NBER WORKING PAPER SERIES

RENTS, REGULATION, AND INDIRECT TAX DESIGN

Carlo Perroni

John Whalley

Working Paper No. 4358

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 1993

We thank Kul Bhatia, Tim Besley, and Jan Davies for helpful comments. Financial support from the Ford Foundation is gratefully acknowledged. This paper is part of NBER's research program in Public Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

Working Paper #4358
May 1993

RENTS, REGULATION, AND INDIRECT TAX DESIGN

ABSTRACT

This paper discusses the implications of rents and regulations which support them for the design of indirect taxes such as VATS. Intuition suggests high tax rates on industries or products with rents; but we argue that whether rents are natural (due to fixed factors) or market structure related (monopolistic) makes a large difference. In the latter case, a high tax may induce adverse behavioral changes. We develop a general equilibrium tax model based on Canadian data and which incorporates both types of rent, and we use numerical simulation analysis to explore the implications of different types of rents for the design of indirect taxes. Our results suggest that the ways in which taxes should deviate from uniformity depends crucially on the mechanisms that generate rents. They also imply that a broadly based uniform tax will typically not be the optimal choice for economies where rents represent a significant share of value added, even when preferences are homothetic. Finally, they demonstrate that the presence of rents substantially affects measures of the social costs of indirect taxes, both in total and at the margin, and in both directions depending upon the nature of the rents involved.

Carlo Perroni
Department of Economics
Social Science Center
University of Western Ontario
London, Ontario N6A 5C2
CANADA

John Whalley
Department of Economics
Social Science Center
University of Western Ontario
London, Ontario N6A 5C2
CANADA
and NBER

1 Introduction

This paper reports numerical simulation analyses from a general equilibrium model based on 1986 Canadian data which explore the implications of different types of rents for the optimal structure of value added taxes. Designing tax structures so as to extract rents has been a recurrent theme in public finance, although in recent years it has been less prominent in the literature. We stress that while indirect taxes typically only provide an imperfect rent extraction device, the presence of rents has implications for the optimal design of VATs (including rate structures) which go someway beyond the conventional optimal tax considerations of non-taxed leisure and the structure of preferences. Both the presence of rents and their supporting mechanisms can imply tax structures which are at a substantial distance from uniformity. And rents can either lower or raise more conventional welfare cost measures for such taxes, both in total and at the margin.

The implications of our analyses for current practice with the VAT seem especially pronounced. In non-manufacturing sectors (including services) substantial rents occur, both naturally (resource rents) and due to regulatory activities, and our results suggest that higher tax rates should apply to these sectors to partially extract rents. This contrasts with the general presumption in favour of low tax rates on these sectors, because of concerns over income distribution effects such as with taxation of food. We also suggest that the general presumption in optimal commodity tax design in favour of higher tax rates on food and other related products which have lower demand elasticities may be reinforced once rents are taken into account.

Our results also imply that appropriate indirect tax design depends crucially on the types of rents involved, and especially the mechanisms used to support them. We draw a sharp distinction between what we call natural rents and market structure, or regulation supported, rents. Attempts to tax the latter will generate changes in behaviour, whereas this is less the case with natural rents. Hence, taxes which change endogenously determined monopolistic markups may not only generate larger price increases than implied by the direct tax component, but can also, in effect, act as a tax on a tax. The presumption for sectors with these types of rents is that lower rates should prevail than in other sectors; although as we show, the modelling of regulatory mechanisms can add a further set of complications.

In a final set of model calculations, we also evaluate how labour market rents may change some of these themes. This follows recent literature (Katz and Summers (1989)), which argues that the largest portion of rents in the U.S. economy are in labour markets, reflecting interindustry wage differentials unaccounted for by labour quality. We conjecture that labour rents and rents generated in output markets may have different implications for indirect tax design. We also note that these labour rents largely occur in manufacturing, whereas market structure and regulation related rents are larger in agriculture and services, with potentially differing and, to some degree, offsetting implications for indirect tax design.

The bottom line conclusion we offer is that both the presence of rents and their supporting mechanisms substantially affect indirect tax design. In their presence, appropriate tax rate profiles by product seem to be at some distance from the uniform rate broadly based value added tax often advocated by tax reformers, and this is not only for conventional optimal tax reasons involving labour leisure distortions and preferences. In turn, optimal rate profiles by product can be highly variable, and in many cases opposite to those which reflect income distribution considerations in VAT design.

The plan of the paper is as follows. Section 2 discusses conceptual issues concerning optimal tax design in the presence of rents. Section 3 describes the structure of the numerical general equilibrium model we use, based on 1986 Canadian data. Section 4 presents the results of our simulations. Section 5 concludes with a summary and discussion of wider implications for fiscal structure.

2 The role of rents in indirect tax design

Rents are usually defined by public finance economists as any above normal rate of return to an asset, whether that be capital or labour. Many years ago, Henry George (1914) proposed that the whole U.S. tax system be replaced by a single tax on land, which would have no efficiency implications. In more recent years, the Meade Committee (Meade (1978)) and others (Kay and King (1978), Boadway, Bruce, and Mintz (1983)) have advocated a cash flow corporate tax on the grounds that such tax is equivalent to a tax on pure rent, and hence will be neutral in efficiency impacts, while leaving rents as the revenue source to be taxed. Despite these contributions, the issue of the role of rents in the tax system remains unclear. Available evidence as to the size and distribution of rents appears to be inconclusive, although it seems unlikely that in most OECD economies rents alone could provide a large enough revenue source to finance all government activities. Furthermore, there are issues concerning the definition of rents, as their size and form depends on a number of factors, including the time period under discussion, and the mechanism by which they are thought to be generated.

Rent extraction and tax design

An idea underlying some parts of the public finance literature is to design taxes so as to perfectly extract rents, i.e., construct the tax base so as to tax only pure rent. This is the thinking behind the cash flow corporate tax advocated by the Meade Committee; a tax on sales less all costs including equipment (which would be expensed), but excluding interest costs. Under this tax scheme, the objective function of the firm is multiplicative in tax parameters.

Thus, if the firm's objective function is represented by the value of sales minus costs, i.e.

$$\Pi = pQ - C(Q), \tag{1}$$

where p and Q represent price and quantity produced, and $C(Q)$ is a cost function, and if this objective function is maximized by the firm, either in single period or in discounted present value terms (through maximization of the value of the firm), no changes in behaviour occur under a cash flow tax because tax parameters are multiplicative of the objective function.

Thus, if a tax at rate t is applied to the cash flow of the firm (involving expensing of capital equipment and no deduction for interest payments), its objective function becomes

$$\Pi = (1 - t)\,[pQ - C(Q)], \tag{2}$$

where t is the tax rate.

Cash flow, in turn, in this case is rent because all costs are deducted from sales. As has been pointed out in several places in the literature (see Boadway (1984) for instance), several different tax arrangements have the same effect as this particular tax on rent (cash flow). One is full deduction of interest payments plus economic depreciation, since in discounted present value terms deductions are the same as with expensing.

In contrast to such a cash flow tax, however, indirect taxes will only apply to the revenue component of equation (1). The objective function of the firm will not be multiplicative in tax rates, and taxes will therefore have behavioural effects. If a wage subsidy were used at the same time as an indirect tax on sales, the combined tax-subsidy scheme would have the effect of taxing the total return to capital, which in turn would also tax the rent component which accrues to owners of the firm. Such a tax would be neutral if the supply of capital is inelastic, and would be equivalent to a combination of a cash flow tax with a tax on the normal return to capital.[1]

Tax schemes that achieve neutral taxation of rents generated in product markets, whether they are natural rents or monopolistic rents, will not, however, be able to produce neutral rent extraction if rents are the result of monopolistic or regulatory

[1]Neutrality in this case is a direct result of the Ramsey rule for optimal taxation; see Auerbach (1985).

rents in *labour* markets. Thus, if rents in labour markets occur, any tax whether it be a cash flow tax or an indirect tax will have behavioural effects. To illustrate this, suppose that labour is the only input into production and that firms purchase labour services at a constant *ad valorem* premium m above the competitive wage (reflecting the rent component of the return to labour). In this case (1) becomes,

$$\Pi = pQ - (1+m)C(Q), \tag{3}$$

where $C(Q)$ represents input costs valued at the competitive (net-of-markup) wage rate. Under a cash flow tax with full expensing of cash wage costs (i.e., $(1+m)C(Q)$), labour rents would escape taxation.

To achieve neutral rent extraction in this case, a cash flow tax would need to be designed to allow expensing only of $C(Q)$. Similarly, an indirect tax would only achieve neutrality when accompanied by an *ad valorem* subsidy to labour based on the competitive wage rate. Since the latter is typically difficult to observe (due to differences in labour quality), neutral rent extraction through either a cash flow or an indirect tax scheme is infeasible in this case.

Thus, optimal indirect tax design inevitably involves trading off the behavioural effects of different taxes in terms of preference related and rent related effects. Indirect taxes are in widespread use in many economies around the world (in the form of VATs), and are likely to continue to be central to any modern tax system, motivating our analysis. We do not consider wage subsidies, in large part because they are not commonly used along with indirect taxes in most countries. Under this restriction, indirect taxes inevitably imply imperfect rent extraction, including for rents generated in product markets. We finally note that rent extraction through indirect taxes is made more difficult if these are restricted to final demands (ruling out taxes or subsidies on intermediate goods), since interindustry transactions tend to make the implicit rent content of final goods more uniform across sectors, and hence harder to extract through differential rate taxation.

Natural rents, monopolistic rents, regulatory rents, labour rents

Although we use the term rent to denote above-normal returns to any market activity, rents can still arise for different reasons and hence attempts to tax them will have different effects. As we emphasize in our introduction, a theme from our later model based analyses is that not only is the treatment of rents important in tax design, but a correct identification of the different types of rent is also crucial, since taxing each has different behavioural consequences.

We begin with what we term natural (or Ricardian) rents, which we think of as accruing to sector-specific factors of production in fixed supply. These occur, for instance, in natural resource sectors; and cause production to exhibit decreasing returns to scale and supply to be imperfectly elastic. In general in such cases, the elasticity of supply will be inversely related to the size of rents in the sector,[2] but directly related to the elasticity of substitution between the immobile factor and other

[2] For example, if the production technology is Cobb-Douglas, the output supply elasticity is $(1-\theta)/\theta$, where θ is the input value share of the fixed factor. See Clarete (1984), and Clarete and Whalley (1987).

inputs.

In the presence of natural rents, the degree of specificity of factors tends to dictate what is the appropriate indirect tax scheme, with higher tax rates applying to sectors with more pervasive fixed factors (Dixit (1970)). In the extreme case where all production is accounted for by the fixed factor in the sector, Q in equation (1) is fixed and an indirect tax on output is fully borne by the fixed factor. If, however, marginal costs are increasing but finite, then an indirect tax on output will be less than fully borne by the fixed factor, providing for only partial extraction of rents through the tax scheme.

Monopolistic rents have sharply different implications from natural rents for indirect tax design. In classical Chamberlinian monopolistic competition, equilibrium will be characterized by an endogenously determined markup over marginal cost:

$$p = (1 + m)c, \tag{4}$$

where m is the *ad valorem* markup and c is the marginal cost of production. Thus, under monopolistic competition, there will be passthrough of indirect taxes in the form of higher product prices, with reduced tax impact on monopoly rents.

Key in determining the degree of passthrough will be elasticities in preferences and technology, and assumptions on market structure, including whether or not free entry is allowed. If, for example, we consider a specific (i.e., per-unit) tax, and assume m to be constant (reflecting a constant elasticity of demand facing individual firms), and if c is also constant; then at the margin the degree of passthrough will be equal to $(1+m)$,[3] (whereas with natural rents less than 100% of the tax is shifted onto buyers). Because of such over-shifting, under monopolistic pricing optimal tax rates tend to be inversely proportional to the size of monopolistic rents (Myles (1989)).

A further source of rent is regulation, also with implications for indirect tax design. Quantity regulation, for instance, reduces the elasticity of supply, and thus has similar implications for tax design to natural rents. In contrast, regulatory schemes which support monopolistic behaviour may have similar tax implications to monopoly rents. Consider, for example, marketing boards, modelled as setters of regulatory policies which maximize the rents of affiliated producers; acting, in effect, as collusive price-makers. In this case, costs to producers, $C(Q)$, may be thought of as comprising two separate components: a conventional input cost component from technology, and a further private cost component representing regulatory costs. The latter may involve lobbying costs of various kind which have to be borne by producers, either to maintain the regulated market structure intact, or to seek out new restrictions that will allow them to further increase monopoly markups. These additional regulatory costs can have their own implications for tax design, dampening quantity responses to indirect tax changes and effectively reducing market power for producers. Regulation may also be associated with real resource use in rent-seeking efforts (Krueger (1974)), with further tax design implications because of the socially wasteful resource dissipation.

In Table 1, we summarize these rent types and their implications for indirect tax

---

[3]Under monopolistic pricing, an equal-yield *ad valorem* tax will generate comparatively less tax shifting; see Stiglitz (1988).

Table 1: Types of Rents and Implications for Indirect Tax Design

Rent Type	Characteristic	Tax Implication
Natural rents	Specific factors of some form	More heavily tax sectors with such rents
Monopolistic rents	Above normal return to assets due to market power	Depending on elasticities, it may be optimal to more lightly tax high-rent sectors
Regulation supported rents	Monopolistic rents supported by regulation with lobbying costs	Marginal lobbying costs may affect behavioural responses to taxes

design. Different implications seem to follow for different sectors of the economy, because of the varying importance of the rental components involved. For instance, in OECD economies, regulation supported rents seem generally to be more heavily concentrated in agriculture and services, whereas labour rents tend to be concentrated in manufacturing. The combined effect on indirect tax design can be substantial, depending both on the size of rents and the other underlying parameters of the economy.

Finally we note that, although the tax literature has traditionally emphasized rents in output markets, factor markets and more explicitly labour market rents can also represent a large share of total rents (Katz and Summers (1989)). Such rents may result from bilateral bargaining, monopolistic wage setting by unions, or labour market regulation. In contrast to output market rents, labour market rent generating mechanisms may also distort input decisions by producers and induce intersectoral reallocations of factors. Labour market rents may also affect the optimal design of indirect taxes. Not only will taxes have to be designed so as to counteract the presence of monopolistic margins in consumer prices; they will also have to aim at correcting the misallocation of factors associated with rent supporting labour market imperfections.

The outcome of this discussion is that rents can clearly have important implications for indirect tax design. Even when preferences are implicitly separable between taxed and untaxed goods, a uniform rate broadly based tax may not be the optimal choice for economies where rents comprise a significant component of value added. And how commodity taxes should deviate from uniformity depends crucially on the mechanisms that generate such rents. The natural way to explore the implications of these mechanisms for indirect tax design is by numerical simulation. In the sections that follow, we report on some results from a general equilibrium model based on a Canadian data set which shed further light on these issues.

3 A general equilibrium tax model with rents

In order to explore the implications of rents for the design of indirect taxes, both in terms of optimal rates structure and their welfare costs, we employ a numerical general equilibrium model of the Canadian economy, calibrated to 1986 data, into which we have incorporated the natural rents, market structure rents and regulation supported rents that we discuss above. The core of the model is the standard, simplified, tax based general equilibrium model as set out in the numerical examples in Shoven and Whalley (1984, 1992). Our model, as is theirs, is static with technology and preferences specified, and the economy for simplicity is treated as closed. Its novelty relative to earlier work is its explicit incorporation of rents through market structure features, fixed factors, and lobbying cost functions. A calibrated version of this model is then used to analyze optimal indirect tax rate profiles under various assumptions as to the nature and distribution of rents in the economy, as well as provide associated welfare cost estimates both with and without rents and with alternative rent treatments.

Demand

On the demand side of the model we assume a representative consumer, endowed with fixed amounts of labour and capital. This demand representation includes consumption demand, investment demand, government demand as well as any net trades with the rest of the world. Representative consumer demands include both leisure and consumer goods, the latter being modelled 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 *et al.* (1985)).

Because so much previous optimal commodity tax literature has focussed on non-taxation of leisure and the implications of preference structures (see Atkinson and Stiglitz (1972), and Deaton (1981)), we also employ a non-homothetic specification of preferences. We use a non-homothetic, three-stage LES expenditure function defined over the gross-of-tax prices of produced goods $(p_i(1+t_i), \forall i)$, the price of leisure (w_0), and a utility index U:

$$E(p,t,w_0,U) = U\left\{\beta {w_0}^{1-\vartheta} + (1-\beta)\left[\sum_\ell \mu_\ell \left(\prod_i [p_i(1+t_i)]^{b_{i\ell}}\right)^{1-\delta}\right]^{\frac{1-\vartheta}{1-\delta}}\right\}^{\frac{1}{1-\vartheta}}$$

$$+\sum_\ell \bar{x}_\ell \prod_i [p_i(1+t_i)]^{b_{i\ell}}. \tag{5}$$

Here, δ represents the elasticity of substitution between above-subsistence levels of consumption of different consumer goods, ϑ is the elasticity of substitution between consumption and leisure, β is the leisure share parameter, the μs are consumption share parameters referred to consumer goods. The $\bar{x}$s are subsistence levels for consumer goods, and the bs are the coefficients in the transition matrix linking producer goods to consumer goods. Under this specification, when all $\bar{x}$s are zero preferences are homothetic and implicitly separable.

Production

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

Technology in each sector is represented by a three-stage, constant-elasticity-of-substitution (CES) unit cost function defined over goods prices (p), factor prices (w), and the shadow price of a sector-specific factor in inelastic supply (p_{Kj}):[4]

$$c_j(p, w, p_{Kj}) = \left\{ \left[\sum_i a_{ij} {p_i}^{1-\gamma} + \left(\sum_f a_{fj} {w_f}^{1-\sigma} \right)^{\frac{1-\gamma}{1-\sigma}} \right]^{\frac{1-\omega}{1-\gamma}} + a_{Kj} {p_{Kj}}^{1-\omega} \right\}^{\frac{1}{1-\omega}}, \ \forall j, \quad (6)$$

where ω is the elasticity of substitution between the sector-specific factor and other inputs, σ is the elasticity of substitution between primary factors, γ is the elasticity of substitution between intermediate inputs and value added, and the as are share parameters in technology.

Monopolistic and regulation supported rents

To capture market structure supported rents in our model, we specify two variants. In the first, we assume an oligopolistic structure in product markets. In each sector, we assume a fixed number of firms using identical technologies. These each produce a symmetrically differentiated product as in Dixit and Stiglitz (1977). Demand by consumers and by the other productive sectors is for a composite of these differentiated products.

In this case, the price of the composite product is obtained as a CES aggregate of the individual goods prices:

$$p_j = \left[\sum_s (p_j^s)^{1-\rho_j} \right]^{\frac{1}{1-\rho_j}}, \ \forall j, \quad (7)$$

---

[4]The shadow price of the sector-specific factor is the shadow value associated with the resource constraint.

where p_j^s is the price charged by firm s in sector j. Individual firms behave as Bertrand competitors, and symmetrical product differentiation implies that in a Bertrand-Nash equilibrium a common markup rate will prevail in each sector.

In the second variant, regulation is represented as oligopolistic behaviour in the presence of flexible quantity constraints. The latter reflect historical quota allocations assigned through some politically established regulatory body (such as a marketing board), with the characteristic that deviating from a historically determined quota requires firms to lobby, and thus is costly to the firm. We specify these costs as quadratic in the deviation from initial quotas $\bar{Q}_j^s$, and proportional to marginal production costs c_j, i.e.

$$\frac{\eta_j}{2\bar{Q}_j^s}\left(Q_j^s - \bar{Q}_j^s\right)^2 c_j, \quad \forall j. \tag{8}$$

This specification implies an increasing marginal lobbying cost function equal to

$$\frac{\eta_j}{\bar{Q}_j^s}\left(Q_j^s - \bar{Q}_j^s\right) c_j, \quad \forall j, \tag{9}$$

(assuming c_j to be constant), where η_j represents the elasticity of combined marginal costs evaluated at the quota output level $\bar{Q}_j^s$. As η_j increases, the quantity constraint on output for the firm becomes more inflexible. We also assume that a fraction ν of all rents (gross of lobbying costs) generated by regulation is dissipated through unproductive rent-seeking activities.[5]

In a further elaboration of our model, we adopt a structure similar to the above to represent labour market rents. Unions are modelled as Bertrand competitors that sell

[5]We do not explicitly model other forms of regulation such as those that are price based.

symmetrically differentiated labour services, specific to a certain production sector. These different types of labour flow from homogeneous labour services obtained from the representative consumer. Regulation in labour markets is modelled analogously to regulation in output markets.

The government's optimal tax problem

In the model, the government levies *ad valorem* taxes on final consumption for the five produced goods; effectively a VAT. For simplicity we take this to be the only tax used by government.[6] The revenue from these taxes is returned to the consumer in the form of a lump-sum transfer. In all of our calculations, the government faces a real revenue constraint: tax revenues must be sufficient to guarantee a constant real transfer to the consumer, expressed in terms of an ideal consumer price index.

The government's problem consists of choosing tax rates which maximize the representative consumer's welfare, given this revenue requirement. The other constraints in the government's optimal tax problem consist of a full set of Bertrand-Nash general equilibrium conditions as outlined later in this section.[7]

For each model scenario we analyze, we also compute the percentage welfare gain

---

[6]We specify a benchmark tax rate of 35% which is substantially higher than actual Canadian VAT (or GST) rates. This rate corresponds roughly to the ratio of total taxes collected by all levels of government to GDP for Canada in the late 1980's and early 1990's.

[7]We solve this nonlinear program with GAMS/MINOS (Brooke, Kendrick and Meeraus (1988).

of a move from uniform taxation to the corresponding optimal indirect tax structure,[8] as well as the marginal excess burden associated with the optimal structure.[9]

Model data and parameters

The commodity aggregation for produced goods and productive sectors is specified as follows:

AGR Agriculture, Mining, Forestry and Fishing;

MAN Manufacturing;

CSV Utilities, Telecommunications, Insurance, Banking;

DSV Transportation and Distribution;

OSV Other Services.

This aggregation is meant to reflect sectoral differences in the distribution of rents and their supporting mechanisms. Primary factors are disaggregated into labour (LAB) and other value added (CAP). Consumption, investment and net exports are aggregated into a single final consumption sector (FIN). The net expenditure matrix

---

[8]The percentage welfare gain is computed as the ratio of the equivalent variation of the tax change to benchmark, *above subsistence* income.

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

for this classification, derived from the 1986 Canadian input-output table, is shown in Table 2.

Consumer demands are grouped into six categories:

FD Food, Alcohol, Tobacco;

HO Housing and Furnishing;

CL Clothing and Personal Care;

TR Transportation and Travel;

EN Entertainment;

OT Other.

We employ a transition matrix linking these producer and consumer good classification, based on the coefficients reported in Ballard *et al.* (1985), and adjusted for consistency with the 1986 Canada input-output table (Table 3). Ratios of subsistence levels to total demands (Table 4) reflect LES demand system estimates for Canada reported by Harris and MacKinnon (1979).

Available literature on the size and origins of rents in OECD economies is surprisingly sparse. Rents, of course, are time dependent (short and long run rents differ greatly), and reflect a residual calculation which is subject to differences in interpretation and execution. Anderson (1993) reports estimates of natural resource rents for Canada as high as 10% of GDP, while monopolistic rents in product markets appear to be smaller. Katz and Summers (1989) argue that in U.S. manufacturing sector rents accruing to capital account for less than 1.7% of value added, whereas union

Table 2: Canada 1986 Net Expenditure Matrix (CAN $B)

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

Source: Statistics Canada.

Table 3: Production-Consumption Transition Matrix

Producer goods	Consumer goods					
	FD	HO	CL	TR	EN	OT
AGR	0.53				0.07	
MAN		0.12	0.33	0.20	0.26	0.05
CSV				0.02		0.39
DSV	0.47	0.24	0.67	0.69	0.56	0.11
OSV		0.64		0.09	0.12	0.45

Source: Based on coefficient matrix from Ballard *et al.* (1985).

wage differentials produce rents of significant size in labour markets. Their estimates suggest rent related wage premia as high as 30% for certain sectors (e.g., utilities).

On the basis of a review of a limited amount of currently available literature, we formulate best guesses for the size of combined sectoral rents as a share of total value added (Table 5). In our numerical simulations, we then explore a number of scenarios where such rents are interpreted alternatively as natural rents and as monopolistic or regulation supported rents, both in output and labour markets.

Finally, we specify exogenous values for the ratio of the labour endowment to labour supply, and for all elasticity parameters in the model (Table 6) with the exception of the elasticities that define the degree of product differentiation within sectors (ρ_j). The latter are endogenously determined by our calibration procedure so as to support the markup rates implied by any given set of assumptions as to the size and composition of rents.[10]

In our initial equilibrium we assume a 35% uniform tax on final consumption, which in turn determines the revenue requirement for government in all subsequent equal-yield equilibria. We then use our model to compute optimal indirect tax rates, and associated social costs of taxes, for a number of different scenarios.

---

[10] With symmetrical product differentiation, there exist more than one combination of values for ρ_j and for the number of firms in sector j which can support a given equilibrium markup rate. In our calibration procedure, we have chosen to select the number of firms exogenously (we arbitrarily make it equal to 100 in all sectors) and let ρ_j to be endogenously determined.

Table 4: Ratios of Subsistence Levels to Total Demands

Food, Alcohol, Tobacco	0.63
Housing and Furnishing	0.35
Clothing and Personal Care	0.16
Transportation and Travel	0.07
Entertainment	0.08
Other	0.24

Source: based on Harris and MacKinnon (1979).

Table 5: Values Assumed for Combined Sectoral Rents as a Share of Total Value Added

Agriculture, Mining, Forestry and Fishing	0.40
Manufacturing	0.10
Utilities, Telecommunications, Insurance, Banking	0.30
Transportation and Distribution	0.20
Other Services	0.05

Source: various literature sources; see text.

Table 6: Elasticities and Other Key Model Parameters

Elasticity of substitution between sector-specific factors and other inputs	ω	1.0
Elasticity of substitution between intermediate inputs	γ	0.5
Elasticity of substitution between primary factors	σ	1.0
Ratio of total labour endowment to labour supply	ζ	1.5
Labour supply elasticity	ξ	0.5
Elasticity of substitution in consumption	δ	1.0

Computation

In order to compute an oligopolistic equilibrium for our model, we use a technique of specifying a "reference" equilibrium together with a number of perturbed equilibria (one per productive sector). These perturbed equilibria are linked to the reference equilibrium by small perturbations in the markup rates of the representative firms of each sector. We then search for 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 are zero.[11]

[11] It is possible to use a similar approach to analyze the case where the strategic variable of a firm is the quantity it produces (Cournot competition). If we compare the Bertrand-Nash and the Cournot-Nash equilibria for a given parameter specification, we may 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 $(\rho_j, \forall j)$ are determined endogenously so

Formally, let us denote the markup rate of a representative firm in sector j by m_j, and the markup rate of all other firms in the same sector by $\bar{m}_j$; the payoff of the representative firm in sector j is denoted as Π_j. The reference equilibrium is identified by the superscript 0, and the perturbed equilibria by the superscript $r = 1, \ldots, G$, where G is the number of oligopolistic sectors in the economy. We perturb markup rates as follows:

$$m_j^r = m_j^0 + \Delta m, \quad j = r; \tag{10}$$

$$m_j^r = m_j^0, \quad j \neq r; \tag{11}$$

$$\hat{m}_j^r = m_j^0, \quad \forall j. \tag{12}$$

Here, Δm is a small but finite scalar. A Bertrand-Nash equilibrium is then supported by prices and activity levels that clear markets and ensure non-positive normal profits in the reference and perturbed equilibria, and by markup rates that represent best responses by individual firms, i.e., such that

$$\frac{\Pi_j^r - \Pi_j^0}{\Delta m} = 0, \quad j = r. \tag{13}$$

---

as to support a monopolistically competitive equilibrium with markup rates equal to exogenously given values. Consequently, the behaviour of the model with Cournot competition is close to that with Bertrand competition.

4 Simulations and results

To analyze the impacts of sectoral rents on indirect tax design, we use a "central case" model specification (Table 7) around which we conduct sensitivity and variational analysis. We assume natural rents are largest in agriculture and services, but that monopolistic rents are proportionally larger in manufacturing. We assume lobbying for monopolistic rents occurs in agriculture and services,[12] and in our central case, assume no rent dissipation (rent seeking), although we vary this latter assumption in sensitivity analysis. Our central case also ignores labour market rents (both assumptions are subsequently varied in sensitivity analysis).

Table 7: Main Features of the Central Case
Model Specification

	Sectors				
	AGR	MAN	CSV	DSV	OSV
Share of total rents in value added	0.4	0.1	0.3	0.2	0.05
Share of natural rents in total rents	0.5	0.001	0.25	0.001	0.001
Share of monopolistic rents in total rents	0.5	0.999	0.75	0.999	0.999
Lobbying costs coefficient (η)	5	0	5	5	0
Coefficient of rent dissipation (ν)	0.0	0.0	0.0	0.0	0.0

- Monopolistic and regulation supported rents arise in output markets

[12]Regulatory quantity constraints in these sectors are assumed to be relatively inflexible ($\eta = 5$).

We have performed numerical optimal tax calculations using both this central case specification and for a number of other different model specifications. While the distribution and size of total sectoral rents in the benchmark equilibrium is the same in all cases, the underlying rent-generating mechanism varies across cases. For each case, we report optimal tax rates on final demands for all produced goods, the marginal excess burden of raising $1 of revenues proportionally around the optimal rates (MEB), and the percentage welfare gain of a move from uniform taxation to an optimal tax structure.

Table 8 reports central case results, showing how indirect tax design is affected by the presence of rents. We report results for both homothetic and LES preferences. In our central case (first column) sectors with high natural rents (agriculture) pay taxes more than double of those of sectors with market structure-supported rents. MEBs are lower due to natural rents, and a significant welfare gain occurs from moving from a uniform to a non-uniform optimal rate structure; reflective of unexploited welfare gains if a uniform tax structure is instead adopted. With homothetic preferences, in the no-rent case uniform taxes are optimal, but the marginal welfare cost of taxation is higher than when rents are present. The second and third columns of Table 8 show optimal tax rates when preferences are non-homothetic. In this case the explicit incorporation of preference estimates for Canada for an LES system (as used by Harris and MacKinnon (1979)) compounds the effects from incorporating rents of higher taxes on agriculture and lower taxes on manufacturing.

Table 8: Central Case Model Analyses
of Indirect Tax Design

	Central rent assumptions		No rents	
	Homothetic	LES	Homothetic	LES
Optimal rates (%)				
Agriculture etc.	40.8	48.9	35.0	48.8
Manufacturing	20.3	17.6	35.0	30.2
Utilities etc.	32.7	30.4	35.0	34.0
Transport. etc.	46.8	45.5	35.0	32.4
Other services	23.0	21.4	35.0	33.0
% MEB	7.8	7.8	12.7	12.5
% Welfare gain (see footnote 8)	0.15	0.26	0.00	0.07

Table 9: The Impact of Changes in Rent Assumptions on Model Results

	Cases		
	(1) Central case (homothetic)	(2) All rents natural rents	(3) All rents monopolistic rents
Optimal rates (%)			
Agriculture etc.	40.8	36.6	22.6
Manufacturing	20.3	23.2	41.5
Utilities etc.	32.7	31.6	29.0
Transport. etc.	46.8	47.5	31.9
Other services	23.0	23.2	48.2
% MEB	7.8	5.8	22.3
% Welfare gain (see footnote 8)	0.15	0.12	0.19

Table 9 reports results from re-computation of optimal tax structures under various changes in the treatment of rents in the model. Treating all rents as natural rents involves higher optimal rates in the high rent sectors (agriculture and utilities), and lowers MEB estimates. The relatively smaller variance in optimal rates, and the small welfare gain involved with a move from uniformity to an optimal tax structure, shows that rent extraction through indirect taxation in this case is imperfect. An opposite pattern of tax rates is obtained by changing all rents to a treatment as monopolistic rents. This doubles tax rates in manufacturing, halves rates in agriculture, and triples the MEB estimates, as taxes compound at the margin with monopolistic markups.

Table 10: The Effects of Varying Lobbying Cost Coefficients and Coefficients of Rent Dissipation on Model Results

	Cases		
	(1) Central case (homothetic) $\eta = 5$ $\nu = 0$	(2) $\eta = 100$ $\nu = 0$	(3) $\eta = 5$ $\nu = 0.25$
Optimal rates (%)			
Agriculture etc.	40.8	34.7	46.6
Manufacturing	20.3	12.5	0.9
Utilities etc.	32.7	27.4	30.3
Transport. etc.	46.8	62.2	87.5
Other services	23.0	15.3	1.2
% MEB	7.8	3.9	–4.9
% Welfare gain (see footnote 8)	0.15	0.39	1.28

Table 10 shows how both lobbying cost coefficients and assumptions on rent dissipation can further affect analyses.[13] The second column shows that higher lobbying costs tend to reduce the degree of tax over-shifting, thus making the pattern of optimal taxes relatively more uniform, while the third column shows the effects of rent dissipation. In this case, although taxes compound with markups at the margin,

[13]Lobbying cost coefficients are varied only in those sectors for which lobbying costs are non-zero in the central case.

Table 11: Comparison of Results under Model Treatment with Rents Arising in Product Markets or in Labour Markets (Monopolistic and Regulation Supported Rents)

	Cases	
	(1) Central case (homothetic)	(2) Labour market rents
Optimal rates (%)		
Agriculture etc.	40.8	38.7
Manufacturing	20.3	22.4
Utilities etc.	32.7	38.2
Transport. etc.	46.8	43.1
Other services	23.0	25.6
% MEB	7.8	13.1
% Welfare gain (see footnote 8)	0.15	0.11

higher taxation in high rent sectors generates inframarginal reductions in rent dissipation. Optimal tax rates on manufacturing are as low as 0.9 percent, and negative marginal excess burdens result.

Finally, in Table 11, we analyze the influence of labour market rents on indirect tax design, in this case considering these rents in isolation from monopoly and market structure-supported rents in product markets. Tax rate profiles are similar in pattern to those in the homothetic central case. MEBs, however, in this case are double those in the base case, reflecting the presence of intersectoral factor distortions.

The conclusion we draw from these results is that rents affect the design of optimal indirect taxes, changing both rate profiles and welfare cost estimates. Their influence varies sharply depending on the type of rent involved, and any associated regulatory processes. Their influence needs to be more widely recognized and to be taken into account in indirect tax design.

5 Summary and conclusion

In this paper we examine how the presence and form of rents affects the optimal design of indirect taxes. We stress that these influences occur, even when preferences are implicitly separable between taxed and untaxed goods, and focus on various rent-generating mechanisms: factor specificity, market power, and regulation. We report calculations from a general equilibrium model based on Canadian data which suggest that a broadly based value-added tax will typically not be the optimal choice for economies that exhibit departures from the competitive, constant returns-to-scale paradigm and where production activities generate rents of significant size. Estimates of the social cost of taxes are also affected. How the structure of commodity taxes should deviate from uniformity depends crucially on the institutional mechanisms that generate such rents.

In closing, we note that in many countries around the world (especially in Central and Latin America) the shares of capital in national income are dramatically higher than in the Canadian case we consider here. Moreover, the market structures in such countries can be extremely concentrated, suggesting that rents and their supporting mechanisms are central elements of economic structure. Hence, in these countries rents may even be more important for indirect tax design than in the Canadian case. Rents and the public finance implications that follow from them is not a topic that has attracted much attention in recent work, but for the reasons above we feel that this is an area on which more future research could usefully focus.

References

ANDERSON, F.J. (1993) "Issues in a Natural Resource Economy." Research Report no. 9304. Department of Economics, University of Western Ontario.

ATKINSON, A.B., and STIGLITZ, J.E. (1972) "The Structure of Indirect Taxation and Economic Efficiency." *Journal of Public Economics* 1, 97-119.

AUERBACH, A.J. (1985) "The Theory of Excess Burden and Optimal Taxation." In Auerbach, A.J. and Feldstein, M., ed., *Handbook of Public Economics*, Volume 1. Elsevier.

BALLARD, C.L., FULLERTON, D., SHOVEN, J.B., and WHALLEY, J. (1985) *A General Equilibrium Model for Tax Policy Evaluation.* University of Chicago Press.

BOADWAY, R.W., and WILDASIN, D.E. (1984) *Public Sector Economics*, 2nd edition. Little Brown.

BROOKE, A., KENDRICK, D., and MEERAUS, A. (1988) *GAMS: A User's Guide.* Scientific Press.

CLARETE, R.L. (1984) *The Cost and Consequences of Trade Distortions in a Small-Open Economy: A General Equilibrium Model of the Philippines*. Ph.D. dissertation, Economics Department, University of Hawaii.

CLARETE, R.L., and WHALLEY, J. (1987) "Comparing the Marginal Welfare Costs of Commodity and Trade Taxes." *Journal of Public Economics* 33, 357-362.

DEATON, A. (1981) "Optimal Taxes and the Structure of Preferences." *Econometrica* 49, 1245-1260.

DIXIT, A.K. (1970) "On the Optimum Structure of Commodity Taxes." *American Economic Review* 60, 295-301.

DIXIT, A.K., and STIGLITZ, J.E. (1977) "Monopolistic Competition and Optimum Product Diversity." *American Economic Review* 67, 297-308.

GEORGE, H. (1914) *Progress and Poverty*. Doubleday Publishing.

KATZ, L.F., and SUMMERS, L.H. (1989) "Industry Rents: Evidence and Implications." *Brookings Papers on Economic Activity: Microeconomics 1989*. The Brookings Institution.

KAY, J.A., and KING, M.A. (1978) *The British Tax System*. Oxford University Press.

KRUEGER, A.O. (1974) "The Political Economy of the Rent-Seeking Society." *American Economic Review* 64, 291-303.

HARRIS, R.G., and MACKINNON, J.G. (1979) "Computing Optimal Tax Equilibria." *Journal of Public Economics* 11, 197-212.

MEADE, J.E. (1978) *The Structure and Reform of Direct Taxation*. Report of a committee chaired by Prof. J.E. Meade. Allen and Unwin.

MYLES, G.D. (1989) "Ramsey Tax Rules for Economies with Imperfect Competition." *Journal of Public Economics* 38, 95-115.

SHOVEN, J.B., and WHALLEY, J. (1984) "Applied General Equilibrium Models of Taxation and International Trade: An Introduction and Survey." *Journal of Economic Literature* 22, 1007-1051.

SHOVEN, J.B., and WHALLEY, J. (1992) *Applying General Equilibrium*. Cambridge University Press.

STIGLITZ, J.E. (1988) *Economics of the Public Sector*. 2nd ed., Norton.