RENTS AND THE COST AND OPTIMAL DESIGN OF COMMODITY TAXES

Carlo Perroni and John Whalley*

Abstract—This paper numerically investigates the significance of rents for both the welfare costs and the optimal design of commodity taxes using a general-equilibrium model calibrated to 1986 Canadian data. In the data we use, Ricardian rents are concentrated in agriculture and utilities, with market structure rents concentrated in manufacturing. Different types of rents have different implications for the welfare cost of taxes, and hence also for appropriate tax design. Ricardian rents lower the cost of taxes; rents supported by imperfect competition (with no free entry) raise the cost of taxes; rents supported by regulation generate rent-seeking costs, and if taxed improve resource allocation. Model results show a markedly nonuniform optimal tax structure, and a substantial influence of the treatment of rents on the pattern of optimal tax rates by commodity.

I. Introduction

In this paper we report numerical simulation results which explore the implications of different types of rents, their sizes, and their supporting mechanisms for both the social costs and the optimal rate structure of commodity taxes (V A T), using a general-equilibrium model calibrated to 1986 Canadian data. Our study goes beyond existing theoretical literature on rents and taxes (V A T), using a general-equilibrium model explicitly incorporating rent-generating mechanisms. Previous numerical analyses of optimal commodity tax design (Atkinson and Stiglitz (1972), Harris and Mackinnon (1979)) have ignored the role of rents in optimal tax design.

Rents can arise for a variety of reasons, and attempts to tax them can have varying effects because of the different types of rents involved. Taxes on sectors in which natural (or Ricardian) rents occur may fit the paradigm of a nondistorting tax, but taxes on monopolies can act as a tax on a tax (the monopoly markup) and may be efficiency worsening. Taxes on regulated sectors, where lobbying costs or rent-seeking behavior occur, may even be efficiency improving. In short, the size, nature, and distribution of rents affect both the costs of taxes and the optimal rate structures.

Our model results show that, relative to a no-rent world, optimal tax rate profiles by product are some distance from the uniform-rate broadly based value-added tax often advocated by tax reformers. Results also indicate that the distorting costs of taxes may be higher or lower (and significantly so) depending on the types of rent involved and their supporting mechanisms. Natural rents tend to lower both total and marginal welfare costs of taxes, while market structure rents tend to raise them. The presence of rent seeking lowers the cost of taxes, since taxes lower both rents and associated rent-seeking costs. In nonmanufacturing sectors, both substantial Ricardian (resource rents) and regulatory (agriculture and services) rents occur, and model results suggest that if reform of regulatory restraints is not possible, higher tax rates should apply in these sectors to reduce rent-seeking costs as well as to tax Ricardian rents. This contrasts with the general policy presumption in favor of low tax rates on these sectors because of concerns over income distribution effects (as with taxation of food).

The structure of the paper is as follows. Section II describes our model, and section III discusses the data and parameters used for calibration. Section IV presents our results, section V summarizes and concludes.

II. A General-Equilibrium Tax Model with Rents

The implications of rents for commodity tax design vary depending on the mechanisms that support them. Natural (or Ricardian) rents accrue to sector-specific factors in fixed supply. Where all production in a sector is accounted for by a fixed factor, indirect taxes on output are fully borne by the fixed factor. If marginal costs are increasing but finite, a tax on output will be less than fully borne by the fixed factor. In such cases production exhibits decreasing returns to scale, and supply is imperfectly elastic. The expectation, then, is higher optimal tax rates in sectors with more significant fixed factors (Dixit (1970)). The elasticity of supply will also typically be inversely related to the size of rents, but directly related to the elasticity of substitution between the immobile factor and other inputs.

Market structure rents have different tax implications. Under imperfect competition, equilibrium is characterized by an endogenously determined markup over marginal cost. Here there will be partial pass-through of output taxes in the form of higher product prices, with reduced tax impact on market structure supported rents compared to the natural rent case. The degree of pass-through is determined by elasticities in preferences and technology, and assumptions on market structure, including whether or not free entry is allowed. Because of tax shifting under markup pricing, optimal tax rates tend to be inversely proportional to the size of market structure rents (Myles (1989)).

Rents supported by regulation offer yet further implications. Quantity constraints that reduce the elasticity of supply produce tax implications similar to those of natural rents, but regulatory schemes that support monopolistic behavior may have tax implications similar to monopolistic...
rents. Such schemes may also dissipate real resources through rent seeking (Krueger (1974)), with the tax implication that a lower net of tax rent reduces socially wasteful resource dissipation.

Appropriate commodity tax design in the presence of all these types of rents and rent supporting mechanisms inevitably involves trading off preference-related and rent-related effects. Even when preferences are implicitly separable between taxed and untaxed goods, a uniform rate broadly based commodity tax may not be the best choice for economies where rents comprise a significant component of value added.

The natural way to explore the implications of all these considerations for both the costs of commodity taxes and their optimal design is by numerical simulation. For this purpose we use a number of variants of a numerical general-equilibrium model under alternative treatments of the nature and distribution of rents, each calibrated to 1986 Canadian data. These model variants are built around a standard tax-based general-equilibrium model as set out in Shoven and Whalley (1984, 1992)—a static model with separately specified technology and preferences.

We use a range of models both to account for the competing advantages and disadvantages of alternative modeling approaches, and because of uncertainties over parameter values. Ricardian rents are modeled by specifying sector-specific factors. To represent market supported rents, we use a standard specification of imperfect competition with symmetrically differentiated firm products (modeled by adopting so-called Dixit–Stiglitz preferences, widely used in the literature) and constant-returns-to-scale technologies, and explore model variants with either Cournot or Bertrand conjectures. Finally, we represent regulation supported rents as supported by directly unproductive profit-seeking activities. Because of the added complexity in simultaneously modeling the various market structures and rent supporting mechanisms with trade in an open economy, our model is treated as closed.3

A. Demand

The demand side of the models we use assumes a representative consumer endowed with labor and capital. Consumer demands include both leisure and consumer goods, the latter being modeled as Cobb–Douglas composites of producer goods, through a production–consumption transition matrix. This is necessary because of the differences in classification between producer and consumer goods in social accounts data (see Ballard, Fullerton, et al. (1985)). Demands cover consumption demand, investment demand, and government demand, as well as trade with the rest of the world. We use both homothetic and nonhomothetic specifications of preferences, because previous optimal commodity tax literature has emphasized the uniform tax implications for consumption goods of nontaxation of leisure under homothetic preference structures (see Atkinson and Stiglitz (1972), Deaton (1981)).

The three-stage linear expenditure system (LES) expenditure function used in the model is defined over the price of leisure $w_0$, a utility index $U$, goods prices $p$, and ad valorem consumption tax rates $t$ as

$$E(p, t, w_0, U) = U\left[\beta w_0^{1-\epsilon} + (1 - \beta) \times \left[\sum_l \nu_l \left(\prod_i \left[p_i (1 + t_i)^{\mu_i_l}\right]^{\frac{1-\delta}{1-\epsilon}}\right)\right]^{\frac{1}{1-\epsilon}} + \sum_l \bar{x}_l \prod_i \left[p_i (1 + t_i)^{\mu_i_l}\right]\right]$$

where $\delta$ represents the elasticity of substitution between above-subsistence consumption of consumer goods, $\epsilon$ is the elasticity of substitution between consumption and leisure, $\beta$ is the leisure share parameter, and the $\mu_i$ are consumption share parameters for consumer goods. The $h_{ij}$ are coefficients in the transition matrix, linking producer goods to consumer goods (i.e., shares of producer goods in the composition of consumer goods), and the $\bar{x}_l$ are subsistence levels for consumer goods. When all $\bar{x}_l$ are zero, preferences are homothetic and implicitly separable. In this case, if there are no rents, uniform taxation is optimal.

B. Production

Production in each sector exhibits decreasing returns to scale, reflecting the presence of sector-specific factors. Variable inputs in production include labor, capital, and intermediate inputs. Capital is intersectorally mobile, but in aggregate it is assumed to be in fixed supply.

Technologies in each sector are modeled by means of a three-stage constant-elasticity-of-substitution (CES) unit cost function defined over goods prices $p$, factor prices $w$, and the price of the sector-specific factor in inelastic supply $p_{kj}$.

$$c_j(p, w, p_{kj}) = \left[\sum_i a_{ij} p_i^{1-\gamma} + \sum_j a_{kj} w_{kj}^{1-\sigma}\right]^{\frac{1-\gamma}{1-\sigma}} + a_{kj} p_{kj}^{1-\omega}\right]^{\frac{1}{1-\omega}}$$

where $\omega$ is the elasticity of substitution between the sector-specific factor and other inputs, $\sigma$ is the elasticity of substitution between primary factors, $\gamma$ is the elasticity of
substitution between intermediate inputs and value added, and the $a_{ij}$ are share parameters in technology.

C. Market Structure and Regulation Supported Rents

We use different model variants to alternatively capture market structure and regulation supported rents in a variety of formulations, each with its pros and cons. In the first, we use a structure with differentiated products, involving a fixed number of firms using identical constant returns technologies to produce symmetrically differentiated products. Under this specification rents reflect only product variety. Furthermore, if the number of firms in a given sector is sufficiently large, aggregate sectoral rents do not vary with entry. Unlike models of Chamberlinian competition featuring variable average costs and free entry, our specification involves nonzero monopolistic rents in equilibrium, enabling us to still study the implications of nonzero market structure supported rents for the optimal design of commodity taxes.5

We also use similar structures to analyze cases where the strategic variables for each firm are either the quantity it produces (Cournot) or the price it charges (Bertrand). Symmetric product differentiation implies that in both Bertrand–Nash and Cournot–Nash equilibria a common markup rate will prevail in each sector. If we compare the Bertrand–Nash and the Cournot–Nash equilibria for any given parameter specification, we observe markedly different equilibrium markup rates. On the other hand, in our calibration procedure the elasticities that define the degree of product differentiation within sectors are determined endogenously so as to support an equilibrium with markup rates equal to exogenously given values. Consequently, the behavior of the model with Cournot conjectures is close to that with Bertrand conjectures.

In all these variants demand by consumers and by other productive sectors is for symmetric CES composites of the goods produced by all firms in a sector (so-called Dixit–Stiglitz preferences, after Dixit and Stiglitz (1977)). The dual representation of this specification is obtained through CES price aggregates of the individual goods prices,

$$p_j = \left[ \sum_s (p_s^j)^{1-p_j} \right]^{1/(1-p_j)}, \quad {\text{for all } j}$$

where $p^j_s$ is the price charged by firm $s$ in sector $j$, and $p_j$ is an elasticity of substitution parameter reflecting the degree of product differentiation in sector $j$.

In further model variants, regulation modifies firm behavior through quantity constraints.6 The latter are taken to reflect historical quota allocations assigned by politically established regulatory bodies (such as marketing boards), which have the characteristic that deviating from historically determined firm-level quotas requires firms to lobby. This is costly to the firm, and we assume that these costs are quadratic in the deviation from initial quota levels, and proportional to marginal production costs $c_j$,

$$\frac{\eta_j}{2Q_j} (Q_j^* - Q_j)^2 c_j, \quad {\text{for all } j}$$

where $\eta_j$ is a constant and the $Q_j^*$ represent the quotas.

This specification implies an increasing marginal lobbying cost function equal to

$$\frac{\eta_j}{Q_j} (Q_j^* - Q_j) c_j, \quad {\text{for all } j}$$

(assuming $c_j$ to be constant). Thus $\eta_j$ represents the elasticity of combined marginal lobbying and production costs evaluated at the initial quota output level. We assume that a fraction $v$ of all rents (gross of lobbying costs) generated by regulation is dissipated through unproductive rent-seeking activities. For higher values of $\eta_j$, the quantity constraint on output for firms becomes more inflexible.7

D. Taxes in Model

In the model the government levies ad valorem commodity taxes on the final consumption of five produced goods (agricultural products, manufacturing, utilities, transport, other services). These can be thought of as reflecting either a retail sales tax or a consumption-type VAT. For simplicity, we analyze the optimal structure of commodity taxes in the presence of rents in isolation from the rest of the tax system.8

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4 Also see Willig’s (1981) discussion of sector-differentiated capital tax rates, with imperfect competition and interindustry flows. He analyzes optimal sector-differentiated capital taxes in the context of two models that incorporate interindustry flows and imperfect competition, assessing whether taxes should be relatively low, for equal capital market effects, on capital employed in sectors that are more primary, are more monopolized, obtain inputs from more monopolized sectors, and that sell output to more monopolized sectors.

5 This specification provides an imperfect approximation of rents associated with endogenous entry barriers (e.g., barriers supported by advertising or collusive practices). In such cases, tax changes could affect industry concentration, an effect that is not captured by our model.

6 We do not explicitly model other forms of regulation, such as those that are price based. Price-based regulation typically requires some form of quantity-based supporting mechanism (quantity restraints by firms, stockpiling, or government purchasing agencies), and hence are more complex to model (see Imam and Whalley (1982)). To the extent that such mechanisms include quantity-based components, our treatment here partly captures their effects. We also ignore lobbying efforts directed at tax authorities rather than at quantity regulators.

7 For a discussion of modeling of lobbying and the implications for the measurement of rent seeking, focusing on tax and subsidy support, see Faith (1991).

8 Our treatment is motivated in part by the features that VAT is a key part of OECD tax systems, and that rate structure issues have been central to the policy debate on the tax. Analyzing commodity taxes in isolation from other taxes implies that the welfare costs of these taxes are lower relative to other literature estimates (such as Ballard et al. (1985)) because in practice tax rates across products and income sources in the various elements of the tax system compound one another (i.e., both commodity and income taxes together form a joint tax wedge distorting labor–leisure decisions). We also
by setting a revenue target of 50% of the gross domestic product (GDP) (approximately the OECD average revenue-to-GDP ratio). The percent welfare change under a move from uniform taxation in the base case to a corresponding optimal tax structure. The revenues from these taxes are returned to the representative consumer in the model as lump-sum transfers. In all model calculations the government faces the revenue constraint that tax revenues must be sufficient to guarantee constant real transfers to the consumer. These are indexed using a consumer ideal price index.

The government’s problem consists of choosing tax rates that maximize the representative consumer’s welfare, given the revenue requirement. The other constraints in the optimal tax problem consist of a full set of Bertrand–Nash or Cournot–Nash equilibrium conditions, as outlined below. We also compute the marginal excess burden associated with equiproportional tax increases around the optimal structure.

E. Calibration and Model Solution Procedures

We specify our model parameters using the standard calibration procedures widely used in applied general-equilibrium analysis (see Shoven and Whalley (1992)). We calibrate to a 1986 Canadian benchmark equilibrium data set incorporating rents, as described below.

To compute an equilibrium for each model variant, given the incorporation of market structure, we use a technique of specifying a “reference” equilibrium together with a number of perturbed equilibria (one per productive sector). The latter are linked to the reference equilibrium by small perturbations in the markup rates of the representative firms for each sector. We then search for full equilibrium prices and activity levels which simultaneously support the reference and the perturbed equilibria, and for which the derivatives of the payoffs of the representative firms with respect to perturbations in their individual markup rates or output levels are zero.

III. Data, Calibration, and Model Parameters

As noted above, we generate model parameters by calibrating the model to a 1986 Canadian benchmark data set incorporating rents. In implementing this procedure, we do not capture the separate effects of taxes and subsidies whose revenue effects net out, but whose distortionary effects do not.

The ratio of total taxes collected to GDP for all levels of government in Canada in the late 1980s and early 1990s was approximately 0.4. The higher ratio we use is meant to reflect a higher average marginal rate for overall taxation, and is also reflective, on average, of the higher revenue-to-GDP ratio in other OECD economies.

The percent welfare gain is computed as the ratio of the equivalent variation from the tax change to benchmark above-subsistence income.

We solve this nonlinear program with GAMS/MINOS (Brooke et al. (1988)).

This is obtained by computing a new equilibrium where all commodity tax rates are multiplicatively scaled so as to generate a 0.1% increase in real tax revenues.

Table 1.—Canada 1986 Net Expenditure Matrix (CAN $B)

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Goods</th>
<th>AGR</th>
<th>MAN</th>
<th>CSV</th>
<th>DSV</th>
<th>OSV</th>
<th>FIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR</td>
<td>−97.165</td>
<td>17.000</td>
<td>2.314</td>
<td>5.937</td>
<td>10.976</td>
<td>60.938</td>
<td></td>
</tr>
<tr>
<td>MAN</td>
<td>12.345</td>
<td>−111.005</td>
<td>2.000</td>
<td>9.851</td>
<td>38.908</td>
<td>47.901</td>
<td></td>
</tr>
<tr>
<td>CSV</td>
<td>10.588</td>
<td>7.680</td>
<td>−85.795</td>
<td>13.273</td>
<td>10.400</td>
<td>43.854</td>
<td></td>
</tr>
<tr>
<td>DSV</td>
<td>5.400</td>
<td>4.545</td>
<td>0.524</td>
<td>−201.146</td>
<td>15.869</td>
<td>174.808</td>
<td></td>
</tr>
<tr>
<td>OSV</td>
<td>12.542</td>
<td>16.760</td>
<td>14.213</td>
<td>31.047</td>
<td>−185.368</td>
<td>110.806</td>
<td></td>
</tr>
<tr>
<td>LAB</td>
<td>25.101</td>
<td>44.591</td>
<td>32.152</td>
<td>115.203</td>
<td>65.527</td>
<td>−282.574</td>
<td></td>
</tr>
<tr>
<td>CAP</td>
<td>31.189</td>
<td>20.429</td>
<td>34.592</td>
<td>25.835</td>
<td>43.687</td>
<td>−155.732</td>
<td></td>
</tr>
</tbody>
</table>

Source: Statistics Canada.

take elasticity and other key parameters, such as markups, as exogenous, relying on literature-based estimates.

A. Model Aggregation

The commodity aggregation used in the 1986 data set and the model covers five produced goods and productive sectors:

- AGR Agriculture, mining, forestry, and fishing
- MAN Manufacturing
- CSV Utilities, telecommunications, insurance, banking
- DSV Transportation and distribution
- OSV Other services

This aggregation is chosen, in part, to reflect key sectoral differences in the distribution of rents and their supporting mechanisms.

Primary factors are disaggregated into labor (LAB) and other value added (CAP). Consumption, investment, and net exports are aggregated into a single final consumption sector (FIN). The net expenditure matrix used in model calibration, derived from the 1986 Canadian input–output table, is shown in table 1 for this classification.

Consumer demands are grouped into six categories:

- FD Food, alcohol, and tobacco
- HO Housing and furnishing
- CL Clothing and personal care
- TR Transport and travel
- EN Entertainment
- OT Other

We use a transition matrix to link these producer and consumer good classifications, based on the coefficients reported in Ballard, Fullerton, et al. (1985), and adjusted for consistency with the 1986 Canadian input–output table (see table 2). Given the LES demands used in the model, we also require estimates of ratios of subsistence levels to total demands (see table 3). Demand system estimates for Canada reported in Harris and Mackinnon (1979) are adapted for use here.

B. Elasticities and Other Exogenous Parameters

We specify exogenous values for the ratio of the aggregate labor endowment to labor supply and for the elasticity of

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[9] The ratio of total taxes collected to GDP for all levels of government in Canada in the late 1980s and early 1990s was approximately 0.4. The higher ratio we use is meant to reflect a higher average marginal rate for overall taxation, and is also reflective, on average, of the higher revenue-to-GDP ratio in other OECD economies.

[10] The percent welfare gain is computed as the ratio of the equivalent variation from the tax change to benchmark above-subsistence income.

[11] We solve this nonlinear program with GAMS/MINOS (Brooke et al. (1988)).

[12] This is obtained by computing a new equilibrium where all commodity tax rates are multiplicatively scaled so as to generate a 0.1% increase in real tax revenues.
has natural rents largest in agriculture and services, while market structure rents are larger in manufacturing. It also assumes that lobbying for market structure rents occurs only in agriculture and services,\textsuperscript{15} and that there is no rent dissipation (rent seeking). We vary this latter assumption in sensitivity analysis. We also explore a number of scenarios where such rents are alternatively interpreted as natural rents and as market structure or regulation supported rents.

An important issue in the modeling of tax effects on Ricardian rents is whether there are capitalization effects due to taxes. These arise when taxes impact on the expected net-of-tax income returns from an asset, and are in turn reflected in the current period price of the asset. Tax changes which affect Ricardian rents can thus result in windfall gains or losses for the owners of the asset generating the rents. In the presence of capitalization effects, analyses of \textit{de novo} tax policy (i.e., comparing no-tax and with-tax equilibria) and analyses of the reform of existing taxes (i.e., comparing across with-tax equilibria) may have different implications, particularly when capital gains are taxable. Since our single-period static approach makes no distinction between stocks and flows, such effects are not captured by our analysis.

### IV. Model Results

To explore the impacts of rents on both the welfare cost and the optimal structure of commodity taxes, we conduct sensitivity and policy variational analyses around the central-case specification. We report numerical estimates of the excess burden of taxes (the welfare gain under a move from uniform taxation to equal-yield lump-sum taxation) for two preferences specifications (LES and homothetic), and two types of conjectures. We also report the marginal excess burden (MEB) of raising $1 of revenues by proportionally scaling either existing or optimal taxes.

Table 6 reports results for the welfare costs of taxes, showing how these are affected by the presence of rents and different modeling treatments with respect to conjectures. As indicated earlier, because of the way model calibration is performed to a given markup, results are little affected by the choice between Cournot and Bertrand conjectures, an implication confirmed by results in table 6.

13 With symmetrical product differentiation, there exists more than one combination of values for $\rho_j$ and the number of firms in a sector $j$ which can support a given equilibrium markup rate. In our calibration procedure, we select the number of firms exogenously (we set it equal to 100 in all sectors) and let $\rho_j$ be endogenously determined.

14 An alternative approach suggested to us by Kul Bhatia would be to calibrate model parameters to estimates of marginal supply responses in the presence of rents (effectively supply elasticities). For natural rents, the share of such rents in value added in sectoral data is closely related to implied output supply elasticities. But estimates of such supply elasticities are also sparse, making this approach equally difficult to implement.

15 Regulatory quantity constraints in these sectors are assumed to be relatively inflexible ($\eta = 4$).
The central-case estimates of the welfare costs of uniform-rate 50% commodity taxes are approximately 2.5%. Excluding rents from the model entirely leaves cost estimates little changed because of the joint presence of Ricardian rents and market structure supported rents, and the offsetting effects of these two rent components on the welfare cost of taxes. However, if all rents in the model are Ricardian rents, cost estimates fall, whereas if all rents are market structure related rents, cost estimates approximately double. The latter occurs depending on the treatment of rents. Excluding rents from the model increases marginal welfare costs, with a further increase if all rents are made market structure related. Lobbying costs lower marginal welfare costs, and explicitly incorporating rent seeking makes them negative. Once again, therefore, both the presence of rents and their form and supporting mechanisms substantially affect model estimates of the welfare costs of taxes, both in total and at the margin.

Table 7 reports optimal tax rates by product and sector for the same cases considered in table 6. Substantial variation in welfare costs across products and sectors is evident. Marginal welfare cost estimates show similar variation, depending on the treatment of rents. Excluding rents from the model increases marginal welfare costs, with a further increase if all rents are made market structure related. Lobbying costs lower marginal welfare costs, and explicitly incorporating rent seeking makes them negative. Once again, therefore, both the presence of rents and their form and supporting mechanisms substantially affect model estimates of the welfare costs of taxes, both in total and at the margin.

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**Table 5.—Treatment of Rents and Rent Supporting Mechanisms in the Central-Case Model Specification by Sector and Characteristics of Renta l Components**

<table>
<thead>
<tr>
<th>Rent Component Characteristics</th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Utilities, Telecom, Insurance, Banking</th>
<th>Transport and Distribution</th>
<th>Other Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of total rents in value added</td>
<td>0.4</td>
<td>0.1</td>
<td>0.3</td>
<td>0.2</td>
<td>0.01</td>
</tr>
<tr>
<td>Share of natural rents in total rents</td>
<td>0.5</td>
<td>0.001</td>
<td>0.25</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Share of total rents</td>
<td>0.5</td>
<td>0.999</td>
<td>0.75</td>
<td>0.999</td>
<td>0.999</td>
</tr>
<tr>
<td>Lobbying cost coefficient $\eta$</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Coefficient of rent dissipation $v$</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Total rents refer to the sum of natural, regulation supported, and market structure rents in each sector.

**Table 6.—Rents and Costs of Taxes in Alternative Model Variants**

<table>
<thead>
<tr>
<th>Model</th>
<th>Welfare Gain from Replacement by Nondistorting Tax (Hicksian EV as % of Base-Case Income)</th>
<th>Marginal Welfare Cost in Cents from Raising $1 of Additional Tax Revenue from Base-Case Taxes</th>
<th>Marginal Welfare Cost in Cents from Raising $1 of Additional Tax Revenue Using Optimal Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>LES Preferences Bertrand</td>
<td>2.47</td>
<td>14.1</td>
<td>11.1</td>
</tr>
<tr>
<td>LES Preferences Cournot</td>
<td>2.48</td>
<td>14.1</td>
<td>11.1</td>
</tr>
<tr>
<td>Homothetic Preferences Bertrand</td>
<td>1.75</td>
<td>13.6</td>
<td>11.3</td>
</tr>
<tr>
<td>Homothetic Preferences Cournot</td>
<td>1.75</td>
<td>13.6</td>
<td>11.3</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
</tr>
<tr>
<td>(9)</td>
<td>(10)</td>
<td>(11)</td>
<td>(12)</td>
</tr>
</tbody>
</table>

Notes: These calculations each involve proportionally scaling tax rates so as to raise one additional dollar of revenue. In the second case (columns (5)–(8)) the taxes scaled are the proportional commodity taxes used in the base case. In the third case (columns (9)–(12)) these are the optimal tax rates as reported in table 7.

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**Table 7.—Optimal Rate Structures in the Presence of Rents, Homothetic Preferences Case (Tax Rates by Product/sector in %)**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Bertrand</th>
<th>Cournot</th>
<th>Bertrand</th>
<th>Cournot</th>
<th>Bertrand</th>
<th>Cournot</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR</td>
<td>58.6</td>
<td>58.4</td>
<td>48.3</td>
<td>48.3</td>
<td>76.4</td>
<td>76.5</td>
</tr>
<tr>
<td>MAN</td>
<td>32.5</td>
<td>32.5</td>
<td>20.7</td>
<td>20.8</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>CSV</td>
<td>48.1</td>
<td>48.2</td>
<td>39.0</td>
<td>39.0</td>
<td>54.6</td>
<td>54.7</td>
</tr>
<tr>
<td>DSV</td>
<td>61.4</td>
<td>61.6</td>
<td>86.0</td>
<td>85.9</td>
<td>150.0</td>
<td>149.8</td>
</tr>
<tr>
<td>OSV</td>
<td>37.7</td>
<td>37.7</td>
<td>26.1</td>
<td>26.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

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16 These cost estimates are considerably lower than other widely cited welfare cost estimates of tax systems from general-equilibrium tax models without rents (for the United States, Ballard et al. (1985); for the United Kingdom, Piggott and Whalley (1985)). This difference occurs for a number of reasons. One is that these other models capture the full range of actual tax instruments (income, corporate, sales, social security, property, excise) and have more variance in model tax rates. Another is that these models also capture both taxes and subsidies whose distortions compound, but whose revenue effects net out (see footnote 8).
optimal commodity tax rates by product is present in these results, consistent with the results reported above for marginal welfare costs of raising revenue around uniform or optimal tax rates. The central case involves higher optimal rates in the high Ricardian rent sectors (agriculture and transportation), also suggesting that products currently given light tax treatment on income distribution grounds (such as food) should, on efficiency grounds, alternatively receive harsher tax treatment. This variation in tax rates by product is amplified by increasing lobbying costs, and by considering partial rent seeking.

Table 8 reports results from cases in which the size of rents in the base-case data is varied, first through a 50% increase, and subsequently through a 50% reduction. Results are reported for optimal tax rates, with more variation in LES than homothetic cases.

### V. Summary and Conclusion

This paper reports numerical simulation results on the role and significance of rents for the calculation of the welfare cost and optimal design of commodity taxes using a general-equilibrium model calibrated to 1986 Canadian data. The novelty in our model relative to those used in earlier general-equilibrium tax work is the simultaneous incorporation of sector-specific factors, rent generating and supporting mechanisms, and directly unproductive profit-seeking activities.

Only limited acknowledgment is given in the literature to the role that rents can play in commodity tax design, and here it is emphasized how various types of rents exert different influences. Ricardian rents lower the cost of taxes; market structure rents raise them; and regulation-supported rents can lower them if rent-seeking activities (reduced by taxes borne by rents) accompany these rents. Available evidence on the size and distribution of rents, even if limited, seems to indicate that rents are large and sectorally concentrated. Thus rents can play an important role in commodity tax design, dominating other considerations that have traditionally been stressed in the literature, such as the structure of preferences.

We use model variants to compute optimal commodity tax structures and to obtain estimates of the marginal welfare cost of taxation. Results indicate substantial influence of rents over both welfare cost estimates of taxes and design simulations of commodity taxes, along the lines suggested above, in part because in the model Ricardian rents are concentrated in agriculture and resources, with market structure rents concentrated in manufacturing. Optimal rate calculations suggest high tax rates on agriculture (food) and lower tax rates on manufacturing on efficiency grounds, opposite to what is now common policy on income distribution grounds. Rents thus seem to have important implications for commodity tax design.

### REFERENCES


