Warner Climate Change Legislation (2008);David W. Kreutzer et al., Heritage Ctr. for Data Analysis, The Economic Consequences of Waxman-Markey (2009); Warwick J. McKibbin et al., Brookings Inst., Consequences of Alternative U.S. Cap-and-Trade Policies (2009); David Montgomery et al., CRA Intl. & Nat'l Black Chamber of Commerce, Impact on the Economy of the American Clean Energy and Security Act of 2009 (2009); David Montgomery et al., CRA Intl. & Coal. for Affordable American Energy, Impact on the Economy of the Climate Provisions in the Obama Administration's FY 2010 Budget Proposal (2009); David Roland-Holst & Fredrich Kahrl, Clean Energy and Climate Policy for U.S. Growth and Job Creation (2009); David Roland-Holst & Fredrich Kahrl, The Florida Economy and a Federal Carbon Cap (2009); Michelle Michot Foss & Gurcan Gulen, Ctr. for Energy Econ. at Univ. of Texas-Austin, The Proposed American Clean Energy and Security Act of 2009: Considerations for the Texas Economy (2009); Sci. Applications Intl. Corp., Analysis of the Waxman-Markey Bill Using the National Energy Modeling System (2009); U.S. Energy Info. Admin., Energy Market and Economic Impacts of the American Power Act of 2010 (2010); Apollo Alliance & Good jobs First, Winning the Race: How American Can Lead the Global Clean Energy Economy (2010); James K. Boyce & Matthew E. Riddle, Pol. Econ. Res. Inst., Clear Economics: State-Level Impacts of the Carbon Limits and Energy for America's Renewal Act on Family Incomes and Jobs (2011); David Roland-Holst, *Energy Prices and California's Economic Security* (UC-Berkeley Research Paper No. 0910071, 2009); and David Roland-Holst & Fredrich Kahrl, *Energy Pathways for the California Economy* (UC-Berkeley Research Paper No. 0903241, 2009).

111 *See* Union of Concerned Scientists, National Renewable Electricity Standard Campaign, http://www.ucsusa.org/clean_energy/solutions/renewable_energy_solutions/national-renewable-electricity-campaign.html (last visited Sept. 1, 2011); Ctr. for Climate & Energy Solutions, Clean Energy Standards, http://www.c2es.org/federal/policy-solutions/clean-energy-standards (last visited Mar. 8, 2012).

112 President Barack Obama, 2011 State of the Union (2011), *available at* http://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address.

113 Republican Staff Commentary, U.S. Congress Joint Economic Committee, *Regulating Greenhouse Gas Emissions: Small and Uncertain Benefits at Large Economic Costs* 2 (2011), *available at* http://jec.senate.gov/republicans/public/?a=Files.Serve&File_id=e1359335-536e-4c6d-95c5-44d4f09f34c2.

114 *Job Creation and Carbon Dioxide Regulation, Hearing Before the U.S. House of Representatives Subcommittee on Regulatory Affairs, Stimulus Oversight, and Government Spending* (testimony of David Kreutzer, Research Fellow, Heritage Foundation) (2011), *available at* http://www.heritage.org/research/testimony/2011/04/job-creation-and-carbon-dioxide-regulation#_ftnref5.

115 Office of Senator Harry Reid, Job Growth from Investment in Renewable Energy: An Overview (2011), *available at* http://reid.senate.gov/issues/upload/Energy-RnwblEnergyJobGrwth.pdf.

116 *See generally* EPA, Regulatory Actions: Air Transport, http://www.epa.gov/airtransport/actions.html; Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals; Final Rule, 76 Fed. Reg. 48,208 (Aug. 8, 2011) (to be codified at 40 C.F.R. pts. 51, 52, 72, 78, and 97).

117 National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards for Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units; Proposed Rule, 76 Fed. Reg. 24,976 (proposed May 3, 2011) (to be codified at 40 C.F.R. pts. 60 and 63).

118 EPA, Cross-State Air Pollution Rule, http://www.epa.gov/airtransport/ (last visited Sept. 8, 2011) (giving annual costs and benefits in 2014); EPA, Fact Sheet: Proposed Mercury and Air Toxics Standards (2011), *available at* http://www.epa.gov/mats/pdfs/proposalfactsheet.pdf (giving annual costs and benefits in 2016).

119 Final Transport RIA, *supra* note 63 (describing a net increase of about 2,230 job-years in environmental protection employment in 2014, as well as about 700 job-years gained each year in the utility sector). EPA's employment analysis has been criticized by Masur & Posner, *supra* note 70.

120 Utility MACT RIA, *supra* note 63, (reporting the central estimate).

121 *See supra* Fig. 3; James Heintz et al., Pol. Econ. Res. Inst. & Ceres, New Jobs—Cleaner Air: Employment Effects under Planned Changes to the EPA's Air Pollution Rules (2011); NERA Econ. Consulting & Am. Coalition for Clean Coal Electricity, Proposed CATR + MACT (2011).

122 Senator James Inhofe, Press Release, *Obama EPA's Transport Rule Latest Impediment to Job Growth* (July 7, 2011), http://epw.senate.gov/public/index.cfm?FuseAction=PressRoom.PressReleases&ContentRecord_id=055f25e5-802a-23ad-488b-36db8fda09b9.

123 Gabriel Nelson, *Utility Groups Trade Blows on New EPA Emissions Rules*, N.Y. Times (via Greenwire), June 8, 2011, http://www.nytimes.com/gwire/2011/06/08/08greenwire-utility-groups-trade-blows-on-new-epa-emission-87246.html. Whitfield has already tried introducing a temporary delay to both rules via an amendment to the TRAIN Act, citing the American Coalition for Clean Coal Electricity estimate as evidence that "the Utility MACT and new Transport rules will have devastating effects on our economy as it continues to work toward recovery." Rep. Ed Whitfield, Press Release, *Whitfield Amendment Delays EPA Rules, Allows Study of Impact on Jobs, Economy*, July 12, 2011, http://whitfield.house.gov/2011/07/whitfield-amendment-delays-epa-rules-allows-study-of-impact-on-jobs-economy.shtml.

124 *See, e.g.,* Iowa Environmental Council, Job Creation and Air Quality Regulations (2011), http://www.iaenvironment.org/documents/AQ_Job%20Creation_Feb2011.pdf (citing the PERI study).

125 *See* Ryan Lizza, *As the World Burns: How the Senate and the White House Missed Their Best Chance to Deal with Climate Change*, The New Yorker, Oct. 11, 2010.

126 *Id*.

127 *See supra* Fig. 3.

128 *See, e.g., Climate Change Legislation: Considerations for Future Jobs, Hearing Before the U.S. Senate Comm. On Finance*, 111th Cong., Nov. 10, 2009, http://finance.senate.gov/hearings/hearing/?id=d78bd542-c0af-6b4a-c184-06e7b4f992e9; *Hearing Before the U.S. House Subcomm. On Regulatory Affairs, Stimulus Oversight, and Government Spending,* 112th Cong., Apr. 6, 2011 (testimony of David Kreutzer, Heritage Foundation Research Fellow), http://www.heritage.org/research/testimony/2011/04/job-creation-and-carbon-dioxide-regulation; Minority Staff Report of the House Committee on Oversight and Government Reform, Comprehensive Staff Analysis of the Economic Impact of the Waxman-Markey Cap-and-Trade Legislation (2009) (citing the Heritage Foundation study); *Ensuring and Enhancing U.S. Competitiveness While Moving Toward a Clean Energy Economy, Hearing Before the U.S. Senate Comm. On Environment & Public Works,* 111th Cong., July 16, 2009 (testimony of Harry C. Alford, CEO of Nat'l Black Chamber of Commerce); Christa Marshall, *Sens. Cantwell and Collins Continue to Push Their Climate Alternative*, ClimateWire, Mar. 25, 2010 (citing the PERI report).

129 Carol Zabin & Lisa Hoyos, Opinion, *Setting the Record Straight on AB32 and Jobs*, San Francisco Chronicle, Oct. 6, 2010.

130 Carol Zabin & Lisa Hoyos, *A Green Jobs Generator*, L.A. Times, Apr. 21, 2010.

131 Craig Miller, *Governor Rejects LAO Jobs Report on AB-32*, KQED News, Mar. 9, 2010, http://blogs.kqed.org/climatewatch/2010/03/09/governor-rejects-lao-jobs-report-on-ab-32.

132 Ross et al., *supra* note 77, at 2 ("The ultimate choice should be driven several considerations: What is the size of the policy shock? Are economically important sectors impacted? How many markets are affected by the policy change?").

133 Berck & Hoffman, *supra* note 77, at 146, 154.

134 *See* U.S. Bureau of Economic Analysis, Regional Multipliers from the Regional Input-Output Modeling System (RIMS-II): A Brief Description, http://www.bea.gov/regional/rims/brfdesc.cfm; Morgan, *supra* note 88, at 5; Berck & Hoffman, *supra* note 77, at 145.

135 Berck & Hoffman, *supra* note 77, at 134.

136 Morgan, *supra* note 88, at 4.

137 *Id.* at 5-6 ("The results of any economic impact model will be only as accurate and realistic as the assumptions and data used to produce them. . . . When used 'off-the-shelf' with their default values, different models are likely to produce widely varying multipliers for the same project in the same geographic area.").

138 S. Hoffmann, S. Robinson & S. Subramanian, *The Role of Defense Cuts in the California Recession: Computable General Equilibrium Models and Interstate Factor Mobility*, 36 J. Regional Sci. 571 (1996).

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