

GATT Rulings, Excise Reforms and Trade Patterns: The Alcoholic Beverages Industry in Canada

Ian J. Irvine and William A. Sims*

Concordia University

Abstract

This paper uses a disaggregated micro-model of the alcoholic beverage sector to investigate reforms of discriminatory pricing practices attributable to differential provincial markups and federal excise levies in Canada. The reform of markups has been demanded in a recent GATT ruling. We find that major changes in the structure of this industry could follow and that both provincial and federal government tax revenues respond to measures initiated by the other level of government. A cooperative tax reform strategy, which leaves each level of government with unchanged revenues, is then modeled. This entails major changes in trade patterns, relative outputs and producer revenues.

I. Introduction

In response to a request by the European community, a GATT Panel ruled in 1988 that practices, commonly used by provincial liquor boards in Canada¹, such as

* Department of Economics, Concordia University, Montreal, Quebec, Canada, H3G 1M8.

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1. The provincial liquor boards in Canada have a monopoly on the importation of alcoholic beverages within their jurisdiction. The federal and provincial governments also tax the production and sales of these beverages.

discriminatory markups and restrictions on listings policy and points of sale, acted as barriers to the importation of alcoholic beverages and were therefore in violation of several GATT articles [FOCUS, 1988 and 1992]. At present, the removal of such barriers is being negotiated and it is therefore important to predict the consequences of such reforms. The primary focus of this paper is upon the impact of eliminating the discriminatory tax structure levied on foreign and domestic alcoholic beverages.

A second objective of the paper is to investigate how trade patterns and revenues in the industry would respond to an overhaul of the current system of excise taxes and duties levied by the federal government. The producers of some alcoholic beverages (primarily spirits) have long maintained that the current system of taxation discriminates unfairly against them: that if excise rates were to reflect the alcohol content of different beverages, a major realignment of rates would result. Since imported products are not concentrated equally across the broad beverage groups, such reforms would also influence the pattern of trade.

In addition to examining how such changes may affect the industry's output, it is natural to examine how the tax revenues of federal and provincial governments will respond when these practices are reformed. A classic problem in the economic relations within federal states is how tax revenues are shared and how powers of taxation are apportioned. This is a particularly interesting issue in Canada at the present time, given that the federation is likely to face changes in the distribution of its political and economic powers.

The determination of appropriate tax rates on alcoholic beverages is of interest quite apart from these revenue generation and industry structure issues. An important policy role for alcohol taxation is to limit expenditure on alcoholic beverages in order to deter excessive consumption. It is also desirable to set rates so that the resource allocation effects of having prices in excess of social costs are minimized. Since the problem of optimal taxation of alcoholic beverages has been investigated elsewhere [Irvine and Sims, 1992], it is not addressed in this paper.

Several authors have examined the price elasticity of demand for beer, wine and spirits in Canada [*e.g.* Fuss and Waverman, 1987 (FW), Johnson, Oskanen, Veall and Fretz, 1989 (JOVF)]. Using these results it is possible to make rough estimates of the effects of tax changes. The present paper uses a detailed micro-model of the alcoholic beverages sector which makes it possible to address the issues discussed above. Rather than simply analyzing the effects of tax changes at the level of *beer*,

wine or spirits, we analyze them at a *highly disaggregated level* – that is, for different products which make up these aggregates². It is necessary to operate at this level of disaggregation to analyze the GATT ruling and possible changes in excise levies. This is because imported products must be distinguishable from domestically produced products, and excise levies vary considerably within the broad categories of *beer*, *wine* and *spirits*.

In order to do this the utility tree approach discussed by Strotz [1957] and German [1959] is utilized. This allows the incorporation of *a priori* elasticity and tax information specific to alcoholic beverages at different levels of aggregation. But it also necessitates the use of a certain model structure. In particular it requires certain constraints on the preference ordering, in the form of separability and, in some cases, homotheticity in order to insure the consistency of the multi-stage optimization procedure.

II. An Economic Model of the Alcoholic Beverages Sector

A. Demand

i) General Overview

The demand side of the model is represented by a consumer who has a three level utility tree. At the top level the consumer obtains utility from the consumption of alcoholic beverages (A) and all other goods (Z) and allocates income on the basis of relative prices and income. That is, she maximizes a weakly separable utility function,

$$U = U\{U_A(A), Z\} \quad (1)$$

where U_A is a branch utility function for A ; $A = A(X_B, X_W, X_S)$ is the alcoholic beverage aggregator function; and Z is a vector of other aggregate commodities which enter the utility function. The budget constraint is:

$$M = P_A A + P_Z Z \quad (2)$$

where M is total expenditure, P_A is the aggregate price of alcoholic beverages and $P_A A = M_A$. This is the first level of the model and it yields the optimal expenditure

2. The products in each beverage group or aggregate are listed in Table 1.

on A and Z as a function of P_A , P_Z and M . At the second level the consumer maximizes the alcohol branch utility function,

$$U_A = U_A \{u_B(X_B), u_W(X_W), u_S(X_S)\} \quad (3)$$

subject to the appropriate constraint, and this yields demand functions for beer (X_B), wine (X_W) and spirits (X_S). At the third level the consumer allocates expenditures among the products in each beverage group depending on relative prices in each group and expenditure $M_i (i = B, W, S)$.

This utility tree budgeting procedure is necessitated by the problem at hand and requires specific constraints on the preference ordering. In particular it is assumed that preferences are weakly separable. Given the appropriate assumptions this procedure will be consistent³. That is, it will yield the same demands that would arise if we had maximized utility (*i. e.* equation (1)) as a function of all the individual elementary commodities consumed subject to the relevant budget constraint.

Our framework explicitly models only the lowest two levels of the tree. At the top level a value of the own price elasticity of demand for alcoholic beverages is chosen which is consistent with estimates in the literature. The effect of price changes at any point in the model upon expenditure on alcoholic beverages is incorporated by specifying an aggregating structure for prices and quantities given the own price elasticity of demand for alcohol.

The advantage of the utility tree is that it allows the incorporation of *a priori* information into the simulation model. Most demand elasticity estimates for alcoholic beverages are for the level of disaggregation described in the upper two levels of the model. For example, FW and JOVF provide information on demand elasticities for beer, wine and spirits⁴. There is also some information on the overall demand elasticity for alcoholic beverages. However we can trace no information on the demand elasticities for alcoholic beverages at the level required for tax analysis. Since provincial markups and excise levies vary across different varieties of alcohol products based on where they are produced, their alcoholic content, etc., it is at this disaggregated level where elasticity information is required.

3. The conditions necessary for consistent budgeting in such circumstances are discussed in Blackorby, Primont and Russell [1978] and are presented in the context of the current model in Irvine and Sims [1991a].

4. FW estimate a variant of the Deaton and Muellbauer [1980] Almost Ideal Demand System, while JOVF estimate a series of single equation error-correction models.

The third level of our model is disaggregated in a fashion dictated by current tax structures. While the first and second levels allow us to incorporate information regarding relevant elasticities and tastes, the third level allows us to model a reasonable tax structure while simulating over the unknown values of conditional demand elasticities for elementary commodities.

ii) Specifics of the Model

The second level branch utility function (equation 3) for alcoholic beverages is defined explicitly as:

$$U_A = \left\{ \alpha_B^{\frac{1}{\sigma}} (X_B - \gamma_B)^{\frac{\sigma-1}{\sigma}} + \alpha_W^{\frac{1}{\sigma}} (X_W - \gamma_W)^{\frac{\sigma-1}{\sigma}} + \alpha_S^{\frac{1}{\sigma}} (X_S - \gamma_S)^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}} \quad (3')$$

Equation (3') is merely a transformation of a standard CES utility function. A utility function of this type was used by Brown and Heien [1972] and has been referred to as an S-branch utility function. While the CES is homothetic and hence has unitary income elasticities of demand, the S-branch is quasi-homothetic (*i.e.* homothetic to $\{\gamma_B, \gamma_W, \gamma_S\}$ rather than the origin). While the income-consumption curves for (3') are linear, this function does not constrain the income elasticities to be unity. It also provides additional degrees of freedom, through the choice of the γ 's, with regard to the price elasticities. The γ 's and σ , the elasticity of substitution, can be chosen to impose values on the price elasticities which are consistent with available estimates. The α 's, which are taste parameters, are determined residually.

The homothetic sub-utility function⁵ for aggregate $X_i (i = B, W, S)$ is:

$$U_i = (X_i - \gamma_i)^{\frac{\sigma-1}{\sigma}} = \left\{ \left[\sum_j d_{ij}^{\frac{1}{\sigma_i}} x_{ij}^{\frac{\sigma_i-1}{\sigma_i}} \right]^{\frac{\sigma_i}{\sigma_i-1}} - \gamma_i \right\}^{\frac{\sigma-1}{\sigma}} \quad (4)$$

Thus the aggregator function is defined as:

$$X_i = \left[\sum_j d_{ij}^{\frac{1}{\sigma_i}} x_{ij}^{\frac{\sigma_i-1}{\sigma_i}} \right]^{\frac{\sigma_i}{\sigma_i-1}} \quad i = B, W, S \quad (5)$$

5. Since (4) is homothetic and (3') is weakly separable, the branch utility function, U_A , is homothetically separable. This is true despite the fact that U_A is itself, not homothetic.

where d_{ij} is a taste parameter and σ_i is the elasticity of substitution between the elementary commodities in aggregate X_i ($i = B, W, S$). It is homogeneous of degree 1 in the x_{ij} 's and is also monotonic transformation of U_i .

In order for $P_i X_i = M_i$ it is necessary that⁶:

$$P_i = \left\{ \sum_j d_{ij} p_{ij}^{1-\sigma_i} \right\}^{\frac{1}{1-\sigma_i}} \quad (6)$$

It is also necessary that both the price (P_i) and quantity (X_i) aggregators be homogeneous of degree 1 in their respective arguments [Blackorby *et al*, 1978].

By maximizing (3') subject to the budget constraint:

$$M_A = P_B X_B + P_W X_W + P_S X_S \quad (7)$$

the second level Marshallian demands (X_i^m) for product groups i ($i = B, W, S$) can be determined and thus, in the case of beer, for example,

$$M_B = P_B X_B^M = P_B \gamma_B + \theta_B \left[M_A - \sum_i P_i \gamma_i \right] \quad (8)$$

where $\theta_B = (\alpha_B P_B^{1-\sigma} / \sum \alpha_i P_i^{1-\sigma})$ is the marginal propensity to spend on beer (or the marginal budget share). Note that this equation indicates that the expenditure on any product group depends on P_B, P_W, P_S as well as M_A . At the third level the maximization of (4) subject to a given level of M_i results in the demand function for each of the elementary commodities:

$$X_{ik} = \left\{ \frac{d_{ik} p_{ik}^{-\sigma_i}}{\sum_j d_{ij} p_{ij}^{1-\sigma_i}} \right\} M_i \quad i = B, W, S. \quad (9)$$

A change in the elementary commodity price of a good in commodity group i affects the demand for that commodity directly through (9) and indirectly through its effect on M_i as determined in (8). The impact of such a price change on elementary

6. One need only derive the expenditure function for U and divide by the quantity aggregator X_i to derive P_i .

commodities in other groups is through its effect on M_i (*i.e.* through equation (8))⁷.

B. Cost Conditions and Producer Prices

While producer prices at the existing output levels can be obtained readily from the available data, the degree to which such prices vary in response to output changes is important. On the supply side we first identify the sectors in which there exist either returns to scale or oligopolistic structures and then incorporate reasonable pricing behavior.

For imports, production is assumed to take place in a broadly competitive market which is efficient – that is, where the scale economies are exhausted. Accordingly, variations in import quantities are achieved without any alteration in the supply price.

The supply assumptions adopted for domestic products vary with the beverage: Since spirits are produced by firms which trade internationally and are not subject to any interprovincial barriers within Canada, we can assume that small changes in output will not cause any variations in supply price. However, neither domestic beer nor wine is produced in such an environment.

The brewing industry in Canada (and Ontario)⁸ is dominated by two major producers and thus exhibits an oligopolistic market structure. Second, it operates subject to scale economies in most provinces [Smith and Sims, 1985] – primarily as a result of interprovincial trade restrictions. In Ontario, beer is produced in more scale efficient plants than in other provinces [Irvine, Sims and Anastasopoulos, 1990] and pricing is subject to government regulation, making these two factors less critical.

An extensive literature exists on the dependence of optimal pricing in an oligopoly upon taxation, demand conditions, the number of firms, returns to scale and firm conjectures. For example, Dixit [1986], Dixit and Stern [1982] and Stern (1987) have all investigated this problem. Our model solution requires an estimate of the change in supply price for beer (P_s) following a change in the tax wedge (t) –

7. The impact of a change in the price of an elementary commodity also effects the demands in all beverage groups through its effect on P_A and, ultimately, M_A . For more on the specifics of the model and the incorporation of such price effects see Irvine and Sims [1991a].

8. Due to data limitations the empirical analysis in this paper will focus on the province of Ontario.

i.e. dP_S/dt . However, since beer prices are regulated by the Ontario government, these oligopoly pricing models are not useful in formulating a pricing mechanism. Instead it is assumed that the regulated price set for beer in Ontario allows a constant markup of producer price over unit costs. As a result, a reduction (expansion) of output in brewing will result in a rise (fall) in unit costs and also producer and consumer prices⁹. The percentage change in unit costs resulting from an output change is based upon the cost function estimates obtained by Smith and Sims [1985].

Unfortunately, no econometric evidence on cost conditions in the wine industry is available. But the small scale of production worldwide suggests that scale economies are unimportant and that it is reasonable to assume that producer price is unresponsive to tax or output changes in this sector. In any case, domestic wine accounts for only 5% of expenditures on alcoholic beverages in Ontario, whereas beer accounts for 50%. Thus any inaccuracy in the assumptions governing cost conditions in the wine sector should have little effect on the results.

III. The Mechanics of Markup and Excise Rate Changes

Since one of the objectives of this paper is to examine the effects of markup and excise policy changes on government revenues, it is useful first to disaggregate their impacts into three components: the immediate effect associated with the product whose price is changed; the secondary effect arising from the change in demand for, and resulting change in tax revenue from, all other alcoholic beverages; and the tertiary effects resulting from any switches in expenditure from/to other goods (Z) to/from alcoholic beverages as a consequence of the relative change in P_A and P_Z .

The tertiary effects will depend upon the price elasticity of demand for *alcoholic beverages as a whole*. Any tax-induced price change feeds its way through the model to a change in one of the beverage prices and then through to the price of alcohol, P_A . Since the available evidence indicates that the overall price elasticity of

9. It is assumed that the beer industry in Ontario is prevented from maximizing profits due to government price regulation [Brewers Association of Canada, 1982, p. 52-53]. This is corroborated by the low econometric estimates of the elasticity of demand for domestic beer in Ontario. It seems clear that in such a case the producers would at minimum attempt to pass along all of the cost increase resulting from the output response to the tax.

demand for the alcoholic beverage aggregate is less than unity, more (less) expenditure is allocated to good Z if P_A falls (rises). As a result, the demand for Z and tax revenues from Z would both rise (fall) in response to a tax-induced fall (rise) in P_A . Therefore when the market for Z (all other goods) is included, the tax revenue effect of a rate change is moderated.

In this paper we present the results for primary and secondary effects only. The reason for this is the lack of information on the tax wedges in markets other than those for alcoholic beverages (*i.e.* market Z). This omission is likely to be negligible because the tax wedges in market Z are minimal relative to those in the alcoholic beverages sector. For example, for some spirits products the wedges between consumer and producer prices are of the order of 600% [Irvine and Sims, 1992]. In addition, as will be shown in section V, overall changes in expenditures on alcoholic beverages tend to be small for the policy changes analyzed here.

IV. Data, Prices and Model Parameterization

The data on prices and quantities used in the model are for the province of Ontario. Provincial, rather than national, data are used because the provinces have considerable taxing powers in this area and, as a consequence, the rates vary across provinces. The province of Ontario was chosen because of data availability and because of its dominant position in the Canadian economy. Ontario comprises approximately one third of Canada's population, and its sales of beer¹⁰, wine and spirits account for 36.6%, 33.5% and 38.8% of the national market, respectively.

Broadly, there are two components to the wedge between producer and consumer prices: The federal government is responsible for setting import levies, excise duties and taxes, and the goods and services tax¹¹. The provinces then impose

10. U.S. brand beers, produced under license in Canada, are not subject to higher foreign markups and, in terms of taste and quality, are remarkably similar to the other Canadian domestic brews marketed by the 2 large producers. As a result, these licensed beers are included in the *domestic* category. Since these licensing agreements are viewed as long-term and, since distributional practices in Ontario are not altered in the scenarios investigated here, these agreements are assumed to continue through the reforms analyzed.

11. In January, 1991 the federal sales tax (FST) was replaced with the goods and services tax (GST). These taxes are imposed at different points in the sales process: the FST was imposed at the point of sale by the manufacturer and the GST is imposed on value-added at each point of sale.

markup's, service charges and a provincial sales tax. The markup (which is a tax in all but name) is *ad valorem* in Ontario and is generally levied at highly differentiated rates on the various products. For example, the markup on imported liqueurs is 145% of the price, inclusive of excise duties, while that on domestic beer is 26.5%. A complete list of markups is presented in column 1 of Table 1.

Considerable power lies with provincial governments and substantial revenues from the sale of alcoholic beverages accrue to them. Out estimates for Ontario indicate that provincial government revenues are at least twice federal revenues and, in addition, exceed producer revenues. Consequently, efforts to reform the system of levies could not be carried out unilaterally by the federal government, given the jurisdiction of the provincial governments and the importance of these revenues. This has made the implementation of the GATT ruling more problematic than if only one level of government were involved and distinguishes this particular ruling from most others made by the various GATT panels.

Data were obtained from Revenue Canada on the total value and volume of sales of each of the 19 products for 1989. By knowing the various taxes, markups and duties applicable to each product it is possible to approximate a supply price for each and, therefore, and estimate of the total wedge between producer and consumer price¹².

The product classification (see Table 1) of necessity involves some aggregation. The degree of aggregation adopted enables a clear distinction to be drawn between Canadian origin and foreign products, as is required to examine the consequences of implementing the GATT ruling. Furthermore, the breakdown is sufficiently detailed to capture the variations in federal excise rates (see Table 2, column 1).

The data upon which the model is based are for 1989 – the latest year for which full information was obtainable. In 1989 the federal sales tax was still operative and was replaced by the goods and services tax (GST) in January, 1991. Since these taxes are imposed at different points in the pyramid of levies, the effects on consumer price of any markup or excise rate change will depend upon whether the GST or FST is in effect. In the results discussed below, the data are transformed to be consistent with the hypothetical existence of the GST in 1989.

In parameterizing the model we imposed values of σ , γ_B , γ_W and γ_S to yield own

12. Taxes and levies are imposed on producers in the following order: levies on imports; excise duties/taxes; provincial service charges; provincial markups; the goods and service tax; and, the provincial sales tax.

price elasticities for beer, wine and spirits similar to those estimated by FW (*i.e.* -0.34 , -0.87 and -0.67 , respectively). These choices, in conjunction with the data, imply a set of values for α_b , α_w , and α_s , the taste parameters in equation (3'). The price elasticity of demand for the alcoholic beverages aggregate is -0.65 . This figure approximates a weighted average of the own and cross price elasticities.¹³ Unknown parameter values at the third level of the model are obtained by specifying *reasonable* values for each σ_i and then solving for the d_{ij} 's such that model replicates the base solution¹⁴. The sensitivity of the model to different values of the σ_i 's is discussed in section V. iv).

V. Results

In this section the effects of reforming the discriminatory aspects of alcohol taxation in Ontario are simulated in three scenarios. Since the changes analyzed would otherwise involve alterations in the distribution of tax revenue between federal and provincial authorities, which might be politically unacceptable, each scenario constrains the revenue impacts of the tax reforms. In the first scenario discriminatory provincial markups are abolished in favour of uniform markups for foreign and domestic beverages. Since provincial authorities would not likely accept budgetary losses from this reform, the markups are designed to keep provincial revenues from each beverage group constant. The second scenario simulates an equalization of excise levies, per unit of alcohol, across beverages, designed to maintain federal revenues constant. Finally, in scenario three, the reforms of the first two scenarios are combined subject to the constraint that federal and provincial revenues remain constant.

i) GATT – Uniform Markups

To examine the effects of abolishing differential markups we adopt the assumption that the provincial government attempts, in the process, to keep its total revenue from each alcoholic beverage group constant. The data are such that each domestic product has a corresponding foreign product. In some instances differen-

13. The derivation of the relationship used to calculate the price elasticity of demand for the alcoholic beverage aggregator is available from the authors.

14. The σ_i values were chosen to insure that beverage aggregates with a larger number of products display a higher degree of substitutability.

tial markups have been applied to out-of-province (but within Canada) and within-province products. In introducing the uniform markups we work on the assumption that this distinction would be abolished in addition to the distinction between foreign and domestic products.

In the solution algorithm the uniform markup is a sales-weighted average of the domestic and foreign rates defined in Table 1. All government and producer revenues resulting from this are then computed. If the provincial government revenues fall short of, or exceed the original revenue from each beverage group all markups are boosted or reduced by a uniform factor. The procedure continues until convergence is achieved.

The results presented in Table 1, show that because of the relative similarity of markups on domestic and foreign products, under the present rules, no major changes materialize within the spirits group. However, major industry changes in the wine sector¹⁵ come about due to the changes in the relative markups. In the beer market domestic products lose 1.5% of sales while foreign products increase their sales by almost 40%.

It should be emphasized that the results in Table 1 spring only from a consideration of changes in *prices*. However, the GATT panel ruled that not only are discriminatory markups contrary to the GATT articles, but so too are the distribution and listing practices of most of the provincial liquor boards in Canada¹⁶. This scenario assumes these listing/distribution practices are unchanged. This explains the moderate change in the market shares of domestic and imported beers, given the substantial change in their relative prices.

Second, federal government revenues change in response to these markup revisions. The federal government's two major revenue sources are the excise levies and the GST. The former are levied before markups and the latter after. Any markup induced change in price alters both federal excise and GST revenues, with the changes depending upon the various price elasticities embedded in the model. It is interesting that total federal government alcohol revenues change remarkably little in the face of some quite major changes in product prices – an indication that policy

15. The *greater than 7%* categories account for over 95% of the wine market with the imported *greater than 7%* alone accounting for 72%.

16. For example, at the time of writing, beer produced outside of Ontario is marketable only in liquor stores subject to very punitive markups, rather than in the regular beer outlets at much lower markups.

Table 1

Scenario 1: Equalize Provincial Markups on Foreign and Domestic Products
Constraint: Provincial Government Revenues Constant for Each Beverage Group

	Provincial Markups 1989(%) (1)	Equilibrium Standardized Markups(%) (2)	% ΔP (3)	% ΔPR (4)	% ΔPGR (5)	% ΔFGR (6)
SPIRITS						
Dom. Whiskey	130.49	132.56	0.90	-1.34	0.12	-1.13
Dom. White	138.00	139.47	0.62	-0.93	0.06	-0.78
Dom. Liqueurs	138.00	142.27	1.79	-2.64	0.18	-2.09
Dom. Rum	138.00	138.47	0.20	-0.30	0.01	-0.26
Imp. Whiskey	138.59	132.56	-2.53	3.90	-0.35	3.20
Imp. White	145.00	139.47	-2.26	3.48	-0.24	2.93
Imp. Liqueurs	145.00	142.27	-1.12	1.69	-0.12	1.28
Imp. Rum	145.00	138.47	-2.67	4.13	-0.28	3.49
Coolers	56.97	57.00	0.02	-0.04	0.00	-0.03
TOTAL			0.04	-0.01	0.00	-0.11
WINES						
Dom. <7%	47.40	46.16	-0.84	0.73	-0.25	0.31
Dom. >7%	31.27	60.59	22.33	-23.33	7.63	-15.45
Imp. <7%	78.67	46.16	-18.20	29.36	-3.47	14.50
Imp. >7%	74.42	60.59	-7.93	10.93	-2.21	6.50
TOTAL			-1.12	-0.31	0.00	0.42
BEERS						
Dom. Light	26.50	28.74	1.86	-1.46	4.21	-0.90
Dom. Regular	26.50	28.74	1.86	-1.46	4.18	-0.92
Dom. Premium	26.50	28.74	1.85	-1.47	4.36	-0.82
Imp. Light	92.20	28.74	-33.02	37.64	-42.82	23.14
Imp. Regular	92.20	28.74	-33.02	37.64	-45.78	18.14
Imp. Premium	92.20	28.74	-33.02	37.64	-48.35	10.53
TOTAL			-0.18	-0.39	0.00	0.35
OVERALL TOTAL			-0.26	-0.32	0.00	0.16

Note: The Columns define the Ontario provincial markups which existed in 1989, the equilibrium markups calculated in the paper, percentage changes in consumer price (ΔP), producer revenues (ΔPR), provincial government revenues (ΔPGR), and federal government revenues (ΔFGR).

coordination on this front may not be a difficult policy matter.

While not reported in the table, our estimates indicate that total expenditure on alcoholic beverages falls by less than one percent. The domestic share of producer revenues falls from 87% to 85%, which represents a 2.3% decline in domestic producer revenues and a 12.5% increase in foreign producer revenues.

ii) Excise Duty and Tax Changes

The current system of excise duties and taxes administered by the federal government discriminates heavily against spirits, in the sense that the rate per percent of alcohol applied to spirits is from two to three times the rate applied to normal strength wine and beer – regardless of whether the products are domestic or foreign. Whenever realignment is discussed, it is normally in the context of these levies. The rates, in terms of cents per percent of alcohol, are: 11.07 for spirits, 5.5 for beer and 4.2 for wine.

Were the rate on spirits to be reduced to the wine/beer rates, its consumer price would fall by approximately 25%. While the immediate impact of the duty reduction would be about 10% of consumer price, the cumulative effects of the high provincial markups, the GST and the PST would more than double that figure. Such a price reduction would yield considerable gains to producers and would reduce federal government revenues considerably.

To model the potential implications of excise changes we compute the average effective excise levy per percent of alcohol per litre for the three beverage groups¹⁷. This rate is slightly in excess of 7¢. In simulating the effect of a move toward a uniform excise levy we recompute the consumer and producer prices for each product and, through the model, the resulting equilibrium set of quantities sold. At this equilibrium, if total federal government revenues differ from their base level, the levy is increased or decreased accordingly until an equilibrium is found which generates the original federal government revenues. The results are given in Table 2.

In contrast to the markup realignment, this scenario results in major changes in relative outputs, accompanied by a 2.65% fall in expenditures on alcoholic beverages. Since the relative (and absolute) prices of spirits fall and those of beer and wine increase there is a major shift in demand towards the spirits category. The beer

17. Base level excise duties and taxes are presented in Table 2.

Table 2***Scenario 2: Equalize Excise Rates per percent of Alcohol per Litre.******Constraint: Federal Government Revenues from All Alcoholic Beverages Constant***

	Excise Rates 1989(¢/L) (1)	Equilibrium Uniform Excise Rates(¢/L) (2)	% ΔP (3)	% ΔPR (4)	% ΔPGR (5)	% ΔFGR (6)
SPIRITS						
Dom. Whiskey	442.64	291.40	-17.45	13.58	-5.82	-20.67
Dom. White	442.64	291.40	-18.18	15.10	-5.39	-19.84
Dom. Liqueurs	276.65	182.12	-12.20	3.53	-8.81	-24.60
Dom. Rum	442.64	291.40	-18.24	15.21	-5.35	-19.79
Imp. Whiskey	442.64	291.40	-15.38	9.42	-7.10	-22.20
Imp. White	442.64	291.40	-18.65	16.09	-5.11	-18.58
Imp. Liqueurs	276.65	182.12	-9.77	-0.62	-10.16	-24.64
Imp. Rum	442.64	291.40	-18.81	16.43	-5.01	-17.97
Coolers	24.59	36.42	4.82	-20.63	-17.18	-0.41
TOTAL			-15.86	8.23	-6.68	-20.53
WINES						
Dom. <7%	24.59	43.71	8.19	-14.78	-11.84	22.15
Dom. >7%	51.22	87.42	7.60	-14.17	-10.81	21.55
Imp. <7%	24.59	43.71	4.82	-11.20	-8.36	13.11
Imp. >7%	51.22	87.42	7.83	-14.41	-9.78	16.62
TOTAL			7.77	-14.33	-10.02	17.99
BEERS						
Dom. Light	27.98	29.14	0.63	0.14	0.68	3.01
Dom. Regular	27.98	36.42	4.97	-2.95	0.85	17.30
Dom. Premium	27.98	43.71	7.48	-4.73	1.15	29.57
Imp. Light	27.98	29.14	1.07	-0.20	0.76	2.67
Imp. Regular	27.98	36.42	4.85	-3.09	1.32	13.91
Imp. Premium	27.98	43.71	4.59	-2.90	1.42	19.51
TOTAL			4.09	-2.39	0.83	14.42
OVERALL TOTAL			-7.56	-1.81	-4.54	0.00

Note: The columns define the Federal excise rates which existed in 1989, the equilibrium uniform excise rates calculated in the paper, percentage changes in consumer price (ΔP), producer revenues (ΔPR), provincial government revenues (ΔPGR), and federal government revenues (ΔFGR).

products experience a smaller percentage decrease in sales than wine because of the greater price elasticity associated with the wine products. Nonetheless, the fall in sales for domestic regular beer represents a major contraction for the producers. Overall producer revenues from alcoholic beverages decline by 1.8%, while domestic and foreign producer revenues fall by 1.3% and 5.4%, respectively. In contrast to markup reforms, foreign producers fare worse in this scenario relative to domestic producers. This is explained by the dominance of foreign producers in the wine sector, where the excise driven price increase is substantial.

The provincial governments would also lose a considerable amount of revenue as a result of these excise reforms. Accordingly, it is likely that they would object to such changes or, alternatively, implement rate change of their own in order to compensate for lost revenues. Since such secondary moves would in turn alter federal revenues it is obvious that a search for a cooperative reform strategy is imperative. In the final scenario such a strategy is considered.

iii) Simultaneous Excise and Markup Reforms

The effects of simultaneously reforming the excise rates and abolishing the differential markups on domestic and imported products are analyzed in this section. This reform is carried out subject to two sets of revenue constraints: Federal revenues *in toto* remain constant and provincial revenues *from each beverage group* are constrained to remain constant. The results are given in Table 3.

The results of this cooperative game are similar to those for the scenario in which only the excise levies are reformed, in the sense that major changes in relative prices materialize and expenditures on the different beverage groups change considerably. While each level of government should be indifferent between this equilibrium and the base solution, total revenue to domestic and foreign producer falls by 2.37%, with the big loser being the wine industry. Domestic producers' share of overall revenues decline from 87% to 86% as a result of a 3.06% decline in domestic producer revenues and a 2.3% increase in foreign producer revenues. This is accompanied by a fall in expenditure on alcoholic beverages as a whole of approximately 1%.

iv) Sensitivity to Parameter Variations

A key issue in these simulations is the sensitivity of the results to variations in parameter values – in particular those for which priors are weak. To address this,

Table 3

Scenario 3: Equalized Excise Rates per percent of Alcohol per Litre and Provincial Markups on Foreign and Domestic Products

Constraint: Federal Government Revenues from All Alcoholic Beverage Constant and Provincial Government Revenues Constant for Each Beverage Group.

	Provincial Markups 1989(%) (1)	Equilibrium Standardized Markups(%) (2)	% ΔP (3)	% ΔPR (4)	% ΔPGR (5)	ΔFGR (6)
SPIRITS						
Dom. Whiskey	145.26	290.48	-12.28	10.41	1.07	-21.69
Dom. White	152.82	290.48	-13.20	12.18	1.32	-20.72
Dom. Liqueurs	155.89	181.55	-5.68	-0.97	-2.31	-25.97
Dom. Rum	151.72	290.48	-13.64	13.03	1.33	-20.25
Imp. Whiskey	145.26	290.48	-13.11	12.00	-0.74	-19.85
Imp. White	152.82	290.48	-16.17	18.18	1.33	-16.60
Imp. Liqueurs	155.89	181.55	-5.82	-0.75	-4.00	-23.44
Imp. Rum	151.72	290.48	-16.69	19.31	1.42	-15.54
Coolers	62.45	36.31	8.44	-19.66	-9.63	2.15
TOTAL			-11.34	6.71	0.00	-20.71
WINES						
Dom. <7%	61.42	43.57	18.42	-18.55	-6.04	20.64
Dom. >7%	80.61	87.14	47.96	-39.03	7.92	-2.49
Imp. <7%	61.42	43.57	-5.33	8.96	-2.96	31.61
Imp. >7%	80.61	87.14	11.59	-12.01	-2.27	21.33
TOTAL			19.80	-20.88	0.00	14.74
BEERS						
Dom. Light	28.07	29.05	1.86	-0.50	4.03	2.55
Dom. Regular	28.07	36.31	6.24	-3.56	4.22	16.69
Dom. Premium	28.07	43.57	8.78	-5.33	4.65	28.92
Imp. Light	28.07	29.05	-32.71	38.58	-42.86	27.35
Imp. Regular	28.07	36.31	-30.18	34.55	-45.76	37.64
Imp. Premium	28.07	43.57	-30.34	34.79	-48.25	37.58
TOTAL			3.27	-1.93	0.00	15.20
OVERALL TOTAL			-2.58	-2.37	0.00	0.00

Note: The columns define the equilibrium provincial markups and uniform excise rates calculated with the model for this scenario, percentage changes in consumer price (ΔP), producer revenues (ΔPR), provincial government revenues (ΔPGR), and federal government revenues (ΔFGR).

the model is simulated using alternative sets of parameter values: one for the overall elasticity of demand for alcoholic beverages, ϵ_A , the other for the substitution elasticities in the individual aggregator functions, σ_i , (see equation 5).

The overall elasticity of demand for alcoholic beverages we have used is -0.65 . This is consistent with the econometric findings of both FW and JOVF, though less than a more recent estimate of -1.1 by Atkinson, Gomulka and Stern, [1990] for the UK. A value of -1.0 for ϵ_A implies a constant expenditure on alcoholic beverages in the face of tax reforms. Since most of the scenarios we examine involve slight declines in the general price level¹⁸ and hence less expenditure on alcoholic beverages as a whole, this alternative elasticity results in greater revenue buoyancy to producers, and federal and provincial governments with the difference, however, being quite small.

When we specified smaller substitution elasticities for the aggregator functions the result is less elastic product demands. In such a case, tax induced price variations require smaller quantity changes to satisfy the government revenue constraints imposed. Once again, however, the impact of this change on the results presented is minimal.

VI. Conclusions

This paper investigates the impacts of reforming discriminatory taxing policies used in the alcoholic beverages sector in Canada. These practices include: (a) a provincial pricing policy designed to protect some segments of the domestic industry which, in recent years, has been the target of various GATT rulings, and (b) a federal excise duty and tax system which has been criticized as inequitable. Our principal conclusions are the following:

Reforming the present discriminatory system could have a substantial impact on the revenues of both levels of government as well as domestic producers. This could ultimately compromise such reform. Thus, the scenarios we have investigated analyze ways of satisfying potential objections to reform by incorporating revenue constraints for the various levels of government. Assuming that the federal and provincial governments agree to GATT and domestic demands for a renewed tax structure on alcoholic beverages, simulations of the type we have presented

18. The model indicates that P_A fell by 0.26%, 7.56% and 2.58% in scenarios 1, 2 and 3, respectively.

should be valuable in examining the many possible outcomes from the reform process.

Second, from an analytic standpoint the results describe the significant interactions which exist between policies which are primarily *trade* related and those which are primarily *domestic* in their orientation. Each set of policies has the potential to play an indirect, but significant role, in the other domain (*e.g.* domestic excise reforms will have a substantial impact on trade patterns).

Third, the alcoholic beverages industry is quite distinct from most other sectors of the Canadian economy: it is subject, not only to taxation by two levels of government, but the lower level of government has, in addition, power over non-pricing aspects of its sale and distribution. This makes the study of the GATT ruling we have examined particularly complex. Since this sector provides provincial governments with major revenues, the implementation of the GATT demands involves a negotiation, not simply between domestic and foreign governments, but between different levels of government in Canada. This, of course, is attributable to the constitutional in Canada. This, of course, is attributable to the constitutional rights granted to provincial governments in regard to regulating and pricing alcoholic beverages.

Fourth, we have quantified the effects of the policy changes examined at a disaggregated level. The results of the scenarios indicate that a move to satisfy the GATT rulings and a simultaneous move to equalize excise levies per unit of alcohol will have a substantive effect on the industry as a whole, involving major changes in the sales of the different beverages. We have detailed these changes in the text.

Finally, the limitations of the study should be noted. We have modeled the reforms for the Province of Ontario, not the whole economy. There is, however, little reason to believe that the general outcomes presented here would be significantly different if all provinces were incorporated. But alternative constraints on government revenue constancy might be necessary. Second, we have not considered tax revenue changes arising in sectors other than alcoholic beverages. To the degree that the elasticity of demand for alcohol is not unit elastic, tax revenues in other sectors of the economy would change in response to changes in alcohol taxes. As argued in section III, however, such effects would not likely be significant. Last, we have not analyzed the welfare implications of the tax changes. But, as we have shown elsewhere [Irvine and Sims, 1992], the externalities associated with the

consumption of alcohol must also be addressed in any such analysis. This is a major undertaking, which goes beyond the scope of this paper.

References

- Atkinson, A., J. Gomulka and N. Stern [1990], "Spending on Alcohol: Evidence from the Family Expenditure Survey 1970-1983," *The Economic Journal* 100; pp. 808-827.
- Blackorby, C., I. Primont and R. Russell [1978], *Duality, Separability and Functional Structure*, New York, American Elsevier.
- Brewers Association of Canada [1982], *International Survey: Alcoholic Beverage Taxation and Control Policies*, Ottawa, Canada.
- Brown, M. and D. Heien [1972], "The S-Branch Utility Tree: A Generalization of the Linear Expenditure System," *Econometrica* 40; pp. 737-747.
- Deaton, A. and J. Muellbauer [1980], "An Almost Ideal Demand System," *American Economic Review* 70; pp. 312-326.
- Dixit, A. [1986], "Comparative Statics for Oligopoly," *International Economic Review* 27; pp. 107-122.
- Dixit, A. and N. Stern [1982], "Oligopoly and Welfare," *European Economic Review* 19; pp. 123-143.
- FOCUS [1988], *GATT Newsletter*, April/May, Vol. 54.
- FOCUS [1992], *GATT Newsletter*, March, Vol. 88.
- Fuss, M. and L. Waverman [1987], "The Demand for Alcoholic Beverage in Canada: An Application of the Almost Ideal Demand System," Department of Economics and Institute for Public Policy Analysis Working Paper 8714, University of Toronto.
- Gorman, M. [1959], "Separable Utility and Aggregation," *Econometrica* 27; pp. 469-481.
- Irvine, I. J., W. A. Sims and A. Anastasopoulos [1990], "Interprovincial Versus International Free Trade in the Brewing Industry," *Canadian Journal of Economics* 23; pp. 332-347.
- Irvine, I. J. and W. A. Sims [1991a], "CIRAB-CAN: A Disaggregated Computer Simulation Model of Alcoholic Beverage Demand in Canada," Department of Economics Discussion Paper 9101, Concordia University, Montreal, Canada, H3G 1M8.

- Irvine, I. J. and W. A. Sims [1991b], "Gorman Polar Forms and the S Branch Utility Tree," Department of Economics Discussion Paper 9104, Concordia University, Montreal, Canada, H3G 1M8.
- Irvine, I. J. and W. A. Sims [1992], "The Welfare Effects of Alcohol Taxation," *Journal of Public Economics* (forthcoming).
- Johnson, J., E. Oskanen, M. Veall and D. Fretz [1989], "Short-run and Long-run Elasticities for Canadian Consumption of Alcoholic Beverages: An Error-correction Mechanism/Cointegration Approach," McMaster University, Department of Economics Working Paper.
- Smith, J. B. and W. A. Sims [1985], "The Impact of Pollution Charges on Productivity Growth in Canadian Brewing," *Rand Journal of Economics* 16; pp. 410-423.
- Stern, N. [1987], "The Effects of Taxation, Price Control and Government Contracts in Oligopoly and Monopolistic Competition", *Journal of Public Economics* 32; pp. 133-158.
- Strotz, R. H. [1957], "The Empirical Implications of a Utility Tree", *Econometrica* 25; pp. 269-280.