THE SENSITIVITY OF WINE INDUSTRY OUTCOMES TO MODEL ASSUMPTIONS IN GST SCENARIOS

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Abstract

This study provides an example of applying an AGE model to consider the effects on the wine industry of broader tax reform. The sensitivity of results is considered with respect to the choice of base year for static analysis and an alteration to the long-run capital assumption. Systematic sensitivity analysis is used to evaluate the extent to which expenditure and export demand elasticities determine industry-specific outcomes. The analysis is extended to evaluate the impacts of policy uncertainty.

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Introduction

Policy simulations using comparative statics in an applied general equilibrium model typically result in small changes relative to the base case. Is the choice of base year critical to comparative static results in an industry undergoing rapid change? The purpose of this paper is to observe the sensitivity of modelled outcomes of GST scenarios within an AGE framework to the base year and parameter choice.[1] In considering the choice of year for the database, it compares projected results from 1996 and 2003 databases. Next, systematic sensitivity analysis (SSA) is used to obtain estimated standard deviations for variables within the model arising from policy simulations. Some discussion of the differences that arise in GST outcomes by using a dynamic instead of static approach to modelling follows. Finally, SSA is used to depict the effect of policy uncertainty on the wine industry.

The Australian wine industry is the focus of this paper. It remains a small industry despite its spectacular growth since the mid-1980s, accounting for about 0.2 per cent of GDP. Between 1996 and 1999, both the quantity and quality of production grew. Wine output increased by 26 per cent, entirely due to an increase in premium wine production. Given the massive increase in vineyard plantings in the late 1990s, we can expect a further increase in output between 1999 and 2003 of over 40 per cent (Table 1).

Consumer preferences for wine have also changed over time. Some of the changes that have occurred are more apparent if the industry is divided into non-premium, premium red and premium white segments. For example, domestic consumers have switched from non-premium to premium, particularly red, wines with relatively little change in per capita consumption over the past 15 years. Much of this story is hidden if we model only a single wine industry. Then, we might conclude erroneously, on the basis of reasonably constant per capita consumption since the mid-1980s, that consumer preferences for wine are stable. The author knows of no parameter estimates for wine disaggregated into non-premium and premium segments. To analyse industry impacts, given the importance of disaggregation, we impose parameters on the different wine entities, ensuring that the expenditure-weighted sum of the parameters reflects historical estimates.

[1] The static AGE model, FEDSA-WINE, used for all analysis in this paper is outlined in Appendix 1. Harrison and Pearson (1994a; 1994b) provides a guide to the GEMPACK software used to run the model.

Updating the database

The first step in updating an existing input-output database with an emphasis on wine is to undertake a historical simulation. In this case, the simulation projected the database of FEDSA-WINE from 1996 to 1999. The method is to impose percentage changes in observed variables on the model through closure reversals. For example, the macroeconomic components of GDP on the expenditure side are available from national accounts. We can ascribe observed changes in real consumption, real investment, government expenditure, exports and imports to the model. In turn, usually exogenous shifters that set the macroeconomic component proportional to GDP are endogenised. All-input productivity changes were imposed on most industries, based approximately on the economy-wide estimate reported in Dixon, Menon and Rimmer (1996). These productivity changes need to be sufficient so that the excess supply curves in all industries are consistent with observed changes in trade data and the real exchange rate, for given changes in employment.[2] As the emphasis of the study is on wine, historical data at the industry level concentrates mainly on changes in wine sales volumes and prices (Table 1). The key estimates in this study are the changes in consumer preferences and shifts in export demands of the three wine types.

These estimates and macroeconomic forecasts for the period 1999 to 2003 provide the basis for projecting the model to 2003 (Tables 2 and 3). The increase in wine supply is based also on net new plantings for 1998 and 1999, assuming that they will have attained full yields by 2003. Table 1 contains the historical data and forecasts for the grape and wine industries. Macroeconomic forecasts, productivity forecasts and commodity-specific forecasts of changes in consumer preferences are imposed on the model, as summarised in Tables 2 and 3.

The main sector-specific features of the observed period 1996 to 1999 are strong growth in export demand for premium wine and a swing in consumer preferences away from non-premium wine and towards premium, particularly red, wine.

Modelling the GST package

The policy simulations in this paper depict the GST package. In summary, indirect taxes on intermediate inputs into production are reduced by about 40 per cent. Most taxes on capital

[2] Strictly, we should also exogenise changes in capital stocks. Instead, the same change in the rate of return is imposed on all industries in the historical period. This minimises data requirements for industries other than the grape and wine industries.

creation are removed, except for new taxes on housing construction. Some state duties are removed. The broad-based tax on household consumption increases consumer tax revenue by about 50 per cent.

The scenarios examined in this paper all concern the long run. National employment is fixed, with wages therefore varying with labour income. The long-run assumption in this static model is that capital is reallocated between industries to equalise the rate of return across all industries. We will return to this assumption later. At the macroeconomic level, real investment and real government spending are exogenous. The balance of trade is exogenous, although a small surplus is imposed in each simulation. This is because foreigners must fund any increase in capital stocks, as domestic real investment is exogenous. Therefore, the balance of trade surplus pays a return to foreigners on capital that is in addition to that of the base case. Real consumption is the only endogenous component of expenditure-side GDP.

The GST raises consumer taxes. At the same time, it lowers taxes on intermediate inputs, capital and investment. In the absence of terms of trade effects, the effect of lowering these taxes is to increase the capital-to-labour (K/L) ratio permanently, at a constant rate of return on capital. This will raise the marginal product of labour permanently, and also raise national capital stocks, as by assumption, national employment is unchanged.

The model projects an adverse, if small, terms of trade effect from introducing a GST. Import prices (c.i.f, in foreign currency units) are exogenous, as the small country assumption applies to Australia's imports. For exports, Australia has a significant share of world markets for homogeneous primary products. Some product differentiation applies to Australia's growing manufactured exports, lowering the export demand elasticities for these products. Consequently, if exports expand as modelled for the GST package, world prices will decline and worsen Australia's terms of trade. The GST scenario favours exports of primary and manufactured products relative to services. This is because a GST on services effectively imposes an export tax on tourism and education.

Specifically, in the package, the wine industry is subjected to an increase in taxes. After allowing for the GST on the mark-up for wine served on licensed premises, a top-up tax of 21.8 per cent would apply, in addition to the GST, to raise the same revenue as the current 41 per cent WST on wine (Wittwer and Anderson, 1999). The Coalition government instead, after negotiating with the Democrats, has settled on a 29 per cent top-up tax (the "wine equivalent tax" or WET) plus exemption of the first $300,000 of cellar door sales from the WET. This latter concession replaces the 15 per cent WST rebate on cellar door sales and

although significant for small wineries, has little impact on the average top-up tax paid by the industry.

Comparing outcomes for two scenarios using the 1996 and 2003 databases

At the industry level, the outcome of the GST depends 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 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. The increase in international competitiveness of an export-oriented industry is not equal to its cost reduction alone, as the GST package also induces a real exchange rate appreciation. The package introduces new taxes on service industries. These are to a large extent non-tradeables, although tourism and education make relatively important contributions to exports. Generally, the GST package raises the price of non-tradeables relative to tradeables, resulting in a real exchange rate appreciation. Hence, the appreciation effect must be subtracted from the cost reduction to calculate the gain in international competitiveness. In the GST scenario, the real exchange rate appreciates by 2.7 per cent (2003 base year, Table 4).

Premium red wine, the most export-oriented of the wine industries, experiences a cost reduction of 4.5 per cent (using CPI as a numeraire), compared with an all-sector average cost reduction of 3.2 per cent. The cost reduction for premium white is also 4.5 per cent, and it is 4.9 per cent for non-premium wine. Therefore, the wine industries improve their competitiveness relative to other domestic industries and, after subtracting the real appreciation effect, in the international market. Wine sold for domestic consumption introduces a complication. In addition to its relative cost reduction, there is also a change in the relative consumer price. While the tax on wine increases with the GST package, the increase is smaller than the economy-wide average for consumption items for non-premium wine. For premium wines, the price increase is slightly larger than CPI (less than 0.1 per cent for red and 0.2 per cent for white wine).

One way of decomposing the effects of the tax package is to use the Fan method (Horridge, Parmenter and Pearson, 1998). This explains the change in output of a given industry as the sum of the local market effect, the import share effect (arising from the local shift from domestic to imported products) and the export effect. Decomposition of the effects is a useful tool for explaining results, because the effects may be in opposite directions. For

example, lowering the price of wine under a GST relative to other consumer goods and services may induce an increase in local wine sales. This will decrease the availability of wine for export.

Table 4 displays the Fan decomposition for the base years 1996 and 2003. For each of the wine industries, the projected outputs for the GST scenario are similar, regardless of the database used. In the decomposition of the premium red and premium white wine industries, however, the pattern differs distinctly. With the greater export orientation of the premium industries in 2003, compared with 1996, nearly half the output gains are attributable to the export effect, due to the relative fall in wine producer prices, with the remainder due to the local sales effect, a result of the increase in macroeconomic real consumption. As the consumer prices of premium wine types exceed CPI, the price effect would partly offset the expenditure (i.e, the increase in macroeconomic real consumption) effect in the contribution of local sales. For non-premium wine, the lower effective tax increase (based on the assumption that the GST on the markup on licensed premises has a smaller weighting for non-premium than premium wines) results in a decline in its real consumer price, so that both the price and expenditure effects contribute positively to local sales. Using the 1996 base, the export effect is smaller and the local sales effect larger than for the 2003 base year, with a slightly larger change in the percentage output for each industry. As the sales composition for non-premium wine is similar in the two base years, the decomposed results for the two base years are similar.

Systematic sensitivity analysis of expenditure and export demand elasticities

AGE modelers often receive criticism for using imposed rather than estimated parameters. In the context of modeling wine options under a GST, this study disaggregates wine into three types. Econometric estimates of demand parameters at present are only available for wine as an aggregated commodity. In addition, there is econometric evidence that preferences for wine are independent of those for beer and spirits (Clements and Selvanathan, 1991). Therefore, it is difficult to justify modifying an AGE model to include a less restrictive demand form for alcoholic beverages than the Stone-Geary specification, if the main focus is to consider the disaggregated effects on wine producers and consumers.

Systematic sensitivity analysis (SSA) indicates the extent to which parameter choice influences modeled outcomes. In this study, it is useful due to an absence of estimated parameters for disaggregated wine types. For each of the wine types, the household

expenditure elasticity is varied from its base value by plus or minus 80 per cent, assuming a uniform probability distribution. This implies that any point in the range is equally likely to be the true parameter value as any other, with no bias towards mean values. For the premium wines, the parameter range is from 0.30 to 2.66. For non-premium wine, the range is from 0.15 to 1.35. In addition, the model uses imposed rather than estimated export demand elasticities. In the same SSA runs, of which the means and standard deviations of percentage changes appear in Tables 4 and 5, the wine export demand elasticities also vary uniformly. For premium and non-premium wines, the range is from –2.0 to –14.0 and –1.0 to –7.0 respectively.

The estimated standard deviation of the local market effect is 0.5 per cent for both premium wine outputs, equal to around half the projected increase in outputs (2003 base, Table 4). The corresponding estimates for the export effect for both premium wines are about two fifths of the projected contributions. In each case, the standard deviation of the total is less than one quarter of the projected total change, a smaller proportion than for the components due to interchanging sales between local sales and exports. Given the wide range of parameters used in the SSA exercise, it seems reasonable to conclude that parameter choice is not critical to the modeled outcome for the premium grape and wine industries in the scenario. Non-premium wine presents a slightly different picture: the estimated standard deviation amounts to more than one third of the total output change, as the contribution of exports is almost negligible.

Reasons for different results

While this study is concerned primarily with wine, differences in results at the macroeconomic level may impact on results in the wine industry, and therefore warrant discussion. For example, MONASH modelling of the overall GST package in a dynamic framework has indicated slightly negative effects on real consumption and welfare in the medium- to long run relative to the forecast baseline (Dixon and Rimmer, 1999). Possible reasons for differences in macroeconomic results between FEDSA-WINE and other models, notably MONASH include differences in shocks and database aggregation. Dixon and Rimmer (1999) devised shocks based on the Treasury model, PRISMOD. In FEDSA-WINE, grape and wine industries are more disaggregated than in other models but other industries are more aggregated. Therefore, even if we attempted to impose identical shocks in FEDSA-WINE, differences in results could arise due to aggregation.

But it would appear that the largest single difference is in the static treatment in FEDSA-WINE in contrast to the dynamic modelling in MONASH. The baseline forecast for an industry has some effect on the outcome in the policy simulation in MONASH, as discussed in an earlier study by the MONASH modellers (Dixon and Rimmer, 1998). In the later study (1999), the authors emphasise the impact that the GST package has on budget shares of consumption items forecast to be relatively slow growing compared with items forecast to be relatively fast-growing. The tax burden of some relatively slow-growing consumption items (not all disaggregated in the 29 sector version of FEDSA-WINE) increases. Since the relevant own-price elasticities are low, increased taxes have the effect of increasing the budget share of slow-growing items. At the same time, the tax burden of some fast-growing items decreases relative to the baseline, and their budget shares decrease. This decreases real consumption relative to the baseline forecast over time. In addition, using a compensating variation measure, the effect on welfare of the tax package in the medium- to long run is ever decreasing. In industry-specific terms, increased macroeconomic real consumption raises the local sales contribution to output in the wine industries in FEDSA-WINE. In MONASH, the expenditure effect on wine is slightly negative.

In addition to the effects of the dynamics of household consumption, MONASH modelling also provides a different story than static analysis in the treatment of capital reallocation. FEDSA-WINE includes a static treatment of capital. In the long-run scenarios summarised in Table 4, capital is reallocated among industries to equalise the after-tax rate of return in all industries. This is the simplest treatment of capital, and may be increasingly inappropriate as scenarios directly impact on a larger number of industries, as with simulations of the GST package. In the dynamic MONASH framework, for example, the industry-specific normal rate of return is raised (lowered) if its capital growth is higher (lower) than baseline growth. This is because the modellers assume that capital growth in a given year is limited by investor perceptions of risk.

Consequently, another critical difference between FEDSA-WINE and MONASH simulations of GST scenarios (Dixon and Rimmer, 1999), in the context of the grape and wine industry, is that national capital stocks increase by 3.3 per cent (2003 base year, Table 4) compared with about 0.9 per cent in the long run in MONASH (Chart 3.1, Dixon and Rimmer, 1999). The dynamic MONASH model therefore projects results that imply a smaller (or negative) increase in real national income.

Does the exaggerated aggregate capital growth effect in FEDSA-WINE imply that the GST package will result in exaggerated gains for the export-oriented premium wine industries, both through a larger-than-otherwise increase in capital stocks or larger-than-otherwise real consumption effect? To consider this question, we could attempt to impose some features of the dynamic modelling on the static exercise. Trying to reconcile the results of a static model with a dynamic model for a given scenario may seem to be a perilous exercise. But an attempt to adjust the rate-of-return on capital in each industry to reflect in part the risk-related allocation of capital assumed in the MONASH model provides another measure of the sensitivity of results. We might approach this by exogenously raising (lowering) the required rate-of-return on those industries whose capital stocks increase (decrease) in the main GST run, relative to the base case. With this method, we can raise the economy-wide rate-of-return sufficiently to reduce the national gain in capital stocks relative to the base case to 0.9 per cent, approximately the medium- to long-run result of the central MONASH simulation (Chart 3.1, Dixon and Rimmer, 1999).

Repeating the main scenario, shown in Table 4, the required rate-of-return in the grape and wine industries is raised relative to the base case, as in most other industries. This adjustment lowers the economy-wide gains. The smaller increase in real consumption (0.2 per cent instead of 1.6 per cent) results in smaller local sales contributions to output for each wine type (0.4 per cent for premium red wine, 0.3 per cent for premium white wine and 1.3 per cent for non-premium wine, 2003 base year, Table 5). Yet, the export contribution to the total increase in sales approximately doubles for both premium wines. Consequently, re-running the SSA analysis for wine parameter uncertainty with the adjusted rates of return results in almost identical means and standard deviations as the main scenario for premium wines, contrary to the expectation that the increase in wine output may decrease in the revised scenario relative to the main scenario.

The wine industries benefit from larger-than-average cost reductions in the GST package. Since the change in macroeconomic real consumption is smaller than in the main scenario, the relative export-orientation and change in international competitiveness of an industry are now increasingly important in determining the policy impact on output. The capital-to-labour ratio increases for the premium wine industries by a smaller proportion than in the main scenario: there are smaller increases in capital stocks and larger increases in labour inputs in the revised scenario. Due to the increased importance of the degree of export-orientation in determining the output change, with the reduced expenditure effect, the labour inflow into premium wine

industries in this scenario is larger than in the main scenario. We might conclude that modifying the rate-of-return assumption has altered the decomposition of effects contributing to changes in output while having surprisingly little effect on the change in total output, at least for the premium wine types. For non-premium wine, as the contribution of local sales to total output is much higher, the adverse expenditure effect of the revised rate-of-return assumption results in a reduced output gain in the revised scenario (relative to the main scenario).

Comparing the outcomes using 1996 as the base year, the gains in output are smaller for the premium industries in the revised scenario. This is because exports are a smaller proportion of total sales than in 2003.[3] For the domestically-focused non-premium wine industry, changing the base year makes little difference to the decomposed results: the gains are about half those of the main scenario in each case.

Using systematic sensitivity analysis to depict policy uncertainty

In attempting to model the GST package, particularly in the early stages of the debate, there was uncertainty about the taxes to be applied to wine. During the formulation of the GST package, the representatives of the wine industry and various interest groups consulted the Commonwealth in respect of an appropriate tax for wine. The industry has come under political scrutiny because the effective tax on wine remains lower than for beer and spirits. The purpose here is to evaluate how much difference a range of tax outcomes may make to wine producers and consumers, rather than to consider the various dimensions of the policy debate on wine.

One extreme is to assume that from a revenue-raising perspective, the purpose of a GST is to spread the tax burden over all consumption of goods and services. On this basis, the appropriate tax level on wine may be the base GST rate, with substantial new revenues being collected from the GST on the markup imposed by hotels, restaurants and clubs, without any top-up tax. The other extreme is to raise the rate of tax on wine so that it is equivalent to the current rate on beer.[4]

We assume in this exercise that the probability distribution over the range of policy outcomes is uniform. It is likely that if the wine tax were raised to that for beer, the top-up

[3] In 1996, exports accounted for about one third of production of both premium wines. The FEDSA-WINE forecast for 2003 is that almost one half of production of both wine types will be exported.

tax, instead of being ad valorem as at present, would be based on the volume of alcohol. This implies that the tax on non-premium would rise by much more than on premium wine. The mean values of the direct shocks on wine consumption taxes in this exercise are slightly negative for premium wine, but large and positive, with a wider feasible policy range, for non-premium wine. The mean shocks approximate a change in the wine tax from an ad valorem basis to a partly volumetric basis, with an increase in the average tax rate of about 10 per cent.

The SSA run over the policy range indicates higher output increases for the premium wine industries than with the existing GST package (i.e., 29 per cent top-up tax on wine plus GST). The mean output gain contributed by the local sales effect is larger (e.g., 3.4 per cent for premium red wine, compared with 1.1 per cent for the main GST scenario), only partly at the expense of the export effect (0.3 per cent compared with 1.0 per cent). The standard deviations of the local sales effects are small relative to the means.

On the other hand, with the base case rate of return in each industry, the standard deviations of the export effects indicate that there is considerable doubt about the GST package being export-enhancing for these industries. For non-premium wines, the mean of total output is now negative, with a large standard error. One way of interpreting this result is that the GST package combined with political pressure for a volumetric tax has introduced uncertainty to the non-premium wine industry, with an expectation that the industry will be worse off than the base case of no change in existing tax policy. This run indicates that the premium wine industries in all probability will gain from tax reforms, while at the same time being relatively more insulated from domestic tax arrangements, through a higher degree of export orientation, than the non-premium industry.

The results with adjusted rates of return on capital in all industries reflect the previous pattern of results: the local market contribution to premium wine output lessens with the altered assumption (from 3.4 per cent for premium red wine to 2.7 per cent and from 4.0 per cent for premium white wine to 3.1 per cent, Table 6), with an enhanced and now clearly positive contribution from exports. Overall, for the premium wine industries, the adjustment makes little difference to modeled changes in total outputs.

The non-premium wine industry suffers output losses, given that the mean of the feasible policy range implies introducing a partly volumetric tax that will increase the effective tax rate paid by non-premium wine consumers. But the standard errors on the local market effect

[4] Indeed, with the possible exception of cigarettes, wine is the only commodity incurring a WST prior to July 2000 to suffer an increase in taxation in the GST package.

and total output are large, implying that the non-premium industry may win or lose from the GST package, depending on the specific wine package finally determined by the Commonwealth government. This outcome for the non-premium segment provides an interesting contrast with the main scenario. Under a 29 per cent top-up tax, the local market effect for non-premium wine is stronger than it is for premium wines, because the effective tax increase is smaller.

In political terms, we might expect there to be some divisions in the wine industry. Some small winemakers believe that a volumetric top-up tax is preferable to an ad valorem tax, because the tax rate paid by consumers will decline for premium products. Others believe that the adverse consequences for regions specializing in non-premium and multipurpose grapes, in particular, make introducing a volumetric tax untenable. In addition, the non-premium segment remains sensitive to domestic consumer tax arrangements as long as most produce is sold domestically. If rapid technological change brings down the price of premium wine significantly, as is possible at least in the commercial or budget end of the premium market, then an increasing number of premium producers may prefer to retain an ad valorem top-up tax under a GST, as the tax paid per unit of volume will fall as the product price falls.

A potential hurdle to the smooth introduction of the wine package under the GST is that already wine grape prices are falling. It is possible that prices will fall further in the 2000 vintage, due to the rapid supply growth, before the GST is introduced. But if the largest of the price falls occur in the first vintage after the GST is passed (i.e., 2001), producers may blame the package disproportionately for the fall. It is this consideration that makes a zero top-up tax on wine under a GST (i.e., the lower-bound tax rate in the policy uncertainty SSA run) politically feasible. At the other end of the spectrum, continued lobbying by various health and welfare groups makes the beer rate of taxation feasible.

Conclusion

This study provides an example of applying an AGE model to consider the effects on a small industry of broader tax reform. Since the wine industry is at present growing rapidly, it appears desirable to update the base year of the model so that the pattern of sales and output of the industry under scrutiny are relevant. And as the GST package is being introduced in July 2000, it appears necessary to update the database to some time period beyond then. Projected outcomes of the tax package for the premium segments of the wine industry are

relatively sensitive to the choice of base year. Contributions to output by type of sale differ markedly between the 1996 and 2003 base years, although total output changes relative to the respective bases are similar.

Since FEDSA-WINE is a static model, it misses out on some of the features that a dynamic model may bring to analysis of tax reform. In an attempt to redress one of the missing features of static analysis, the main scenario is revised so that the required rate of return is raised (lowered) in industries when capital stocks increase (decrease) relative to the base case. This adjustment acts as a proxy for a degree of risk aversion among investors. With an updated database, the revised scenario results in a marked change in decomposed contributions to the output of the premium wine industries without altering the total change significantly. The contribution of exports to the output gain increases with the adjustment. For the domestically-focused non-premium wine industry, the revised assumption reduces the gain from the GST package. And using the 1996 base year, in which exports have a smaller weight in total sales, the gains are smaller than in the main scenario as the export contribution in the premium segments is under-represented relative to a post-GST base year.

An additional concern in modeling tax reforms is parameter choice. In particular, FEDSA-WINE includes wine types disaggregated to a level for which parameter estimates are not available. To represent this uncertainty, systematic sensitivity analysis is used on the main and revised scenarios in this paper. Varying the expenditure and export demand elasticities for each wine type over a broad range with a uniform distribution indicates that the direction of outcomes does not hinge on parameter choice. The estimated standard deviations over the parameter range are small relative to decomposed changes, and even smaller relative to total output changes.

Finally, systematic sensitivity analysis is used to model policy uncertainty concerning the tax package to be imposed on wine under the GST. The mean of the shocks approximates a move from an ad valorem to partly volumetric tax on wine, with an increase in the average tax on wine of approximately 10 per cent. This indicates that the premium wine industries are likely to benefit from tax reform. Most of the uncertainty over the impact of the GST package concerns the non-premium segment of the industry, as it is relatively less insulated from domestic consumer tax arrangements than the export-oriented premium segments.

References

Australian Bureau of Statistics (1999), *Australian Wine and Grape Industry*, Cat. no. 1329.0, ABS, Canberra.

Berger, N., P. Spahni, and K Anderson (1999), *Bilateral Trade Patterns in the World Wine Market, 1988 to 1997, A Statistical Compendium*, Centre for International Economic Studies, University of Adelaide.

Clements, K. and S. Selvanathan (1991), "The Economic Determinants of Alcohol Consumption", *Australian Journal of Agricultural Economics* 35:209-231.

Dixon, P., J. Menon, and M. Rimmer (1996), "An Explanation of the Rapid Growth in Australia's Trade: A General Equilibrium Analysis", Centre of Policy Studies and Impact Project, Monash University, Paper presented to the 25th Annual Conference of Economists, Canberra, September.

Dixon, P., B. Parmenter, J. Sutton and D. Vincent (1982), *ORANI: A Multisectoral Model of the Australian Economy*, Amsterdam: North-Holland.

Dixon, P. and M. Rimmer (1998), "Forecasting and Policy Analysis with a Dynamic Model of Australia", Centre of Policy Studies, Preliminary Working Paper No. OP-90, Monash University.

Dixon, P., and M. Rimmer (1999), "The Government's Tax Package: Further Analysis based on the MONASH model", Centre of Policy Studies, General Paper No. G-131, Monash University, Clayton, April.

Harrison, J. and K. Pearson (1994a), "User's Guide to TABLO, GEMSIM and TABLO-Generated Programs", *GEMPACK User Documentation GPD-2, Release 5.1, Volume 2*, Centre of Policy Studies and the IMPACT Project, Monash University, Clayton.

Harrison, J. and K. Pearson (1994b), "Computing Solutions for Large Scale General Equilibrium Models Using GEMPACK", Preliminary Working Paper No. IP-64, Centre of Policy Studies and the IMPACT Project, Monash University, Clayton.

Knopke, P., L. Strappazzon, and J. Mullen (1995), "Productivity growth: Total factor productivity on Australian broadacre farms", *Australian Commodities*, vol. 2, no. 4, pp. 486-97.

Madden, J. (1990), *FEDERAL: A Two-region Multisectoral Fiscal Model of the Australian Economy*, unpublished Ph.D Thesis, University of Tasmania, Hobart.

Osmond, R. and K. Anderson (1998), *Trends and Cycles in the Australian Wine Industry, 1850 to 2000*, Centre for International Economic Studies, University of Adelaide.

Senate Standing Committee on Trade and Commerce (1977), *Tax and the Wine and Grape Industries*, AGPS, Canberra, August.

Wittwer, G. and K. Anderson (1999), "Impact of tax reform on the Australian wine industry: a CGE analysis", Centre for International Economic Studies, Discussion Paper No. 99/08, University of Adelaide, May.

Table 1: Growth in the Australian grape and wine industries, 1996 to 2003

	1996 observed	1999 observed	% change '96-'99	2003 forecast[a]	% change '99-'03
Domestic consumption (Ml)[b]					
Red premium wine	38.5	62.7	62.9	97.8	56.0
White premium wine	55.4	68.5	23.6	83.9	22.5
Non-premium wine	236.0	241.4	2.3	234.4	-2.9
Wine, total	**329.9**	**372.6**	**12.9**	**416.1**	**11.7**
Production (Ml) [b]					
Red premium wine	148.7	279.9	88.2	529.5	89.2
White premium wine	162.6	210.4	29.4	322.8	53.4
Non-premium wine	364.1	361.4	-0.7	362.1	0.2
Wine, total	**675.4**	**851.7**	**26.1**	**1214.5**	**42.6**
Sales for distillation	67.3	57.8	-14.1	60.0	3.8
Wine exports (Ml) [b]					
Red premium wine	47.0	90.5	92.6	235.8	160.5
White premium wine	54.3	90.0	65.7	153.5	70.5
Non-premium wine	31.3	35.0	11.8	31.3	-10.7
Wine, total	**132.6**	**215.5**	**62.5**	**420.5**	**95.1**
Table grape exports(kt)[b]	38.8	44.7	15.2	83.5	86.8
Wine imports (Ml) [b]					
Red premium wine	5.1	8.1	58.8	27.8	243.5
White premium wine	5.1	7.0	37.3	11.2	60.3
Non-premium wine	5.5	9.2	67.3	10.8	17.7
Wine, total	**15.7**	**24.3**	**54.8**	**49.9**	**105.2**
Winegrape prices ($/tonne)[c, e]					
Red premium grapes	$1,394	$1,437	3.1	$1,244	-13.4
White premium grapes	$899	$813	-9.6	$868	6.8
Non-premium grapes	$392	$402	2.6	$392	-2.4
Wine export prices ($/litre)[b, e]					
Red premium wine	$4.50	$5.74	27.6	$5.29	-7.9
White premium wine	$3.97	$4.90	23.4	$4.77	-2.7
Non-premium wine	$1.64	$1.55	-5.5	$1.53	-1.3
Total	**$3.64**	**$4.71**	**29.4**	**$4.82**	**2.4**
Wine consumer prices ($/litre)[d, e]					
Red premium wine	$12.85	$13.70	6.6	$13.00	-5.1
White premium wine	$10.71	$11.20	4.6	$11.19	-0.1
Non-premium wine	$3.53	$3.53	0.0	$3.49	-1.2
Wine stocks (Ml)[b]					
Red premium wine	238	482	102.6	948.7	96.7
White premium wine	365	460	26.0	607.3	32.0
Non-premium wine	180	147	-18.1	227.2	54.2

Sources and notes for Table 1:

a Author's estimate based on FEDSA-WINE modelling.
b ABS (1999).
c Unpublished Wine and Brandy Corporation data.
d Author's estimates based on b and c.
e All values are real, in 1995-96 dollars

Table 2: Growth assumptions for projections, Australia, 1996 to 2003

Exogenous	Actual	Actual	% change,	Projected for	% change,

Variables	1996	1999	1996 to 1999	2003	1999 to 2003
Population (millions)	18.3	19.0	3.8	19.2	1.1
Real agg. consumption (billions, 1996 dollars)	303.9	340.1	11.9	383.3	12.7
Land bearing winegrapes (hectares)					
Red premium	18,000	41,300	129.4	63,100	52.8
White premium	18,900	28,400	50.3	32,500	14.4
Non-premium	15,700	14,800	-5.7	16,400	10.8
Total	**66,600**	**84,500**	**26.9**	**112,000**	**32.5**

Sources: Australian Wine and Brandy Corporation (unpublished estimates);
ABS gopher://gopher.statistics.gov.au

Table 3: Changes to productivity, wine export demand and domestic wine preferences, 1996-99 and 1999-2003 (% per annum)

	1996-99	1999-2003
Primary factor productivity growth		
Red premium winegrapes	1.6	1.6
White premium winegrapes	1.6	1.6
Non-premium winegrapes	1.6	1.6
Red premium wine	1.6	1.6
White premium wine	1.6	1.6
Non-premium wine	1.6	1.6
All-inputs productivity growth		
Other agriculture (average)	2.0	2.0
Mining (average)	2.5	2.5
Manufacturing (average)	0.8	0.8
Services (average)	0.5	0.5
Export demand growth		
Red premium wine	*39.0*	17.5
White premium wine	*39.0*	17.5
Non-premium wine	*-1.5*	0.0
Domestic taste change		
Red premium wine	*13.4*	6.7
White premium wine	*2.9*	1.5
Non-premium wine	*-2.4*	-3.0

Sources: Italicised numbers are estimated using the historical simulation of the FEDSA-WINE model; productivity numbers are imposed exogenously, based on the economy-wide estimate of Dixon, Menon and Rimmer (1996) for mining, manufacturing and services and Knopke, Strappazzon and Mullen (1995) for other agriculture.

Table 4: Effects of 29% top-up wine tax + GST package (main scenario), % change from base case, 1996 and 2003 base years[a]

	1996				2003			
Fan decomposition	Local market	Import share	Export	**Total**	Local market	Import share	Export	**Total**
Wine								
Premium red	2.1	0.0	0.4	2.5	1.1	0.0	1.0	2.1
	(0.9)	(0.0)	(0.3)	(0.7)	(0.5)	(0.0)	(0.3)	(0.5)
Premium white	2.0	0.0	0.5	2.4	1.1	0.0	1.0	2.2
	(0.9)	(0.1)	(0.2)	(0.7)	(0.5)	(0.1)	(0.4)	(0.6)
Non-premium	2.5	0.0	0.1	2.6	2.3	0.0	0.1	2.3
	(1.0)	(0.0)	(0.0)	(1.0)	(0.9)	(0.0)	(0.0)	(0.8)
Prices	Producer	Consumer			Producer	Consumer		
Premium red	-4.2	0.4			-4.5	0.0		
Premium white	-4.3	0.5			-4.5	0.2		
Non-premium	-4.8	-1.5			-4.9	-1.7		
All sectors	**-3.1**	**0.0**			**-3.2**	**0.0**		
Macroeconomic								
Real appreciation		2.6				2.7		
Terms of trade		-0.2				-0.1		
Capital stocks		3.8				3.3		
Real consumption		2.1				1.6		
Welfare (compensating variation)		2.1				1.6		

a The expenditure elasticity ranges for premium red and white wine are 1.48±1.18, and for non-premium wine 0.75± 0.60. The export demand elasticity ranges are –8±6 for premium wines, and –4±3 for non-premium wine. Estimated standard deviations in parentheses.

Source: Author's FEDSA-WINE projections.

Table 5: Altering rate of return from main scenario, % change from base case, 1996 and 2003 databases[a]

	1996				2003			
Fan decomposition	Local market	Import share	Export	**Total**	Local market	Import share	Export	**Total**
Wine								
Premium red	0.4	0.0	1.0	1.5	0.4	0.0	1.9	2.3
	(0.3)	(0.0)	(0.5)	(0.6)	(0.1)	(0.0)	(0.6)	(0.6)
Premium white	0.5	0.0	1.0	1.5	0.3	0.0	1.8	2.1
	(0.2)	(0.0)	(0.6)	(0.7)	(0.1)	(0.1)	(0.6)	(0.6)
Non-premium	1.0	0.0	0.0	1.0	1.3	-0.1	0.0	1.1
	(0.5)	(0.0)	(0.0)	(0.5)	(0.4)	(0.0)	(0.0)	(0.4)
Prices	Producer	Consumer			Producer	Consumer		
Premium red	-3.5	-0.4			-4.2	0.2		
Premium white	-3.5	-0.5			-4.2	0.4		
Non-premium	-3.7	-1.0			-4.4	-1.4		
All sectors	**-2.8**	**0.0**			**-3.2**	**0.0**		
Macroeconomic								
Real appreciation	2.7				2.1			
Terms of trade	-0.1				-0.1			
Capital stocks	1.0				0.9			
Real consumption	0.2				0.2			
Welfare (compensating variation)	0.2				0.2			

a The expenditure elasticity ranges for premium red and white wines are 1.48±1.18, and for non-premium wine 0.75± 0.60. The export demand elasticity ranges are –8±6 for premium wines, and –4±3 for non-premium wine. Estimated standard deviations in parentheses.

Source: Author's FEDSA-WINE projections.

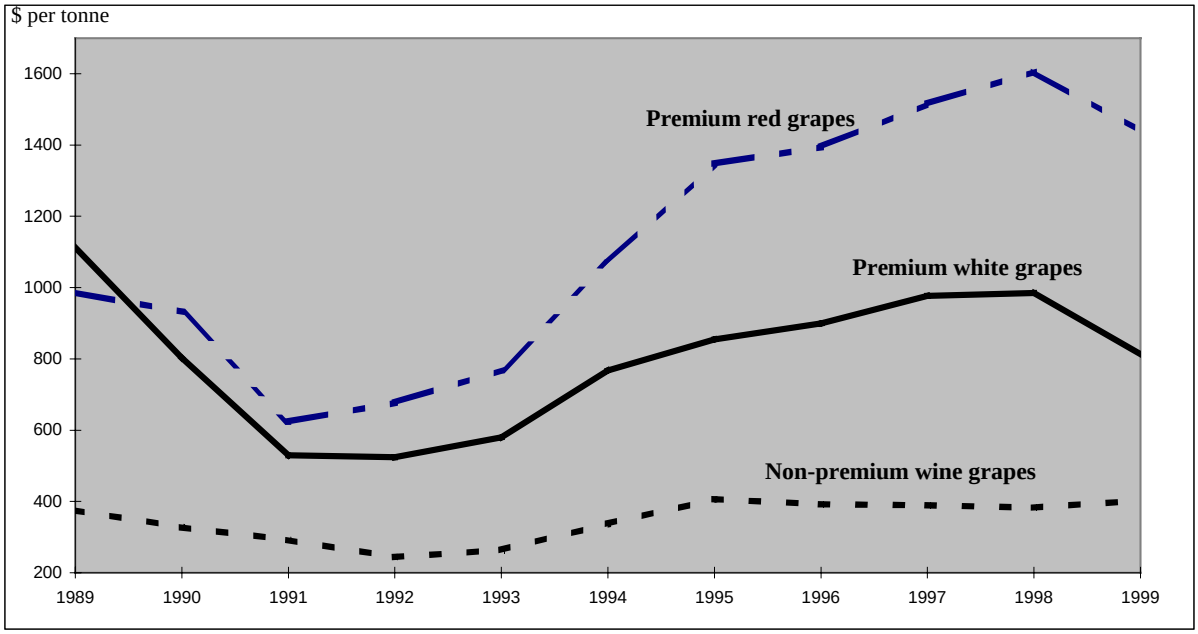
Table 6: SSA analysis of range of wine tax policies with GST package, mean % change from 2003 base case[a]

	Assuming base case rate of return				**Adjusted rate of return**			
Fan decomposition	Local market	Import share	Export	**Total**	Local market	Import share	Export	**Total**
Wine								
Premium red	3.4	-0.3	0.3	3.4	2.7	-0.3	1.2	3.6
	(2.0)	(0.3)	(0.6)	(1.0)	(1.9)	(0.3)	(0.7)	(1.0)
Premium white	4.0	-0.6	0.4	3.7	3.1	-0.6	1.3	3.7
	(2.4)	(0.6)	(0.5)	(1.3)	(2.4)	(0.5)	(0.5)	(1.3)
Non-premium	-0.7	0.1	0.1	-0.5	-1.9	0.2	0.1	-1.6
	(4.5)	(0.3)	(0.0)	(4.2)	(4.4)	(0.3)	(0.0)	(4.1)

a The shock to the power of the consumption tax is –3±14 for premium wine, and 19±36 for non-premium wine. Estimated standard deviations in parentheses.

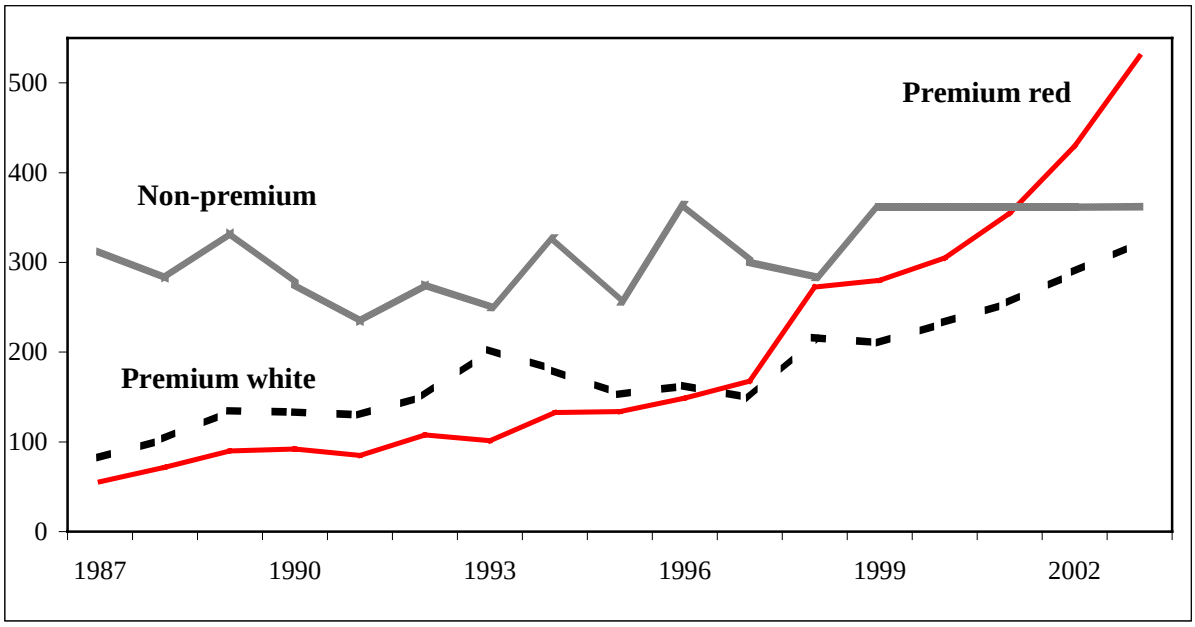
Source: Author's FEDSA-WINE projections.

Figure I: Real wine grape prices, 1989 to 1998 (expressed in 1996 Australian dollars)



Source: Based on Australian Wine and Brandy Corporation data.

Figure II: Australian production of wine by type, 1987 to 2003, megalitres



Source: Based on Osmond and Anderson (1998); ABS catalogue no. 1329.0; author's FED-SA projections.

Appendix A: Details of the FEDSA-WINE model

The FEDSA-WINE model is based on the ORANI model of the Australian economy (Dixon, Parmenter, Sutton and Vincent, 1982). It disaggregates 'other agriculture' into premium red wine grapes, premium white wine grapes, non-premium grapes, and other agriculture, and also disaggregates wine into premium red wine, premium white wine and non-premium wine. It separates South Australia from the rest of Australia, based on the methodology developed by Madden (1990). That potentially is helpful in examining the wine industry because half that industry is located in South Australia where the proportions of grapes and wine that are premium quality are well above that for the rest of Australia (an advantage not exploited in the present paper). The model's input-output database is derived from 1995-96 national accounts, manufacturing and other census data, trade data from the ABS, and tax data from ABS and budget papers.

FEDSA-WINE contains 29 industries producing 29 commodities, including premium red wine grapes, premium white wine grapes and non-premium grapes among the agricultural industries, and premium red wine, premium white wine, non-premium wine, beer and spirits among the manufacturing industries. We treat each of the three wine industries as export oriented.

Any split between premium and non-premium grape varieties and wines is bound to be somewhat arbitrary. We define premium white winegrape varieties to include Chardonnay, Riesling, Sauvignon Blanc, Semillon and Chenin Blanc (but not Colombard). Premium red winegrape varieties are defined to include Cabernet Sauvignon, Cabernet Franc, Pinot Noir and Ruby Cabernet in all regions. In regions of South Australia other than the Riverland, all Shiraz production is included. Riverland Shiraz was split half and half between the premium and non-premium categories. This was necessary, given the wide dispersion of Shiraz prices, from $220 to $1,275 per tonne in the Riverland, which was near both the high and low prices for all grape varieties produced in the region in 1995-96. Premium wine is distinguished from non-premium by its container: premium is defined to include only wines sold in bottles of no more than one litre. Since their volumes are relatively small and stable over time, for simplicity we have put all fortified and sparkling wines in the non-premium category.