

Metcalf, Gilbert E.

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⁹ K. J. Forbes, "Cheap Labor Meets Costly Capital: The Impact of Devaluations on Commodity Firms", NBER Working Paper No. 9053, July 2002, and *Journal of Development Economics* (2002), 69(2), pp. 335–65.

¹⁰ K. J. Forbes, "How Do Large Depreciations Affect Firm Performance?", NBER Working Paper No. 9095, August 2002, and *IMF Staff Papers* (2002), 49, pp. 214–38.

¹¹ See the symposium on *Global Linkages* published in the *Review of Economics and Statistics*, 2004, 86(3).

¹² K. J. Forbes and M. Chinn, "A Decomposition of Global Linkages in

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¹⁵ K. J. Forbes, "The Microeconomic Evidence on Capital Controls: No Free Lunch", NBER Working Paper No. 11372, May 2005, and S. Edwards, ed., *International Capital Flows*, 2007, forthcoming. Also see K. J. Forbes, "Capital Controls:

Mud in the Wheels of Market Discipline", NBER Working Paper No. 10284, February 2004, and *The Cato Journal*, 2005, 1, pp. 153–66.

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Tax Policy Towards Energy and the Environment

Gilbert E. Metcalf*

My research over the past several years has focused on the role of taxes and other instruments in environmental and energy policy. I have focused mainly on instrument design issues in a general equilibrium framework, as well as on the distributional implications of energy and environmental taxation.

Environmental Policy

An influential paper by Bovenberg and deMooij touched off a large research agenda on the optimal design of environmental taxes in a second-best world with pre-existing taxes.¹ It had long been understood that taxes on pollution could help to internalize pollution externalities. Beginning in the 1980s, analysts began to argue that the rev-

enue from pollution taxes could be used to reduce other distortionary taxes, thereby generating a second "dividend" with a pollution tax. Some analysts concluded that the existence of this second dividend argued for a higher tax on pollution than the first-best Pigouvian prescription, where the tax is set equal to the social marginal damages of pollution.

Bovenberg and deMooij showed that for reasonable consumer preferences the optimal tax would, in fact, be lower than social marginal damages. Their insight was that while an environmental tax would enhance efficiency by discouraging pollution, it was still a distortionary tax and could interact with other distortionary taxes with first-best efficiency losses. Building on this initial

result, researchers began to identify the gains from raising revenue via environmental policy instruments (pollution taxes or auction revenues from cap and trade systems). With Don Fullerton, I showed that the popularly held view that revenue-raising instruments were preferred to non-revenue-raising instruments focused on the wrong point.² What mattered was whether policies created scarcity rents and whether the government received the rents and used them to lower other distortionary taxes.

The result — that the second-best tax on pollution was below social marginal damages — was troubling to many environmentalists who were concerned that it implied that in a world with distortionary taxation more pollution should be allowed. Such a con-

clusion confuses price and quantity effects. That a first-best price rule ("set pollution taxes equal to social marginal damages") is modified in the presence of tax distortions ("set pollution taxes below social marginal damages") does not imply anything about changes in the optimal level of pollution. Using a simple analytic general equilibrium model, I provide a counter-example to show that having a tax below social marginal damages could be consistent with a higher level of environmental quality.³

The analytic general equilibrium framework constructed for the research just described was easily extended to a consideration of monopoly behavior among polluting firms and instrument design when policymakers cannot target pollution directly but rather must target some proxy for pollution.⁴ The interest in second-best environmental policy design was widespread at this point and the NBER co-sponsored a conference on environmental policy with FEEM in Italy that Carlo Carraro and I co-organized.⁵ One of the hotly debated topics during this period was whether tradable permits for pollution (like those for SO₂ trading under the Clean Air Act Amendments of 1990) should be given away or sold. One paper from that conference made the important point that this was not an either-or situation; rather, some of the permits could be traded and some sold.⁶ The paper showed that only a small portion of permits need be given away in order to preserve the equity value of the energy industries because most of the burden of the permit price is passed forward to consumers in the form of higher prices.

I also have applied insights from the literature on second-best environmental taxation in my research on climate modeling. In particular, an empirical analysis of European energy and climate policy suggested that the benefits from auctioning permits from a European carbon cap and trade system vary substantially across countries, suggesting the need for country-specific policy guidance.⁷ That research also showed that when environmental revenues (either from a carbon

tax or from selling tradable permits) were recycled by reducing existing taxes, certain European countries might do worse by lowering particular taxes than by giving the money back in a lump sum. While this is a standard theoretical result from the theory of the second-best, the CGE modeling results confirm that it is more than an intellectual curiosity.

In addition to considering the efficiency effects of environmental taxation, I have studied the distributional issues that arise with environmental taxation. Many environmental taxes are regressive. For example, a carbon tax would raise the price of energy products, products that are necessities in household budgets. I carried out an incidence analysis of a mix of environmental taxes and showed that the taxes, while regressive on an annual income basis, are less regressive when analyzed on a lifetime income basis.⁸ This is a common finding for consumption taxes.⁹ In addition, I noted that while an environmental tax might be regressive, an environmental tax reform could have any desired degree of progressivity. In particular, I constructed a tax reform where the revenue from a mix of environmental taxes is used to lower other taxes in a distributionally neutral fashion. More recently, I've broadened the discussion of how one might use the proceeds from a carbon tax to fund corporate tax integration. In particular, I measure the industry impacts from such a reform.¹⁰

Energy Policy

In addition to work on environmental policy, I have long focused on energy policy with a particular emphasis on energy conservation. Early work with Kevin Hassett identified the impact of energy tax credits for home conservation improvements.¹¹ That research identified an interesting asymmetry between price policies and investment policies. Consider a conservation investment that will reduce energy by a known amount over some future period. A government policy to double energy prices henceforth should have the same impact on the propensity to make this conservation investment as an alternative policy to subsidize half the cost of the investment. However, we found that the investment subsidy was substantially more effective than the price pol-

icy. It may be that consumers do not believe that future energy tax increases are credible. Or, it may be that the publicity effects from investment credits influence consumers' purchasing behavior.

Energy conservation will be an important component of any policy to reduce energy consumption and to enhance energy security in the United States. The United States already has made impressive gains in how efficiently it uses energy. Energy intensity (energy use per dollar of GDP) has steadily fallen from a 1917 peak of thirty-five thousand BTUs per dollar of GDP (year 2000 dollars) to a current level of 9.3 thousand BTUs. In recent research, I document that roughly two-thirds of this decline can be attributed to improvements in energy efficiency and one-third to changes in the composition of economic activity in the United States.¹² I also investigate the mechanism through which increases in energy prices affect energy intensity. I find that the dominant effect is through energy efficiency rather than through an inducement to shift from energy-intensive to non-energy-intensive activities. In other words, whatever forces have contributed to a shift towards a service economy in the United States, higher energy prices are not among them.

Energy policy was at the forefront of Congressional attention in 2005 when Congress passed the first major energy legislation since 1992. This legislation contained tax incentives worth \$14 billion over a ten-year period. Some of these incentives were extensions of existing initiatives while others were new. I recently reviewed the new legislation and federal energy tax policy more generally.¹³ In considering tax policy initiatives towards energy, it is worth noting the four major reasons for government intervention in energy markets: externalities from energy production and consumption, national security, market failures in energy conservation, and Hotelling rent expropriation on imported oil. Federal energy policy is not well targeted towards those four concerns. I also show in that research that current energy tax policies make clean coal increasingly competitive with pulverized coal electricity generating plants. The initiatives also make wind and biomass competitive with natural gas electricity generation. Finally, despite the United States being the

* Gilbert E. Metcalf is a Research Associate in the NBER's Program on Public Economics and a Professor in the Department of Economics at Tufts University.

third largest producer of petroleum products in the world, the federal tax initiatives towards energy supply have a negligible impact on world supply or prices.

Taxation and Public Pricing

A third strand of research focuses on taxation and public pricing issues more generally. One aspect of that research considers the interplay between market structure and the appropriate form of commodity taxation when firms produce differentiated products and thus can exert some degree of market power. It has long been known that tax policy can substitute for direct regulation to achieve the socially optimal market structure.¹⁴ Research with George Norman suggests that the role of tax policy is more nuanced once one allows for more general market structures and technologies.¹⁵ Whereas the previous literature found that positive ad valorem taxes could help effect optimal market structure, we find that taxes may be required under some circumstances and subsidies in other circumstances. The degree of spatial contestability plays a key role in determining the sign of the optimal tax rate. Once one allows for flexible manufacturing technologies, the story changes considerably. Flexible manufacturing allows firms to switch product specifications easily with the result that firms can easily customize products for consumers. Flexible manufacturing can occur in traditional industries (for example, textiles) as well as in the Internet based economy. Internet shopping provides us the opportunity to get our own personalized web pages at sites like Amazon. It may well be, with some sites, that we also get our own personalized prices. We show that with flexible manufacturing, commodity taxes are now ineffective at helping to achieve optimal market structure.

Another example of this research agenda concerns the optimal pricing of an excludable public good in the presence of distortionary taxation. With Jongsang Park, I posited a model of excludable public goods where consumers obtain utility based on the amount of the public good provided and the number of times the public good is consumed. One example would be an uncongested national park.¹⁶ The government chooses the size of the park and consumers

choose how often to visit the park. The government also uses a non-linear income tax to effect redistribution from high-ability to low-ability types (where ability is unobservable). The tax structure relies on a self-selection mechanism to achieve a separating equilibrium. We show that if the public good is a complement to leisure, then it is optimal to set a positive price on the public good. The higher price on the public good induces more labor supply, which discourages high-ability workers from choosing the consumption-labor bundle designed for low-ability workers. In effect, the public good price helps us to discriminate the high from low-ability workers.

Summary

Much of my current research is directly or indirectly focused on the economics of climate change. Climate change is a topic at the intersection between environmental and energy economics and is one of the most difficult issues facing policymakers today. Any effort to reduce greenhouse gas emissions will require a shift in the forms of energy we currently use as well as a reduction in overall energy consumption. My current research focuses on how governments can best evaluate and design policies to address this critically important problem.

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⁶ A. L. Bovenberg and L. Goulder, "Neutralizing the Adverse Industry Impacts of CO₂ Abatement Policies: What Does It Cost?" in *Behavioral and Distributional Effects of Environmental Policy*, pp. 45–85.

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⁸ G. E. Metcalf, "A Distributional Analysis of Green Tax Reforms", NBER Working Paper No. 6546, May 1998, and *National Tax Journal* 52(4), 1999: pp. 655–81.

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¹⁰ G. E. Metcalf, "Corporate Tax Reform: Paying the Bills with a Carbon Tax", NBER Working Paper No. 11665, October 2005, forthcoming in *Public Finance Review*.

¹¹ K. Hassett and G. E. Metcalf, "Energy Tax Credits and Residential Conservation Investment: Evidence from Panel Data", NBER Working Paper No. 4020, August 1995, and *Journal of Public Economics* 57, 1995: pp. 201–17.

¹² G. E. Metcalf, "Energy Conservation in the United States: Understanding its Role in Climate Policy", NBER Working Paper No. 12272, June 2006.

¹³ G. E. Metcalf, "Federal Tax Policy Towards Energy", NBER Working Paper No. 12568, October 2006. This paper was written for the NBER's 2006 Conference on Tax Policy and the Economy.

¹⁴ J. A. Kay and M. J. Keen, "How Should Commodities Be Taxed?" European Economic Review 23(3), 1983: pp. 339–58.

¹⁵ G. E. Metcalf and G. Norman, "Oligopoly Deregulation and the Taxation of Commodities", NBER Working Paper No. 9415, January 2003, and in Contributions to Economic Analysis and

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NBER Profile: Charles H. Dallara

Charles H. Dallara was elected to the NBER's Board of Directors at its Fall 2006 meeting. Dallara, who is a Managing Director of the Institute of International Finance (IIF), will serve as a Director-at-Large.

Prior to joining the IIF, Dallara was a Managing Director at J.P. Morgan & Co. from 1991 to 1993. During the 1980s, he served in a variety of senior financial positions in the U.S. government. He was appointed by former President Bush to the position of Assistant Secretary of the U.S. Treasury for International Affairs in May 1989 and served in that position until June 1991.

A native of Spartanburg, South Carolina, Dallara earned a B.S. in econom-

ics from the University of South Carolina in 1970 and an honorary doctorate from the university in 1991. He did graduate work at the Fletcher School of Law and Diplomacy, Tufts University, receiving his M.A. in 1975, an M.A. in Law and Diplomacy in 1976, and a Ph.D. in 1986.

Dallara is a member of the Council on Foreign Relations and serves on the International Advisory Board of the Instituto de Empresa. He is also a member of the Board of Overseers of the Fletcher School of Law and Diplomacy of Tufts University. He resides in Oak Hill, Virginia with his wife, Peixin, and has three children, Stephen, Emily, and Bryan.

