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Impact Of Tax Reform On The Australian Wine Industry: A CGE Analysis

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Impact of the GST and Wine Tax Reform on Australia's Wine Industry: A CGE Analysis

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Impact of the GST and Wine Tax Reform on Australia's Wine Industry: A CGE Analysis

Abstract

This study analyses the impacts of the Goods and Services Tax (GST) introduced on 1 July 2000, and the associated wine tax reform, on both the premium and non-premium segments of the grape and wine industry using a computable general equilibrium (CGE) model of the Australian economy. Through input cost reductions, the grape and wine industry is projected to gain from the GST tax package. Thus the industry can still gain even though wine consumption is taxed a little more heavily after than before the introduction of the GST. This is particularly so for the export-oriented premium wine segment. A switch from the current ad valorem to a revenue-neutral volumetric tax on wine under the GST is shown also to favour the premium segment of the industry, but at the expense of the non-premium segment.

Key words: wine tax, wine, grapes, value-added taxation (GST), CGE modelling

JEL codes: C53, D58, E62, H22, O56, Q13, R13

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Australia's Wine Industry: a CGE Analysis

Glyn Wittwer and Kym Anderson

I. INTRODUCTION

For more than a century government policies in Australia and overseas have contributed much to the boom-bust cycles in the Australian wine industry (Osmond and Anderson 1998). While the 1990s boom was mainly the result of sustained export demand growth, a key question given the influence of government policy historically on the wine industry is how the broad-based goods-and-services tax (GST) package introduced on 1 July 2000, and possible future amendments to wine taxation in particular, are likely to affect the industry.

Would the switch to a GST help or hurt the wine industry? As it turned out, wine is one of the few commodities subject to a wholesale sales tax (WST) that the Coalition government targeted for continued taxing at the wholesale level. More than that, it has had an increase in taxation under the GST package. The increase came in two forms. One was the replacement of the previous 41 per cent WST with a 'wine equalisation tax' (WET) at the wholesale level of 29 per cent which, with a subsequent GST of 10 per cent at the retail level, is equivalent to a 4 to 6 percentage point rise at the wholesale level. The other source of revenue arises from wine that is consumed on licensed premises, through the GST on the on-premise service charge. Consequently, the 29 per cent WET on wine imposed by the Commonwealth in place of the previous WST raises the wine tax rate significantly.

This study uses a computable general equilibrium (CGE) model of the economies of South Australia (where half the national wine industry is located) and rest of Australia to model the impacts of the GST package on the Australian wine industry. This model, FEDSA-WINE (Wittwer 2000), is based on earlier Australian CGE models, ORANI-G (Dixon *et al.* 1982; Horridge *et al.* 1998), FEDERAL (Madden 1992) and MMRF (Naqvi and Peter 1996). It includes a detailed fiscal module at both the Commonwealth and state levels. Earlier CGE studies of the wine industry deal with wine taxation alone rather than a generalised movement from direct towards indirect taxation (Meagher *et al.* 1985; CIE 1995a). The justification for using a general equilibrium rather than partial equilibrium approach is the importance of indirect effects. These include changes in the costs of production of the wine industry brought about by the abolition of wholesale sales taxes, the expenditure effect of the GST package and the impact of the package on wine exports. Only the change in taxation can be calculated from partial analysis. The remaining effects require data, parameters and behavioural equations beyond those concerning only the wine industry.

II. THE FEDSA-WINE SIMULATION MODEL

The main focus of this study is the impact of the introduction of the GST package on the wine industry plus the impact on South Australia relative to the rest of Australia. The household demand equations play an important part in analysing impacts. In FEDSA-WINE, these equations are based on the Klein-Rubin (1949) utility function with directly additive preferences:

$$U = \frac{1}{Q}\prod_i (X_i - \psi_i)^{\beta_i} \qquad (1)$$

Domestic consumption of each commodity is divided into supernumerary and subsistence components. In levels terms, U represents utility, Q the number of households, X_i the total consumption of good i, ψ_i the subsistence component of this consumption and β_i the marginal budget share of good i ($0 \leq \beta_i \leq 1$ and $\Sigma \beta_i = 1$).

The maximisation of utility subject to the budget constraint $Y = \sum_i P_i X_i$ gives rise to the linear expenditure function for good i of the following form:

$$P_i X_i = P_i \psi_i + \beta_i (Y - \sum_i P_i \psi_i) \tag{2}$$

Assume $V = (Y - \Sigma_i P_i \psi_i)$, which is the aggregate supernumerary expenditure, then equation (2) becomes

$$P_i X_i = P_i \psi_i + \beta_i V \tag{3}$$

Next, we totally differentiate equation (3) and divide by $P_i X_i$:

$$\frac{dP_i X_i + P_i dX_i}{P_i X_i} = \frac{\psi_i dP_i}{P_i X_i} + \frac{\beta_i dV}{P_i X_i} \frac{V}{V} \tag{4}$$

We rearrange (4) to express the percentage change in X_i as a function of the percentage changes in V and P_i:

$$x_i = \phi_i (v - p_i) \tag{5}$$

where $\phi_i = \frac{V \beta_i}{P_i X_i} = 1 - \frac{\psi_i}{X_i}$, i.e., the supernumerary proportion of total expenditure on X_i. The Frisch parameter γ is the (negative) ratio of total to luxury expenditure, given by $-\frac{Y}{V}$. Since $\beta_i = \frac{\varepsilon_i P_i X_i}{Y}$, where ε_i is the expenditure elasticity of good i, $\phi_i = -\varepsilon_i / \gamma$. Hence, we can rewrite (5) as

$$x_i = -\frac{\varepsilon_i}{\gamma}(v - p_i) \tag{6}$$

The RHS of (6) divides the change in household consumption into expenditure ($-\frac{\varepsilon_i}{\gamma}v$) and price ($\frac{\varepsilon_i}{\gamma}p_i$) effects.

FEDSA-WINE disaggregates wine into three categories. This distinguishes the premium red and premium white segments from the non-premium wine. The premium segments are growing rapidly while the non-premium segment is relatively static, in both consumption and production terms. Movements in consumer preferences are evident from changing wine budget shares. In 1987, the shares were 14 per cent for premium red wine, 30 per cent for premium white wine and 56 per cent for non-premium wine. The respective shares in 1999 were 35 per cent, 31 per cent and 34 per cent (Wittwer 2000). Similarly, export growth has favoured the premium segments. Exports of premium red wine grew from 5 megalitres (Ml) in 1987 to 88 Ml in 1999. Premium white exports grew from 5 Ml to 83 Ml and non-premium exports from 14 Ml to 46 Ml in the same period (AWEC 2000). Since the industry is changing rapidly, the FEDSA-WINE database has been updated to 2003 to reflect sales weights of the present decade rather than those of the 1990s (Wittwer 2000).

Parameters

Most available estimates of cross-price and own-price elasticities include wine as a single aggregated commodity. They also rely on data from periods prior to the marked taste changes of the past few years (Abdulla and Duffus 1988; Clements and Selvanathan 1991). Such estimates of domestic demand elasticities drawing on pre-1990s data may be more applicable to non-premium than premium

wine, given the change in budget shares since the 1980s. In FEDSA-WINE, the expenditure elasticities imposed are 2.0 for premium red wine, 1.2 for premium white wine and 0.6 for non-premium wine.[1]

Although Australia's share of the global trade is small, around four-fifths of exports are to four destinations, the UK, the USA, New Zealand and Canada. In the UK, Australia's exports account for 13 per cent of consumption at present, and in New Zealand, over 50 per cent (Berger *et al.* 1999; AWEC 2000). The export demand elasticities in FEDSA-WINE are –6.5 for each wine type, derived from simulations with a global wine model using Armington (1969) elasticities of 4.0 and elasticities of substitution between different imports of 8.0 in each destination (Wittwer *et al.* 2001).

Closure

The scenarios examined in this paper all concern the long run. National employment is fixed, with wages therefore varying with labour income. Regional shares of national employment are endogenous. We assume that capital is reallocated between industries to leave the rate of return unchanged from the base case in all industries. At the macroeconomic level, real government spending and real investment are exogenous. The latter implies that domestic savings are sufficient only to maintain domestically funded investment at base case levels. The balance of trade surplus is set equal to the increase in returns to capital, to pay foreign capital owners for additional capital that they finance. Real consumption is the only endogenous component of domestic absorption in these scenarios. The Commonwealth public sector borrowing requirement (PSBR) is exogenous and the income tax rate (both personal and corporate) endogenous.[2] The PSBRs of the

two state governments in the database also are exogenous, by endogenising transfers from the Commonwealth to the states. The numeraire is the consumer price index.

In each scenario, indirect taxes on intermediate inputs into production are reduced by about one third. Most taxes on capital creation are removed, except for new taxes on housing construction. It turns out that the broad-based tax on household consumption excluding food increases consumption tax revenue by about 40 per cent in this scenario, despite the removal of most wholesale sales taxes (the exceptions being alcoholic beverages, tobacco and fuel).[3]

The first scenario reported depicts the comparative static long-run impacts of introducing the GST and the 29 per cent WET on the wine industry. In the second scenario, we depict the effect of policy uncertainty. This entails shocking wine consumption tax shifters by the mean of two politically possible extremes, one being no WET at all under the GST, the other a volumetric WET to raise the tax rate to the equivalent of the pre-GST beer rate. We use systematic sensitivity analysis (SSA) to vary the tax rate between these two extremes. Finally, the third and fourth scenarios examine the impacts of introducing a top-up tax on wine in a volumetric form, set equal to the pre-GST beer rate.

III. RESULTS

A top-up tax of 22 per cent would be necessary, in addition to the GST, to raise the same revenue as the current 41 per cent WST on wine.[4] The Coalition government instead, after negotiating with the Democrats, settled on a 29 per cent top-up tax (the so-called 'wine equivalent tax' or WET) but with exemption of $300,000 of direct (cellar door plus mail order) sales from the WET, plus partial

exemptions for a winery's direct sales up to $580,000.[5] How significant is the exemption? About 6 per cent of domestic sales are direct at present. Given that larger wineries will usually have in excess of $580,000 of direct sales, the proportion of domestic sales that will be exempt from the top-up tax is likely to be only a fraction of the 6 per cent. The exemption therefore will have little effect on the average top-up tax paid by consumers. Hence we ignore the tax concessions on direct sales in the following analysis.

The first scenario: introducing the GST package with a 29% WET

Dixon and Rimmer (1999) use a back-of-the-envelope (BOTE) model to explain some of the key impacts of the GST. We use some of their findings from the BOTE model to help explain our long run results. This model contains one good (grain) produced domestically by a constant-returns-to-scale production function of labour and capital inputs. It includes one imported good, vehicles. Grain and vehicles are investment and consumption goods formed as Cobb-Douglas functions. The costs of hiring labour and capital equate to the value of their marginal products. The model also includes different types of taxes.

The marginal product of capital (a negative function of K/L) is given by:

$$M_k = \rho . T_q . T_g . T_i . (\frac{P_v}{P_g})^{\alpha_{vi}} \tag{7}$$

The marginal product of labour is:

$$M_l = W_{rb} . T_c . T_g . (\frac{P_v}{P_g})^{\alpha_{vc}} \tag{8}$$

where ρ is the after-tax rate of return divided by the unit cost of capital. W_{rb} is the after-tax real wage rate. T_c, T_q, T_g and T_i are the powers of taxes on consumption,

capital income, production (used as a proxy for taxes on intermediate inputs) and investment. P_v/P_g is the terms of trade. The shares of vehicles and grains in consumption and investment are α_{vc}, α_{gc}, α_{vi} and α_{gi}, such that $\alpha_{vc} + \alpha_{gc}=1$ and $\alpha_{vi} + \alpha_{gi}=1$.

In the GST package, taxes on income, production and investment decrease, so that in equation (7), $T_q.T_g.T_i$ decreases. In the long run, we assume that the after-tax rate of return ρ is constant. Therefore, at constant terms of trade, a move from direct to indirect taxes results in a decrease in M_k, so that K/L increases. Since labour is fixed by assumption in the long run, an increase in capital raises K/L. This increases M_l, and implies that real after-tax wages also rise.

Within our modelling, national capital stocks increase relative to the base case by 3.0 per cent. And real after-tax wages rise by 1.0 per cent. The terms of trade decline by 0.5 per cent, small enough not to alter the direction of these outcomes.[6] The increased income arising from the increase in M_l leads to an increase in real consumption of 0.25 per cent, with a slightly larger gain in South Australia (0.36 per cent, Table I). South Australia does slightly better than the rest of Australia in the scenario because two important industries in the state, cars and wine, gain from the package. In the case of cars, a sharp cut in the tax rate on sales occurs in the package, thereby expanding output.

This change in tax mix will lower the costs of production relative to CPI. At the industry level, the outcome of the GST depends largely on the movement in costs relative to other industries. If the cost decrease is of a larger magnitude than the economy-wide average, this should induce a relatively larger movement of

Table I: Effects of the GST package with different wine tax options (mean % change from base case)

Scenario:	**1: parameter uncertainty**[a]				**2: policy uncertainty**[b]			
Wine output								
Fan decomposition	Local market	Export	Import share	**Total**	Local market	Export	Import share	**Total**
Premium red	0.67	1.10	-0.01	1.76	4.30	0.56	-0.24	4.62
	(0.04)	(0.33)	(0.01)	(0.36)	(3.07)	(0.46)	(0.19)	(2.40)
Premium white	0.35	0.89	0.04	1.29	2.79	0.55	-0.43	2.89
	(0.03)	(0.27)	(0.03)	(0.26)	(2.08)	(0.30)	(0.39)	(1.37)
Non-premium	1.02	0.32	0.00	1.35	0.18	0.33	0.04	0.54
	(0.02)	(0.12)	(0.00)	(0.13)	(2.70)	(0.03)	(0.12)	(2.56)
Prices[c]	Input costs		Consumer			Input costs	Consumer	
Premium red	-4.49		0.01			-4.27	-5.59	
Premium white	-4.45		0.28			-4.27	-5.74	
Non-premium	-4.79		-1.67			-4.76	2.36	
Services	-2.64		4.98			-2.61	5.01	
Other	-4.98		-5.32			-4.94	-5.36	
All sectors	**-3.33**		**0.00**			**-3.30**	**0.00**	
Wine tax revenue			16.5				0.4	
Wine consumption	Price effect		Expend. effect	Total	Price effect		Expenditure effect	Total
Premium red	-0.01		1.54	1.53	6.84		1.53	8.36
Premium white	-0.19		0.92	0.73	4.24		0.92	5.16
Non-premium	0.56		0.46	1.03	-0.46		0.45	-0.02
Macroeconomic								
Real appreciation			2.46				2.43	
Capital stocks			3.01				2.98	
Real after-tax wage			1.03				1.03	
Supernumerary consumption			1.40				1.36	
Real consumption								
- Australia			0.25				0.25	
– South Australia			0.36				0.54	
– Rest of Australia			0.25				0.23	

Notes: a In scenario 1 with a 29% WET on wine, SSA is used to vary the export demand elasticities for each wine type: –6.5±4. Estimated standard deviations for national output changes, based on these parameter ranges, are in parentheses.
b The shocks ascribed to the power of the consumption tax are: premium red -3±14, premium white -3±14 and non-premium 10.5±27.5. Estimated standard deviations for national output changes, based on these ranges of shocks, are in parentheses.
c Price relative to CPI.

Source: Authors' FEDSA-WINE projections.

The package introduces new productive resources into the industry than the national average. The premium red and premium white wine industries export

around half of their output by 2003, and so changes in their international competitiveness are also relevant.

taxes on service industries, many of which produce non-tradables (although tourism and education make relatively important contributions to exports). The GST package thus raises the price of non-tradables relative to tradables, resulting in a real exchange rate appreciation. Hence, we subtract the appreciation effect from an industry's cost reduction to calculate its gain in international competitiveness.

Premium red wine, the most export-oriented segment of the wine industry, has an input cost reduction of 4.5 per cent (relative to CPI), as does premium white, while that for non-premium wine is 4.8 per cent. The industry average cost reduction is 3.3 per cent: the average reduction in non-service industries is 5.0 per cent and in services 2.6 per cent. The difference between services and non-services is mainly due to the removal of wholesale taxes on intermediate inputs, with service industries being relatively less intensive in the use of taxed inputs than other industries. Therefore, the wine industry improves its competitiveness relative to other industries in the domestic market, but not relative to other non-service industries. In the scenario, the real exchange rate appreciates by 2.5 per cent (Table I). Therefore, for an industry to improve its international competitiveness in the scenario, its unit cost reduction must exceed the real appreciation induced by the tax package, as the latter raises costs relative to foreign competitors.[7] Since the unit cost reduction for each wine segment exceeds the real appreciation, the tax reform package has a positive effect on international competitiveness.

Wine sold for domestic consumption introduces a complication. In addition to its relative cost reduction, there is also a change in its real consumer price. For non-premium wine, the tax increase with the GST package is more than offset by the unit cost reduction. For premium wines, however, the price increase is slightly larger than CPI (0.01 per cent for red and 0.28 per cent for white) due to the assumption that a higher proportion than that for non-premium wines is consumed on licensed premises. This makes premium wine consumption more exposed to the GST on the on-premise mark-up, and therefore subject overall to a higher effective tax increase.

Turning to equation (6), we can decompose the price and expenditure effects on household wine consumption. The pre-simulation values of $-\frac{\varepsilon_i}{\gamma}$ are 1.10, 0.66 and 0.33 for premium red, premium white and non-premium wines respectively. The national increase in supernumerary expenditure *v* is 1.40 per cent in the first scenario. Domestic consumption of the respective wine types increases by 1.53 per cent, 0.73 per cent and 1.03 per cent (Table I). The change in consumption of premium red consumption calculated from (6) comprises a price effect of -0.01 (= 1.1 x –0.01) and an expenditure effect of 1.54 (= 1.1 x 1.40), for a total increase of 1.53 per cent. The two effects calculated for premium white wine are –0.19 (= 0.66 x –0.28) and 0.92 (= 0.66 x 1.40), totalling 0.73 per cent. And for non-premium wine, the price effect is 0.56 (= 0.33 x – -1.67), the expenditure effect 0.46 (= 0.33 x 1.40) and the total 1.03 per cent. Decomposition shows us that expenditure effects dominate price effects.

One way of explaining industry outputs is through the market clearing assumption of the model: the percentage change in output is a weighted sum of

percentage changes in sales volumes, decomposed by sales point. In quantity terms, let D denote domestic production, L_d local sales of domestic product and X exports. The market-clearing equation is:

$$Dd = L_d l + Xx \tag{9}$$

The variables l and x are the percentage changes in local sales and exports that contribute to the percentage change in output d. Next, we obtain an expression for the change in local sales (l^*) in order to account for the effect of import replacement on domestic output:

$$Ll^* = L_d l + Mm \tag{10}$$

where L is the total quantity of local sales from all sources, M the level of imports and m the percentage change in imports. The modified market-clearing equation becomes:

$$Dd = Ll^* + Xx — Mm \tag{11}$$

In computing large change solutions, the decomposed components of equation (11) will not add exactly to Dd.[8] To overcome this, we define an ordinary change variable q so that

$$PD^0 q = PDd, \tag{12}$$

where D^0 is the initial quantity of total sales, and P is the price level that is updated during the solution procedure. To decompose total output, let

$$q = q_l + q_x + q_m, \tag{13}$$

where q_l is the local market contribution, q_x the export contribution and q_m the import replacement contribution (each in ordinary change terms) to total output. The local market contribution to percentage change in domestic production is

defined as the percentage change in local sales from local and imported sources, weighted by the value of locally sourced sales:

$$q_l = \frac{L_d l^*}{D^0}. \tag{14}$$

The export contribution is $q_x = \frac{Xx}{D^0}$. Finally, the import contribution is calculated as a residual from equation (13). This decomposition method is known as 'Fan decomposition'.[9]

For each of the three wine types, at the national level, the local market contribution explains only part of the proportional increase in output in the first scenario. For premium red wine, this contribution is 0.67 per cent out of the total increase in output of 1.76 per cent. For premium white wine, the contribution is 0.35 out of 1.29 per cent (Table I). Although the consumer price of both premium wines rises slightly, the expenditure effect, through the increase in real incomes, dominates the local market contribution. The increase in international competitiveness of the premium wine segments translate to increased exports, as domestic consumption increases absorb only part of the increased output. The local market contribution explains virtually all the output increase for non-premium wine, due to the relatively small export weighting in total non-premium sales. Tax revenue collected from on-premise and off-premise wine consumption rises by 16.5 per cent due to a rise in the effective tax rate, relative to the pre-GST WST rate, and a slight increase in domestic consumption.

Systematic sensitivity analysis (SSA) can indicate the extent to which parameter choice influences modelled outcomes (Arndt 1996; Arndt and Pearson, 1996). In this study, where we do not use formally estimated export demand

elasticities, SSA is especially important. Hence, the wine export demand elasticities were varied uniformly from their base values by plus or minus 4 (i.e., —6.5±4). This SSA method implies that any point in the range is equally likely to be the true parameter value as any other, with no bias towards mid-range values. The standard deviations for the contributions to national wine output percentage changes, based on the parameter range, appear in Table I. In the first scenario, uncertainty surrounding export demand elasticities for premium wines translates to uncertainty in output changes, with standard deviations of 0.36 per cent for red and 0.26 per cent for white wine. For non-premium wine, export demand parameter choice is less critical, as sales are mostly to the domestic market.[10]

The second scenario: using SSA to depict policy uncertainty

Under the proposed GST with a top-up ad valorem WET, interest remains in alternative tax proposals, including a volumetric WET. Some lobbyists continue to advocate a volumetric tax on wine as a more direct means of addressing the alleged negative externalities associated with alcohol abuse. Some groups are also seeking higher taxes on wine, given that taxes on beer and spirits are higher than on wine in Australia (Wittwer 2000, Table F.1). Setting the tax on wine to the pre-GST levels applying to beer therefore is one political possibility.

Others argue that Australia's wine tax is already excessive by the standards of other wine-producing nations, which may provide a case for lower taxes (Berger and Anderson 1999). The sole purpose of most varieties of wine grapes is as an input into wine production. Hence, grape prices are highly sensitive to changes in market conditions for wine and, at least in the short run, taxation policies. This sensitivity might explain why there was no consumption tax on wine

in Australia until 1984, apart from a two-year period in the early 1970s. Much of the impending massive increase in wine grape supply will coincide with the first few vintages under a GST. In response to industry concerns of falling prices, and the possibility that the tax hike on wine under the GST may shoulder a disproportionate share of the blame for this, the Commonwealth government may consider, in extreme political circumstances, reducing the top-up tax on wine.

In the second scenario, systematic sensitivity analysis is used to address this policy uncertainty by varying the consumer tax on wine. The maximum shock applied to wine is equal to the pre-GST beer rate of taxation using a volumetric top-up tax. The minimum shock applied is equal to a GST with no top-up tax. The mean shocks entail a decrease in the tax on premium wine and a substantial increase in the tax on non-premium wine. These are equivalent to introducing a partly volumetric top-up tax.

For premium wines, the local market contribution (driven by positive price and expenditure effects) explains most of the total increase in output for premium wines. This is because a lower rate of taxation induces more imports and diverts sales from exports. The mean output gains are higher than in the first scenario, being 4.6 per cent for premium red wine and 2.9 per cent for premium white wine (Table I). The standard deviations of the total output changes, although relatively large, are smaller than for the local market contributions alone, indicating substitution between domestic and overseas sales. The respective standard deviations for the local contributions and total outputs indicate that although the premium segments remain sensitive to the rate of consumer taxes on wine, the sensitivity is smaller than if the segments were less export oriented. Note

that the output gains in scenario one for premium wines are below the range of gains implied by the means and standard deviations in the second scenario. This indicates that the 29 per cent WET on wine as part of the GST package is not a good outcome for the premium segment of the industry (using the pre-GST beer rate of taxation as a worst-case tax scenario).

The non-premium segment presents a different picture. The range of shocks imposed implies that there is only a small probability that the tax rate on non-premium wine will decrease. The outcome for the segment is dominated by the local market contribution. In the long run, the non-premium wine segment can withstand a moderate consumer tax increase without a loss of output, due to the relative cost reduction of the industry as a result of the GST. A revenue-neutral volumetric WET (which the mean shocks in scenario two approximate, with a wine tax revenue increase over the base case of only 0.4 per cent) as part of the GST package appears not to be output reducing for the non-premium segment, as non-premium output expands in scenario two. But raising the volumetric tax per unit of alcohol above the revenue-neutral rate would remove the gains in competitiveness arising from the GST package entirely for the non-premium wine segment.

National welfare, as measured by real consumption, barely changes between scenarios one and two. But the gain in real consumption is larger in South Australia in scenario two than scenario one. The proportion of premium wine in total wine production is larger in South Australia than the rest of the nation, so that a volumetric tax favours the region slightly.[11]

The introduction of a revenue-neutral volumetric WET would have a positive price effect on premium wine output and a negative price effect on non-premium wine. The outcome would be positive for the premium segments and ambiguous for the non-premium segment. A volumetric tax implies a large increase in taxes on non-premium wine, so the difference between the no top-up tax option and a volumetric WET option (at the pre-GST beer rate of taxation) is greater for non-premium than premium wines. Hence, the estimated standard deviation of output arising from policy uncertainty is greater for the non-premium segment, despite its relatively small income (and hence own-price) elasticity.

Modelling a volumetric top-up tax under alternative demand assumptions

The substitution effect arising from changes in consumer prices may have two parts: specific substitution, in which the marginal utility of income is held constant; and general substitution, in which goods compete for an extra dollar of income. The Klein-Rubin based linear expenditure system, as used in FEDSA-WINE, assumes preference independence. This implies there are no specific substitution possibilities.

The Klein-Rubin assumption may be appropriate in a model in which all commodities represent broad aggregations of different classes of goods. As disaggregation increases, some goods become more alike and consequently are more likely to display specific substitution at least within a group of goods. The three wine types in FEDSA-WINE are candidates for specific substitutability. Here, we model the introduction of the GST package with a volumetric tax, applied at the pre-GST beer rate of taxation. Two different household demand assumptions are used in modelling wine consumption. The third scenario uses the

Klein-Rubin type as in the previous scenarios. The fourth scenario uses modified household demand equations, based on the methodology of Clements and Smith (1983), and used previously by Meagher *et al.* (1985) and CIE (1995b), to allow for specific substitutability between wine types.

Clements and Smith describe how to include a block of commodities for which own- and cross-price parameters have been estimated into a linear expenditure system. The utility function is divided into two, in this case, a set of wine commodities (S_w) containing the first *w* commodities, and a set of non-wine commodities (S_r):

$$U(X_1, \ldots, X_n) = U_1 (X_1, \ldots, X_w) \quad + U_2 (X_{w+1}, \ldots, X_n) \tag{15}$$

Demand for a composite wine commodity is determined within a Stone-Geary utility function, as for the non-wine commodities in the model.

Let us first note the relationship between the unconditional Slutsky parameters (π_{ij}) and the uncompensated price elasticities (η_{ij}), where S_i is the expenditure share of good *i*:

$$\eta_{ij} = \pi_{ij}/S_i - S_j\varepsilon_i \tag{16}$$

In the preference-independent Stone-Geary form, the unconditional Slutsky matrix is:

$$\pi_{ij} = \frac{1}{\gamma}[\beta_i(\delta_i - \beta_j)] \tag{17}$$

with $\delta_{ii} = 1$ and $\delta_{ij} = 0$ for $i \neq j$. A composite wine commodity *W* forms part of the linear expenditure system. However, within the wine block, if we have additional own- and cross-price parameter estimates, the unconditional Slutsky matrix for wine commodities becomes:

$$\pi_{ij} = \pi_{ij}^{w} + \frac{1}{\gamma}[\beta_W (1 - \beta_W)]\,\beta_i^{'}\,\beta_j^{'} \qquad (18)$$

In (18), π_{ij}^{w} is the matrix of conditional Slutsky parameters, β_W is the marginal budget share of the wine composite, and $\beta_i^{'}$ (= β_i/β_W) is the conditional marginal budget share of each wine type. Equation (17) calculates the Slutsky parameter when one or both of *i* and *j* are in the set S_r, and equation (18) applies only when both *i* and *j* are S_w. In the absence of estimated parameters specifically applicable to the wine disaggregation of the model, imposed Slutsky parameters are used in the modified system of demand for wine, as shown in Table II.

Table II: Demand parameters in the modified demand system of FEDSA-WINE

	Conditional Slutsky coefficients (x 100)			**Uncompensated unconditional price elasticities, 2003 database**		
	π_{i1}^{w}	π_{i2}^{w}	π_{i3}^{w}	η_{i1}	η_{i2}	η_{i3}
Premium red	-0.21	0.14	0.07	-1.16	0.04	0.11
Premium white	0.14	-0.24	0.10	0.05	-0.81	0.12
Non-premium	0.07	0.10	-0.17	0.18	0.16	-0.71

A volumetric top-up tax on wine introduced at the equivalent of the pre-GST beer rate results in output increases for both premium wines. However, the local market effect switches sign, from being slightly negative with preference independence to being positive if the wine types are specifically substitutable. With the standard demand form, the output of the non-premium wine segment of decreases by 3.4 per cent, whereas with specific substitutability, the decline is 7.2 per cent (Table III).

Non-premium grapes, unlike premium grapes, are multi-purpose, being sold as either inputs to non-premium wine, or as table or dried grapes. Since the

wine boom started in the late 1980s, table and dried grape exports have declined as wine exports have grown (ABS 1999). A tax increase on non-premium wine increases the availability of non-premium grapes for export. In the case of the Klein-Rubin demand form, the export effect almost completely offsets the local market effect, so that there is little change in output. With the Clements-Smith modification, the export effect offsets less of the drop in local market sales, so that output declines by 1.2 per cent.

Table III: Pre-GST beer rate on wine in GST package, % change from base case[a]

Scenario:	**3**				**4**			
Household demand form	**Clements-Smith modification**				**Klein-Rubin**			
Fan decomposition	Local market	Export	Import share	**Total**	Local market	Export	Import share	**Total**
Non-premium grapes	-3.02	1.88	-0.01	-1.21	-1.30	1.05	0.00	-0.26
Wine								
Premium red	0.21	1.21	0.02	1.45	-0.57	1.32	0.06	0.80
Premium white	0.27	0.94	0.08	1.29	-0.55	1.06	0.20	0.70
Non-premium	-7.87	0.42	0.33	-7.18	-3.95	0.38	0.22	-3.37

Source: Authors' FEDSA-WINE projections.

IV. CONCLUSION

The premium segments of the wine industry could still gain from the GST package even though it was accompanied by a substantial increase in the wine consumption tax. This is because the package is likely to increase the international competitiveness of the export-oriented premium segments of the industry, partly offsetting the adverse impact on the domestic market of any wine tax hike. For non-premium wine, where the total outcome is more dependent on domestic sales, an increase in the top-up tax on non-premium wine beyond the 29 per cent WET

imposed on 1 July 2000 (e.g., by introducing a volumetric tax) could eliminate the benefit of lower input costs arising from the GST package.

The two main reasons for having a top-up tax on wine are to collect revenue and to address any net negative externalities arising from wine consumption. In principle the GST should have eliminated the first reason by raising sufficient revenue from taxing all consumption of goods and services at an appropriate uniform rate. As to the second reason, if there are net negative externalities, the most direct approach would be to tax the source of the externality, namely alcohol, which suggests a volumetric tax should be used. But the perceived health benefits of moderate wine consumption are encouraging the industry to argue that the net externalities are positive, not negative, and so the WET should be removed. In the end it is likely that political sensitivities, rather than difficult-to-resolve debate over the size of the net externalities from wine consumption, will determine the taxes imposed on wine.

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[1] The only study to include disaggregated wine types and to be based on relatively recent data, by CIE (1995a), estimates that premium red wine has an expenditure elasticity of 2.45, premium white wine 1.38, and non-premium wine 0.35. We have adopted these parameters with some modifications to reflect the different expenditure weights in our more-recent data.

[2] The modelled income tax cuts are less than those introduced by the Coalition government with the GST package. Dixon and Rimmer (1999) note that the GST package included a fiscal stimulus, implying that future (i.e. long run) direct tax cuts will be smaller than otherwise.

[3] Some details of the GST package changed during this study due to compromises between the Coalition government and the Democrats. FEDSA-WINE, with only 29 sectors (of which six are wine related), is not sufficiently disaggregated to capture all details in other sectors.

[4] To convert a GST (g) plus top-up tax (t) on the retail sale to a WST (w) equivalent, $w = g(1+m)(1+t) + t$, where m is the retail price margin. For a 29% top-up tax, a 10% GST and 33% retail margin, the wholesale tax equivalent $w = 0.10(1 + 0.29)(1 + 0.33) + 0.29 = 0.46$. The GST applied to on-premise markups raises w further, with the actual level depending on the on-premise share in total wine consumption and the size of the on-premise margin, as shown in Wittwer (2000), p. 187 .

[5] The latter concession is in addition to the 15 per cent WST rebate (to encourage wine tourism) on direct sales. Wineries with more than $580,000 of direct sales do not receive the WET exemption at all.

[6] Export prices fall due to export volume growth along the export demand curves of FEDSA-WINE, which have finite elasticities. Import demands, on the other hand, are assumed to be infinitely elastic, so that import prices do not change. Hence the terms of trade decline.

[7] The average cost reduction we calculate (3.3%) is greater than the projected real appreciation (2.5%). But to calculate an economy-wide gain in international competitiveness, we should use more disaggregated data. In addition, sectoral export values rather than sector costs may be more appropriate weights for calculating the input cost reduction.

[8] This is because multistep computation percentage changes are compounded, whereas ordinary changes are added.

[9] The method is named after Mr Fan Mingtai of the Beijing Institute of Quantitative and Technical Economics.

[10] FEDSA-WINE's long-run closure assumes costless capital reallocation. An alternative assumption, to reflect a degree of risk aversion among investors, is that the rate of return on capital attracts premiums (discounts) as capital stocks increase (decrease). If we use this method to diminish the growth in capital stocks arising from the GST package to 1.0 per cent (approximately the long-run increase modelled by Dixon and Rimmer, 1999), aggregate household consumption does not change relative to the base case. This makes the percentage change in output more dependent on exports, and more sensitive to export demand parameter choice.

[11] The change in tax instrument explains part of the additional gain in real consumption in South Australia. The remainder is attributable to the lower increase in wine tax revenue in scenario two than scenario one relative to the base case, as increased wine taxes penalise the state.