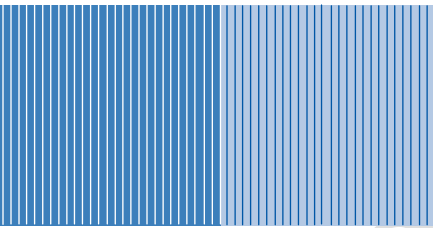


June 15, 2011

**Assessment of the Obama
Administration's Cost-Benefit
Analysis of
Clean Air Act Regulations**



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I. Executive Summary

The U.S. Environmental Protection Agency (EPA) has repeatedly claimed that air quality regulations will provide up to \$2 trillion in annual economic benefits, based on estimates for the year 2020. This is contained in its second report on the “Benefits and Costs of the Clean Air Act from 1990 to 2020” as well as in numerous public statements by senior EPA officials. The methodology behind these numbers is suspect, and the magnitude is greatly exaggerated. But even if the numbers were correct, EPA is building a very misleading impression of what that \$2 trillion means. In 2020 U.S. GDP is projected to be about \$20 trillion. Does the EPA mean that in the absence of air quality regulations, GDP in 2020 would be only \$18 trillion? Not at all, and other information in the same report proves it.

EPA’s own macroeconomic study, buried in the same report as the widely quoted \$2 trillion number, finds that in 2010 the same air quality regulations have reduced U.S. GDP by between \$32 and \$79 billion, and that by 2020, the impact of those regulations could range from a loss of \$110 billion to a gain of \$5 billion. Why are EPA’s GDP impact estimates so much smaller than the \$2 trillion in benefits that EPA claims Clean Air Act (CAA) regulations will create?

The reason these numbers conflict so dramatically is that the claimed \$2 trillion benefit has nothing to do with the actual amount of goods and services produced in the U.S. economy or the number of jobs that are available. The \$2 trillion figure is a “willingness to pay” number, constructed by EPA from surveys asking questions about how much the respondent would be willing to pay to avoid a very small increase in air pollution health risk and from studies that compare wages across occupations with different risks. At best, “willingness to pay” numbers state a non-market value that, in a well-done study, would indicate something about individual attitudes toward health risk from pollution. But they are not tied to the added income those individuals might expect from living longer or the effects of pollution on the economy.

Thus, the \$2 trillion net benefits claimed by EPA will never show up as increased output or jobs in the real economy. However, the EPA macroeconomic study that is also found in the CAA Prospective Study measures those output and job impacts, and it finds – as would be expected when resources are diverted from investment that increases overall production or productivity into installation of pollution control equipment—that the impacts are for the most part negative. The only exception is a case where the macroeconomic modelers translated EPA’s estimates of reduced medical expenses and “lives saved” into a larger workforce and increased personal income and found GDP increased—but the increase was just \$5 billion (or \$0.005 trillion) not \$2 trillion.

What can we learn from this? Existing regulations are unquestionably slowing economic growth today. Whether the environmental benefits of those regulations might be worth the cost is a policy question, but there is no denying that the cost takes the form of lower production of goods and services that go into consumption and investment. And this tells us nothing about the balance of benefits and costs for future regulations, each of which needs to be examined to compare economic costs to environmental benefits.

II. Deconstructing EPA's Report: Two Studies in One

EPA Administrator Lisa P. Jackson has described her agency's report on "*Benefits and Costs of the Clean Air Act from 1990 to 2020*" as showing that "*the benefits of avoiding early death, preventing heart attacks and asthma attacks, and reducing the number of sick days for employees far exceed costs of implementing clean air protections. These benefits lead to a more productive workforce, and enable consumers and businesses to spend less on health care -- all of which help strengthen the economy.*"

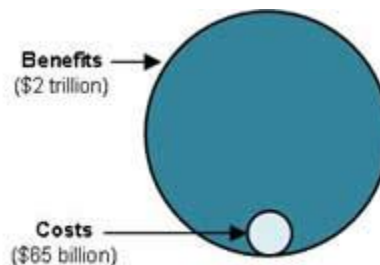
The report claims that by 2020 regulations issued under the Clean Air Act Amendments will provide an annual benefit of almost \$2 trillion, compared to costs of \$66 billion, a 30 - 1 benefit-cost ratio. EPA also translates this into a net benefit of \$16,000 per household in 2020. And this is not all—in the most optimistic case, benefits in 2020 are calculated at \$5.5 trillion, for a ratio of benefits to costs of 90 - 1.

The entire output of the U.S. economy in 2020 is projected to be about \$20 trillion. Should we then take EPA's claims to mean that in 2020 the U.S. will be producing 10% more goods and services than it could have produced without the Clean Air Act Amendments? Does it mean that the average household is 10% richer? Let's take a closer look at the numbers.

EPA's presentation of the results of the report creates the impression that there are \$2 trillion of tangible economic benefits in 2020. The excerpt below is copied directly from the EPA website:¹

This net improvement in economic welfare is projected to occur because cleaner air leads to better health and productivity for American workers as well as savings on medical expenses for air pollution-related health problems. The beneficial economic effects of these two improvements alone are projected to more than offset the expenditures for pollution control.

Source: U.S. EPA



The juxtaposition of the picture of \$2 trillion in benefits with the statement about “beneficial economic effects” creates an impression that Clean Air regulations have contributed that much to the tangible output of the economy. It is certainly true that the economic costs estimated by EPA are tangible costs, amounting in 2020 to \$65 billion of goods and services that will not be available for consumption and investment in increased productivity. But the claimed benefits of the Clean Air Act Amendments do not take that form. Over 90% of the monetary benefits included in EPA's benefit-cost study come from assumed reductions in mortality risk associated with ozone and particulate matter (PM), and the remaining monetary benefits are about equally divided between reduced illness and improved visibility.²

1 <http://www.epa.gov/cleanairactbenefits/prospective2.html>.

2 EPA uses survey data to determine willingness to pay for improved visibility in national parks, urban areas, etc., and this becomes an additional benefit of reducing emissions that contribute to reduced visibility.

The calculated “monetized” benefits of reduced mortality are based on two types of studies:

- Surveys that ask what respondents would be “willing to pay” for a small reduction in risk (“stated” WTP).
- Studies of wage differentials between occupations with different risks of accidental death (“revealed” WTP).

Surveys of “willingness to pay” have been criticized widely for providing inaccurate and sometimes grossly exaggerated measures of benefits.³ There are solid reasons to be skeptical of the huge numbers that EPA has assigned to relatively small increases in life expectancy, but no matter how they are estimated, “monetized benefits” based on “willingness to pay” do not create a single new job, nor do they make more tangible goods and services available to consumers. The value of improved visibility is also based entirely on questionnaires asking people about their “willingness to pay.”⁴ Taken together, these “willingness to pay” measures amount to 97% of the total value of benefits.

EPA goes on to state that, *“Economy-wide modeling shows that long-term economic growth is greater and American household economic welfare is improved because benefits such as fewer sick days and lower medical costs more than offset the economy-wide cost of investing in air pollution control.”* Despite its location next to the discussion of \$2 trillion in benefits, this statement has nothing to do with those benefits. It describes, instead, a macroeconomic analysis that reached strikingly different conclusions about economic impacts.

EPA’s own estimates of impacts of the Clean Air Act on “long term economic growth and household economic welfare” bear no resemblance to the \$2 trillion claimed benefit of Clean Air Act regulations. The “economy-wide modeling” that EPA refers to is a macroeconomic study also conducted by EPA as part of the assessment of Clean Air Act costs and benefits. This study started with the same estimates of reduced mortality and morbidity as the “willingness to pay” study, but it found nothing like \$2 trillion in benefits in any year. EPA’s statements about economic benefits are phrased and concatenated in a way that creates the entirely misleading impression that the \$2 trillion benefit has something to do with jobs, economic growth and real output of the economy.

Thus, EPA’s Prospective Report actually contains two different types of studies. The first study that EPA presents in its report is a traditional cost-benefit analysis. In this study EPA estimates the direct costs—pollution control expenditures plus higher costs of goods purchased directly by consumers—that are incurred by those who must comply with the regulations. It also calculates monetary estimates of benefits that include willingness to pay for reduced mortality risk, reduced health costs, and reduced damages to property.

3 See, for example, the papers in Jerry A. Hausman (ed.), "Contingent Valuation: A Critical Assessment Contributions to Economic Analysis," Volume 220, Emerald Group Publishing Limited.

4 Which have been subjected to equally cogent criticism for producing arbitrary and exaggerated results. Anne E. Smith and M. Kemp, *et al.*, “Methods and results from a new survey of values for eastern regional haze improvements,” *Journal of the Air and Water Management Association*, Vol. 55, Nov. 2005, p. 1767-1779.

The second study extends the usual macroeconomic analysis of the overall economic burden of increased pollution control expenditures to include the effects of a larger labor force and reduced health care costs on the economy as a whole.

The macroeconomic analysis demonstrates the very important point that the \$2 trillion net benefits claimed by EPA will never show up as increased output or jobs in the real economy. Even though it contains some questionable assumptions taken over from the estimates of direct costs and reduced morbidity and mortality used in the first study, the macroeconomic analysis reaches commonsense conclusions:

1. In the absence of tangible economic benefits from improved health and longevity, existing EPA regulations have created no net new jobs and are reducing economic output (measured as GDP). Past regulatory decisions are slowing the economy now, with a loss of up to \$79 billion attributable to those regulations in 2010, growing to up to \$110 billion by 2020.⁵
2. Even if EPA's estimated health benefits are included in the measures of real macroeconomic activity, EPA estimates that GDP today is \$32 billion lower than it would have been, and the maximum benefit of having a larger labor force by 2020 is only \$5 billion. EPA assumes that all those added workers will automatically find jobs, so that the programs have no effect on unemployment.⁶

To understand why EPA's own macroeconomic analysis contradicts EPA's claims of \$2 trillion of net benefits from Clean Air Act regulations, it is necessary to look into the nature of benefits included in the cost-benefit and macroeconomic analyses, respectively. Estimated GDP increases in the macroeconomic analysis come from having more able-bodied workers available to take jobs.

Estimated benefits in the benefit-cost analysis largely come from estimates of "willingness to pay" for reduced mortality risk. "Willingness to pay" to avoid risks is not the same as the value added to the economy of a healthier and longer-lived workforce. It is misleading to imply anything about real economic activity from EPA's calculations of "willingness to pay" for possible health benefits.

5 EPA, "The Benefits and Costs of the Clean Air Act from 1990 to 2020 Final Report – Rev. A," U.S. Environmental Protection Agency Office of Air and Radiation, March 2011, Table 8-7, http://www.eenews.net/assets/2011/03/01/document_gw_03.pdf. Referred to in this paper in the "Benefit-Cost Report."

6 *Ibid.*; Table 8-8.

III. The Willingness to Pay Study in EPA's Report

The “willingness to pay” study starts with calculations of reduced emissions attributable to the Clean Air Act Amendments of 1990 over the period from 1990 to 2020. Fully 93% of the dollar value of benefits estimated by EPA come from estimates of reduced mortality risk attributed to lower concentrations of PM and ozone.

A. Improper use of “Willingness to Pay” results

EPA's benefit estimate states that an increase of substantially 0.7 years in the adult population's average life expectancy is worth 10% of GDP in 2020. How could the value be so high? It happens because EPA starts with estimates of “willingness to pay” that were originally based on extremely small reductions in mortality risk, then simply scales these small-risk values up linearly to get estimates of the “willingness to pay” for a much larger risk change. Such proportional scaling is only valid as long as the hazard being valued is a very small risk too. To illustrate this point, consider the fact that if EPA had estimated a reduction in mortality risk 10 times as large, it would have concluded that individuals would be willing to give up all of their income—and starve—in order to enjoy about an extra 7 years of life. The contradiction is obvious, and it stems from EPA's use of an invalid method of extrapolating from questions about very small risks to evaluation of much larger risks.⁷

The writers of the EPA report, indeed, lay out exactly the reasons for not believing their “monetary value” estimates for mortality reductions of the magnitude they claim the Clean Air Act brings about:

An additional uncertainty that is pertinent for this study's results is the potential bias in using estimates of VSL that correspond to small changes in risk for the relatively larger changes in mortality risk estimated in this study. As the results section below indicates, the large changes in PM_{2.5} that represent the difference between the with-CAAA and without-CAAA scenarios by 2020 lead to a change in annual mortality risk of approximately 1 in one thousand for adults aged 25 and older, or 7 in ten thousand for all ages, which corresponds to a roughly ten percent change from the national baseline mortality risk of approximately 1 in one hundred.⁸ This risk change is large compared to the mean mortality risk faced by subjects in the wage-risk studies that underlie our estimate of VSL – the mean risk for individual studies in our group of 26 varies from 4 in 10,000 to 5 in 100,000, although clearly some individuals in those samples face higher individual risks.⁹ Economic theory suggests that individuals' incremental willingness to

7 This example and conclusion come directly from the theoretical basis for a decline in individual “willingness to pay” as the size of the risk increment increases. The quasi-concavity of the utility function implies directly that “willingness to pay” for any good must decline as that good takes a larger share of the total budget.

“Willingness to pay” must be bounded from above by an individual's remaining lifetime income – since it is impossible to pay more than total income; Thus, at some point the individual will find that continuing spending on increasingly necessary purchases of other goods becomes more valuable than another small reduction of mortality risk.

8 “...risk is not immediate - instead we model this risk as occurring with latency over the course of the ensuing 20 years.”

9 See W. Kip Viscusi, "Fatal Tradeoffs," Oxford University Press, 1992, Table 4-1.

*pay to reduce mortality risk declines with an increasing size of the risk increment, but the rate at which it declines is uncertain.*¹⁰

Thus, in EPA's own words they are applying the results of "willingness to pay" surveys to situations far different from those about which the respondents were questioned and introducing an admitted bias toward exaggerated results. "Willingness to pay" measures based on small changes in mortality risk typically imply that an individual would be willing to pay several times more than his or her lifetime income to avoid a 100% prospect of dying. If the risk being evaluated using these measures is relatively small, there is no contradiction. But when the hazard involved scales up to a willingness to pay that is a relatively large fraction of income, the application of the value of a statistical life comes into question.¹¹ This is exactly what comes out of EPA's calculation of benefits of mortality risk reductions attributed to the Clean Air Act.

B. "Willingness to pay" for reduced mortality risk has nothing to do with production of tangible goods and services

EPA takes an estimate of "willingness to pay" for reduced pollution risk from a survey of academic studies. Two methods are used in that literature: surveys of stated "willingness to pay" and statistical analysis of wage differentials between occupations with different mortality risks that show revealed "willingness to pay" to avoid risk. These studies either ask or infer what individuals would be willing to pay, in advance and before they are suffering any particular ailment or accident, to reduce their risk of dying by a stated, small amount.¹²

These observations of "willingness to pay" measures provide no information about how a reduction in mortality risk would affect job opportunities or the overall performance of the economy. They simply do not address such issues at all. Other measures, such as the value of lost earnings associated with the loss of one year of work, or the reduced cost of medical treatment due to fewer ailments, do have some concrete meaning in terms of economic

10 This issue is discussed to some extent in Thomas J. Kniesner, W. Kip Viscusi, and James P. Ziliak, "Policy relevant heterogeneity in the value of statistical life: New evidence from panel data quantile regressions," *Journal of Risk and Uncertainty*, 40:15–31, 2010.

11 For a thorough discussion of why willingness to pay measures only apply to relatively small risks, see Ron Howard, "On Making Life and Health Decisions," *Societal Risk Assessment*, Plenum Press, 1980.

12 There are a number of well-known difficulties with stated preference studies. The problem of confronting the respondent with meaningful choices from which a valuation can be inferred is soluble, and has been addressed appropriately in some studies. But many of those on which EPA bases its calculations ask for simple statements of a dollar amount the respondent would pay to avoid a specific risk, without any effort to help the respondent understand what he or she would be giving up in terms of other consumption to make that payment. Revealed preference studies like the wage differentials work cited by EPA avoid some of these difficulties, but introduce others, mainly the difficulty of obtaining reliable statistical estimates of the valuation put on mortality risk since it is correlated with so many other characteristics of different occupations. This shows up in the distribution of estimates from revealed preference studies, which provide the extremes of the range of estimates cited by EPA (EPA, "The Benefits and Costs of the Clean Air Act from 1990 to 2020 Final Report – Rev A," U.S. Environmental Protection Agency Office of Air and Radiation, March 2011, p. 5-23, Table 5-5). The lowest 4 estimates come from revealed preference studies as do the highest 13. Moreover, the wage differentials studies are based on a sample with very small changes in mortality risk across categories. Thus, as discussed above, there is no legitimate basis for extrapolating these estimates to the very large mortality risk reductions claimed for the Clean Air Act.

performance. But “willingness to pay” measures do not. Instead, they state a non-market value that, in a well-done study, would indicate something about individual preferences toward small reductions in risk from pollution, but not the added income those individuals might expect from living longer.

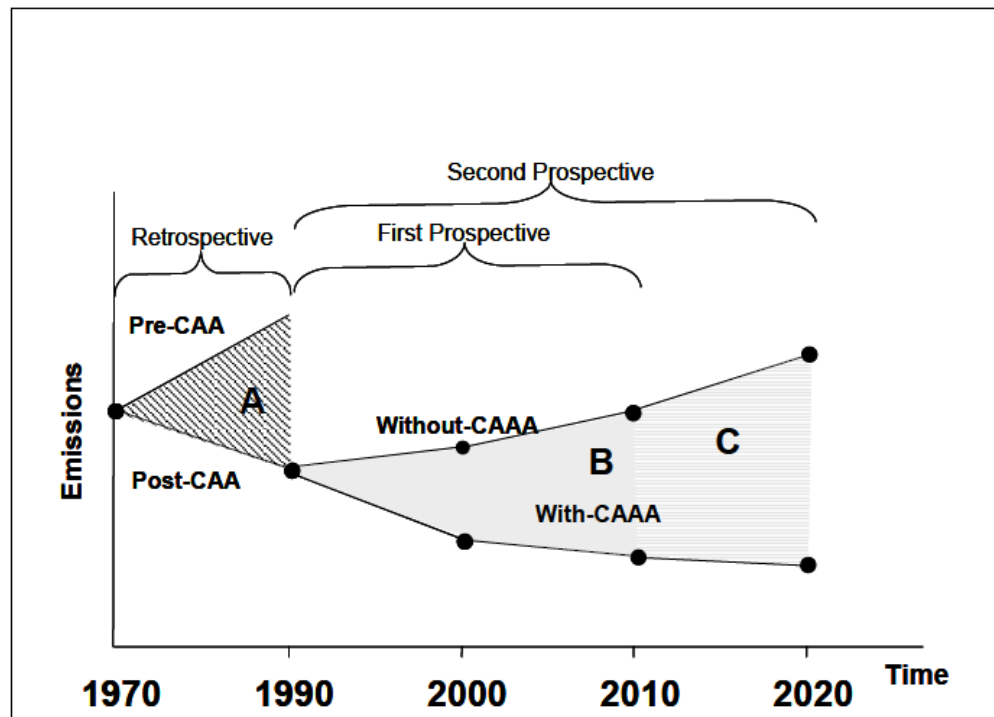
Some components of the \$2 trillion benefit estimated by EPA do come from lost or wasted output and could represent an increase in real output of goods and services valued by consumers. EPA includes estimates of materials damage and impacts on forestry and agricultural productivity—but they add up to only \$11 billion out of the \$2 trillion estimate! Avoided medical expenses do not increase measured GDP, but they do free income for more pleasant uses; yet the entire category of avoided expense adds up to only \$70 billion. The remaining \$1.9 trillion that EPA estimates all comes from “willingness to pay” measures and surveys.¹³ If \$1.9 trillion were a reasonable estimate of “willingness to pay” for true mortality reductions, then adoption of the Clean Air Act regulations could well be justified. But even in this case, the regulations would not increase GDP or jobs by anything resembling that amount.

C. Baseline assumptions and emission reductions

The chart below, from EPA’s report, shows a “without-CAAA Amendments” baseline that includes all emission reductions that would be achieved if the Clean Air Act Amendments of 1990 had not been passed—that is all emission reductions that could be achieved through regulations authorized by the original Clean Air Act Amendments. Reductions represented by areas B and C should be limited to those brought about by regulations that could not have been issued without the Clean Air Act Amendments. We conclude that EPA’s “baseline” is too high, for reasons stated below, and because of this, areas B and C (which are proportional to EPA’s benefit estimates) are too large.

¹³ EPA, “The Benefits and Costs of the Clean Air Act from 1990 to 2020 Final Report – Rev. A,” U.S. Environmental Protection Agency Office of Air and Radiation, March 2011, p. 7-5.

FIGURE 1-1. CLEAN AIR ACT SECTION 812 SCENARIOS: CONCEPTUAL SCHEMATIC



EPA overestimates the emission reductions that are claimed to lead to reduced mortality and other benefits by overstating baseline emissions in two ways:

1. Ignoring how the recession has lowered forecasts of economic and emissions growth.
2. Attributing to the CAA Amendments PM_{2.5} reductions that should have been included in the baseline, because they would have been achieved under the original CAA authorities.

Ignoring effects of the recession: The outdated 2005 forecast used to define the EPA baseline was made before the recession brought down expectations for future energy use, economic growth and emissions, and if future emissions are overestimated, emission reductions will be as well.

Including PM_{2.5} regulations that would have occurred under the CAA of 1977 alone: An even larger exaggeration of benefits comes from EPA's attributing emission reductions to the Clean Air Act Amendments even though those reductions would have been required under the Clean Air Act of 1977. EPA claims that it includes only emission reductions attributable to regulations issued under the authority of the Clean Air Act Amendments of 1990, projected out to 2020. However, EPA is in error to include reductions in PM_{2.5}, the source of 97% of the claimed \$2 trillion in benefits, in the study. Those PM_{2.5} reductions should be in the baseline instead. All the authority necessary to issue the PM_{2.5} National Ambient Air Quality Standards (NAAQS) and associated regulations was provided in the Clean Air Act of 1977. Section 109 of the Clean Air Act was not changed by the 1990 amendments, which means that Congress did

nothing to affect the NAAQS process. The lawsuit that resulted in the PM_{2.5} NAAQS in 1997 was not about forcing a new standard for PM_{2.5}, but more about forcing the PM NAAQS review to move on a timetable that was already established in the CAA. Even if a PM_{2.5} standard had not been established, the PM NAAQS review required by the CAA of 1977 was already leading toward tightening of the PM₁₀ NAAQS. If only the PM₁₀ standard had been tightened, it still would have forced down the levels of PM_{2.5}, as opposed to letting them grow in the way shown in the without-CAAA case.¹⁴ Therefore, EPA has grossly exaggerated benefits of the Clean Air Act Amendments from the start by its assumption that there is a large difference in PM_{2.5} concentrations with and without CAAA of 1990. It has falsely constructed the baseline for the most critical pollutant.

Future reductions will be much smaller than past: It is also clear that future emissions reductions cannot possibly be as large as the emissions reductions attributed to the CAAA. The chart above is not scaled precisely, but it brings up a point seen clearly in EPA's discussion of PM_{2.5} concentrations before and after control. The reduction in concentrations of PM_{2.5} to be achieved up to 2020 by the Clean Air Act is greater than the difference between the remaining concentration and background,¹⁵ so that it is mathematically impossible to achieve as large a reduction again. This observation alone disposes of claims that future regulations will have similar benefits—emissions of the types being analyzed have been brought down to such low levels that even eliminating all those emissions would lead to a much smaller change than past regulations achieved. It is completely inappropriate to imply that any future regulations could provide comparable benefit-cost ratios, since the remaining amount of pollution it is possible to remove is so small compared to past accomplishments and the costs of reducing emissions so much further will escalate.

D. Underestimation of costs

In its calculation of direct costs of pollution controls, including those imposed since the Clean Air Act Amendments and those projected to be used in the future, EPA made a number of assumptions that bias its results toward underestimating the likely value of uncertain costs. The same assumptions are used in its macroeconomic modeling and lead to underestimation of macroeconomic impacts as well.

Unrealistic cost caps: A major source of underestimation of costs is EPA's practice of assigning arbitrarily low cost caps to unidentified control measures that must be adopted in addition to those analyzed in order to achieve attainment. EPA imposes these cost caps both in the definition of the control measures that will be required to achieve air quality standards and in costing the remaining "unidentified measures" that will have to be adopted by states to come into compliance. These cost caps have no economic basis and are, in fact, lower than the observed costs of measures already in place. In particular, EPA assumes a \$15,000/ton cap on costs of NO_x controls, despite data in its own report showing that the marginal cost of NO_x controls is already above \$25,000/ton in many areas and over \$40,000/ton for offsets in California. Since the unidentified measures will be in addition to the identified ones, it is unreasonable to assume

¹⁴ See charts on p. 4-15 of the Benefit-Cost Report.

¹⁵ *Ibid.*; p. 4-15 shows most of the Eastern U.S. in the range of 6 – 10 µg/m³ and nothing above 15 µg/m³, while stating that there are "reductions of more than 20 µg/m³ in some areas."

that they will cost less unless EPA is convinced that it has adopted unnecessarily costly requirements in its identified measures.

Learning curves: Direct cost estimates also assume aggressive “learning curves” that arbitrarily reduce costs over time, in spite of substantial literature and direct advice to the contrary from EPA’s science advisors. Costs of mobile source controls are almost certainly underestimated due to an assumption that learning curves eliminate 60% of on-road regulatory costs. In general, EPA selected the very high end of the range of learning rates suggested by its science advisors and ignored important recent studies suggesting that cumulative output is not a causal factor in reducing costs. Economist William Nordhaus describes potential errors similar to those in EPA’s studies of mortality risk: confounding variables make any naïve inferences from observation of historical cost reductions invalid. Cost reductions in new technologies could be caused by cumulative production (the learning hypothesis), but they could equally well arise from other causes also highly correlated with the passage of time, including R&D, general technology improvement unrelated to production, manufacturing in cheaper locations overseas, or introduction of new generations of technology.¹⁶ EPA gives reasons for all its learning curve assumptions, but none are good enough to exclude the opposite (e.g. zero learning) as a reasonable alternative scenario to determine sensitivity to key results.

Hidden costs: EPA ignores the ways in which regulations have degraded attributes of vehicles and fuels that consumers value. Not controlling, in particular, for changes in acceleration, payload, vibration, noise, and harshness of ride, cold starting, load capacity, refueling time and other “subjective” issues has led to underestimation of costs in previous studies of mobile source regulations. EPA’s failure to take into account the ways in which mandated fuels and vehicle technologies have degraded vehicle performance has been a major flaw in all studies of the costs of mobile source regulations, and EPA repeats those omissions in this study.

¹⁶ William D. Nordhaus, “The Perils of the Learning Model for Modeling Endogenous Technological Change,” Cowles Foundation Discussion Paper No. 1685, January 2, 2009. Available at SSRN: <http://ssrn.com/abstract=1322422>.

IV. The Macroeconomic Study in EPA's Report¹⁷

EPA's description of its macroeconomic model is brief and comprehensive:

EMPAX-CGE is a dynamic, intertemporally optimizing model that solves in 5-year intervals from 2005 to 2050. It uses the classical Arrow- Debreu general equilibrium framework wherein households maximize utility subject to budget constraints, and firms maximize profits subject to technology constraints. The model structure, in which agents are assumed to have perfect foresight and maximize utility across all time periods, allows agents to modify behavior in anticipation of future policy changes, unlike dynamic recursive models that assume agents do not react until a policy has been implemented.

The EMPAX-CGE modeling system has traditionally estimated the social cost of environmental regulation. Environmental benefits of air quality improvements have not to date been considered within the modeling system. In this analysis, EPA has considered a subset of environmental benefit adjustments within the modeling system and continues to provide an EV welfare metric associated with consumption and leisure. However, the welfare metric still excludes other direct 'willingness to pay' (WTP) welfare effects that are included in the 812 benefits analysis.

A. Costs of regulations

The macroeconomic study included two scenarios. In the first, it performed the usual analysis of how diverting resources into pollution control expenditures would reduce the resources available for investment and production of the goods and services that are directly consumed and enjoyed by consumers. In the second, EPA added estimates of the benefits of reduced mortality, which takes the form of a larger labor force, and reduced expenditures on health care, which in turn shifts resources at zero cost from a health care industry to other uses. It takes some intricate tweaks of the model to introduce the assumption that consumers are better off when they spend their incomes on things other than health care, since this is not a feature of normal national income accounting.¹⁸ A simple shift of expenditures from health care to other goods and services would not normally be measured as an increase in GDP.

B. The "Cost-Only" Case

For each model year (2010, 2015, and 2020), U.S. GDP is approximately 0.5% lower with the Clean Air Act programs. In 2020, the projected GDP decrease is \$110 billion. Consumption is

17 Chapter 8 of the Benefit-Cost Report is supplemented by the April 2010 "812 Economic Analyses Using the EMPAX-CGE Modeling System, Revised Draft." Report Prepared by RTI International, Research Triangle Park, NC. RTI Project Number 0212224.000.004.

18 "The EMPAX-CGE model simulates and compares two potential macroeconomic outcomes: a U.S. economy with Clean Air Act programs and the U.S. economy without these programs. We use two methodological approaches that represent the Clean Air Act scenarios. The first approach only considers private compliance expenditures associated with Clean Air Act programs. The second includes private compliance expenditures and two benefits-related adjustments: (1) increases in the labor force associated with reduced mortality and morbidity and (2) household health expenditure reductions associated with improved health." 812 Economic Analysis, p. 1-11.

also 0.5% lower with Clean Air Act programs. In 2020, consumption falls by \$75 billion. Average annual welfare levels (as measured by Hicksian equivalent variation) are approximately 0.4% lower with Clean Air Act programs. EPA points out in its supporting documentation that reduced work hours are valued as “leisure time” so that the loss in welfare is less than the reduction in GDP or consumption. However, EPA does not otherwise address the reduction in hours of work or wages that would accompany this loss in GDP.

C. The “Cost and Health Benefit” Case

Under the second approach, the EMPAX-CGE modeling system estimates GDP impacts that also include selected air quality benefits. These benefits, which include reduced mortality and morbidity and reduced health care costs, offset some of the private expenditures on pollution control, so that the net effects tend to be slightly higher than a baseline without Clean Air Act programs. For example, after 2015, GDP increases as more people experience fewer lost working days and health expenditures also fall. In 2020, projected GDP increases by \$5 billion above what it would have been without the Clean Air Act Amendments, or 0.02%. Consumption is also higher with Clean Air Act programs after 2015. In 2020, consumption rises by \$5 billion, 0.03% of projected consumption for the year 2020.

In the cost-only case, consumers incorporate the compliance costs in each year into their expectations and smooth their welfare over time. This results in relatively constant percentage changes in GDP, consumption, and equivalent variation. In contrast, in the case that includes health improvements of the Clean Air Act, labor endowments increase over time compared to the baseline, allowing households to enjoy more leisure time (raising welfare) and supply more labor (raising GDP). Consumers will anticipate this increase in their future income and act accordingly. For instance, the measure of overall economic welfare increases in 2010 although GDP falls, because consumers have more time available to enjoy as leisure. This is less paradoxical than in the cost-only case, when a leisure value was assigned to the reduction in hours worked that was caused by lower productivity and slower economic growth. In 2015, EPA assumes that households anticipate their future increases in well-being and accordingly save less, so that their consumption increases while GDP still declines.

D. Problems in modeling macroeconomic benefits of reduced health expenditures and mortality

How many workers? In calculating macroeconomic benefits of reduced mortality, EPA may be overestimating the increase in the labor force attributable to reductions in PM2.5 and ozone mortality. EPA uses a population model to calculate increases in population by age group and gender that would be attributable to the CAAA if EPA’s estimates of mortality risk due to PM2.5 were correct. It then uses age- and gender-specific labor force participation rates to calculate the overall increase in the labor force. There is no problem with this part of the calculation. But it is based on an assumption that has no empirical foundation—that mortality risk is reduced proportionally for all age groups. This is at best an unsupported assumption that exaggerates the increase in the working-age population. If, as some data suggest, PM2.5 increases mortality risk more for the oldest age groups than for others, the population model will exaggerate the increase in the working-age population. Indeed, if only the elderly faced an increase in mortality risk,

there would be no increase in labor supply at all. Only a uniform distribution of changes in mortality risk, which is at this point an unsupported hypothesis, leads to EPA's conclusions about a larger labor force.

Even with these optimistic assumptions, EPA finds that there are near-term reductions in GDP from the regulations, not increases, and that the increased labor force produces more output only slowly over time. Moreover, the implications for per capita income are interesting—the increased labor force adds more people but does not make them better off, even when GDP increases in 2020 in EPA's "cost plus health benefits" case. Average life expectancy for the working age population increases by about 0.2% for the age 30-45 cohort, but GDP is increased by only .09%, indicating a reduction in output per worker of about 0.1%. If EPA had published results for changes in wages and labor compensation, they would likely have fallen similarly.

Value of less health spending: GDP measurement is indifferent to what consumers are buying, except for the effects of inflation and changes in relative prices, because it assumes that they want what they buy and that more is better. Since removing the need to spend on health care to maintain the same level of health does make consumers better off, the part of the model that calculates "real income" and "welfare" is modified to give the same level of utility with smaller health expenditures. This creates a "welfare" effect of improved well-being that has nothing to do with economic output or jobs—there are just different jobs and types of economic output, and consumers are better off because with lower health care expenditures they can buy those other, more enjoyable or life-enhancing goods and services.¹⁹

Less work = more leisure: EPA's treatment of the labor market is striking. It makes the point that overall economic welfare includes not only the value of goods consumed but also the value of leisure time. This leads to a conclusion that many non-economists find surprising: that if reduced productivity and slower economic growth lead to less demand for labor and lower hours worked, households gain a benefit of increased leisure time that largely offsets their loss in income. Moreover, EPA fails to include in its discussion the estimate of impacts on real wages and total hours worked that its model must have produced. Had these labor market results been published, they would have clearly shown negative impacts on hours worked and wages in the "cost only" case and, as mentioned above, a reduction in real wages and total compensation. All of this suggests that the best description of the findings of the macroeconomic study is that the Clean Air Act regulations do nothing to increase workers' opportunities and, although they might make more work effort available, they lead to lower wages and compensation per worker.

E. Common bias both studies

The macroeconomic study assumes that EPA's estimates of increased mortality risk attributed to ozone and PM are correct, and it translates the estimate of "avoided deaths" into a statistical survival curve to project the change in population levels. Thus any problems with the starting point—EPA's conclusions that ozone and PM are the cause of increased mortality and the manner in which "avoided deaths" is calculated—is shared between the two approaches. The

¹⁹ Even though EPA's population modeling projects an increase in the number of individuals in the oldest age categories, EPA does not appear to account for the increased health care spending likely to be required by this on-average more elderly population.

macroeconomic study, like the benefit-cost analysis, assumes the same percentage change in mortality risk for all age groups, and for members of the labor force and for those not seeking work. This assumption, if incorrect, leads to overestimation of the increase in the workforce attributable to the Clean Air Act programs.

Both studies rely on cost estimates for pollution control technologies that lead to a systematic bias downward in cost calculations of pollution control expenditures and in their macroeconomic effects. Thus major flaws in the macroeconomic study come from the calculations of direct costs and benefits that were transferred over from EPA's separate study of direct costs and benefits.

F. What the macro-economic analysis tells us

Even with these flaws that lead to underestimation of economy-wide losses, the macro-economic study provides important lessons.

1. Diverting investment and household resources into pollution control does not create additional jobs or output.

Even EPA finds that effects on labor markets are negative, whether or not health effects are included. The fact that compliance costs reduce real wages and total compensation is mentioned only obliquely in the technical discussion in the RTI supplement of how EPA's model deals with the excess burden of taxation.²⁰

2. EPA's estimates of macroeconomic impacts of improved health of workers contradict claims that green jobs increase total employment.

The methodology and conclusions of the EPA macroeconomic analysis demolish any claims that environmental regulations will cause a net increase in jobs in the economy. The basis of the benefit estimates in the macroeconomic modeling is the (correct) assumption that sick workers will not be replaced by unemployed workers to maintain output; green jobs studies assume that all jobs that appear anywhere, and in particular those producing pollution control equipment, will be filled by the unemployed. If the EPA macroeconomic study adopted the green jobs assumption, it would find no macroeconomic loss from increased morbidity because all the vacancies and sick days could be filled at no cost by bringing in unemployed workers. Indeed, it would find more jobs being offered due to sick leave. If the green jobs studies adopted the macroeconomic study's correct representation of labor markets, they would have to conclude that, on balance, regulations and "green investment" cannot increase total employment.

3. Macroeconomic benefits of changes in labor availability and reduced medical expenses are real but much smaller than \$2 trillion.

The only case in which the macroeconomic study estimates an improvement in GDP is in 2020 in the case where all health benefits including greater labor supply are included. Yet even in this

²⁰ 812 Economic Analysis, p. 1-9.

case the increase in GDP over an alternative with no Clean Air Act regulations is only \$18 billion – less than 1% of EPA’s \$2 trillion in benefits based on “willingness to pay.”

FINAL

V. The EPA Macroeconomic Study Provides No Support for Claims of Huge Monetary Benefits or Stimulus for “Green Growth”

The differences between the two EPA studies included in the same report known as the “Benefits and Costs of the Clean Air Act from 1990 to 2020” are striking, and bring home the speculative nature of statements about “willingness to pay” for reduced mortality risk. Nor does the benefit-cost analysis indicate the value of output or net jobs that would be added to the economy if mortality were reduced. The benefit-cost analysis includes a monetary value of benefits that never enters the economy and, even if correctly measured, will not be associated with growth of new industries or new jobs. EPA’s own macroeconomic study demonstrates this.

A. No support for claims that regulations increase jobs or promote new industry

The “cost-only” scenario is the one that is relevant to claims that regulatory measures will create jobs by forcing additional investment and spending on pollution controls.²¹ It is the scenario that would show net economic benefits and increased total jobs if costly regulations could provide economic stimulus. In this scenario, the EPA study unambiguously finds that there will be overall negative economic effects—lower GDP, consistent losses in real purchasing power, and reduction in the output of all industries except natural gas. If EPA had reported model results for labor markets, they would have revealed lower wage rates and lower total worker compensation. These directly contradict claims in recent studies that there would be job benefits from increased investment to comply with regulatory mandates even if they provided no environmental benefits.²²

Nor does anything in the Prospective Study imply that environmental regulations will create or enlarge a U.S. industry making and exporting pollution control equipment. Its findings are consistent with the basic observation that costly environmental regulations do not create industries producing pollution control equipment for export or domestic use. Regulations create a demand in the U.S. for that equipment, but leave it open to all to supply that equipment. At the same time, environmental regulations increase the cost of doing business in the U.S. relative to other countries. Thus domestic manufacturers of mandated equipment and its components are put at a cost disadvantage relative to competitors located in countries that do not incur the cost of regulation. The result is to shift the supply chain for pollution control and electric generation equipment offshore toward less-regulated regions where companies are better able to compete in producing components for power plants and pollution controls. The result is that regulation increases demand for pollution control equipment, but reduces domestic supply.

21 As, for example, in testimony before the House Energy and Commerce Committee, Gina McCarthy, Assistant Administrator for EPA’s Office of Air and Radiation, stated that “Over the past seven years, the Institute for Clean Air Companies (ICAC) estimates that implementation of just one rule – the Clean Air Interstate Rule Phase 1 – resulted in 200,000 jobs in the air pollution control industry.”

22 J. Heintz *et. al.*, “New Jobs - Cleaner Air: Employment Effects Under Planned Changes to EPA’s Air Pollution Rules,” Ceres and Political Economy Research Institute (PERI), February 2011 and R. Pollin, H. Garret-Peltier, J. Heintz, and H. Scharber, “Green Recovery,” PERI and Center for American Progress, September 2008.

The experience of the past decade has proven that environmental standards or clean energy mandates will not create industries in the U.S. that will export clean technology to the rest of the world. To the contrary, the cost of such mandates is borne where they are imposed, but the equipment may well be produced by workers in other countries. For instance, in 2008 U.S. wind turbine imports were \$2.5 billion and exports were \$22 million; less than half the wind turbines installed in the U.S. in 2007 were manufactured by U.S. companies.²³ China is becoming the world's largest manufacturer of wind equipment,²⁴ and is exporting that technology to the United States. U.S. solar manufacturers, including some that are technologically advanced, are moving to China to manufacture solar arrays.²⁵ German experience has been similar; its huge subsidies for wind energy largely drew electric power from Denmark where the generation capacity had already been installed. And now Vestas (Denmark's largest wind producer) recently closed all or most of its Danish manufacturing, despite the large EU demand for such technologies.

Clean Air Act regulations do not allow for a "border adjustment" to offset higher domestic costs—in fact, the WTO explicitly prohibits such offsets for regulatory programs. So even if the goal is to implement an industrial policy, EPA is the wrong agency to choose to create one. A study by economist Michael Spence that was discussed in the Business Section of the Washington Post²⁶ confirms this point. Spence points out that what he calls the tradable sector—which includes manufacturing—has grown in output but not jobs, while the nontradable sector—principally government and health care—has provided the job growth. He then addresses the challenge of how to create U.S. job growth in the tradable sector—which means policies that improve the productivity of U.S. workers so that growth in output is not accompanied by increased outsourcing. EPA's regulations increase costs and lower worker productivity, thus leaving U.S. workers even more vulnerable to competition from cheaper foreign suppliers. This is not to say that environmental protection should be abandoned, but it does imply that environmental regulations must be designed carefully and sparingly, because they do make the task of spurring job and income growth more difficult.

B. Neither EPA study addresses pending or proposed regulations

The Prospective Study provides no information about the likely costs and benefits of new regulations, such as the Air Toxics rule announced in March 2011 or greenhouse gas regulation. Neither the benefit-cost analysis nor the macroeconomic study deal in any way with recently announced or pending regulations. It should be obvious that no study of existing regulations can tell us anything useful about the likely costs or benefits of new regulations, and that any suggestion that the Prospective study supports rules like the utility boiler maximum achievable control technology (MACT) is incorrect. No matter how well such a study is performed or how

23 U.S. International Trade Commission, Office of Industries, "Wind Turbines: Industry and Trade Summary," Publication ITS-02.

24 "With their government-bestowed blessings, Chinese companies have flourished and now control almost half of the \$45 billion global market for wind turbines. The biggest of those players are now *taking aim at foreign markets, particularly the United States, where General Electric has long been the leader.*" Keith Bradsher, "To Conquer Wind Power, China Writes the Rules," The New York Times, Dec 14, 2010, <http://www.nytimes.com/2010/12/15/business/global/15chinawind.html>.

25 Edward L. Glaeser, "Why Green Energy Can't Power a Job Engine," The New York Times, <http://economix.blogs.nytimes.com/2011/01/18/why-green-energy-cant-power-a-job-engine/?ref=business>.

26 Steven Pearlstein, "Good for GDP not good for workers," The Washington Post, March 13, 2001, G-1.

large an excess of benefits over costs it finds for one set of regulations, that finding does not transfer to any set of different regulations. Studies of past regulations, however well-executed, cannot provide estimates of the costs or benefits of future regulations.

EPA Assistant Administrator Gina McCarthy implied exactly the opposite in testimony before the House Energy and Commerce Committee on February 15, 2011. She stated that: “EPA is starting to update its existing Clean Air Act programs in order to address greenhouse gas emissions. The Clean Air Act tools that we will be using to do so are exactly the same Clean Air Act tools that have been responsible for achieving dramatically cleaner air and important public health benefits at reasonable costs.” This is a non-sequitur.

If there were a direct connection between past and present regulations – for example if new regulations were only adding to requirements on specific sectors, or tightening limits on the same pollutants – then some generalization would be possible.²⁷ But the generalization would be quite the opposite of the spin being put on the findings of the Prospective Study. The proper generalization is that under these conditions new regulations will have smaller benefits and higher costs than past regulations. If EPA takes the most cost-effective actions first, tighter regulations on the same sources must have smaller marginal benefits and higher marginal costs. Only if EPA chose extraordinarily inefficient control technologies in implementing existing regulations, and neglected the much cheaper control options that are to be implemented in new regulations, could anything else be true.

In most cases, new regulations are just different from the existing set. The new regulations on electric generators that are being considered by EPA—along with the Clean Air Transport Rule (CATR), MACT, ash-handling, water, and greenhouse gases, as well as potential regulations needed to implement new ozone and PM_{2.5} NAAQS—are specific as to timing and content and quite different from the existing set of regulations studied in the report. This point must be obvious, but it is missed by anyone who cites the Prospective Study in defense of new regulations.

²⁷ EPA even points out that in the benefit-cost study that it has not addressed the issue of the cumulative effect of regulations on a single source.

VI. Conclusions

The benefit-cost analysis in the Prospective Study has been portrayed as finding benefits in excess of costs by a ratio as high as 90 to 1. These are not tangible benefits that take the form of increased output and jobs. They are the result of problematic techniques for ascertaining a theoretical concept of how much people would be willing to pay to avoid an increased risk of death. This concept, if applied well, may have some merit in helping guide policy makers towards spending programs that a society considers worthwhile, but the monetized estimates of such benefits are entirely conceptual and do not inject any real spending power into the economy.

The macroeconomic study probably over-estimates beneficial effects of reduced mortality and morbidity on output of goods and services and on total employment. Even so, EPA finds costs, not benefits, to the economy as a whole. The macroeconomic analysis finds that in the most favorable case, net tangible benefits are only \$18 billion or 1% of what the cost-benefit analysis has been used to claim. The 90 – 1 ratio becomes more like 1 – 1.

When the questionable effects on mortality are eliminated from the macroeconomic analysis, there are only net costs of \$109 billion in 2020. This directly contradicts other claims that regulations create jobs and stimulate economic growth on their own (independently of whether they have any environmental benefit). EPA's own analysis shows those claims are not true.

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