SIMPLIFYING THE TAX CODE IN NEW YORK STATE: THE CASE FOR ENVIRONMENTAL TAXATION AND REVENUE SUBSTITUTION

Thomas R. Sadler[*]

ABSTRACT

In a policy of revenue substitution, the State of New York could increase tax system efficiency while improving environmental quality. Revenue from a state environmental tax on chemical emissions could be used to eliminate pre-existing taxes on business activity. This paper simulates policy implementation and concludes that, in addition to simplifying the state tax code, the revenue-neutral regulation could improve environmental quality, provide a market-based incentive for pollution abatement and maintain the size of the public sector.

I. INTRODUCTION

For state governments, balancing the budget and maintaining a tax code conducive for economic growth are fundamental challenges. One way for the governing authority to reduce reliance on distorting taxes is through ecological tax reform (ETR), an important new development in public finance and environmental economics. Conceptually, ETR means the public sector uses revenue from environmental taxation to finance lower rates on pre-existing taxes that distort economic decision-making. The idea of ETR is to shift some tax burden away from production, labor and income, all economic "goods," toward pollution, an economic "bad" (Bosquet, 2000). In the process, the public sector may simplify the tax code. For the purpose of political feasibility, the key for ETR is revenue neutrality (Pearce, 1991). Even though environmental taxation constitutes new regulation, the size of the public sector remains the same.

Many articles point to the benefits of ETR. Von Weizsacker and Jesinghaus (1992) argue that ETR could enhance environmental quality and increase tax-system efficiency. Hamond et al. (1997) conclude that, while giving polluters a long-term incentive for pollution abatement, ETR could improve many economic problems simultaneously by increasing the incentive for work, savings and investment. Parry and Bento (2000) find the presence of tax-favored consumption can reduce the efficiency costs of new environmental taxes. In an empirical survey of research on ETR, Bosquet (2000) concludes that, in the short term, ETR has the potential of increasing employment and significantly reducing pollution. Even though the potential of ETR creating a double dividend—a cleaner environment and employment gains—is still open to debate, the empirical evidence has found examples of this result (Sadler, 2001; Bosello et al., 2001).

Using a method similar to the frameworks of these other studies, this paper contributes to the literature by modeling ETR and simulating policy implementation in New York State. While many papers have simulated policy implementation at the national level in the United States and abroad, no research

---

[*] Department of Economics and Finance, Manhattan College, Riverdale, NY

has simulated ETR at the state level. Regardless of federal regulation, many reasons exist for implementation at the state level. Specifically, the policy could serve state environmental and fiscal goals. At the state level, regulators could identify polluters and implement effective policy. In addition, state regulation could provide policy makers with experience and familiarity that could be used at the national level. In other words, implementation of ETR at the state level could build momentum for national policy.

This paper estimates the extent to which ETR might reduce New York State's reliance on taxes on business activity. New York is the focus of the paper because, on a per-capita basis, the burden of state taxes exceeds that of every state but Alaska. The choice of chemical emissions as the target for environmental taxation results from an Environmental Protection Agency (EPA) requirement that firms report annual emissions.

Of particular policy interest in the paper is the ability of the public sector to tax a wide environmental base and limit the efficiency cost of the new tax policy. Using plausible parameter values, the paper finds that, in a revenue-neutral framework, the public sector in New York could reduce reliance on business taxes while providing a permanent incentive for the abatement of chemical emissions.

To develop this argument, this paper is organized as follows. Section 2 discusses the New York State tax system. Section 3 develops a first-best model of environmental taxation, including the formulation of environmental tax rates. Section 4 discusses chemical damage scores of the EPA. Section 5 develops a second-best policy framework. Section 6 simulates policy implementation. Section 7 concludes.

II. NEW YORK STATE TAX RECEIPTS

Table 1 lists New York State tax receipts from 1990 through 1999. As Table 1 makes clear, the public sector in New York State relies on personal income tax revenue for over 50 percent of its budget, although business and sales taxes make significant contributions. Under the category of corporation and business taxes, New York State taxes transportation, power, water, utilities, telecommunications and other activities.

Table 1—New York State Tax Receipts, 1990-1999

Year	Total State Collections	Personal Income	Corporation and Business	Sales, Excise and User	Property	Others
1999	37,165,396,955	20,662,375,214	5,820,785,763	9,224,443,948	1,412,773,448	45,018,583
1998	33,927,730,472	17,758,697,181	5,957,475,493	8,879,450,323	1,284,470,485	47,636,990
1997	32,076,909,740	16,370,887,332	5,920,605,026	8,609,791,751	1,126165,580	49,460,050
1996	32,178,839,324	16,998,212,766	5,709,784,799	8,330,926,856	1,086,847,097	53,067,806
1995	32,704,550,205	17,589,489,166	5,689,177,572	8,310,519,743	1,050,356,853	60,006,780
1994	31,254,356,521	16,033,514,352	6,229,073,291	7,862,010,220	1,054,582,023	75,166,635
1993	29,826,321,068	15,318,849,593	5,707,269,896	7,653,003,325	1,019,403,278	127,794,976
1992	28,594,999,541	14,913,380,341	5,190,949,381	7,374,501,861	1,030,726,798	85,441,759
1991	26,887,360,839	14,527,036,203	4,075,702,297	7,096,991,545	1,119,385,965	88,244,829
1990	26,930,157,402	15,240,467,249	3,378,609,123	7,125,785,027	1,097,369,979	87,926,024

Source: New York State Department of Taxation and Finance

III. FIRST BEST MODEL OF ENVIRONMENTAL TAXATION

Chemical manufacturers emit pollutants at different stages of the production process, including waste disposal. Chemical emissions, which may be hazardous, pose risk to human health and environmental quality. The risk stems from the properties of individual chemical releases: persistence, bioaccumulation and toxicity. According to the U.S. EPA (1998), highly persistent chemicals do not easily break down in the environment; bioaccumulative chemicals cannot be readily metabolized and can accumulate in ecological or human food chains via consumption or intake; and toxic chemicals pose risks to human health and the environment in many ways, depending on pollution concentration and chemical synergy. For example, when concentrated in an enclosed lake, the release of lead may poison an entire fish population.

Because of the ubiquity and uncertain impacts of chemical emissions, public policy makers face a difficult task in regulating these pollutants. But a variety of policy instruments are available. The EPA relies on command and control (CAC) regulation for chemical waste streams in the water, air and earth, which means mandating emission levels and abatement technology and restricting the use of certain chemicals (McKenzie, 1994). The Toxic Substances Control Act, Resource Conversation and Recovery Act, the Clean Air Act, and the Clean Water Act regulate chemical emissions (Sadler, 2000).

The steep cost of CAC regulation is creating momentum for a shift to a more decentralized policy regime. One example is the Toxics Release Inventory (TRI), an environmental databank, which is part of the 1986 Emergency Planning and Community Right-to-Know Act (EPCRA). The EPCRA mandates that a manufacturer with 10 or more employees in SIC codes 20-39 (with certain threshold requirements) must disclose the quantity of chemical emissions. Data from the annual reports to the EPA are tabulated in the TRI and published on the EPA website. Because interested parties may track chemical releases in their area and pressure companies to reduce pollution, the TRI represents a form of incentive policy (Konar and Cohen, 1997).

In addition, the United States taxes certain chemical inputs to production. These taxes target industries thought responsible for pollution and contamination. The revenue finances trust funds in the Superfund program to clean up the sites. However, the taxes do not discourage the economic activity that pollutes the environment (Fullerton, 1996).

As a result of the high cost of CAC regulation and the ineffectiveness of current environmental taxes on chemical inputs, the following model and policy simulation point to a more cost-effective and focused form of incentive policy. Using the TRI as the tax base for a system of environmental taxation would minimize administrative cost, because firms are already required to report to the TRI.

State government may use environmental tax revenue to finance lower rates on pre-existing taxes or eliminate certain taxes altogether. From the public perspective, the challenge is to formulate environmental tax rates on a per-unit basis that reflect the economic value of marginal pollution damage. The goal is to implement an environmental tax system that provides a long-term incentive for emission abatement.

The environmental tax system in this paper targets all on- and off-site emissions of companies in New York covered by the EPCRA. For target firms, the production of output (Y) leads to chemical emissions ($e_1,\ldots, e_n$). These chemical releases lead to different levels of marginal damage, depending on the rate and quantity of emissions, meteorological conditions, chemical synergy, proximity to humans and other factors. We assume that chemical emissions are the only source of environmental damage not already internalized by public policy.

Emissions in the absence of regulation (e_a) are a function of output, $e_a = \theta Y$. Total emissions (E) equal the sum of individual releases (e_a^i): $E = \Sigma e_a^i$. Production cost of chemical polluters is a function of output: $C_1(Y)$. In response to an environmental tax, a firm reduces emissions (e_t^i) below its pre-regulation level, $e_t^i < e_a^i$. The cost of pollution abatement (C_2) increases with the level of emission reduction and output: $C_2 = C_2(e_a^i - e_t^i, Y) = C_2(\theta Y - e_t^i, Y)$. Marginal environmental damage (MED) from chemical emissions $D(e_t^i)$ is an increasing function of e_t^i. MED may increase at different rates.

State regulators may increase efficiency by estimating the economic value of marginal damage and by levying an environmental tax. Environmental regulators must focus tax rate design on the difference between marginal private cost (MPC) and marginal social cost (MSC), which is MED. A first-best tax internalizes MED in price, so polluters consider the environment as a priced input. Efficiency considerations require that MPC equal MSC, and that MED equal marginal control cost. In the absence of regulation or the presence of inefficient CAC policy, these equations do not hold.

Equations (1) - (15), adapted from Lesser et al. (1997) and Sadler (2000), show how regulators may set environmental taxes according to MED. Total private cost (TPC) associated with production equals the sum of production cost and the cost of abatement:

$$TPC = C_1(Y) + C_2[\theta Y - \Sigma e_t^i, Y], \tag{1}$$

where $i = 1,\ldots, n$. Marginal private cost equals the marginal cost of increasing production plus the marginal cost of controlling additional emissions:

$$MPC = \partial C_1/\partial Y + \theta C_{21} + C_{22}. \tag{2}$$

Total social cost includes C_1, C_2 and the damage from chemical emissions:

$$TSC = C_1(Y) + C_2[\theta Y - \Sigma e_t^i, Y] + \Sigma D(e_t^i). \tag{3}$$

Marginal social cost equals MPC plus marginal damage:

$$MSC = \partial C_1/\partial Y + \theta C_{21} + C_{22} + \Sigma D_i'(de_t^i/dY). \tag{4}$$

To account for the marginal damage of chemical releases, regulators must implement environmental taxes. The per-unit tax on chemical emissions adjusts TPC:

$$TPC = C_1(Y) + C_2[\theta Y - \Sigma e_t^i, Y] + t_e^i e_t^i. \tag{5}$$

As a result, MPC becomes:

$$MPC = \partial C_1/\partial Y + \theta C_{21} + C_{22} + \Sigma t_e^i(de_t^i/dY) \tag{6}$$

First-best taxes are set according to MED, the difference between the MSC of equation (4) and the MPC of equation (6):

$$MSC - MPC = \Sigma D_i'(de_t^i/dY) - \Sigma t_e^i(de_t^i/dY) = (\Sigma D_i' - \Sigma t_e^i)(de_t^i/dY). \tag{7}$$

As equation (7) makes clear, the regulatory challenge is to adjust MPC by an environmental tax. Equation (7) and MED will equal zero if $t_e^i = t_e^{i'} \leq t^*$, where t^* is a first-best environmental tax that equals MED. Marginal external damage will be positive or negative as $t_e^{i'}$ is less than or greater than t^*, respectively.

The policy challenge is to estimate the economic value of MED. But instead of trying to implement an optimal environmental tax with imperfect information, a more realistic policy is to calculate the tax on one pollutant relative to others by comparing the relative damage of each. An EPA index of chemical damage values may facilitate this process.

IV. CHEMICAL DAMAGE SCORES

To prioritize the minimization of certain chemical releases, the EPA focuses on highly persistent, bioaccumulative, and toxic (PBT) chemicals, which pose long-term risk to humans and the environment. In particular, the EPA has established a chemical ranking of individual releases. The ranking methodology includes four criteria: PBT score, chemical prevalence in hazardous waste, evidence that chemicals exist in the environment at specific levels of concern, and the extent to which a chemical is targeted by the EPA (US EPA, 1998).

The four criteria provide a comprehensive procedure to calculate the relative risk of chemical releases. While the scientific methods of formulating the chemical rankings are beyond the scope of this paper, US EPA (1998) describes the methods in detail. To form a final list of target chemicals, the EPA aggregates the four criteria scores for individual chemical releases and arranges the scores in rank order from one to 100. Because the final scores take into account actual on- and off-site releases, the damage scores reflect potential risk to humans and the environment.

On a converted scale between zero and one, Table 2 lists the EPA damage scores per pound of emissions for the chemicals targeted in the policy simulation. One pound of mercury emissions, for example, is more hazardous with a damage score of 0.91 than one pound of chloroform emissions with a damage score of 0.674. For target pollutants in the policy simulation, the scores are used to measure marginal damage.

Table 2

EPA Chemical Damage Scores Per Pound of Emissions,

on a Scale from 0 to 1

Chemical	Score	Chemical	Score	Chemical	Score
1,1,1 Trichloroethane	0.674	Bromoxynil octanoate	0.25	Methyl parathion	0.34
1,1,1,2-Tetrachloroethane	0.424	Bromomethane	0.444	Naphthalene	0.701
1,1,2,2 Tetrachloroethane	0.521	Cadmium	0.924	Nickel	0.667
1,2-Dichlorobenzene	0.625	Carbofuran	0.382	Nitrobenzene	0.549
1,2 Dichloroethane	0.542	Chloroacetic Acid	0.278	Oxyfluorfen	0.111
1,2,4-Trichlorobenzene	0.667	Chloroform	0.674	Parathion	0.444
1,3-Dichlorobenzene	0.542	Chlorpyrifos Methyl	0.25	Pendimethalin	0.361
1,4-Dichlorobenzene	0.563	Chromium	0.778	Pentachlorophenol	0.653

2,4-D	0.444	C.I. Disperse yellow 3	0.167	Phenanthrene	0.681
2,4-Dinitrophenol	0.486	Cobalt	0.491	Phenol	0.674
2,4,5-Trichlorophenol	0.507	Copper	0.569	Phosgene	0.444
3,3'-Dichlorobenzidine	0.174	Decabromodiphenyl Oxide	0.292	Picric acid	0.236
3,3'-Dimethoxybenzidine	0.236	Diazinon	0.292	PCBs	0.868
3,3 Dimethoxybenzidine Dihydrochloride	0.167	Dicofol	0.361	Polycyclic Aromatic Cmpds.	0.917
4,4 Methylenebis (2-Chlorroaniline)	0.382	Dibenzofuran	0.438	Selenium	0.576
Acetaldehyde	0.257	Dibutyl Phthalate	0.694	Silver	0.796
Acrolein	0.299	Diphenylamine	0.444	Simazine	0.194
Acrylamide	0.34	Dimethoate	0.257	Tetrachloroethylene	0.618
Aldicarb	0.257	Ethylene Oxide	0.34	Tetrachlorvinphos	0.167
Allyl Alcohol	0.34	Fluometuron	0.167	Thiodicarb	0.292
Aluminum	0.389	Heptachlor	0.507	Thiram	0.278
Ametryn	0.194	Hexachlorobenzene	0.674	Triallate	0.292
Anthracene	0.674	Hexachlorocyclopentadiene	0.674	Trichloroethylene	0.618
Antimony	0.646	Hexachloroethane	0.493	Trifluralin	0.403
Arsenic	0.736	Lead	0.944	Triphenyltin chlor.	0.167
Atrazine	0.278	Linuron	0.167	Vanadium	0.38
Benomyl	0.382	Manganese	0.481	Zinc	0.856
Beryllium	0.583	Mercury	0.91		
Bromoacil	0.148	Methoxychlor	0.618		

Source: EPA

V. SECOND BEST ENVIRONMENTAL TAX POLICY

To adjust MPC and accurately tax chemical emissions, the regulator must identify the monetary value of marginal damage, D_i' in equation (7). This procedure requires two steps. First, the regulator must identify the marginal damage of an additional unit of chemical emissions, as compared to other target pollutants. Table 2 provides this information. The second step is to assign a tax rate that reflects the monetary value of pollution damage. The following environmental tax policy addresses these two issues by targeting a single base called a damage unit (DU). Because information on the monetary value of MED over a range of emissions is not available for chemical emissions, a second best policy framework is necessary.

One DU is defined to equal one emission pound of a hypothetical pollutant with a damage score of 100 in the EPA scoring list. One emission pound of the hypothetical pollutant equals one DU. With this hypothetical pollutant established as the numeraire, one emission pound of mercury equals 0.910 DU, one emission pound of silver equals 0.796 DU, and so on, according to the quantity of DU in Table 2.

The policy simulation below levies a single tax rate (t_{DU}) on one DU, and a different tax rate is then computed for each pollutant. For target chemicals, the resulting calculation is a tax rate per pound of emissions:

$$(t_{DU})(\text{DU/Emission Pound}) = \text{Tax Rate/Pound of Emission} \qquad (8)$$

For example, if t_{DU} = \$2.00, a polluter would have to pay, according to the damage values in Table 2, \$1.89 for one emission pound of lead, \$1.85 for one emission pound of cadmium and so on.

To generate revenue, the tax rate per emission pound is multiplied by the quantity of annual on- and off-site emissions from the TRI:

$$\text{Tax Revenue} = (\text{Tax Rate/Pound of Emissions})(\text{Emissions}). \tag{9}$$

With the application of DU for target pollutants, TPC and TSC become:

$$TPC = C_1(Y) + C_2[\theta Y - t_{DU}\Sigma e_t^i DU_i,\ Y] + t_{DU}\Sigma e_t^i DU_i, \text{ and} \tag{10}$$

$$TSC = C_1(Y) + C_2[\theta Y - t_{DU}\ \Sigma e_t^i DU_i,\ Y] + \Sigma D_i e_t^i, \tag{11}$$

where $i = 1,..., n$. External cost, the difference between (11) and (10) is:

$$TSC - TPC = \Sigma D_i e_t^i - t_{DU}\Sigma e_t^i DU_i, \tag{12}$$

which will be less than, equal to, or greater than zero as t_{DU} is greater than, equal to, or less than some $t_{DU}' < t^*$, where t^* is a first-best tax.

Environmental taxation is formulated on the basis of MPC and MSC:

$$MPC = \partial C_1/\partial Y + \delta C_{21} + C_{22} + t_{DU}\Sigma DU_i(de_t^i/dY), \text{ and} \tag{13}$$

$$MSC = \partial C_1/\partial Y + \delta C_{21} + C_{22} + \Sigma D_i'(de_t^i/dY). \tag{14}$$

The difference between (14) and (13), marginal environmental damage, is

$$MSC - MPC = \Sigma D_i'(de_t^i/dY) - t_{DU}\Sigma DU_i(de_t^i/dY) = (\Sigma D_i' - t_{DU}\Sigma DU_i)de_t^i/dY. \tag{15}$$

In (15), the extent to which the EPA damage scores (DU_i) reflect actual marginal damage (D_i') determines how well the system approximates the first-best policy.

VII. POLICY SIMULATION

For policy simulation, 1999 TRI emission data were gathered for eighty-five chemicals in New York for SIC codes 20-39. The chemicals and total emissions are listed in Table 3. The key in the policy simulation is setting the tax rate on one DU. The Oak Ridge National Laboratory and Resources for the Future (1994) report aids this formulation process. Research from ORNL and RFF (1994) indicates that the marginal damage from one pound of lead emissions is $32.13. Lead was the only chemical emission included in the ORNL and RFF (1994) study. If the monetary value of damage for one pound of lead emissions, with a DU value of 0.994, is $32.13, the tax rate on a hypothetical chemical with a DU of one is $34.04. The policy simulation therefore assigned a tax rate of $34.04 per DU.

Table 3
Results of Policy Simulation: Tax Rates and Revenue

Chemical	Total pounds of emissions	Tax rate per emission pound	Revenue
1,1,1 Trichloroethane	4063	22.9430	93,217
1,1,1,2-Tetrachloroethane	0	14.4330	0
1,1,2,2 Tetrachloroethane	0	17.7348	0
1,2-Dichlorobenzene	0	21.2750	0
1,2 Dichloroethane	73,225	18.4497	1,350,978
1,2,4-Trichlorobenzene	0	22.7047	0
1,3-Dichlorobenzene	0	18.4497	0
1,4-Dichlorobenzene	0	19.1645	0
2,4-D	0	15.1138	0
2,4-Dinitrophenol	0	16.5434	0
2,4,5-Trichlorophenol	0	17.2583	0

3,3'-Dichlorobenzidine	0	5.9230	0
3,3'-Dimethoxybenzidine	0	8.0334	0
3,3 Dimethoxybenzidine Dihydrochloride	0	5.6847	0
4,4 Methylenebis (2- Chlorroaniline)	5	13.0033	65
Acetaldehyde	53,835	8.7483	470,964
Acrolein	0	10.1780	0
Acrylamide	3	11.5736	35
Aldicarb	0	8.7483	0
Allyl Alcohol	0	11.5736	0
Aluminum	142,994	13.2416	1,893,464
Ametryn	0	6.6038	0
Anthracene	755	22.9430	17,322
Antimony	17,914	21.9898	393,926
Arsenic	24	25.0534	601
Atrazine	0	9.4631	0
Benomyl	0	13.0033	0
Beryllium	0	19.8453	0
Bromoacil	0	5.0379	0
Bromoxynil octanoate	0	8.5100	0
Bromomethane	42,682	15.1138	645,086
Cadmium	6572	31.4530	206,709
Carbofuran	252	13.0033	3277
Chloroacetic Acid	1541	9.4631	14,583
Chloroform	1430	22.9430	32,808
Chlorpyrifos Methyl	0	8.5100	0
Chromium	591,935	26.4831	15,676,286
C.I. Disperse yellow 3	0	5.6847	0
Cobalt	3479	16.7136	58,147
Copper	199,987	19.3688	3,873,500
Decabromodiphenyl Oxide	17,507	9.9397	174,014
Diazinon	0	9.9397	0
Dicofol	0	12.2884	0
Dibenzofuran	0	14.9095	0
Dibutyl Phthalate	1377	23.6238	32,530
Diphenylamine	528	15.1138	7980
Dimethoate	0	8.7483	0
Ethylene Oxide	7	11.5736	81
Fluometuron	0	5.6847	0
Heptachlor	0	17.2583	0
Hexachlorobenzene	0	22.9430	0
Hexachlorocyclopentadiene	1118	22.9430	25,650
Hexachloroethane	0	16.7817	0
Lead	68,893	32.1338	2,213,791
Linuron	0	5.6847	0
Manganese	41,386	16.3732	677,623
Mercury	67	30.9764	2075
Methoxychlor	0	21.0367	0
Methyl parathion	0	11.5736	0
Naphthalene	10,283	23.8620	245,373
Nickel	533,012	22.7047	12,101,867
Nitrobenzene	0	18.6880	0
Oxyfluorfen	0	3.7784	0
Parathion	0	15.1138	0
Pendimethalin	0	12.2884	0
Pentachlorophenol	0	22.2281	0

Phenanthrene	0	23.1812	0
Phenol	89,026	22.9430	2,042,520
Phosgene	76	15.1138	1149
Picric acid	0	8.0334	0
Polychlorinated Biphenyls	11401	29.5467	336,862
Polycyclic Aromatic Compounds	42,063	31.2147	1,312,983
Selenium	47	19.6070	922
Silver	1752	27.0958	47,472
Simazine	0	6.6038	0
Tetrachloroethylene	37,933	21.0367	797,986
Tetrachlorvinphos	0	5.6847	0
Thiodicarb	0	9.9397	0
Thiram	0	9.4631	0
Triallate	0	9.9397	0
Trichloroethylene	376,319	21.0367	7,916,517
Trifluralin	0	13.7181	0
Triphenyltin chloride	0	5.6847	0
Vanadium	0	12.9352	0
Zinc	27,484	29.1382	800,835
Total	2,400,975		53,469,197

Using equation (8), a tax rate per emission pound was calculated for each target pollutant. To calculate total revenue, equation (9) was used. Table 3 includes these calculations. The total revenue generated on 2,400,975 emission pounds in New York State would have equaled $53,469,197.

Because of information limitations, the simulation included eighty-five chemicals. However, as the EPA continues to expand the mechanism that estimates damage scores, the statewide environmental tax policy could eventually target up to 3000 chemicals. This level of inclusion could potentially increase the amount of revenue generated by a factor of thirty, raising over a billion dollars. Governing authority could then use the revenue to simplify the tax code, finance a lower tax rate on business income and eliminate many business taxes in New York State. While the environmental tax represents new regulation, the overall size of the state public sector would not change. Revenue substitution would encourage business activity while the market-based policy would enhance environmental quality by discouraging chemical releases.

VII. CONCLUSION

This paper finds that, by reducing or eliminating taxes on business activity, ecological tax reform could increase the efficiency of New York State's tax system and improve environmental quality. In a revenue-neutral policy framework, the key for policy implementation is formulating environmental tax rates that reflect the marginal environmental damage of individual chemical releases. For chemical emissions, this policy requirement rests on the reliability of the EPA damage scores.

The level of policy success depends on the size of the environmental tax base, the extent to which the environmental tax encourages emission reduction and the degree to which the elimination of pre-existing taxes compensates companies for having to pay an environmental tax. To minimize efficiency losses, policy implementation would require an increase in the number of chemical emissions that fall under policy jurisdiction. Additional research will expand the size of the chemical set and investigate the environmental implications of a tax rate that will raise a higher level of revenue.

REFERENCES

Bosello, Francesco; Carraro, Carlo and Galeotti, Marzio. "The Double Dividend Issue: Modeling Strategies and Empirical Findings." *Environment and Development Economics*, 2001, 6, pp. 9-45.

Bosquet, Benoit. "Environmental Tax Reform: Does It Work? A Survey of the Empirical Evidence." *Ecological Economics*, 2000, 34, pp. 19-32.

Fullerton, Don. "Why Have Separate Environmental Taxes?" in James Poterba, ed., *Tax Policy and the Economy 10*. Cambridge, MA: MIT Press, 1996, pp. 33-70.

Hamond, M. Jeff; DeCanio, Stephen J.; Duxbury, Peggy; Sanstad, Alan H. and Stinson, Christopher H. “Tax Waste, Not Work.” *Challenge*, November-December 1997, 40(6), pp. 53-62.

Konar, Shameek and Cohen, Mark. "Information As Regulation: The Effect of Community Right to Know Laws on Toxic Emissions.” *Journal of Environmental Economics and Management*, 1997, 32, pp. 109-124.

Lesser, Jonathan A.; Dodds, Daniel E. and Zerbe, Richard O. *Environmental Economics and Policy*. New York: Addison-Wesley, 1997.

McKenzie, Fiona. "Policy Formulation for the Management of Hazardous Pollutants." *Journal of Environmental Planning and Management*, 1994, 37(1), pp. 87-105.

Oak Ridge National Laboratory and Resources for the Future. *Estimating Externalities of Coal Fuel Cycles*. New York: McGraw-Hill, Inc, 1994.

Parry, Ian W.H. and Bento, Antonio M. "Tax Deductions, Environmental Policy, and the ‘Double Dividend’ Hypothesis." *Journal of Environmental Economics and Management*, 2000, 39, pp. 67-96.

Pearce, David, "The Role of Carbon Taxes in Adjusting to Global Warming." *The Economic Journal*, 1991, 101, pp. 938-948.

Sadler, Thomas R. "Regulating Chemical Emissions with Risk-Based Environmental Taxation." *International Advances in Economic Research*, May 2000, 6(2), pp. 287-305.

Sadler, Thomas R. "A Movement Toward Validation of the Double Dividend Hypothesis." *The Journal of Business Economics Research*, April 2001, 3(2), pp. 81-98.

United States Environmental Protection Agency. "Notice of Availability of Draft RCRA Waste Minimization PBT Chemical List." *Federal Register*, 1998, 63(216), pp. 60332-60343.

Von Weizsacker, Ernst U. and Jesinghaus, Jochen. *Ecological Tax Reform*. London: Zed Books, 1992.