The Research & Experimentation Tax Credit

By:

Chris R. Edwards
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Tax Foundation

November 1, 1993
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# The Research Tax Credit

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The Research Tax Credit

1. Overview

As part of the Economic Recovery Tax Act (ERTA) of 1981, Congress enacted a temporary 25 percent tax credit designed to spur research spending by business. The credit was available to businesses with research spending in excess of a base period amount. As an incremental credit, it was designed to encourage additional research spending while minimizing revenue loss to the federal Treasury.

Concerns about the “competitiveness” of U.S. businesses and studies showing low research spending by U.S. business have prompted Congress to renew the research credit repeatedly since 1981. The credit was extended and lowered to 20 percent in the Tax Reform Act of 1986 (TRA’86), extended in 1988 and 1989, modified and extended in 1990, and extended in 1991. The credit expired temporarily on June 30, 1992.

President Clinton had proposed to reenact the research credit on a permanent basis in his FY’94 budget. Congress instead enacted yet another temporary extension to the credit as part of the recently passed budget bill. The credit is extended, with no major changes, retroactive to July 1, 1992, and will expire on June 30, 1995, unless it is extended.

However, Congress may act to modify the credit and establish it on a permanent basis. Senator John Danforth (R-Mo.), the original author of the credit, has been joined by Senator Max Baucus (D-Mont.) in introducing S. 666 in the current Congress. S. 666 makes the credit permanent and further refines the credit to make it more effective.

The research tax credit provides an additional incentive for research spending beyond the incentive provided by the research deduction. Research expenditures may be viewed as capital spending since they provide future benefits and would normally generate future amortized deductions. However, since 1954 businesses under section 174 have been able to expense all qualified research spending in the current year, thus providing a tax benefit.

The research tax credit has encouraged some additional private research investment since being implemented in 1981. However, the credit’s incentive effects have been
substantially diminished by its structure and because businesses have been hesitant to
invest in additional research when the tax benefit of doing so has been temporary and
transient.

This paper provides an overview of the purpose, legislative history, and effective-
ness of the research tax credit and summarizes recent proposals to reauthorize the credit.

2. Rationale for a Research Credit

Concern has been raised in recent years that the United States, as a nation, under-
invests in technological research. While the United States defense industry has provided a
large stimulus to military research, concern has focused on civilian research spending.

Statistics indicate that U.S. spending on civilian research, in proportion to the size of
our economy, falls short of some other advanced nations, in particular, Germany and Ja-
pan. This is a concern of the Clinton administration, which noted in its February discussion
paper on technology policy that, "currently, the United States invests 1.9 percent of GDP in
non-defense research, as compared to 3.0 percent in Japan and 2.7 percent in West Ger-
many." (See Figure 1 for the most recent National Science Foundation comparative data.)
While these statistics show a marked difference in research spending between countries,
the interpretation of the figures and policy prescriptions is not clear. The figures may indi-
cate a statistical measurement difference between countries or may indicate a structural
difference between economies.

Figure 2 indicates that for total research spending, including defense spending, the
United States is more in line with Japan and Germany. (Figure 3 offers total research
spending for the U.S. in constant 1993 dollars.) Since the United States specializes in
defense research, it is not surprising that if one excludes this industry from the tally, the
U.S. research effort appears lower. Nonetheless, some researchers are quick to conclude
that, "these [non-defense research] figures suggest that greater amounts of corporate
resources should be allocated to R&E." (Billings and McGill 1992)

Aside from conclusions based on aggregate statistics, two arguments are commonly
given in support of government action to increase research spending.
Both views are given in support of a permanent extension to the research tax credit in the
February 1993 Clinton administration technology discussion paper.

The first view, supported by Billings and McGill, among others, is that government
should support private research to strengthen U.S. "competitiveness." The concern is that, "without additional allocations of R&E funds to the private sector, the ability of U.S. companies to meet the international competitive threat on a long-term basis may be impaired." With government tax incentives, U.S. businesses would presumably be more competitive, both because of the extra research performed and as a result of lower tax costs.

Economic theory is usually offered in support of a government subsidy to research
spending, as well. A 1993 report by the Congressional Research Service (CRS), for example, states that, “there is widespread agreement that investment in research and development is under-provided in a market economy.” Research, like education, is assumed to provide spillover benefits to the rest of society, in addition to the private benefits of such investment. Because private investors cannot reap the full benefit from their research expenditures, a “market failure” occurs and private research spending is lower than the most desirable amount for society as a whole. So, while businesses may optimize the amount of research they do for their own benefit, “society” would be better off if they did more.

In effect, by foregoing some tax revenue through the research tax credit, the government is making additional private investment in research possible and promoting higher productivity growth and an increase in spillover benefits. These benefits will quickly be spread in the modern economy where information about technologies and market opportunities are disseminated more and more easily. It has become easier for one company to capture the benefits of another company’s research spending. This may, on the one hand, reduce a business’s incentive to invest in research, but, on the other hand, may increase the benefit of government offering research spending incentives.

The implications for policy of this reality of the modern economy are more unclear given today’s global economy. Technological advancements are diffused quickly in an integrated world economy without regard for national borders. If in response to “market failure” the U.S. government subsidizes research, it will be the world economy, not just the U.S. economy, which will benefit. Extra research performed by U.S. businesses will have spillover benefits, not just to other U.S. businesses and citizens, but also to Japanese and German businesses and citizens.

3. The Structure of the Research Tax Credit

The Economic Recovery Tax Act of 1981 implemented a tax credit for businesses which increased qualified research spending above a base period amount. Since then, the statutory rate, the definition of research, and the base for the credit, have all been modified as Congress has sought to make the credit as effective as possible.

3.1 Statutory Rate

ERTA implemented a 25 percent tax credit for a five-year period expiring in 1986. With the Tax Reform Act of 1986, the credit was reduced to a statutory rate of 20 percent.
However, as discussed below, the statutory rate does not give a good reflection of the overall effective rate of the credit.

3.2 Definition of Research

For the research tax credit implemented in 1981, Congress borrowed the definition of research used for the research deduction (section 174). This definition is fairly broad and
includes, “all such costs incident to the development of an experimental or pilot model, a plant process, a product, a formula, an invention, or similar property and the improvement of already existing property.” However, ERTA disallowed certain expenditures from qualifying for the credit, including expenditures made outside the U.S., expenditures in the social sciences, arts, and humanities, and expenditures funded by another person, from the credit.

Qualified research costs primarily include salaries and wages of research staff and payments for research supplies. Capital expenditures, for assets such as buildings to be used for research, generally do not qualify for the deduction or the credit. And although the credit is often termed the “R&D credit,” development costs, such as marketing costs, are generally not eligible for the credit.

Concerns about an overly broad definition of research led to a narrowing of the credit’s definition in TRA’86. In particular, Congress was concerned that real technological advancements only, and not just routine product development, should be eligible for the credit. For example, expenditures to improve a product’s styling or cosmetic design were ineligible for the research credit after 1986.

Research expenditures eligible for the credit now include a) expenses for research salaries and supplies, b) some computer use costs, and c) 65 percent of contract research payments by a business. To qualify for the credit, research must be technical in nature and not related to management functions, and must be part of a “process of experimentation,” thus not taking place after the beginning of commercial production.

3.3 Base Calculation for the Credit

The research credit is designed as an incremental credit. By establishing an incremental credit, Congress has attempted to maximize the incentive effect of the credit while minimizing revenue loss to the Treasury. However, such an approach adds complexity to the tax credit as a base amount of research expenditures must be defined by legislation.

Until 1990, businesses claiming the credit calculated current year qualified research expenditures in excess of the average of the previous three years research expenditures. This meant that a business which increased its research spending one year raised the base and lowered the benefit of the credit for future years.

This moving average base approach was changed in the Omnibus Budget Reconcili-
Figure 3: Total and Nondefense R&D in the United States (Constant 1993$)

Source: National Science Foundation.

As a benefit to businesses, the fixed base percentage cannot exceed 16 percent.
But as a restriction, the minimum base amount cannot be less than 50 percent of qualified research expenses in any given year. For start-up businesses, the fixed based percentage is set at three percent if the business does not have sufficient taxable years between 1984-1988.

The following example shows a business which maintains research expenditures at a constant 4 percent of sales over the time period.

*Example:*

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales ($ mils.)</th>
<th>Qualified Research ($ mils.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>100</td>
<td>4.0</td>
</tr>
<tr>
<td>1985</td>
<td>105</td>
<td>4.2</td>
</tr>
<tr>
<td>1986</td>
<td>110</td>
<td>4.4</td>
</tr>
<tr>
<td>1987</td>
<td>116</td>
<td>4.6</td>
</tr>
<tr>
<td>1988</td>
<td>122</td>
<td>4.9</td>
</tr>
<tr>
<td>1989</td>
<td>128</td>
<td>5.1</td>
</tr>
<tr>
<td>1990</td>
<td>134</td>
<td>5.4</td>
</tr>
<tr>
<td>1991</td>
<td>150</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Fixed Base Percentage = \( \frac{(4.0 + 4.2 + 4.4 + 4.6 + 4.9)}{(100 + 105 + 110 + 116 + 122)/5} \)

\[= \frac{4.42}{110.6} = 0.04 \text{ million or } \$40,000 \]

Base Amount for 1990 = \(0.04 \times \frac{(110 + 116 + 122 + 128)/4}{110.6} \)

\[= 4.8 \text{ million} \]

Base Amount for 1991 = \(0.04 \times \frac{(116 + 122 + 128 + 134)/4}{110.6} \)

\[= 5 \text{ million} \]

Credit for 1990 = \((5.4 - 4.8) \times 0.20 = 0.12 \text{ million or } \$120,000 \)

Credit for 1991 = \((6.0 - 5.0) \times 0.20 = 0.20 \text{ million or } \$200,000 \)

This example illustrates that even though a business may keep its research spending at a constant percentage of sales, it can increase the research credit if its sales are expanding. On the flip side, a business with declining sales that manages to keep research to the same percentage of sales may not be eligible for the credit. Some people argue this latter business is the type of business that should be assisted by a research subsidy in order to encourage research in tough business climates when a business might be under cost-cutting pressure.
The new base calculation method established in OBRA'89 is generally regarded as an improvement over the previous method. According to a study by Hall (1992) the change raised the effective rate of the credit substantially. A recent report by the CRS agrees and points out that this method reduces the disincentive effect of the old moving average calculation where each increase in research spending by a business led to a higher base and lower tax benefits in future years. Billings and McGill support these assessments and estimates that the effective credit rate was raised, on average across all industries, to 2.11 percent with the new base calculation method, from 1.98 percent under the old method.

However, Billings and McGill argue that the new credit calculation is unfair to businesses in tough economic climates. A “perverse consequence” of the new base calculation method, he states, “is an increased after-tax cost of R&E activities for businesses that are increasing R&E activity in a period of stagnant sales. In fact, such businesses should be the target of R&E tax incentives.” On this point the CRS agrees and notes that, “[r]esearch by businesses whose outlays are shrinking is, in principle, just as valuable as research by expanding businesses.”

The semiconductor industry, for example, argues that the base calculation for the research tax credit is unfavorable to their industry because of conditions in the mid-1980s, which are the years the fixed base for the credit are based on. Sales by U.S. businesses were depressed below normal, resulting in a high fixed base percentage and reduced tax benefits for current research spending levels.

A more general flaw of the incremental credit is that it provides no benefit to businesses whose market condition mandates stagnant or declining R&D spending. Consider, for example, a business that invested $100 million in R&D in 1992, and suppose that business must cut R&D spending in 1993, for whatever reason, to $70 million in the absence of any tax credit. Had the business qualified for a credit in 1993, it might have increased spending to $80 million or more. The extra $10 million in R&D spending made possible by the credit is no less valuable than if the business had been able to increase 1993 spending from $100 million to $110 million. In effect, the current incremental credit works only as long as the businesses can continually increase their R&D spending.

3.4 University Basic Research

The research tax credit features a distinction regarding expenditures to support university research. Prior to 1986, the credit was applicable to only 65 percent of a corporation’s payments to a university to perform basic research. TRA’86 legislation elimi-
nated this 65 percent distinction and set up a separate base calculation for support of university basic research to increase the incentive for this type of activity.

4. Other Features of the Tax Code Effect on Research

While the statutory rate of the research credit is 20 percent, the credit’s interaction with other aspects of the tax code alter its effective rate for particular businesses.

4.1 The Research Tax Deduction

As noted, since 1954 Congress has supported research by allowing businesses to expense qualified research spending rather than amortizing expenditures over a number of years. The Office of Technology Assessment (OTA) notes that this ability to expense research spending "reduces the cost of a dollar's worth of research performed today from $1.00 to about $0.66."

Prior to 1988 legislation, a business could utilize the research tax credit while at the same time getting the full benefit from expensing all research under section 174. After 1988, research expenditures available for deduction were reduced by 50 percent of the value of the credit claimed in that year. OBRA legislation in 1989 further reduced the benefit of the deduction to businesses as 100 percent of the research claimed for credit purposes must be subtracted from expenditures deducted under section 174.

Billings and McGill provide an example of how this provision, combined with the restriction that the base amount cannot be less than 50 percent of qualified research expenses, reduces the credit’s effective rate to a maximum of 6.6 percent.

*Example:* Corporation A spent $10 million on qualified research in 1990. Because of the 50 percent restriction, the base amount cannot be less than $5 million. Therefore, the maximum credit is 20 percent of this, or $1 million. However, the section 174 research deduction is reduced by the $1 million credit so that the federal income tax liability will increase by $340,000 (34 percent * $1 million). Therefore, Corporation A will receive a net benefit from the credit of $660,000 or 6.6 percent of $10 million.

4.2 The Alternative Minimum Tax

The interaction of the Alternative Minimum Tax (AMT) also serves to reduce the benefit of the research credit. If a business is subject to AMT, it cannot claim the research credit in the current year. A business may carry the credit forward but this of course re-
duces its value, particularly since once businesses become subject to the AMT they rarely return to paying regular income tax.

The denial of the research credit for businesses paying AMT is difficult to justify on either tax or research policy grounds. Businesses are subject to AMT for reasons unrelated to their research spending. Moreover, there is no reason to presume that research spending by these businesses is any less valuable to society than spending by businesses paying regular income tax. In fact, businesses paying AMT are often the research-intensive businesses that Congress had in mind when it enacted the credit.

The legislation offered by Senators Danforth and Baucus, S. 666, recognizes this problem and allows businesses paying AMT to offset a portion of their AMT liability with the research credit.

4.3 Foreign Source Income

A significant complication to calculating the tax benefit of research spending for U.S. multinationals involves the allocation of research expenses between U.S. and foreign source income. The tax rules regarding allocation are an important issue for multinationals, who must consider tax liability when making decisions on the level and location of new research expenditures.

The complicating factor involves the foreign tax credit that the United States allows against income taxes paid to foreign governments. In basic terms, allocating research expenses to domestic income will reduce tax liability on U.S. source income, and allocating research expenses to foreign source income will reduce U.S. tax liability on foreign source income through the foreign tax credit. However, for companies in an excess foreign tax credit position (that is, when tax payments to foreign governments exceed U.S. tax liability on foreign source income), allocating U.S. research expenses to foreign source income effectively denies them the benefit of the research tax deduction.

Rules for the allocation of expenses to foreign source income are specified in Treasury Regulation 1.861-8 adopted in 1977. In 1981 ERTA suspended these rules and allowed all research expenditures to be allocated against U.S. income. But since then the rules have been repeatedly modified and, currently, 36 percent of research expenditures must be allocated to either foreign or domestic income on the basis of sales or income. The Omnibus Budget Reconciliation Act of 1993 (OBRA'93) modifies this rule to alter the 36 percent allocation to 50 percent for one year. That is, 50 percent of research must be
allocated on the basis of sales or income and the other 50 percent is allocated automatically to income sourced to the place of performance of the research.

5. Effectiveness

A number of statistical studies have been conducted on the effectiveness of the research tax credit. Most studies conclude that the research credit has had only a modest impact on research spending. In a 1989 study, the General Accounting Office (GAO) found that the credit stimulated less than $0.5 billion of additional research per year over the period 1981 to 1985. A 1992 study by Baily and Lawrence (1992) estimated the credit stimulated about $2.8 billion in additional research per year between 1981 and 1989 (in 1982$).

In a recent study of about 1,000 U.S. businesses, Hall (1992) found a stimulus to research spending of about $2 billion annually during the 1980s from the credit. However, Hall argues that changes in the credit in 1990 have made the credit significantly more effective. Hall estimates that the effective rate of the credit was less than five percent from 1981 until 1990, but that the change in base calculation implemented in 1989 in OBRA raised the effective rate of the credit to more than 10 percent. The CRS also believes the latest version of the credit is more effective, stating, “[f]or many businesses, the 1989 changes probably increased the incentive effect of the credit substantially.”

Nonetheless, most researchers point to the incremental nature of the credit as a continuing weakness. Billings and McGill point to inconsistencies with both the old and new base calculation methods. In particular, he points out that businesses facing tough competition and experiencing declining sales are the businesses that need an extra incentive to invest in research, but that the current mechanism may penalize them. He suggests these problems may warrant replacing the incremental credit with a credit based on total research spending. Hall (1992) agrees, stating, “[i]t is this [incremental] feature of the credit which, although admirable in intent, has led to the weak incentive effects observed....”

Clearly, few businesses can increase research expenditures continually, as such a credit seems to assume. And businesses cannot sustain an artificially high level of research unless they receive an ongoing tax benefit which an incremental credit does not provide. Nonetheless, the pressure to preserve the tax base has forced Congress to arrive at this compromise of an incremental incentive, thus diluting its effectiveness.

Another factor frequently cited for the credit’s ineffectiveness is that, like many
features of the tax code, it has been temporary and continually changing. Researchers have noted that the high adjustment costs associated with the long-term nature of research projects makes research spending particularly vulnerable to uncertainty in tax policy (see Hall, 1992). Moreover, many smaller, research-intensive businesses are limited by cashflow constraints when making research investment decisions. It is very risky for them to begin a research project assuming the associated expenses will qualify for the credit, if there is a chance the credit will expire halfway through the project.

Appraisals of the research tax credit’s effectiveness must consider the many changes in the U.S. economy over the past decade. Most obviously, business cycle upturns and downturns, structural shifts in the economy, and the defense buildup and subsequent reductions will influence any aggregate measures of research spending.

In addition, the frequent changes in corporate tax rates and bases since 1981 have influenced research spending. For example, capital expenditures to support research spending have become variably more or less expensive as Congress has lowered corporate income tax rates and expanded and contracted corporate tax bases. For example, ERTA lowered the cost of research by allowing businesses to depreciate all capital expenditures for research over a three-year period. TRA’86 increased the cost of research by requiring businesses to depreciate these capital expenditures over five years. Also, the reduction of the corporate rate to 34 percent under TRA’86 made the research deduction relatively less beneficial since the tax on alternative, less-favored investments was lowered.

6. Other Countries

Most other developed countries encourage research spending through the tax code. In a recent survey of 23 developed nations the OTA (1993) found that “most nations permit research spending to be deducted from taxable income in the year incurred,” generally with a provision to carry forward unused deductions to future years. In addition, many countries have a tax credit mechanism to stimulate research spending. For example, Canada, France, and Japan all have incremental credits similar to the U.S. research tax credit.

Interestingly, the top two research countries statistically, Japan and Germany, differ markedly in research tax policy. Notably, Germany does not have a research tax credit. In contrast, the Japanese government grants a 20 percent credit for research expenditures greater than 10 percent of taxable income or the highest dollar amount in any prior year, whichever is less. As a further encouragement for small- and medium-size businesses, these companies are permitted to use six percent of current research expenditures as the
tax credit amount. In addition, a seven percent research investment tax credit is available for all businesses for the acquisition cost of certain defined basic technology capital assets. All in all, Japan’s tax provisions for research appear quite generous.

7. Current Proposals

As a tax expenditure, the research tax credit has produced a revenue loss to the federal Treasury of between $700 million and $2 billion annually since being implemented in 1981. While the concern for revenue loss in Congress is more acute than ever, there is a great concern over the competitiveness of U.S. business, particularly with a continuing sluggish economy and persistently large trade deficits. For this reason, a tax credit to support research has wide, bipartisan support in Congress. President Clinton proposed reenacting and making permanent the research tax credit in his FY’94 budget.

7.1 The President’s Proposal

President Clinton’s FY’94 budget proposed to extend the research tax credit retroactively to June 1992 and to make it permanent. In addition, the proposal added a new rule regarding the calculation of a fixed-base percentage for start-up companies. The president’s budget estimates the proposal would have resulted in a revenue loss to the Treasury of $9.6 billion between FY’93 and FY’98.

7.2 The Omnibus Budget Reconciliation Act of 1993

While the House of Representatives originally passed the budget bill with the president’s permanent extension of the research credit; the Senate passed only a one-year extension. The final budget package passed by Congress contains a compromise three-year extension of the credit. Once again, the dominance of the deficit in budget negotiations took precedence. By repeatedly enacting temporary extensions to the credit, Congress can appear to show smaller revenue losses in the five-year budget tallies while denying businesses the benefit of stability in the tax code and denying society the benefits of a fully effective research tax credit.

7.3 The Danforth and Baucus Research Credit Proposal

Senators Danforth and Baucus have introduced S. 666, legislation that would modify and make permanent a research tax credit. The principle modifications to the credit include a liberalized method for calculating the fixed-base percentage. Rather than using the arbi-
trary period 1984-1988 as a base, the bill allows the taxpayer to use the lowest percentage obtained from any four consecutive years between 1983 and 1993.

The bill also provides for:

- a flat 10 percent credit to small businesses with sales under $100 million, in the hopes of simplifying the credit calculation;

- businesses paying AMT to offset 50 percent of their AMT liability with the research credit;

- a separate base calculation for civilian research by defense businesses so as to encourage the transition to civilian research in the economy.

In general, this latest research tax credit proposal reflects a further fine-tuning of the credit, a process which has been ongoing since 1981. The enactment of a permanent credit would simplify use of the credit for business whereas further fine-tuning may make the credit more effective at the expense of added complexity.

8. Conclusion

Many factors determine the level of research spending by business. Tax policy can encourage increased spending by lowering the cost of additional research spending. However, in practice, Hall (1992) notes, “[t]he R&E tax credit as it has been implemented during the 1980s is a good example of how even a simple public policy idea which has bipartisan support can emerge from Congress both greatly complicated and weakened in its effects.”

In particular, the fact that the credit has been both temporary and incremental have weakened the incentive effect for businesses. However, modifications to the credit’s base calculation method in 1990 and current proposals to make the credit permanent promise to make the credit more effective.

It is doubtful, however, that such marginal changes in the tax code could make up the difference between U.S. levels of nondefense research spending compared to level attained by the Japanese. Since the United States spends about two percent of GDP on nondefense research and Japan spends three percent, it would take a $63 billion research spending increase in this country to reach the Japanese level. This figure is an order of magnitude greater than the relatively small impact of perhaps a few billion dollars of extra
spending generated from the current research tax credit. Therefore, if increasing the level of private nondefense research spending to levels approaching those of our major competitors is to become a national priority, many additional measures will need to be taken, including expanding the research tax credit.
Value-Added Taxes and Other Consumption-Based Taxes: An Annotated Bibliography

By:

Bruce Bartlett
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Office of Economic Policy
U.S. Treasury Department

April 1993
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About the Author

Bruce Bartlett was deputy assistant secretary of economic policy at the U.S. Department of Treasury in the Bush administration. Prior to that he was executive director of the Joint Economic Committee of the United States Congress. Currently he is a visiting fellow at the Cato Institute.

The opinions expressed are those of the authors and do not necessarily reflect the views of the Tax Foundation.
Value-Added Taxes and Other Consumption-Based Taxes: An Annotated Bibliography

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U.S. Treasury Department

April 1993
INTRODUCTION

For centuries economists and philosophers have debated the virtues of consumption or expenditure taxes. In the 17th and 18th centuries Thomas Hobbes, David Hume, William Petty and Alexander Hamilton favored taxes on consumption because they were limited and largely voluntary--people could reduce their tax by reducing their consumption--and because saving was untaxed. Consumption taxes were also viewed as more fair.

In the late 19th and early 20th centuries, such important economists as John Stuart Mill, Alfred Marshall, and Irving Fisher carried forward the argument. Increasingly, however, the debate revolved around the appropriate definition of income for tax purposes and whether saving ought to be included in the tax base. Fisher and a number of other economists argued that taxing saving and the return to saving constituted a double tax. By contrast, Robert Haig, Henry Simons and others argued that the appropriate tax base would include all income, including interest, saving, capital gains and other items which would be excluded from a consumption tax.

From the 1940s through the 1960s the Haig-Simons view largely prevailed. Since the 1970s, however, growing concerns about economic growth, inadequate saving and investment, the growing U.S. trade and budget deficits, and international competitiveness have revived interest in consumption taxes, especially the value-added tax, which was widely adopted in Europe in the 1960s.

The following annotated bibliography reviews some 200 books, articles and papers relating to consumption taxes and the VAT. Although not exhaustive, the list is comprehensive, including theoretical and practical works, economic and legal analyses, historical and contemporary studies, general and technical reviews, and includes opponents as well as supporters of consumption taxes. It is hoped that it will be of value to policymakers in future tax policy debates.
KEY ISSUES REGARDING THE VALUE-ADDED TAX

• Substitute or add-on tax?

Much of the discussion of a VAT assumes that it would be used as a wholesale substitute for the individual income tax, the corporate income tax, the social security tax, the property tax, or existing excise taxes.¹ These studies generally find efficiency gains because the VAT imposes less of an excess burden on the economy than these other taxes. However, if the VAT is imposed as an additional tax on top of other taxes, much of this efficiency gain could be lost (Bartlett 1984, Riley 1990), especially if the VAT leads to an overall increase in the tax burden (Bacon 1972).

• Effect on trade.

Because a VAT is imposed at the border on imports and rebated at the border on exports, many people often assume that the effect of a VAT will be to reduce the trade deficit. In fact, a VAT merely puts imports and exports on an equal footing and does not per se have any impact on the trade balance (Feldstein and Krugman 1990). This is confirmed by the experience of the U.K. (Prest 1980). And were there such an impact, floating exchange rates would adjust accordingly, although this effect is disputed (Raboy 1990). However, over the long-term a VAT may improve the trade balance if it increases competitiveness (Cnossen 1991) or reduces the federal budget deficit (Bierman and Bierman 1987). On the other hand, if VAT revenue were used to reduce taxes on capital, this could lead to increased capital inflows, which would raise the value of the dollar, and thus worsen the trade balance (Aaron 1986).

• Effect on size of government.

A number of studies have shown that imposition of a VAT leads to increased taxes and spending in the long run because the VAT is hidden in the prices of goods and because VAT rates are more easily raised than other types of taxes (Alverson 1986, Nellor 1987). Specific studies of Britain (Bannock 1986, Blundell 1988) and Michigan (Anderson 1987) support this view. However, other studies have failed to find any significant relationship between a VAT and the size of government (Furchtgott-Roth 1990, Stockfisch 1985).

• **Regressivity.**

The inherent regressivity of a VAT is not disputed (i.e., the poor will pay a higher percentage of their income in tax than the wealthy). The real question is whether this regressivity can be adequately redressed and, if so, how? McIntyre (1991) believes that no matter what is done, the regressivity cannot be entirely offset. Others believe that the regressivity issue is overstated (Brannon 1979), that it will tend to fade over time (Bickley 1989), or that it can be offset adequately through transfers (Aaron 1988). As a related matter, some writers indicate that the burden of a VAT would disproportionately impact the elderly because their consumption exceeds their income (Auerbach and Kotlikoff 1983, Gravelle 1988).

• **Flat rate or exemptions?**

Most countries with VATs have offset the regressivity of the tax by exempting or having lower rates on items used heavily by the poor (e.g., food, clothing). Unfortunately, exemptions greatly increase the complexity and administrative cost of the tax (Ballard and Shoven 1987). Consequently, offsetting the regressivity is best done through direct payments, and not through exemptions (Brashares, Speyer and Carlson 1988; Cnossen 1982).

• **Invoice or subtraction method?**

The reason the administrative cost of a VAT is increased when there are exemptions or multiple rates is that they require use of the invoice method for collecting the VAT, which is more complicated than the simpler subtraction method. (Under the subtraction method, firms subtract all of their costs from the sale price and pay a flat tax on the difference—the value added. Under the invoice method, the tax is assessed on the entire sale price with taxes on inputs subtracted. The former method requires no additional paperwork, while the latter demands that records of taxes paid on all inputs be kept and passed along the entire production/sales chain.) The pros and cons of the two methods are reviewed in Carlson and Gordon (1988) and U.S. General Accounting Office (1989).

• **Compliance costs.**

The cost of administering a VAT may be high for both government and businesses depending on what VAT method is used (Kelley 1970; Parker 1976). Under the invoice method, the cost to businesses will be a function of the number of invoices and the sales per invoice (Barker 1972). The burden will be heavier for small firms than large ones, with
the cost to small firms possibly exceeding the revenue raised (Bickley 1988). The cost to government will also be high. The U.S. Treasury Department (1984) estimated that a national VAT would require 20,000 additional revenue agents and cost $700 million (in 1984 dollars) to administer. On the other hand, Galvin (1983) and Murray (1986) note that overall compliance will be improved because the VAT is much more difficult to evade than income taxes, although Wetzler (1991) believes that the alleged self-enforcing nature of the VAT is a myth. Turnier (1984, 1988) discusses ways of minimizing compliance costs.

- **Effect on saving.**
  
  One of the main arguments for a VAT, stressed by virtually all supporters of the VAT, is that it would stimulate saving because it is a tax on consumption. This would be the case only if revenue from the VAT were used to eliminate or reduce taxes on capital or to reduce the budget deficit (i.e., reduce negative saving by government). However, some writers question the assumption that a VAT would increase saving (Davidson 1981, DeFina 1980, Hall 1969, McIntyre 1987, Militzer 1990).

- **Timing questions.**
  
  Auerbach and Kotlikoff (1983) note that between the time a VAT is introduced or passed and the time it is implemented, people will have a strong incentive to reduce their saving and increase consumption. Fullerton, Shoven and Walley (1983) note that growth may decline in the short run after the introduction of a VAT as people reduce consumption. However, in the long run, growth and consumption will be higher due to a larger capital stock.

- **Inflation.**
  
  The first order effect of a VAT is to raise prices by roughly the amount of the tax. However, this is a one-time effect and does not indicate that a VAT is inherently inflationary (Tait 1980). Also, the ultimate effect of a VAT on prices is strongly influenced by monetary policy (Hafer and Trebing 1980, Ruebling 1973).

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• **State and local governments.**

State and local governments rely heavily on retail sales taxes for revenue. Consequently, they have tended to view any sort of federal sales tax, such as a VAT, as an intrusion onto their revenue base. The U.S. General Accounting Office (1990) discusses this concern. On a related matter, Rivlin (1990) urges the states to institute a jointly-administered national VAT.

• **Treatment of services.**

The taxation of services is a special problem for a VAT because it is hard to measure value-added. Henderson (1988) discusses the problem of a VAT with regard to financial services.

• **U.S. experience with a VAT.**

People have been advocating a VAT or VAT-type tax for the U.S. since at least the 1920s (Adams 1921, Jordan 1921, Mills 1921, Fisher and Fisher 1942). During World War II the U.S. Treasury Department even put forward a VAT proposal, called a spendings tax, in part as a means of dampening inflation by reducing consumption. The proposal was not adopted, however. Since the 1950s the state of Michigan has had a form of VAT called the single business tax.

• **Political questions.**

In the late 1970s, Congressman Al Ullman (D., Oregon), chairman of the House Ways and Means Committee, put forward a major VAT proposal (Lindholm 1980a, McLure 1980, Brecher 1982). However, his constituents viewed this as a new sales tax and reacted very negatively, throwing Ullman out of Office in 1980 (Latta 1985).

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BIBLIOGRAPHY


Discusses the relative price effects of substituting a VAT for the corporate income tax. Concludes by calculating which industries would gain and which would lose from such a switch.


Contains papers on the VAT experience in France, Italy, The Netherlands, Sweden, The United Kingdom, and Germany.


Replacing the corporate income tax with a VAT would increase the after-tax return on capital in the U.S., thus attracting foreign capital, which in turn would raise the value of the dollar, thereby hurting exports.


The author believes that the regressivity of a VAT could be offset by additional means-tested income transfers and an expanded earned income tax credit. He also believes that a VAT would not be unduly burdensome to state and local governments.


Most studies of the consumption tax assume that such a tax would be imposed as a wholesale replacement for the income tax. However, in practice consumption taxes tend to exist alongside or in addition to the income tax. This hybrid system creates special problems which have not generally been dealt with. This book contains a number of technical papers dealing with various aspects of the hybrid arrangement.

An early statement favoring a U.S. consumption tax.


Responds to a request from President Nixon to review the possibility of replacing the property tax with a federal VAT. See also Advisory Commission on Intergovernmental Relations (1974).


Prepared in response to a request by President Nixon in his 1972 State of the Union Address. Examines the question of whether a value-added tax would be an appropriate substitute for the residential property tax to finance public education. See also Advisory Commission on Intergovernmental Relations (1973).


Reviews Michigan’s experience with a state value-added tax.


Suggests that VAT revenue could be used to finance corporate tax cuts, tax cuts for middle income workers, and improve competitiveness.


Finds that countries with VATs tend to have higher spending and tax levels than countries without VATs.


Reviews the experience with VAT in Argentina, Belgium, Brazil, France, Mexico, the United Kingdom, and West Germany.

Shows that the burden of the single business tax on Michigan industry is heavy and suggests that the overall burden of taxation in Michigan may be higher because of the tax.


Seminal work advocating a consumption tax. Believes that such a tax would be fairer, simpler, and more efficient than the income tax.


Responds to criticism of earlier article (Andrews 1974) by Alvin Warren (1975). Argues against criticism that a consumption tax would be less fair than an income tax.


Examines the switch from a wage tax to a consumption tax in a life-cycle model. Shows that taxes on the elderly initially will be quite high, since they are no longer paying wage taxes but will now have higher taxes to pay on consumption. Also shows that the timing of implementation of a consumption tax can have important effects; in the interim between introduction of the tax and its implementation, people will have a large incentive to dissave and increase consumption.


Argues that voluntary compliance with the tax law is partially a function of the overall burden of taxation. Suggests that if a VAT were used to increase the overall burden that taxpayer compliance would be greatly reduced.

Believes that a VAT is essentially a proportional income tax and that it should be substituted for all existing federal taxes, including the payroll tax.


The authors find that the efficiency losses are high from exempting certain items from a VAT in order to redress regressivity. If a VAT is imposed it should be as uniform as possible. See also Cnossen (1982).


Finds that revenue-neutral substitution of VAT for the income tax yields modest welfare gains; that such welfare gains are significantly reduced if nonuniform VAT rates are imposed; that a progressive expenditure tax yields lower gains than a VAT; and that a VAT is superior to income tax rate increases if additional revenue is required.


Concludes that introduction of a VAT tends to increase the overall tax level; that VATs are seldom implemented in a neutral manner, thus creating distortions; that the compliance costs are regressive with respect to firm size; and that efforts to reduce the compliance burden on small businesses have not worked.


Finds that compliance costs to the businessman are a function of the number of purchase and sales invoices that must be dealt with and the average sale per invoice. Shows that the larger the average sale per invoice, the lower the compliance cost will be per dollar of sales.


Argues that most analyses favoring a VAT assume that it
would replace an existing tax or the whole tax structure. However, if a VAT is imposed on top of the existing tax structure as an additional revenue source, virtually all of the presumed benefits would be negated.


Raises various concerns about imposition of a VAT.


Indicates that redressing regressivity of a VAT would be very difficult to achieve even if many items are exempt from tax.


Finds that the administrative burden of a VAT on small businesses would be high. The administrative cost to the government would also be high, possibly exceeding the VAT revenue from small businesses. Reviews options for reducing the burden.


Notes that the distributional effects of a VAT depend a great deal on whether one looks at the initial impact or the impact over one's lifetime. In the former case regressivity is high, but is much reduced in the latter. This paper was largely reprinted in Tax Notes (April 23, 1990), pp. 447-466.


The authors argue that the trade deficit is a major problem and that it results from the federal budget deficit, which eats up private saving and causes overconsumption. They believe that a consumption tax to reduce the budget deficit would redress this problem.

Examines the compliance cost of the VAT to small businessmen based on the British experience. The author was formerly an economist with Britain's National Federation of Self Employed and Small Businesses.


Reviews Britain's experience with the VAT. Finds that the administrative cost to businesses is extremely high and that such costs undermine the idea that a VAT is an efficient tax. Also suggests that the VAT has led to an overall increase in the tax burden.


Raises various objections to a VAT.


The author, a professor of economics at Princeton, discusses advantages of a consumption tax over an income tax and practical problems relating to implementation of a consumption tax.


A comprehensive review of issues relating to the consumption tax.


The author believes that the regressivity of a VAT has been overstated and that any such regressivity can be redressed.


Examines problems of a VAT and finds that all can be fixed.

Argues that replacing the corporate income tax with a VAT would not improve the trade balance.


The author believes that a tax on accumulated savings at death is necessary to complement a consumption tax.


Concludes that regressivity is best redressed through direct payments to lower income groups, rather than exempting necessities or increasing existing income transfers.


Analyzes the effects of the 1980 Ullman VAT bill and also the experiences of some European countries with a VAT.


Discusses a proposed value-added tax in Japan, as recommended by the Shoup Mission. (Note: Although such a tax was enacted, it was never implemented and was ultimately repealed.)


 Discusses the Treasury proposal and suggests that such a tax might help curb inflation by dampening demand.


Notes that the VAT was adopted in Europe for unique reasons not applicable to the U.S. and that adoption of a VAT in the U.S. may be more difficult than it was in Europe.


Reviews the different effects of an invoice style VAT and a
business transfer tax. The authors generally support the first method.


Discusses a VAT proposal put forward by Senator William Roth (R., DE).


Advocates a progressive personal expenditure tax.


The author believes that if a VAT is imposed, it should have a uniform rate, rather than variable rates, with lower rates on "necessities" and higher rates on "luxuries." A uniform rate would allow for a lower overall tax rate, would be far easier to administer, and would improve efficiency. See also Ballard and Shoven (1987).


The author addresses various criticisms of the VAT and believes that whatever evils a VAT may have they are preferable to those resulting from the continuation of large budget deficits.


Believes that a VAT would aid international competitiveness.


Argues that a VAT should be used only for raising revenue, not to achieve distributional or other goals, and that it be implemented in as neutral and administratively feasible manner as possible. A VAT also should be preceded by substantial price liberalization and enterprise reform.

Discusses the pros and cons of adopting a VAT as an addition to the existing tax system. Also reviews proposals for a consumption tax.


Presents revenue estimates for a 5 percent VAT on different tax bases. This report is published annually.


Believes that there is no shortage of private saving and that a VAT would have a negative effect on growth by discouraging consumption.


Finds large efficiency gains to substituting a VAT for the corporate income tax, although gains varied greatly by industry. Notes that the analysis does not take into account the possibility that unincorporated businesses would move to incorporate, thus eroding the individual income tax base and requiring a higher VAT rate to maintain revenue neutrality.


The author is skeptical that substituting the income tax with a VAT would stimulate saving.


Reviews consumption tax proposed by Robert Hall and Alvin Rabushka of Stanford University. See also Hall and Rabushka (1985).

Finds that substituting a VAT for the corporate income tax would have allocative efficiency gains. Examines some inter-industry redistribution effects.


Believes that the argument for a VAT is essentially the same as the argument for a federal retail sales tax.


Believes that a VAT is essentially equivalent to a general sales tax and would have similar incentive effects. Some differences are spelled out.


Favors a retail sales tax over a VAT. Contrast with Shoup (1973). See also Krauss (1979).


Argues strongly in favor of a consumption-based tax system, and responds to liberal critics of such a system.


Explains that a VAT gives no particular advantage to exports, even though the tax is rebated at the border. This is because the tax applies to imports at the border as well. Thus the terms of trade are unchanged. The principal effect of a VAT on trade would come from lowering the after-tax cost of capital and increasing the capital stock.

Final and most complete statement of Irving Fisher's expenditure tax proposal. Fisher's principal concern was to eliminate saving from the tax base in order to eliminate double taxation.


Reports a speech by Congressman E. Clay Shaw (R., FL), a member of the House Ways and Means Committee, in which he argues strongly for a VAT on grounds of competitiveness.


Discusses the Treasury's 1942 spendings tax proposal from the point of view of economic theory. Argues that a such a tax would be desirable during wartime, but not during peacetime. At the time the author was with the Treasury Department's tax staff. See also Paul (1954), Poole (1943), and U.S. Treasury Department (1944).


Reviews recent VAT and consumption tax proposals.


Believes that arguments for a consumption tax are compelling and discusses reasons for lack of public support for such a tax.


In the initial shift to a consumption tax people will consume less and save more. However, as the capital stock grows people are eventually able to consume more because the larger capital stock greatly increases national income. The present value of income gains are estimated to be $650 billion in 1973 dollars.


Finds that the growth of taxes and spending in countries...
with VATs was no different than in countries without VATs. See also Stockfishch (1985) and contrast with Nellor (1987).


Believes that a VAT would strengthen tax compliance by bringing some "underground" activities into the tax base and ensuring that everyone paid some tax.


The director of taxes for the Whirlpool Corporation generally favors the single business tax, but suggests improvements.


Reviews general issues relating to the VAT, developed and developing country experiences, and administrative and implementation issues.


Congressman Newt Gingrich (R., GA), proposes instituting a VAT as a replacement for the payroll tax.


Examines the practical problems of implementing and administering a progressive consumption tax. Concludes that although such a tax is theoretically feasible, implementation problems plus the political unlikelihood of Congress enacting an administratively workable tax argue against its adoption.


Believes that, as a practical matter, it is unlikely that the U.S. would ever replace the income tax with a consumption tax, but instead might adopt some form of consumption tax as a supplement to the income tax. This being the case, Graetz prefers raising additional revenue through selective excise tax increases, especially on energy, rather than through a broad-based consumption tax.

The author, an economist with the Congressional Research Service, argues that a VAT would worsen income distribution, that the efficiency gains would be small and partially offset by higher administrative costs. In particular, she sees a VAT as redistributing income from the current generation of elderly to younger and future generations.


The author compares a VAT with an increase in income taxes to reduce the deficit and finds that the superiority of a VAT is extremely modest.


Suggests that support for a VAT may be increasing.


Strongly criticizes the Treasury proposal as "simply a new super-surtax on a comparatively very small number of taxpayers in the upper brackets with additional emphasis on limiting their spending."


Notes that the economic effects of introducing a VAT can be strongly influenced by other government policies, such as monetary policy. See also Ruebling (1973).


Reprint of a 1921 paper generally considered, along with Simons (1938), to be the classic statement in favor of a broad income base for taxation (i.e., Haig-Simons) and against a consumption base. However, Wildasin (1990) argues that a careful reading of Haig finds much support for the expenditure base.

Concludes that the efficiency argument for a consumption tax is weak, because in the long-run growth is a function of population growth and technological change and not taxation. Although there would be some economic gains from switching to a consumption tax, they would be temporary.


Proposes a flat-rate income tax on a pure consumption base.


Echoing Hume (1985), Hamilton argued strongly in favor of a consumption tax on the grounds that it is essentially voluntary and less prone to abuse by the state: "It is a signal advantage of taxes on articles of consumption that they contain in their own nature a security against excess. They prescribe their own limit, which cannot be exceeded without defeating the end proposed—that is, an extension of the revenue."


Reprint of a 1968 paper published by the U.S. Chamber of Commerce. Generally favors a VAT.


Reviews proposal by Irving Fisher and Herbert Fisher (1942) and finds that eliminating saving from the tax base would require much higher tax rates than those estimated by Fisher and Fisher to maintain the same revenue yield.


Examines the special problems of a VAT with regard to financial institutions.
Originally published in 1651, Hobbes argues for a consumption tax on moral grounds: "Equality of Imposition, consisteth rather in the Equality of that which is consumed, than of the riches of the persons that consume the same. For what reason is there, that he which laboureth much, and sparing the fruits of his labour, consumeth little, should be more charged, then he that living idly, getteth little, and spendeth all he gets; seeing the one hath no more protection from the Common-wealth, then the other? But when the Impositions, are layed upon those things which men consume, every man payeth Equally for what he useth: Nor is the Common-wealth defrauded, by the luxurious waste of private men."


Reports a speech by former House Budget Committee chairman James Jones predicting adoption of a VAT by Congress in 1993.


Originally written in 1754, Hume states: "The best taxes are such as are levied upon consumptions, especially those of luxury; because such taxes are least felt by the people. They seem, in some measure, voluntary; since a man may chuse (sic) how far he will use the commodity which is taxed." See also Hamilton (1961).


An early statement favoring a U.S. consumption tax.


Suggests that a federal consumption tax might usefully
augment the income tax, but not replace it.


Classic statement of the case for an expenditure tax by a leading British economist.


Argues that Strnad (1985) has simply redefined income to mean consumption, thus turning the Haig-Simons definition of income into its opposite. See Strnad (1987) for a response.


Rejoinder to Strnad (1987).


Believes that an expenditure tax is administratively feasible, although the administrative burden would be high. However, believes that such burdens would be offset by higher compliance under an expenditure tax.


In 1924, Keynes testified before the Colwyn Committee on debt and taxation. Keynes concluded: "An expenditure tax, though perhaps theoretically sound is practically impossible."


Believes that a VAT is equivalent to a labor tax plus a wealth tax and thus is more progressive than a proportional income tax.

Argues in favor of a national retail sales tax in lieu of a VAT. See also Due (1973).


Reviews some of the implications of a VAT on international trade.


Argues that a VAT is necessary to balance the federal budget.


Argues that a VAT would be better than Gramm-Rudman as a means of reducing the deficit.


Argues that liberals, who have generally opposed a VAT as regressive, ought to support such a tax.


Reviews the experience of former House Ways and Means Committee chairman Al Ullman (D., OR), who was defeated for reelection in 1980 after supporting a VAT.


Argues in favor of a consumption tax.


Reviews experience with a VAT in developed countries and applicability to developing countries. See also Shoup (1988) and Gillis, Shoup and Sicat (1990).

Argues in favor of a consumption tax as a replacement for the corporate and individual income tax. Interestingly, the author, who is noted for his liberal views, states: "The fact that savings, even the savings of the rich, would be automatically exempt should be considered a virtue of sales or value-added taxes: savings and investment are indispensable for economic growth. If the rich did not save and invest in one way or another, in the long run someone else would be obliged to do so."


Discusses a forthcoming Supreme Court case on the constitutionality of the Michigan single business tax. See also Smart and Gleckman (1991).


Strongly advocates a VAT as a partial offset to the corporate and individual income taxes.


Strongly advocates a VAT such as that proposed by Congressman Al Ullman in 1980.


An historical survey.


Advocates complete replacement of all federal taxes with a VAT and a net wealth tax.

English translation of a 1976 report commissioned by the Swedish government. Argues that an expenditure tax would be superior to the existing income tax in Sweden.


Reprint of a 1917 paper in which Marshall favored a consumption tax over an income tax on grounds of equity.


Expresses concern that Congress would not enact a uniform, neutral VAT, but rather would use the VAT to further social and political goals, thus negating the economic benefits of such a tax.


Believes a VAT would not aid saving and investment. Favors an increase in marginal income tax rates to raise revenue.


Believes it is impossible to fully redress the inherent regressivity of a VAT either through exemptions, tax credits or other offsets.


Explains why the Michigan single business tax is a form of value-added tax.


Reviews a VAT proposal put forward by House Ways and Means Committee Chairman Al Ullman in 1979.

General review of the issues by a strong advocate of a VAT.


Proposes a simplified alternative tax (SAT) for socialist economies in transition as an alternative to the income tax. The SAT would be a tax on consumption similar to a VAT. For criticism, see Tait (1992).


Contains separate papers by McLure and Ture. Although both generally favor a VAT, they have different points of view on some technical issues.


Contains the report and recommendations of a committee chaired by James Meade to examine the British tax system. Argues against existing hybrid system in favor of either a comprehensive income tax or a pure expenditure tax.


Reviews Canada’s recent experience with a form of VAT. Points out great complexity of the tax.


Argues in favor of a consumption tax. States that an expenditure tax would be easier to administer than current income tax. Believes that critics overstate implementation problems.


An empirical analysis of the experiences of OECD countries from 1965 to 1986 shows no effect on saving from a VAT.
One of the most powerful arguments for an expenditure tax is that an income tax double taxes saving (first on the saving itself and second on the interest). In his testimony before the Hume Committee in 1852 and before the Hubbard Committee in 1861 (reprinted in this volume), Mill argued powerfully that the income tax constituted a double tax on saving and that only expenditure should be taxed.


Indicates that a VAT would be an effective way to raise new revenue for the federal government.

Mills, Ogden. 1921. Congressional Record, August 17, pp. 5137-5139.

Congressman Ogden Mills, later to become Secretary of the Treasury, was an early advocate of an expenditure tax. During a speech on the House floor in 1921 he stated: "My own feeling is that we should repeal all surtaxes. That we should keep the normal tax, and then we should tax men on what they spend at a graduated rate. Money saved and reinvested in productive enterprises of the country should be taxed at a flat rate."


Argues against an expenditure tax in favor of a comprehensive income tax. The author believes that advocates of an expenditure tax have understated the potential negative effect of such a tax on labor supply. He also believes such a tax would be unfair and that the transition to an expenditure tax would be very difficult.


Supports consumption tax proposal put forward by Senators Sam Nunn and Pete Domenici.


A general discussion of implementation issues.

Discusses flat rate tax proposal put forward by former California Governor Jerry Brown.


Argues that a consumption tax would improve tax compliance.


Finds that arguments for a VAT are weak.


Finds that introduction of a VAT does increase the tax ratio. Contrast with Stockfisch (1985) and Furchtgott-Roth (1990).


Senators Sam Nunn (D., GA) and Pete Domenici (R., NM) co-chaired a blue-ribbon commission which recommended wholesale replacement of the existing tax system with a consumption-based system. This report contains this and other recommendations.


Discusses different effects of a VAT depending on how depreciation is treated. Examines three variations: with depreciation deduction, without depreciation deduction, and with expensing.


Finds that in the short-run, substituting a VAT for the corporate tax will lower real wages and after-tax corporate profits will rise. In the longer-run these effects are mitigated, but do not disappear. The result in either case is increased income inequality.

Finds that whether a VAT increases or reduces economic stability depends on what assumptions are made about shifting. If the tax cannot be shifted, stability will be reduced; if it can be shifted, stability will increase.


Reviews the experience of OECD countries with VATs and other forms of consumption taxes.


Discusses origin and operation of the Michigan business activities tax, a precursor to the single business tax which existed from 1953 to 1967.


Examines the compliance cost of a VAT on different hypothetical firms. Finds that no major change in accounting procedures would be required and that such costs would amount to less than one percent of sales.


The Treasury Department's former general counsel explains the origin and rationale for the spendings tax proposal.


Contains papers from a 1978 conference, including both advocates of a consumption tax and defenders of the income tax.


A 17th century supporter of consumption taxes. In his *Treatise of Taxes & Contributions*, Petty says: "Every man should pay according to what he actually enjoyeth; upon
which account this Tax is scarce forced upon any, and is very light to those, who please to be content with natural Necessities." (p. 94)


Believes that large new revenues are needed to reduce the budget deficit and that a VAT is the best way to raise such revenue.


Notes that the VAT was originally developed in response to the inequities of existing "turnover" taxes in various European countries. The movement toward European economic integration further demanded a movement toward "tax harmonization," leading to expansion of the VAT throughout the EC.


Discusses rationale for and implementation of the Treasury Department's 1942 spendings tax proposal. See also Friedman (1943), Paul (1954), and U.S. Treasury Department (1944).


The U.K. introduced a VAT in 1973. Notes that it is virtually impossible to avoid exemptions, both for political reasons and practical reasons (e.g., financial services). Introduction of the VAT initially exacerbated inflation and has had no discernable effect on the balance of payments.


Argues against the prevailing idea that exchange rates will adjust to cancel-out any impact of the VAT on trade. Concludes that a VAT will have nontrivial effects on trade.


Reports that many business leaders previously opposed to a VAT have become more sympathetic.

Reviews experience with the single business tax and suggests that such a tax could easily work at the federal level as well.


Questions the motives of supporters of a consumption tax. Suggests that they are only looking for revenue to finance additional tax breaks for business.


Argues that imposing a VAT on top of the income tax, rather than in lieu of it, would eliminate most of the economic advantages of such a tax.


Proposes that the states jointly impose VATs, thus implementing a national VAT via the states.


Supports a VAT as a replacement for federal excise taxes.


A U.S. Senator presents arguments for a form of VAT.


Focuses on the interaction between a VAT and monetary policy. See also Hafer and Trebing (1980).

Concludes that the business transfer tax proposal put forward by Senator William Roth (R., DE) is, in fact, a form of value-added tax. Pros and cons are discussed.


Reviews the European experience through 1973.


Reviews alternative consumption tax proposals.


The author, a professor of economics at Swarthmore, believes that a progressive consumption tax is preferable to exemptions on capital income under the existing income tax as a method of promoting capital formation.


Early description of the VAT.


Favors a VAT over a federal retail sales tax. Contrast with Due (1973).


Reviews issues relating to adoption of a VAT by a developing country. See also Gillis, Shoup and Sicat (1990) and Lent, Casanegra and Guerard (1973).


Essentially a popular version of the U.S. Treasury
"Blueprints" study by a former Secretary of the Treasury. See U.S. Treasury Department (1977).


Along with Haig (1959), the classic case for an income base for taxation against an expenditure base.


Raises various administrative questions.


Discusses a recent U.S. Supreme Court case upholding the constitutionality of the Michigan single business tax.
Suggests that other states may now turn to similar taxes.


Supports a VAT as a substitute for existing excise taxes, the corporate income tax, or as a new source of revenue.


Supports substitution of a VAT for the corporate tax.


Believes that if large new revenues are needed, a VAT is far preferable to an increase in corporate or individual income tax rates.


Analyzes a VAT proposal put forward by House Ways and Means Committee Chairman Al Ullman in 1980. Contains simulations
based on the DRI model.


Reviews a proposal by Senator Russell Long to substitute a VAT for the payroll tax. Finds merit in the proposal, but ultimately believes that it would be counterproductive.


Finds no support for the view that imposition of a VAT increases government spending. See also Furchtgott-Roth (1990) and contrast with Nellor (1987).


Argues that a correct interpretation of the Haig-Simons ideal would equalize taxation in present value terms. Thus a true Haig-Simons tax base would consist of pure consumption. See also Kaplow and Warren (1986 and 1987) for criticism of this interpretation and Strnad (1987) for a reply.


One of the first major books on the subject.


Advocates a consumption tax to aid saving and capital formation.

Believes that a VAT would not help trade and that a retail sales tax would be preferable to a VAT.


Early comprehensive treatment of VAT. See also Tait (1988).


Concludes that introduction of a VAT is not inherently inflationary. A shorter version of this paper appeared in *Finance & Development* (June 1981), pp. 38-42.


Comprehensive review of issues relating to VAT.


Contains a number of papers relating to administrative aspects of the VAT.


Argues against expenditure tax. The author, an economist at the Federal Reserve Bank of Boston, believes that the benefits of such a switch are highly uncertain and that redressing inequities and distortions in the transition would be highly complex. Concludes that improving existing tax structure makes more sense.


Indicates that if new revenue is necessary, it would be better to impose a consumption tax than try to get more revenue out of the existing tax system.

Presents econometric simulations indicating large gains in employment and growth from imposition of a VAT under various scenarios.


Reviews the British VAT and implications for a U.S. VAT. Concludes that the number of taxpayers required to engage in compliance activities should be minimized, that the number of items afforded special treatment should be minimized, that additional record-keeping requirements should be minimized, that current terms and concepts be retained as much as possible, and that the tax be designed to minimize the need for professional assistance.


Raises administrative issues to be considered if either a national retail sales tax or a VAT were to be introduced.


Contains an extensive discussion of the VAT in the context of international competitiveness.


Transcript of an early congressional hearing on the VAT. Contains testimony by John F. Due, Charles E. McLure, Norman Ture, Henry Aaron, Allen Sinai, and Lester Thurow, among others.


Notes problems resulting from multiple rates, effects on corporate cash flow, and problems with fraud and evasion. Found that inflationary impact was limited because the VAT generally replaced other consumption taxes.

Identifies questions which would have to be answered before adoption of a VAT.


General review of issues relating to consumption taxes.


Discusses the pros and cons of the two different methods of calculating a VAT--the subtraction method or tax credit method. Finds that the subtraction method is simpler while the tax credit method allows greater flexibility.


General review of issues relating to the VAT.


Notes concerns of state tax policymakers that imposition of a federal consumption tax would preempt their tax base and make it more difficult for states to raise revenue through the retail sales tax.


Presents testimony, data and analysis relating to the proposed spendings tax.


Issued in the waning days of the Ford Administration, this study proposes replacing the individual and corporate income taxes with a comprehensive income tax or cash flow consumption tax. See also Simon (1981).
This study was done as part of President Reagan's tax reform proposal. It concludes that a VAT should not be enacted. The report notes that imposition of a VAT would require 20,000 addition personnel and cost about $700 million to administer.


Contains a number of papers presented at a 1986 conference sponsored by the American Council for Capital Formation, a VAT advocacy group. Most of the authors favor a consumption tax. Walker is a former Deputy Secretary of the U.S. Treasury Department.


Raises numerous objections to a VAT.


Criticizes article by William Andrews (1974) advocating a consumption tax. Believes that such a tax would be unfair because income derived from wealth would escape taxation. For a response, see Andrews (1975).


Argues against a consumption tax, largely on normative grounds. Believes that wealth needs to be taxed.


Favors shifting the current tax system toward a consumption tax by exempting saving from the tax base, rather than adopting a VAT.


Reviews some of the pros and cons of a VAT.

Contains a number of papers on various aspects of a VAT, focusing on both theoretical and practical issues.


Suggests that support for a VAT may be increasing.


Suggests that a VAT would be far more complex and that enforcement would be far more difficult that is usually thought. Indicates that the self-enforcing nature of the tax is largely a myth. The author is Commissioner of Taxation and Finance for the State of New York.


Robert M. Haig is known as the leading advocate of a broad-based income tax. However, a review of Haig's principal work (Haig 1959) appears to indicate previously unknown support for an expenditure tax.


Favors a direct consumption tax over a VAT. Favors the plan put forward by David Bradford (1986).
TAX FOUNDATION BACKGROUND PAPER #3

Effects of Cross-Border Sales on Economic Activity and State Revenues: A Case Study of Tobacco Excise Taxes in Massachusetts, New York City, and Surrounding Areas

By:

KPMG Peat Marwick
Economic Policy Group

January 1993
About the Tax Foundation

As the size of government continues to grow, so too does the need for reliable information about its cost and scope. Since 1937, the Tax Foundation has been monitoring tax and fiscal activities at all levels of government: federal, state and local. In that year, civic-minded businessmen envisioned an independent group of researchers who, by gathering data and publishing information on the public sector in an objective, unbiased fashion, could counsel government, industry and the citizenry on public finance.

More than 50 years later, in a radically different public arena, the Foundation continues to fulfill the mission set out by its founders. Through newspapers, radio, television, and mass distribution of its own publications, the Foundation supplies objective fiscal information and analysis to policymakers, business leaders, and the general public.

The Tax Foundation’s research record has made it an oft-quoted source in Washington and state capitals, not as the voice of left or right, not as the voice of an industry or even of business in general, but as an advocate of a principled approach to tax policy, based on years of professional research.

Today, farsighted individuals, businesses, and charitable foundations still understand the need for sound information on fiscal policy. As a nonprofit, tax exempt 501(c)(3) organization, the Tax Foundation relies solely on their voluntary contributions for its support.

About the Author

The Policy Economics Group of KPMG Peat Marwick is a group of 150 professional economists and financial analysts engaged in a broad range of consulting activities. Most of the Group’s principals have had high-level and tax and fiscal policy positions in the federal government. A key focus of the Group’s activities is the preparation of sophisticated tax policy analysis at the federal, state, and international level. These activities include the preparation of revenue estimates, distributional analyses, economic impact studies, and other tax policy analysis for commercial and government clients.

The opinions expressed are those of the authors and do not necessarily reflect the views of the Tax Foundation.
Effects of Cross-Border Sales on Economic Activity and State Revenues: A Case Study of Tobacco Excise Taxes in Massachusetts, New York City, and Surrounding Areas

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January 1993
THE EFFECTS OF CROSS-BORDER SALES
ON ECONOMIC ACTIVITY AND STATE REVENUES:
A CASE STUDY ON TOBACCO EXCISE
TAXES IN MASSACHUSETTS AND NEW YORK CITY

Introduction

The responsiveness of individuals, whether as consumers, savers, or investors to changes in tax rates is at the heart of much of tax policy analysis and debate. Since 1937 the Tax Foundation has been developing and disseminating research and analysis about the impact of taxes on these economic decisions. To learn more about these decisions, the Tax Foundation asked the Policy Economics Group of KPMG Peat Marwick to estimate how differential tax rates influence one particular class of consumption behavior — cross-border shopping; that is, consumers’ incentives to shop in one tax jurisdiction instead of another because tax rate differentials exist among jurisdictions.

Although this study focuses solely on cross-border shopping, the results of the study naturally raise questions about a range of other areas in which individuals alter their economic decisions in response to changes in taxation. For example, just as differential rates of state taxation encourage the shifting of consumption to low-tax states, differential rates of capital taxation tend to shift the pattern of international investment from high- to low-tax countries. While the degree of shifting may differ case-by-case, the direction of change is clearly the same.

Governments levy taxes to generate revenues for themselves. While estimating these revenue streams is often difficult under the best of circumstances, these calculations become more complicated when individuals can significantly change the expected tax base by varying the location or the nature of their activities. The activities in question may vary from (1) deciding which country is the best site for a new factory, (2) whether to buy a long- or short-lived piece of equipment, or (3) whether to purchase a new washing-machine in one's home state or across the state border where the sales tax — and therefore the price — may be lower. To learn more about the magnitude of these tax-base variations, this study paid particular attention to how such consumer behavior effects reduce the potential yield of a given tax regime.

State-imposed excise taxes on consumption is one area where tax-induced changes in behavior can be analyzed with some confidence, both because relevant data are available and because of the wide array of differential excise tax rates levied across the states. Indeed, several sales tax studies have found relatively small, but statistically significant, shifts in sales caused
by tax rate differences in border areas. This border effect occurs because tax differences which might be too small to change behavior across wide geographic areas become much more important within a narrow region such as along a state, county, or city border.

The impact of this border effect depends on various conditions — the magnitude of the tax rate differential, the size of the population, and the costs associated with cross-border activities. The border effect will come into play whenever there is a significant tax-induced difference in the relative prices of retail commodities.

The wide variation in cigarette excise tax rates across the states make these taxes an ideal candidate for consumer behavior analysis. As of January 1, 1992, state cigarette taxes ranged from a low of 2.5-cents per pack in Virginia, to a high of 47-cents per pack in Hawaii. This diversity in rates leads to increased confidence in an analysis of tax-induced consumption patterns because they should cause very specific behavioral patterns. In addition, the wealth of data available allows nontax factors to be effectively isolated from the impact of varying tax rates on consumption behavior.

The measurement techniques used in this study are significant extensions of a methodology initially developed by the Advisory Commission on Intergovernmental Relations in two published reports in 1977 and 1985. The methodology presented here goes considerably beyond the original ACIR approach; cross-border transactions have been estimated simultaneously and consistently for trade between all adjacent states, and other variables explaining cigarette sales have been introduced into the analysis.

This report presents two case studies of the economic and tax revenue effects of cross-border sales of cigarettes induced by differential cigarette excise taxes. The first case examines the effects in Massachusetts with reference to its neighboring states. The second case examines the effects in New York City with reference to its neighboring in-state jurisdictions and neighboring states. Massachusetts and New York City were selected for analysis because of the recently adopted or proposed increases in cigarette taxes. The focus of this report is on determining to what degree such tax increases will increase cross-border shopping and thus depress in-jurisdiction economic activity and thereby decrease expected tax revenues.

Cross-border transactions refer to three different types of activity. The first type of activity is simple cross-border shopping, where individuals living near the border of a state or city with lower excise taxes choose to buy their cigarettes in the lower-cost jurisdiction. In the

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case of Massachusetts, such cross-border shopping will occur if Massachusetts residents choose to buy their cigarettes in Vermont or New Hampshire. New York City residents could similarly choose to shop across state lines or in surrounding jurisdictions like Nassau, Westchester, Bergen, and Hudson. Massachusetts and New York City will lose economic activity and tax revenue to the degree such import activity takes place.

Such trade could flow in the opposite direction as well. Massachusetts will export cigarettes to higher-cost states, in this case Connecticut, Rhode Island and New York, to the extent that residents from these states choose to purchase cigarettes in Massachusetts to avoid the higher taxes in their home state. Figures 1 and 3, which compares excise taxes in Massachusetts and New York City with those in their neighboring jurisdictions, illustrates the potential for such cross-border shopping.

The second type of cross-border transaction is not out-of-state shopping but the smuggling of cigarettes to avoid high excise taxes. Both cross-border shopping and smuggling are driven by differences in costs or excise taxes. However, smuggling is a phenomenon of a different scale and is engaged in as a commercial, although illegal, profit-making activity rather than as a form of comparison shopping. The smuggling of cigarettes from low excise-tax states, generally cigarette producing states, to high-tax states has been identified by the Advisory Commission of Intergovernmental Relations as an important problem both because of the potential revenue losses to individual states and because of the criminal aspects of the activity (see ACIR (1985)). In the cases of Massachusetts and New York City, cigarettes that are smuggled from Virginia avoid Massachusetts, New York City, and New York state excise taxes, and generate a potentially large loss of both legal sales and revenue. The larger the tax rate differentials become, the greater the incentive people will have to participate in the "black market."

The third type of cross-border transaction results from the consumption of cigarettes by residents of a state when they visit other states as tourists. As with other cross-border transactions, such tourist-related cigarette consumption can constitute either a net gain or loss of cigarette sales within a state depending upon whether the state, on balance, entertains out-of-state visitors or sends its residents out to visit other states. However, unlike other cross-border transactions, net cigarette consumption by tourists is assumed to be unresponsive to changes in either excise taxes or the price of cigarettes. Accordingly, the cross-border effects discussed in this report related only to out-of-state shopping and smuggling.

This study finds that cross-border transactions in cigarettes induced by differential cigarette taxation can significantly affect economic activity and excise tax revenues in Massachusetts, New York City and New York State. These economic and revenue effects are quite separate from the non-economic consequences of encouraging smuggling and the illegal sales of cigarettes.

The impacts of substantial differences in cigarette excise taxes among jurisdictions can be particularly important in border counties, as consumers shift their shopping patterns to seek
out lower-priced cigarettes. To the extent that such shifts in purchases have further impacts on employment and income, state revenues will decline for this reason as well. Thus, the total impacts on state revenues could potentially extend beyond the loss of excise taxes to also encompass losses in income and sales taxes. In the most general terms, the response of economic activity, including cigarette sales, to differences in tax rates implies that states do not have full control of their own tax bases and that each political jurisdiction, in determining its own revenue structure, must be sensitive to the tax rates in neighboring or competing jurisdictions.
General Findings

This section presents the results of a detailed statistical analysis of the factors affecting cigarette sales in the State of Massachusetts. In considering the array of factors that could potentially affect such sales, particular attention has been given to the role of cross-border transactions in cigarettes. In this connection, two sets of issues are addressed: (1) the general issue of whether cross-border transactions can be identified as a significant factor in reducing in-state cigarette sales for Massachusetts, and (2) more specific questions concerning the extent of such cross-border transactions both under the cigarette excise tax of 26 cents per pack prevailing in Massachusetts in 1991 and under the recently adopted increase of the tax to 51 cents per pack.

On the general effects of cross-border transactions, the findings of this study are the following:

- Cross-border transactions have been estimated to be a statistically significant factor affecting the sales of cigarettes in Massachusetts.

- Cross-border shopping is a complex phenomenon that depends on the price of cigarettes in Massachusetts compared to adjacent states and on the populations in border counties who are potential out-of-state consumers.

- Cross-border smuggling of cigarettes has also been estimated to be a statistically significant factor affecting the sales of cigarettes in Massachusetts. This activity depends on the difference in excise tax rates between Massachusetts and Virginia, the latter being the closest low-tax state.

- Both types of cross-border transactions will increase following Massachusetts's excise taxes increase relative to its neighbors and relative to excise taxes in Virginia.

The specific findings of this study concerning cross-border sales are summarized in Table 1. The findings are as follows:

- Cigarette sales lost due to cross-border transactions amount to about 2.7 percent of sales, or about $27 million of sales at the market prices prevailing in 1991.
FIGURE 1

Excise Tax Rates for Massachusetts and Neighboring Areas (June 1991)

Note: Connecticut increased its excise tax to 45 cents on October 1, 1991. Massachusetts will increase its excise tax to 51 cents on January 1, 1993. Vermont raised its excise tax one cent on July 1, 1991, and raised it twice in 1992: One cent on January 1, 1992 and one cent (up to 20 cents) on July 1, 1992.
Of this amount, the bulk of the loss in sales, about 64 percent, is due to smuggling.

With cigarette excise taxes increasing by 25 cents to 51 cents per pack, sales will decline by over 24 percent within Massachusetts, or just under 136 million packs (equal to about $235 million in retail sales at 1991 prices).

The largest share of this decline in sales, 62 percent, is due to increased cross-border shopping, with a further 8 percent due to increased smuggling. The remaining decline in sales is due to a reduced demand induced by higher prices.

An increase of excise taxes of 25 cents per pack will also cause a shift in the direction of trade with Rhode Island and Connecticut: from the export of cigarettes from Massachusetts to Rhode Island and Connecticut to the import of cigarettes from Rhode Island and Connecticut to Massachusetts.

The specific findings of this study concerning the effects on revenues of the State of Massachusetts are shown in Table 2. These findings are as follows:

With the cigarette excise taxes that prevailed in 1991, Massachusetts is estimated to have lost revenues amounting to $4.0 million, or nearly 3 percent of fiscal 1991 collections, as a result of cross-border transactions.

About 64 percent of this revenue loss is attributable to cigarette smuggling with smaller revenue losses resulting from losses of sales to (imports of cigarettes from) Vermont and New Hampshire. Massachusetts actually gained revenue from the export of cigarettes to Rhode Island, Connecticut and New York.

With cigarette taxes increasing from 26 cents to 51 cents per pack, all behavioral effects including the reduction in demand from higher cigarette prices, will reduce tax collections by about $69 million compared to the potential revenue gain of $141 million if no such behavioral response occurred.

Thus, revenues will increase by about $72 million, a reduction of 49 percent from the revenue gain one might expect if taxes had no influence on consumer behavior. In calculating the expected revenue from increasing the cigarette tax, the State should recognize that increasing the tax results in substantially less than twice the current revenues. The projected increase is on the order of only about 51 percent.

About 62 percent of the revenue loss relative to potential revenue results from increased out-of-state shopping, with another 8 percent of the revenue loss resulting from increased smuggling; decreased in-state demand due to higher prices accounts for the remaining revenue loss.
The revenue losses to Massachusetts from cross-border transactions are not matched by equal gains to other states that enjoy increased sales in their own jurisdictions. In the case of both cross-border shopping and longer-distance smuggling, the shift of sales tends to be from higher excise-tax states to lower excise-tax states. Accordingly, the losses to Massachusetts are greater than the gains to other states, and the net result is a decrease in overall state revenues. This decrease results from the lost sales caused by taxation, and demonstrates a more fundamental economic principle: Taxation reduces the wealth potential of an economy. As shown in Figure 2, the lost sales produce a net revenue loss of almost $4 million at the excise tax rates in effect in 1991 and will increase to about $29 million following the increase in the tax on cigarettes to 51 cents per pack.

In sum, sales and revenue losses from cross-border transactions induced by differential excise taxes are estimated to be significant for the State of Massachusetts. Furthermore, these effects will increase substantially with taxes on cigarettes in Massachusetts rising relative to those in other states.
**TABLE 1**

**MASSACHUSETTS TOBACCO SALES UNDER CURRENT LAW AND AFTER A 25 CENT PER PACK INCREASE, FY 1991**

<table>
<thead>
<tr>
<th>Pack of cigarettes sold under current tax of 26 cents per pack</th>
<th>Millions of packs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected retail sales if cross-border effects irrelevant</td>
<td>580</td>
</tr>
<tr>
<td>Gain or loss in retail sales from cross-border trade</td>
<td></td>
</tr>
<tr>
<td>With New Hampshire</td>
<td>-14</td>
</tr>
<tr>
<td>With Vermont</td>
<td>-1</td>
</tr>
<tr>
<td>With Connecticut</td>
<td>5</td>
</tr>
<tr>
<td>With Rhode Island</td>
<td>3</td>
</tr>
<tr>
<td>With New York</td>
<td>2</td>
</tr>
<tr>
<td>Smuggling with other states</td>
<td>-10</td>
</tr>
<tr>
<td>Total cross-border effects</td>
<td>-15</td>
</tr>
<tr>
<td>Actual retail sales</td>
<td>565</td>
</tr>
<tr>
<td>Percent loss due to cross-border sales</td>
<td>-2.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change in packs of cigarettes sold following increase of 25 cents to 51 cents per pack</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral effects</td>
<td></td>
</tr>
<tr>
<td>Reduction in demand</td>
<td>-40</td>
</tr>
<tr>
<td>Cross-border effects</td>
<td></td>
</tr>
<tr>
<td>With New Hampshire</td>
<td>-39</td>
</tr>
</tbody>
</table>
| With Vermont                                                                          | -3 
| With Connecticut                                                                      | -20|
| With Rhode Island                                                                     | -21|
| With New York                                                                        | -2 |
| Smuggling effects                                                                     | -11|
| Total                                                                                | -136|
| Total retail sales following increase in tax                                          | 430|
| Percent of actual retail sales lost due to behavioral effects                          | 24.0%|
| Loss in retail sales at $1.74[^] per pack                                            | $235 million |

[^] Average retail price in Massachusetts in 1991.
### TABLE 2

MASSACHUSETTS TOBACCO EXCISE TAX COLLECTIONS UNDER CURRENT LAW AND AFTER A 25 CENT PER PACK INCREASE, FY 1991

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thousands of dollars</strong></td>
<td></td>
</tr>
<tr>
<td>Tax collections under current tax of 26 cents per pack</td>
<td></td>
</tr>
<tr>
<td>Projected collections if cross-border effects irrelevant</td>
<td>$150,910</td>
</tr>
<tr>
<td>Gain or loss in collections from cross-border trade</td>
<td></td>
</tr>
<tr>
<td>With New Hampshire</td>
<td>-3,648</td>
</tr>
<tr>
<td>With Vermont</td>
<td>-383</td>
</tr>
<tr>
<td>With Connecticut</td>
<td>1,313</td>
</tr>
<tr>
<td>With Rhode Island</td>
<td>775</td>
</tr>
<tr>
<td>With New York</td>
<td>482</td>
</tr>
<tr>
<td>Smuggling with other states</td>
<td>-2,599</td>
</tr>
<tr>
<td>Total cross-border effects</td>
<td>-4,060</td>
</tr>
<tr>
<td>Actual collections</td>
<td>$146,850</td>
</tr>
<tr>
<td>Percent loss due to cross-border sales</td>
<td>-2.7%</td>
</tr>
<tr>
<td>Increase in tax collections following increase of 25 cents to 51 cents per pack</td>
<td></td>
</tr>
<tr>
<td>Projected increase in collections if behavioral effects irrelevant</td>
<td>$141,202</td>
</tr>
<tr>
<td>Behavioral effects</td>
<td></td>
</tr>
<tr>
<td>Reduction in demand</td>
<td>-20,558</td>
</tr>
<tr>
<td>Change in collections from cross-border trade</td>
<td></td>
</tr>
<tr>
<td>With New Hampshire</td>
<td>-19,945</td>
</tr>
<tr>
<td>With Vermont</td>
<td>-1,415</td>
</tr>
<tr>
<td>With Connecticut</td>
<td>-10,398</td>
</tr>
<tr>
<td>With Rhode Island</td>
<td>-10,478</td>
</tr>
<tr>
<td>With New York</td>
<td>-890</td>
</tr>
<tr>
<td>Total</td>
<td>-43,126</td>
</tr>
<tr>
<td>Smuggling effects</td>
<td>-5,424</td>
</tr>
<tr>
<td>Total</td>
<td>-69,108</td>
</tr>
<tr>
<td>Net increase in tax</td>
<td>$72,094</td>
</tr>
<tr>
<td>Total collections following increase</td>
<td>$218,944</td>
</tr>
<tr>
<td>Percent of potential tax increase lost due to behavioral effects</td>
<td>48.9%</td>
</tr>
</tbody>
</table>
FIGURE 2
Cross Border Revenue Effects:
Revenue Gains and Losses

26 Cent Cigarette Tax in Massachusetts

$0.2

$-4.1

$-3.9

Massachusetts (Loss) Other States (Gain) Net loss

(Millions of Dollars)

51 Cent Cigarette Tax in Massachusetts

$27.3

$-29.3

$-56.5

Massachusetts (Loss) Other States (Gain) Net loss

(Millions of Dollars)
THE EFFECTS OF CROSS-BORDER SALES
ON ECONOMIC ACTIVITY AND STATE AND LOCAL REVENUES
FROM CIGARETTE EXCISE TAXES:
THE CASE OF NEW YORK CITY

General Findings

This section presents the results of a detailed statistical analysis of the factors affecting cigarette sales in the New York City. In considering the array of factors that could potentially affect such sales, particular attention has been given to the role of cross-border transactions in cigarettes. In this connection, two sets of issues are addressed: (1) the general issue of whether cross-border transactions can be identified as a significant factor in reducing cigarette sales for New York City, and (2) more specific questions concerning the extent of such cross-border transactions both under the cigarette excise tax of 8 cents per pack prevailing in New York City in 1991 and under a proposed increase in the tax to 13 cents per pack.

On the general effects of cross-border transactions, the findings of this study are the following:

- Cross-border transactions have been estimated to be a statistically significant factor affecting the sales of cigarettes within a taxing jurisdiction.  
- Cross-border shopping is a complex phenomenon that depends on the local price of cigarettes compared to the price in adjacent jurisdictions and on the populations in border areas who are potential consumers outside their jurisdictions of residence.
- Cross-border smuggling of cigarettes has also been estimated to be a statistically significant factor affecting the sales of cigarettes. This activity depends on the difference in excise tax rates between the given jurisdiction and the closest low-tax state, Virginia in the case of New York City.
- Both types of cross-border transactions will increase if the given jurisdiction’s excise taxes increase relative to those in neighboring areas and relative to excise taxes in the low-tax state.

The specific findings of this study concerning cross-border sales in New York City are summarized in Table 3. The findings are as follows:

3 This model was statistically estimated at the state level. However, the estimated relationships also apply to local jurisdictions. This point will be discussed further in Section III.
FIGURE 3

Excise Tax Rates for New York City and Neighboring Areas (1991)
Cigarette sales lost due to cross-border transactions under the current City excise tax of 8 cents per pack amount to about 16.3 percent of sales, or about $239 million of sales at the market prices prevailing in 1991.

Of this amount, the bulk of the loss in sales, about 72 percent, is due to cross-border shopping, with the remaining share due to smuggling. Three-quarters of the cross-border shopping occurs in New Jersey (in Bergen, Hudson, Middlesex, and Union counties), and one-quarter occurs within New York State (in Nassau and Westchester counties).

If local cigarette excise taxes were to be increased by 5 cents to 13 cents per pack, sales would decline by over 7 percent within New York City, or just under 44 million packs (equal to about $91 million in retail sales at 1991 prices).

The largest share of this decline in sales, 69 percent, is due to increased cross-border shopping, with a further 8 percent due to increased smuggling. The remaining decline in sales is due to reduced consumption of cigarettes induced by higher prices.

Two-thirds of the increase in cross-border shopping occurs in New Jersey, and one-third occurs within New York State.

The specific findings of this study concerning the effects on the revenues of New York City are shown in Table 4. These findings are as follows:

With the cigarette excise taxes that prevailed in 1991, New York City is estimated to have lost revenues amounting to $9.2 million, or over 16 percent of fiscal 1991 collections, as a result of cross-border transactions.

About 72 percent of this revenue loss is attributable to purchases in, or imports from, other counties in New York State and New Jersey, with smaller revenue losses resulting from smuggling. The losses of excise tax revenues to the City from cross-border shopping result primarily from shopping in New Jersey, although shopping in Westchester and Nassau counties account for about one-quarter of this revenue loss.

If the cigarette tax were to be increased from 8 cents to 13 cents per pack, all behavioral effects (including the reduction in demand from higher cigarette prices) would reduce tax collections by about $6 million compared to the potential revenue gain of over $29 million if no such behavioral response occurred.

Thus, revenues would increase by about $24 million, which is 20 percent less than the potential revenue gain. In calculating the expected revenue from increasing the cigarette tax, the City should recognize that such a tax increase results in a substantially less than proportionate increase in current revenues. The revenue gain to be expected is only
about 80 percent of the gain that would be realized in the absence of behavioral responses.

- About 69 percent of the revenue loss relative to potential revenue results from increased cross-border shopping, with another 8 percent of the revenue loss resulting from increased smuggling; decreased cigarette demand due to higher prices accounts for the remaining revenue loss.

- Of the revenue loss attributable to cross-border shopping, purchases in New Jersey account for two-thirds, and purchases within New York State account for one-third.

It is important to note that cross-border shopping and smuggling in New York City also affects the revenues of New York State. When City residents buy cigarettes in New Jersey, they avoid both State and City excise taxes. Of course, when City residents purchase cigarettes in Westchester or Nassau County, State revenues are unchanged. Nonetheless, the revenue losses to New York State are substantial. The State loses almost $37 million in excise tax revenues under the current City cigarette tax of 8 cents per pack, and this revenue loss would increase to almost $46 million with a City tax of 13 cents per pack.

Furthermore, the combined revenue losses to the City and State of New York from cross-border transactions are not matched by equal gains to New Jersey and Virginia, which enjoy increased sales of cigarettes. For both cross-border shopping and longer-distance smuggling, the shift of sales is from higher to lower excise-tax jurisdictions. Accordingly, the losses to New York City and State are greater than the gains to New Jersey and Virginia, and the net result is a decrease in economic activity — cigarette sales, in this case — and therefore overall government revenues. As shown in Figure 4, the net revenue loss resulting from lost sales is about $20 million at the excise tax rates in effect in 1991 and would increase to over $31 million if New York City were to increase its tax on cigarettes to 13 cents per pack.

In sum, sales and revenue losses from cross-border transactions induced by differential excise taxes are estimated to be significant for the City of New York. Furthermore, the magnitude of these effects will increase substantially if taxes on cigarettes in New York City rise relative to those in other jurisdictions, with adverse effects on New York State revenues as well.
TABLE 3
NEW YORK CITY TOBACCO SALES UNDER CURRENT LAW
AND AFTER A 5 CENT PER PACK INCREASE, FY 1991

<table>
<thead>
<tr>
<th>Packs of cigarettes sold under current tax of 8 cents per pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected retail sales if cross-border effects irrelevant</td>
</tr>
<tr>
<td>Loss in retail sales from cross-border trade</td>
</tr>
<tr>
<td>With New Jersey</td>
</tr>
<tr>
<td>With Nassau County</td>
</tr>
<tr>
<td>With Westchester County</td>
</tr>
<tr>
<td>Smuggling with other states</td>
</tr>
<tr>
<td>Total cross-border effects</td>
</tr>
<tr>
<td>Actual retail sales</td>
</tr>
<tr>
<td>Percent loss due to cross-border sales</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change in packs of cigarettes sold following increase of 5 cents to 13 cents per pack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral effects</td>
</tr>
<tr>
<td>Reduction in demand</td>
</tr>
<tr>
<td>Cross-border effects</td>
</tr>
<tr>
<td>With New Jersey</td>
</tr>
<tr>
<td>With Nassau County</td>
</tr>
<tr>
<td>With Westchester County</td>
</tr>
<tr>
<td>Smuggling effects</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total retail sales following increase in tax</td>
</tr>
<tr>
<td>Percent of actual retail sales lost due to behavioral effects</td>
</tr>
<tr>
<td>Loss in retail sales at $2.09(^a) per pack</td>
</tr>
</tbody>
</table>

\(^a\) Average retail price in New York City in 1991.
### TABLE 4

NEW YORK CITY TOBACCO EXCISE TAX COLLECTIONS UNDER CURRENT LAW AND AFTER A 5 CENT PER PACK INCREASE, FY 1991

<table>
<thead>
<tr>
<th>Thousands of dollars</th>
<th></th>
</tr>
</thead>
</table>

**Tax collections under current tax of 8 cents per pack**

Projected collections if cross-border effects irrelevant $56,276

Loss in collections from cross-border trade

- With New Jersey -4,969
- With Nassau County -869
- With Westchester County -783
- Smuggling with other states -2,553
  Total cross-border effects -9,174

Actual collections $47,102

Percent loss due to cross-border sales -16.3%

**Increase in tax collections following increase of 5 cents to 13 cents per pack**

Projected increase in collections if behavioral effects irrelevant $29,439

Behavioral effects

- Reduction in demand -1,324
- Change in collections from cross-border trade
  - With New Jersey -2,627
  - With Nassau County -838
  - With Westchester County -517
  Total -3,981
- Smuggling effects -466
  Total -5,772

Net increase in tax $23,667

Total collections following increase $70,769

Percent of projected tax increase lost because behavioral effects are relevant 19.6%
FIGURE 4
Cross Border Revenue Effects:
Revenue Gains and Losses

8 Cent NY City & 39 Cent NY State Tax

13 Cent NY City & 39 Cent NY State Tax

(Thousands of Dollars)

(Millions of Dollars)
METHODOLOGY

The methodology used in this report is one that has been specifically designed to capture the two cross-border effects discussed above: cross-border shopping and smuggling. Cross-border shopping for Massachusetts has been identified and estimated separately for the New Hampshire, Vermont, Connecticut, Rhode Island, and New York borders to determine the extent of exports or imports of cigarettes with respect to each of these states. Cross-border shopping for residents of New York City has been identified and estimated separately for Westchester and Nassau counties in New York State and for four counties in New Jersey (Bergen, Hudson, Middlesex, and Union) to determine the extent of exports or imports of cigarettes with respect to each of these jurisdictions. An estimate of the smuggling of cigarettes to Massachusetts and New York City is based on the presumption that smuggling occurs from the closest low-tax state, in this case, Virginia.

All of these estimates have been made by first specifying and then statistically estimating a regression equation that explains per capita sales of cigarettes in a state as a function of cross-border transactions and a range of other factors that could potentially affect cigarette sales. These relationships have been estimated at the state level, but they apply equally well to sub-state jurisdictions such as New York City. Cross-border shopping is estimated to depend on both the price of cigarettes in a state compared to the price in neighboring states (and border counties) and the populations along state borders which can choose where they will make their cigarette purchases. Smuggling depends on both the excise tax rate in a state compared to that of the nearest low-tax state and the distance to that state. In addition, cigarette sales in a state reflect the basic determinants of the demand for cigarettes — the price of cigarettes in the state (including state and federal taxes), the income of state residents, tourism activity in the state, and the demographic composition of the state.

A regression equation explaining per capita sales of cigarettes as a function of these variables has been fit for all fifty states and the District of Columbia over the three-year period covering fiscal years 1988 through 1990. The data have been taken from various sources including the Tobacco Institute (see Tobacco Institute) and the U.S. Commerce Department. The estimated equation fits the data extremely well and explains over 80 percent of the variance in per capita sales of cigarettes. In particular, estimates of the coefficients for cross-border shopping and for smuggling are highly significant statistically and indicate that differential excise taxes on cigarettes play an important role in inducing cross-border shopping or illegal smuggling of cigarettes.

This general approach to estimating cross-border transactions was initially developed by the Advisory Commission on Intergovernmental Relations in two reports published in 1977 and 1985. The methodology presented here goes considerably beyond the original ACIR approach; cross-border transactions have been estimated simultaneously and consistently for trade between all adjacent states, and other variables explaining cigarette sales have been introduced into the analysis. A technical appendix to this report describes the derivation of the regression equation and presents the results of the regression analysis in more detail.
The methodology outlined above was adapted to estimate cross-border effects for New York City. Estimated sales were calculated by calculating the value of each variable in the model specifically for New York City. To obtain an estimate of cross-border shopping and smuggling, New York City has been treated as a separate jurisdiction. City residents have the option of shopping in the City, in adjacent counties within New York State (Westchester and Nassau counties) or in adjacent counties in New Jersey (Bergen, Hudson, Middlesex, and Union counties).
TECHNICAL APPENDIX

This technical appendix presents the methodology developed by the Policy Economics Group of KPMG Peat Marwick to estimate the effects on cigarette sales of trade across state borders. The purpose of this analysis is to determine the extent to which differential excise taxes among states can give rise to cross-border sales and thus generate revenue losses for states with relatively high cigarette excise taxes.

This appendix first discusses the general methodological approach used in this study and then considers the specific implementation of this methodology. In general terms, a regression model is used to identify all the factors affecting cigarette sales in a given state including the effects of cross-border trade. These trade effects are estimated subject to constraints to ensure that imports by state A from state B (that is, purchases of cigarettes in state B by residents of state A) match exports from B to A (that is, sales of cigarettes in state B to residents of state A). Furthermore, since these trade effects result from differential excise taxes, the model can then be used to simulate the extent to which changes in excise taxes will affect trade between states and thus affect the revenues derived from cigarette excise taxes.4

The analytical model that lies behind the regression analysis is the standard economic approach to examining the consumption of any good or service. Fundamentally, consumption of cigarettes by residents of a state, defined as purchases of cigarettes by state residents regardless of where they are purchased, is a function of the demographic characteristics of the state, the income level of state residents, and the price of cigarettes relative to the price of other goods and services. Equation (1) in Table A-1 is the algebraic representation of this relationship. Given the lack of data on cigarette consumption across states, along with the desire to explicitly include cross-border trade in the analysis, this basic relationship must be modified in various ways to derive an equation that can be estimated empirically. Presented below are the derivation of the estimated equation and a discussion of the variables used for the estimation.

First, it should be noted that the consumption of cigarettes by residents of a given state may be disaggregated into the sum of taxable and non-taxable purchases (or sales) minus net exports to (or plus net imports from) other states as a result of trade, smuggling and tourism (equation 2 of Table A-1). The decomposition of sales into its taxable and non-taxable components is needed because state data are available only for taxable sales. Sales within a state that are exempt from state excise taxes, such as cigarette sales on military bases and Indian reservations, are captured in the estimation equation through the use of proxy variables as discussed further below.

Net exports result from three types of activity: cross-border shopping, smuggling, and tourism. Cross-border shopping depends upon the price of cigarettes, including excise taxes,

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4 This regression approach may be contrasted with other, less analytical approaches to estimating the effects of cross-border trade. One such approach simply assumes that all differences in cigarette sales between two neighboring states are due to trade effects. The application of regression analysis permits trade to be analyzed as one of several factors that may determine the level of cigarette sales in a given state.
in a given state compared to that in neighboring states. Smuggling is a function of the excise tax differential between a given state and the nearest low-tax state and the distance between the two states. Equation 3 illustrates the effects of both of these activities on net exports. If the price of cigarettes is higher in a given state than in an adjacent state, generally because of excise taxes, residents of the state will look for opportunities to make their cigarette purchases across the state border; that is, they will import cigarettes. If the given state has a lower price of cigarettes than its neighbors, cross-border consumption will occur in the opposite direction, that is, cigarettes will be exported. Furthermore, as shown in equations 6 and 7, which define the variable \( w_{ij} \) in equation 3, the approach followed here makes cross-border trade a function of the population in counties adjacent to neighboring states, rather than on the entire population of the state.

Smuggling operates in a similar fashion. The higher the excise tax in a given state, the greater the imports from a low-tax state as a result of smuggling. The effects of smuggling, however, are not limited to border counties.

In addition, tourism can represent either a net addition to or subtraction from the consumption of cigarettes in a state depending on whether expenditures on tourism in the state by out-of-state residents exceeds or falls short of out-of-state tourism expenditures made by residents of the state. To capture this source of demand for cigarettes in states that entertain a relatively large number of out-of-state visitors, a variable has been constructed reflecting net tourist expenditures in each state (equation 8).

Equation 4 simply substitutes equation 3 into equation 2, and equation 5 substitutes equation 1 into equation 4 and rearranges terms in order to derive an estimating equation in terms of the observed variables. The left-hand variable is thus taxable sales which is a function of income, demographic variables, the price of cigarettes relative to other goods, the price of in-state compared to out-of-state cigarettes (which determines cross-border trade), net tourism and non-taxable sales (or the determinants of such sales). The variables used as proxies for non-taxable sales are the percentage of the state population that is Indian (a proxy for sales on Indian reservations) and the percentage of the state population that is in the military (a proxy for sales on military bases) as shown in equation 9.

Although equation 5 is the basic estimating equation, other factors not specifically noted in this equation can influence cigarette sales within a given state. For example, the demographic characteristics of the state can be quite richly represented. The estimated equation presented below includes age, ethnic, and religious variables. Finally, a time trend has been added to capture the secular decline in cigarette consumption. Thus, an augmented version of equation 5 actually underlies the regression analysis.

The resulting equation has been estimated as a pooled time series/cross section regression using data for all fifty states and the District of Columbia over the three-year period from 1988 through 1990. The data for estimating this equation have been taken from The Tobacco Institute, the Bureau of Economic Analysis, and the Census Bureau of the Department of Commerce. All data are measured on a June 30 basis conforming to the fiscal year of most states. In addition, as noted earlier, the model is internally consistent in an accounting sense; that is, by construction, exports from a given state are equal to imports (from the state) by all other states.
The regression results are presented in Table A-2. All the important cross-border variables are highly significant statistically. Also, in the aggregate, the equation explains over 80 percent of the variance in per capita sales of cigarettes across states. These relationships estimated at the state level have then been applied to data specific to New York City inasmuch as the City is a separate taxing jurisdiction with its own authority to impose cigarette taxes and its own borders with adjacent counties either in New York State (Westchester and Nassau counties) or in New Jersey (Bergen, Hudson, Middlesex, and Union counties).

Measures of the goodness of fit of the equation for Massachusetts and New York City are shown in Tables A-3 and A-4. Generally, the equation fits well both for all states taken together and for Massachusetts. And the equation fits reasonably well for New York City as an individual tax jurisdiction. The equation estimates cigarette sales in Massachusetts within plus or minus 6.5 percent. On average, the equation underestimates New York City cigarette consumption by about 13.8 percent.
### TABLE A-1

Equation Listing

(1) \[ c_i = \alpha + \beta \cdot y_i + \text{demog}_i - \pi \cdot (\bar{p}_i \bar{p}) \]

(2) \[ c_i = s(t)_i + s(nt)_i - NX_i \]

(3) \[ NX_i = c_i^* + \sum_j \gamma \cdot [(p_i - p_j) \cdot w_{ij}] + \delta \cdot \frac{[x_i^* - x_j^*]}{d_i} \]

(4) \[ = (3) \text{ into } (2) \]

\[ c_i = s(t)_i + s(nt)_i - c_i^* - \sum_j \gamma \cdot [(p_i - p_j) \cdot w_{ij}] - \sum_j \delta \cdot \frac{[x_i^* - x_j^*]}{d_i} \]

(5) \[ = (1) \text{ into } (4) \]

\[ s(t)_i = \alpha + \beta \cdot y_i + \text{demog}_i - \pi \cdot (\bar{p}_i \bar{p}) + c_i^* + \sum_j \gamma \cdot [(p_i - p_j) \cdot w_{ij}] + \sum_j \delta \cdot \frac{[x_i^* - x_j^*]}{d_i} - s(nt)_i \]

where:

(6) \[ w_{ij} = \frac{\text{people in } i \text{ on } ij \text{ border}}{\text{pop}_i}, \text{ if } i \text{ imports from } j \]

(7) \[ w_{ij} = \frac{\text{pop in } j \text{ on } ij \text{ border}}{\text{pop}_i}, \text{ if } i \text{ exports to } j \]

(8) \[ c_i^* = \theta \cdot \text{tour}_i \]

(9) \[ s(nt)_i = \kappa \cdot \text{ind}_i + \rho \cdot \text{mil}_i \]

c_i = \text{consumption by residents of state } i

c_i^* = \text{consumption due to net tourism in state } i

s(t)_i = \text{taxable sales in state } i

s(nt)_i = \text{tax exempt sales in state } i

NX_i = \text{net exports from } i

p_i = \text{price of cigarettes in state } i

p_j = \text{price of cigarettes in state } j

demog_i = \text{demographic characteristics of state } i

y_i = \text{income in state } i

\bar{p} \cdot \bar{p}' = \text{cigarette prices relative to prices of other goods}

tx_i = \text{excise tax in state } i

tx_i^* = \text{excise tax in nearest low-tax state from state } i

d_i = \text{distance from state } i \text{ to nearest low-tax state}

\text{tour}_i = \text{net tourism per capita in state } i

\text{mil}_i = \text{military population in state } i

\text{ind}_i = \text{Indian/Eskimo population in state } i
TABLE A-2

Regression Results

Dependent Variable: Per capita sales

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-statistic(^5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant ((a))</td>
<td>165.20</td>
<td>11.18</td>
</tr>
<tr>
<td>Income ((\beta))</td>
<td>0.0011</td>
<td>2.21</td>
</tr>
<tr>
<td>Real Price ((\pi))</td>
<td>-0.31</td>
<td>-2.70</td>
</tr>
<tr>
<td>Cross-border ((\gamma))</td>
<td>-0.73</td>
<td>-6.52</td>
</tr>
<tr>
<td>Smuggling ((\delta))</td>
<td>-0.39</td>
<td>-8.07</td>
</tr>
<tr>
<td>Net tourism ((\theta))</td>
<td>5.93</td>
<td>7.68</td>
</tr>
<tr>
<td>Percent Indian ((\kappa))</td>
<td>-1.64</td>
<td>-3.80</td>
</tr>
<tr>
<td>Percent Military ((\rho))</td>
<td>-4.08</td>
<td>-2.14</td>
</tr>
<tr>
<td>Percent Asian</td>
<td>-0.92</td>
<td>-5.11</td>
</tr>
<tr>
<td>Percent Mormon</td>
<td>-0.82</td>
<td>-9.32</td>
</tr>
<tr>
<td>Percent Hispanic</td>
<td>-0.84</td>
<td>-6.77</td>
</tr>
<tr>
<td>Percent 65 &amp; over</td>
<td>-1.51</td>
<td>-2.70</td>
</tr>
<tr>
<td>Time</td>
<td>-2.63</td>
<td>-2.19</td>
</tr>
</tbody>
</table>

R\(^2\) 0.8052  
Root MSE 10.35  
N 153.00

---

\(^5\) The t-statistic is a measure of the degree of confidence in a coefficient. When the statistic is greater than 2 in absolute value, it indicates a high level of confidence that the estimated coefficient is significantly different from zero.
**TABLE A-3**

Estimation Errors for the State of Massachusetts

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Sales</th>
<th>Estimated Sales</th>
<th>Percent Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>111.6</td>
<td>104.4</td>
<td>-6.5%</td>
</tr>
<tr>
<td>1989</td>
<td>104.3</td>
<td>99.0</td>
<td>-5.1%</td>
</tr>
<tr>
<td>1990</td>
<td>97.6</td>
<td>102.8</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

All figures in packs per capita
## TABLE A-4

**Estimation Errors for the City of New York**

<table>
<thead>
<tr>
<th></th>
<th>Actual Sales</th>
<th>Estimated Sales</th>
<th>Percent Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>95.0</td>
<td>82.6</td>
<td>-13.1%</td>
</tr>
<tr>
<td>1989</td>
<td>89.5</td>
<td>80.7</td>
<td>-9.8%</td>
</tr>
<tr>
<td>1990</td>
<td>85.0</td>
<td>68.9</td>
<td>-18.9%</td>
</tr>
</tbody>
</table>

All figures in packs per capita
REFERENCES


