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Wine export demand shocks and wine tax reform in Australia: Regional consequences using an economy-wide approach

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Abstract

We provide economy-wide modeling results of the national and regional implications of two current challenges facing the Australian wine industry: a decline in export demand for premium wines, and a possible change in the tax on domestic wine sales following the Henry Review of Taxation. The demand shock causes regional GDP to fall in the cool and warm wine regions but not in the hot wine regions unless the shock is large. A change from the current ad valorem tax to a similarly low volumetric tax on domestic wine sales causes regional GDP to rise in the cool and warm wine regions, partly offsetting its fall due to the export demand shock; but GDP in the hot wine regions would fall substantially. The switch to a volumetric tax as high as the standard beer rate would raise tax revenue and lower domestic wine consumption by more than one-third, but would induce a one-third decrease in production of non-premium wine as its consumer price would rise by at least three-quarters (while the average price of super premium wines would change very little), hence exacerbating the difference in effects of a tax reform on hot versus warm and cool wine regions' GDP.

Keywords: Wine export demand, wine consumer taxation, regional economy-wide modeling

JEL Codes: D58, F18, H22, Q18, R13

Wine export demand shocks and wine tax reform in Australia: Regional consequences using an economy-wide approach

I. INTRODUCTION

The Australian wine industry has been facing a number of challenges of late. Some of them are weather-related (bushfires, extreme heatwaves, drought and associated unavailability of adequate water, excessive rain or frost in some areas). Some are due to the rapid expansion in Australia's vineyard plantings in the past 15 years, followed by similarly rapid expansions in other New World wine-exporting countries. But two other challenges are the focus of this paper. One is the current decline in export demand for premium wines, in part due to the financial crisis in the United States and the consequent recession there and in many economies. The other is the prospect of a change in the consumer tax on domestic wine sales, once the Henry Review of Taxation in Australia is completed in 2010.[1]

The reason for considering these two challenges together is because the export demand shock has occurred since the databases of existing models of the Australian economy were prepared. Its effects thus need to be simulated first, as a way of re-basing such models, before exploring the effects of any tax changes that may take place after mid-2010. Also, one set of proposed consumer tax changes – from the current ad valorem tax to a volumetric wine tax – would lead to a fall in domestic sales of non-premium

wines but possibly an increase in sales of more-expensive wines, depending in part on the extent to which the tax reform also involved raising the wine tax rate in order to bring it closer to the rates applying to other beverages on a volume-of-alcohol basis.[2] Meanwhile, a decline in demand for exports of premium wine could have the opposite effects. Given that the hot winegrape-growing regions of Australia produce most of Australia's non-premium wine while the cool regions specialize in producing super premium wine (with warm regions having more of a mix of both plus commercial premium wines), these challenges have profoundly differing implications for the various regional economies in Australia, hence the focus of the present study on the regional dimension.

The paper is structured as follows. In the next section we explain the regional economy-wide modeling approach used. We then present the results from four simulations: two alternative export demand shocks (one more negative than the other), followed by two alternative tax reforms that change the current ad valorem wine tax of 29 percent to a volumetric tax (one that brings the new wine tax up to the rate applying to beer of less than 3 percent alcohol, the other to the higher rate applying to standard-strength beer). The final section draws together the implications of the findings.

II. THE MODELING APPROACH

The approach to be taken in this analysis is to use an economy-wide model of the Australian economy that is capable both of distinguishing between the three types of

wine just mentioned (non-premium, commercial premium and super premium) and of showing the impacts at a disaggregated regional level. For that purpose we use the ORANIG model (see www.monash.edu.au/policy/oranig.htm), which has been modified to generate what we call the ORANIG06-WINE model, which is based on 2006 data for the Australian economy. The national economy has been disaggregated into 36 regions, all but six of which are wine-intensive regions. While this model is regional only in a top-down manner, it is appropriate for analysing an external demand shock and a national policy issue such as a change in national alcohol taxes, because in both cases it is defensible to assume that wine prices would change across all regions by the same proportion for each of the three wine types.[3] The advantage of modifying ORANIG for analyzing a change in the national tax on wine consumption is that it is relatively straightforward to make the desirable disaggregation of alcoholic beverages into numerous sectors with a top-down specification.[4]

ORANIG has been modified to create ORANIG06-WINE as follows:

- The published 2001-02 national input-output database has a single wine, spirits and tobacco sector and a single beer sector. The former is split into three types of wine (non-premium, commercial premium and super premium), plus spirits and tobacco, and the beer sector is split into non-premium and premium types. A new ready-to-drink sector, RTDs, is created partly from spirits and partly from the soft drinks sector.
- The database is updated to 2005-06 to reflect available national accounts and international trade data, using the ADJUST procedure devised by Mark Horridge (see www.monash.edu.au/policy/archivep.htm TPMH0058). Value added data in

the model's 2005-06 three wine sub-sectors and its grape sector in each wine region and climate zone are summarized in Appendix Table 1, the shares of gross value of wine production from the three sub-sectors are shown for each region in Appendix Table 2, and the model's structure of costs in wine production that year are summarized in Appendix Table 3.[5]

- The model also includes a top-down regional module that separates out all the significant wine regions of Australia (Appendix Table 1 and Appendix Figure 1). The wine regions are also classified into three climatic zones: cool, warm, and hot. In 2005-06, one-tenth of the value added in grape production came from cool regions, two-thirds from warm regions and not quite one-quarter from hot regions as defined (bottom of Appendix Table 1, based on the regional classifications shown in the final column).[6]
- Indirect taxes on both household consumption and intermediate inputs are split into three: GST, ad valorem top-up taxes, and volumetric taxes. Given the significance of on-premise alcohol consumption, this allows us to account for on-premise taxes in the hotels and restaurants sector. The significance of this is that, as on-premise markups typically exceed 100 percent, we do not overestimate the impacts of particular tax scenarios which would arise from treating all alcohol consumption as if purchases were at off-premise prices. The tax revenue raised from alcohol consumption taxes, according to the model's 2005-06 database, is summarized in Appendix Table 4.
- ORANIG06-WINE also contains a small fiscal module, so as to allow for direct taxation. The significance of this modification is that we wish to ensure that the

overall government budget balance is unchanged. In the event that a wine tax policy change is not budget-neutral, there is an accommodating direct tax rate shift to maintain overall fiscal budget neutrality.

Models in the ORANI family (Dixon et al. 1982) usually have a linear expenditure system (LES) of household demand. The advantage of LES in an economy-wide model is that it models expenditure and price effects with relatively few parameters (*n* parameters in a system of *n* commodities). The disadvantage is that there are no specific cross-price effects, with cross-price elasticities being determined by expenditure effects alone. This system is satisfactory for relatively broad groups of commodities, as are usually found in published input-output tables, but it is undesirable in the context of finely disaggregated commodities that are potentially substitutable, and particularly in a policy scenario in which there is the assumption of such substitution, as in the present case of a wine tax switch. LES is unsatisfactory because a revenue-neutral tax switch is likely to entail negligible expenditure effects and significant price effects; hence a modification that allows for price substitution, even if at the expense of commodity-specific expenditure elasticities, is appropriate. We modified household demands accordingly, by grouping alcohol consumption into three nests, namely beer, wine, and spirits/RTDs. Each of the three has an expenditure elasticity (or marginal budget share) within the LES. Household demand for beer is a constant elasticity of substitution (CES) nest of two beer types, while wine consumption is a CES nest of three types. Finally, spirits and RTDs form a CES nest that is part of the LES. We do not allow for cross-price effects between, for example, non-premium wine and beer types.[7] However, we include

below a sensitivity analysis section in which we explore the effects on our results of altering the CES between the three wine types from the default value of 2.0 to either 0.5 or 4.0.

III. APPLYING THE MODEL: ESTIMATING EFFECTS OF EXPORT DEMAND AND TAX REFORM SHOCKS

Four sets of simulation results are reported in this section: two alternative export demand shocks (one more negative than the other), followed by two alternative tax reforms that change the current ad valorem wine tax of 29 percent to a volumetric tax (one that brings the new wine tax up to the rate applying to light-strength beer, the other to the higher rate applying to standard-strength beer).

The first export demand shock assumes there is a 20 percent decline in super premium wine export demand coupled with a 10 percent rise in commercial premium wine export demand (both measured in value terms), and no change in non-premium demand. As of early 2009, that seemed a reasonable characterization of the type of shock the industry would face in 2009-10. By mid-2009, however, it was clear that the shock was going to be more severe, with demand for commercial premium wine falling even more than that for super premium and with total export sales falling by about $650 million from the 2006 level. Specifically, the second export demand shock assumes there is a 10 percent decline in super premium wine export demand – less severe than initially

feared – but with a 33 percent decline in commercial premium wine export demand (and again no change in non-premium demand).

Once that second shock to the model's database is in place, follow-on changes from the current ad valorem domestic wine consumption tax of 29 percent to a volumetric tax are explored. The first tax simulation raises the wine tax to the rate applying to beer with less than 3 percent alcohol (A$28 per litre of alcohol), and the second tax simulation raises the wine tax to the rate applying to beer with more than 3 percent alcohol (A$40.82 per litre of alcohol). To make it easy to compare results across the simulations, the effects of each of the two tax scenarios are presented as additional to the effects of the second export demand shock.

A change in demand for Australian wine exports

With the recession in high-income countries from 2008, demand for Australian super premium wine exports has shrunk, as consumers eat out less and tighten their spending. Substitution to lower-quality premium wines has been occurring, and initially it was thought that this would result in an increase in commercial premium demand. To simulate that shock, we assume in our first scenario that, relative to 2005-06, there is a 20 percent reduction in export demand for Australia's super premium wine but a 10 percent increase in export demand for commercial premium wine. The estimated macroeconomic effects of this shock, shown in column 1 of Table 1, reveal that this involves a slight decline in Australia's overall exports and imports, real GDP and real household income. In the second and more-severe export demand shock, involving just a 10 percent reduction in

export demand for Australia's super premium wine but a 33 percent decline in export demand for commercial premium wine, shown in column 2 of Table 1, those declines are somewhat greater but still small.

With the first demand shock, regional GDP falls in the cool and warm wine regions (by 0.1 and 0.2 percent, respectively) but rises in the hot wine regions (by 0.2 percent), as shown at the bottom of column 1 of Table 2. This is mostly because, as shown at the bottom of column 1 of Table 3, the volume of wine production falls in the cool and warm wine regions (by 5.7 and 2.5 percent, respectively) but rises in the hot wine regions (by 1.9 percent). With the more-severe export demand shock, by contrast, regional GDP falls in all three climate zones because wine production falls not only in the cool and warm regions but also in the hot wine regions, by 6.1, 8.5 and 9.0 percent, respectively (bottom of column 2 of Tables 2 and 3, with impacts for specific wine regions shown in the bulk of those tables).

The aggregate national decline in wine production with the first demand shock is 1.6 percent. This is made up of a fall in super premium wine output of 8.3 percent and a rise of 5.5 percent for commercial premium (and no significant change for non-premium) wine, while the gross value of grapes in aggregate would fall nationally by just 0.5 percent (column 1 of Table 4). By contrast, the aggregate national decline in the gross value of wine production with the second, more-severe export demand shock is 8.4 percent, with super premium wine falling just 3.7 percent but commercial premium wine production falling 17 percent (and again no significant change for non-premium wine). In that second case, grape production falls nationally by almost 5 percent (column 2 of Table 4).

A switch from an ad valorem to a volumetric domestic wine consumption tax

What if, on top of the more-severe export demand shock, there was a change from the current ad valorem tax on domestic wholesale wine sales of 29 percent to a volumetric tax equal to that applied to beer in Australia?[8] We simulate that tax shock first at the low-alcohol beer rate of A$28 per litre of alcohol and then at the standard beer rate of A$40.82. The motivation for taxing alcohol is to address negative externalities associated with consumption. Studies assessing externalities by alcohol type include Zhao xxx [full citation to follow], who found that the incidence of binge drinking was highest for RTDs and full-strength beer and lowest for bottled wine.

Either tax change would further reduce, albeit slightly, Australian aggregate exports and imports (Table 1). In the hot wine regions the extra tax would lower regional GDP, while in the warm and cool regions the tax change would cause regional GDP to rise slightly, nearly offsetting the negative effects there of even the larger of export demand shock (Table 2). This is because wine production rises in the cool and warm wine regions (by about 9 and 0.5 percent, respectively) but falls in the hot wine regions (by 19 percent) following either of the two tax reforms (see bottom three rows of columns 3 and 4 Table 3). When combined with the export shock, this leads to declines of 8 and 10 percent for the warm and hot wine regions, respectively, but a net increase in cool-climate wine production of 2.8 percent.

The aggregate national change in wine production following the switch from ad valorem to volumetric taxation of wine consumers is small (0.2 percent if the lower

volumetric tax applies, -1.9 of the higher one applies), but the compositional changes are large: super premium wine output rises 15 percent but commercial premium output falls between 8 and 13 percent and the output of non-premium wine falls by almost one-third (columns 3 and 4 of Table 4). When combined with the export shock, the larger tax change would result in changes of 11, -31 and -33 percent for super premium, commercial premium and non-premium wine production, respectively. That amounts to a decline in aggregate national wine production of just over 10 percent.

The large non-premium change in response to the switch to a high volumetric tax is not surprising, given that half of domestic wine sales are non-premium and their consumer price would rise by at least three-quarters. The impact of those tax changes on the volume of domestic consumption of non-premium wine are thus even larger: it falls by 60-65 percent, or nearly three times as much as the decline in domestic sales of commercial premium wine (whose consumer price would rise by 22 or 33 percent). By contrast, the average price of super premium wine would change very little (-3 or 2 percent), but the quantity consumed would rise (by about one-quarter) because the tax change would make it relatively cheaper vis-a-vis lower-quality wines. In aggregate, the retail price of wine to domestic consumers would be roughly 50 percent higher and the aggregate volume of wine consumed domestically would be just over one-third lower (Table 5).

Sensitivity analysis of results

In addition to depending on the data that go into the model, these results also depend on numerous parameters. They are particularly sensitive to the assumed elasticity of substitution in consumption between the three wine types. The default elasticity is 2.0, causing total alcohol tax revenue to rise by about $535 million per year when the volumetric tax is set at the light beer rate, or by $910 million if it were to be set at the standard beer rate of $40.82 per litre of alcohol rather than at the current 29 percent ad valorem rate. But if that elasticity is instead 0.5 (or 4.0), Table 6 suggests that the rise in alcohol tax revenue is about one-third more (or more than one-third less).

That elasticity assumption makes little difference to the change in aggregate domestic volume of wine consumption and hence to the change in wine output, but it makes big differences to the composition of both: Table 7(a) shows that instead of falling 33 percent, non-premium wine output would fall 14 percent (45 percent) if the elasticity was 0.5 (4.0), while instead of rising 15 percent, super premium wine output would rise 1 percent (28 percent) if the elasticity was 0.5 (4.0). This is because the volume of domestic consumption of non-premium wine would fall 27 percent (88 percent) if the elasticity was 0.5 (4.0) instead of 65 percent in the default case, while instead of rising 26 percent, super premium wine consumption volume would rise 1 percent (52 percent) if the elasticity was 0.5 (4.0), as shown in Table 7(b).

One final caveat. Throughout we have ignored the fact that in recent years the government has provided a rebate of the Wine Equalization Tax to those wineries with annual domestic sales below $1.72 million. That rebate amounted to around $110 million in 2006, the model's base year, and to about twice that in subsequent years because New Zealand wineries have also qualified for the rebate on their sales in the Australian market

(under the Closer Economic Relations agreement between the two countries). Had that rebate been incorporated in the baseline, and were it to be discontinued under a volumetric tax scheme, the benefits estimated above from such a tax change for super premium producers and cool climate regions would be less and may even be negative for smaller premium wineries and their associated growers.

IV. CONCLUSION

As is clear from the caveats in the previous section, the above results are very much dependent on both model parameters and the less-than-perfect data available on wine taxes net of rebates and prices and quantities of the three different types of wines and associated grapes produced in the various wine regions of Australia. For example, the lower the degree of substitutability between different wine types, the less effective would be a switch from ad valorem to volumetric taxing of domestic wine consumption aimed at discouraging binge consumption of non-premium wine; and the higher the WET rebate for smaller growers, the less likely it is that they (and possibly consumers of their super premium wines) would gain from a switch to volumetric wine taxation. Better data would allow better analysis both directly and also through improving the opportunities for econometricians to improve available estimates of crucial parameters such as the elasticity of substitution in consumption.

Meanwhile, the results from the above analysis reveal that both the decline in demand abroad for Australian wine and a prospective change in taxation of domestic wine consumption add non-trivially to the industry's current challenges of disposing of excess stocks of wine that have built up in recent years.

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[1] The Henry Review comes a decade after the introduction in Australia of a 10 percent goods-and-services tax (GST), at which time the excise tax on wine was replaced by not only the GST at the retail level but also a Wine Equalization Tax (WET) at the wholesale level. The WET was so called because, by setting it at 29 percent, it together with the GST generated about the same tax revenue for the government as the former excise tax on wine. For an analysis of the impact of that tax reform of a decade ago on the Australian wine industry, see Wittwer and Anderson (2002).

[2] If the 29 percent ad valorem wholesale tax on wine were to be replaced by the excise tax applying to standard-strength beer (A$0.82 per litre of alcohol), then wines retailing above about A$18 per 750 ml bottle would potentially be cheaper, assuming a retail mark-up margin of one-third the wholesale price.

[3] Even in the ORANIG model some industries are designated as "local". These include Utilities, Construction, Trade, Transport, BankFinIns, OwnerDwellng and PersOthSrv. In these sectors, regional output changes follow changes in regional income, which captures regional multiplier impacts, so output changes will differ across regions for these industries.

[4] By contrast, modifying a multi-region bottom-up model such as the TERM model of the Australian economy (www.monash.edu.au/policy/term.htm) would require more complicated coding and large amounts of detailed regional data.

[5] The data available to split each region's wine output and value added into three quality categories are very limited. Better data are available on the distribution of winegrape prices (see AWBC 2009), but they are only an approximate guide because grapes are often transported after harvest to another region for processing. Anderson et al. (2009) divide the 2008 crush into 3 quality categories by assuming grapes valued at less than A$550 per tonne were non-premium and those above A$1200 were super premium.

Those dividers suggest nearly one-third of the crush volume and one-sixth of the crush value was non-premium that year, while one-sixth of the crush volume and a little over one-third of the crush value was super premium, hence around half was commercial premium winegrapes (Anderson et al. 2009, Tables 20-21). Based on similar regional winegrape price and quantity data for 2006 and information about inter-regional grape movements, we have allocated a distribution across the three wine types for each region. Those guesses imply that, as shown in Appendix Tables 1 and 2, a bit over one-third in value terms is commercial premium and one-half is super premium. Since these are close to the opposite of the winegrape value shares adopted by Anderson et al. (2009), the implicit dividing line used here between the commercial and super premium categories is at a slightly lower quality level.

[6] We use the same criteria as Anderson et al. (2009) in categorizing regions into climate zones, as follows. Hot zone: mean January and February temperatures each above 23^{o}C and Growing Degree Days above 2200; Cool zone: mean January and February temperatures each below 20^{o}C and Growing Degree Days below 1550. The data for those variables by region have been carefully compiled by Webb (2006, pp. 239-240 and Section 2.1).

[7] The extent to which preference independence applies for different types of alcohol may be matter of debate. We could have chosen ostensibly more elaborate demand forms, such as a translog system (Dixon et al. 1992) or CRESH (Hanoch 1971). Each of these forms allows for different pairwise elasticities of substitution, although the restrictions of each system may erode their intuitive appeal. That is, target cross-price elasticities between alcohol types regarded as close substitutes may be confounded by the adding-up conditions of the system.

[8] A key motivation for taxing alcohol, in addition to raising government revenue, is to address negative externalities associated with consumption. Studies assessing externalities by alcohol type, including by Srivastava and Zhao (2008), find that the incidence of binge drinking is highest for consumers of ready-to-drink spirits-based sweet beverages (RTDs) and full-strength beer, and are lowest for bottled wine and light beer. This is the rationale behind our chosen scenarios.

Table 1: Simulation results: effects on Australia's macroeconomy

(percent change)

	Changes to wine export demand: 20 percent decline in super premium and 10 percent rise in commercial premium	Changes to wine export demand: 10 percent decline in super premium wine and 33 percent decline in commercial premium	Switch to volumetric wine tax at the beer rate of A$28/LAL[a]	Switch to volumetric wine tax at the beer rate of A$40.82/LAL[a]
Real household income	-0.006	-0.03	-0.04	-0.05
Real investment	0.001	0.00	-0.00	0.00
Real govt spending	0.000	0.00	0.00	0.00
Export volume	-0.047	-0.27	-0.02	-0.02
Import volume	-0.048	-0.28	-0.01	-0.01
Real GDP	-0.003	-0.01	-0.02	-0.03
Aggregate employment	0.000	0.00	0.00	0.00
Average real wage	0.001	0.01	-0.15	-0.24
Aggregate capital stock	-0.002	-0.01	-0.00	0.00
GDP Price Index	-0.005	-0.03	0.08	0.12
Consumer Price Index	-0.004	-0.02	0.14	0.22
Export Price Index	-0.004	-0.02	0.00	0.01
Real devaluation	0.005	0.03	-0.08	-0.12

Source: Authors' model simulation results

[a] LAL = litres of alcohol. The tax simulations use as their base the resulting data after the export demand shock of a 10 percent decline in super premium wine coupled with a 33 percent decline in commercial premium. That is, they are the additional effects due to just the tax change.

Table 2: Simulation results: effects on regional GDP, all sectors

(percent change)

	Changes to wine export demand: 20 percent decline in super premium and 10 percent rise in commercial premium	Changes to wine export demand: 10 percent decline in super premium wine and 33 percent decline in commercial premium	Switch to volumetric wine tax at the beer rate of A$28/LAL[a]	Switch to volumetric wine tax at the beer rate of A$40.82/LAL[a]
RoNSW	0.01	0.03	-0.013	-0.01
NwcstlNSW	0.02	0.02	-0.007	-0.01
HunterBalNSW	0.02	-0.05	-0.016	-0.03
CentTbleNSW	0.05	-0.03	-0.073	-0.09
OrangeNSW	0.01	0.00	0.010	0.01
STblelndNSW	0.00	-0.05	-0.017	-0.02
LMrmbNSW	0.20	-0.76	-2.601	-2.89
MrryDrlngNSW	0.26	-1.34	-1.086	-1.31
RoVIC	0.00	-0.01	-0.004	0.00
YarraRngVic	-0.11	0.03	0.212	0.23
MorningtnVic	-0.05	0.03	0.113	0.13
WCentrlHLVic	-0.07	-0.53	0.129	0.09
WOvnsMrryVic	-0.10	-0.78	-0.274	-0.36
EOvensMurVic	-0.02	-0.19	-0.064	-0.09
SWGoulbuVic	0.00	-0.05	-0.052	-0.06
WstMalleeVIC	0.04	-0.17	-0.131	-0.15
EMalleeVic	0.04	-0.37	-0.194	-0.24
DrlngDwnsQld	0.00	-0.02	-0.012	-0.02
RoQLD	0.01	0.05	-0.007	-0.01
RoSA	-0.04	-0.26	0.004	0.00
SAdelaideSA	-0.10	-0.11	0.176	0.18
BarossaSA	-0.94	-2.27	1.511	1.47
MtLoftRanSA	-0.19	-0.19	0.316	0.33
FleurieuSA	0.00	-0.66	-0.004	-0.06
LwrNthSA	-0.29	-0.83	0.455	0.43
RiverLndSA	0.54	-2.14	-1.523	-1.89
UpperSESA	-0.09	-0.65	0.091	0.04
LowerSESA	-0.16	-0.19	0.162	0.15
NMetroWA	0.01	0.04	0.002	0.01
RoWA	0.01	0.06	-0.007	-0.01
VasseWA	-0.75	-0.82	1.223	1.27
KingWA	-0.18	-0.44	0.294	0.29
TAS	-0.02	0.04	0.052	0.06
NT/ACT	0.00	0.01	0.001	0.00
TOTAL, Australia	**-0.00**	**-0.01**	**-0.077**	**-0.12**
WINE CLIMATIC ZONES				
Hot	0.2	-1.0	-1.4	-1.7
Warm	-0.2	-0.5	0.3	0.3
Cool	-0.1	-0.1	0.1	0.1

Source: Authors' model simulation results

[a] LAL = litres of alcohol. The tax simulations use as their base the resulting data after the export demand shock of a 10 percent decline in super premium wine coupled with a 33 percent decline in commercial premium. That is, they are the additional effects due to just the tax change.

Table 3: Simulation results: effects on regional volume of wine production
(percent)

	Changes to wine export demand: 20 percent decline in super premium and 10 percent rise in commercial premium	Changes to wine export demand: 10 percent decline in super premium wine and 33 percent decline in commercial premium	Switch to volumetric wine tax at the beer rate of A$28/LAL[a]	Switch to volumetric wine tax at the beer rate of A$40.82/LAL[a]
RoNSW	-1.3	-8.2	-4.2	-6.6
NwcstlNSW	-0.1	-11.0	-1.2	-4.1
HunterBalNSW	-0.1	-11.0	-1.2	-4.1
CentTbleNSW	4.9	-15.3	-11.0	-15.7
OrangeNSW	-1.4	-10.4	2.8	0.3
STblelndNSW	-1.3	-8.2	-4.2	-6.6
LMrmbNSW	1.5	-4.7	-25.0	-28.0
MrryDrlngNSW	3.8	-11.9	-15.6	-19.8
RoVIC	-1.7	-9.3	0.8	-1.5
YarraRngVic	-7.4	-4.5	12.9	12.9
MorningtnVic	-7.6	-4.4	13.5	13.5
WCentrlHLVic	-1.6	-10.3	3.2	0.8
WOvnsMrryVic	-1.3	-8.2	-4.2	-6.6
EOvensMurVic	-1.3	-8.2	-4.2	-6.6
SWGoulbuVic	-1.3	-8.2	-4.2	-6.6
WstMalleeVIC	3.8	-11.9	-15.6	-19.8
EMalleeVic	3.8	-11.9	-15.6	-19.8
DrlngDwnsQld	-1.3	-8.2	-4.2	-6.6
RoQLD	-1.3	-8.2	-4.2	-6.6
RoSA	-1.5	-10.4	3.1	0.6
SAdelaideSA	-5.0	-6.8	8.8	7.8
BarossaSA	-3.8	-8.1	6.7	5.2
MtLoftRanSA	-6.4	-5.5	11.2	10.8
FleurieuSA	0.0	-11.7	0.5	-2.5
LwrNthSA	-3.4	-8.5	6.4	4.7
RiverLndSA	4.4	-13.8	-13.0	-17.5
UpperSESA	-1.6	-9.9	1.9	-0.5
LowerSESA	-5.5	-6.4	9.6	8.7
NMetroWA	-1.5	-10.4	3.1	0.6
RoWA	-1.3	-8.2	-4.2	-6.6
VasseWA	-6.3	-5.7	11.2	10.6
KingWA	-3.8	-8.1	7.1	5.6
TAS	-8.2	-3.8	14.6	14.8
NT/ACT	-1.2	-8.2	-4.2	-6.6
TOTAL, Australia	**-1.6**	**-8.4**	**0.2**	**-1.9**
WINE CLIMATIC ZONES				
Hot	1.9	-9.0	-18.8	-18.9
Warm	-2.5	-8.5	0.5	0.4
Cool	-5.7	-6.1	8.9	8.9

Source: Authors' model simulation results

[a] LAL = litres of alcohol. The tax simulations use as their base the resulting data after the export demand shock of a 10 percent decline in super premium wine coupled with a 33 percent decline in commercial premium. That is, they are the additional effects due to just the tax change.

Table 4: Simulation results: effects on volume of Australia's grape and wine production

(percent)

	Changes to wine export demand: 20 percent decline in super premium and 10 percent rise in commercial premium	Changes to wine export demand: 10 percent decline in super premium wine and 33 percent decline in commercial premium	Switch to volumetric wine tax at the beer rate of A$28/LAL[a]	Switch to volumetric wine tax at the beer rate of A$40.82/LAL[a]
Grapes	**-0.5**	**-4.6**	**0.2**	**-0.2**
Wine:				
non-premium	0.0	0.1	-31.0	*-33.2*
commercial premium	5.5	-17.3	-8.3	*-13.4*
super premium	-8.3	-3.7	14.7	*15.0*
TOTAL Wine	**-1.6**	**-8.4**	**0.2**	***-1.9***

Source: Authors' model simulation results

[a] LAL = litres of alcohol. The tax simulations use as their base the resulting data after the export demand shock of a 10 percent decline in super premium wine coupled with a 33 percent decline in commercial premium. That is, they are the additional effects due to just the tax change.

Table 5: Effects of wine tax changes on the volume and price of household consumption of wine in Australia

(percent)

	Switch to volumetric wine tax at the beer rate of A$28/LAL[a]		Switch to volumetric wine tax at the beer rate of A$40.8/LAL[a]	
	volume	price	volume	price
Non-Premium	-60	73	-65	92
Commercial-Premium	-21	22	-26	33
Super-Premium	25	-3	26	2
Total Wine	-34	44	-38	58

Source: Authors' model simulation results

[a] LAL = litres of alcohol. The tax simulations use as their base the resulting data after the export demand shock of a 10 percent decline in super premium wine coupled with a 33 percent decline in commercial premium. That is, they are the additional effects due to just the tax change.

Table 6: Sensitivity analysis of effects on alcohol tax revenue of a switch to a volumetric wine tax at the beer rate

(A$million)

(a) volumetric wine tax at the light beer rate of A$28/LAL[a]

	Wine CES = 0.5	Wine CES = 2.0 [default value]	Wine CES = 4.0
Beer	-1	-1	-1
Spirits	-1	-1	-1
Wine	787	537	314
Total tax	**785**	**535**	**312**

(b) volumetric wine tax at the standard beer rate of A$40.82/LAL[a]

	Wine CES = 0.5	Wine CES = 2.0 [default value]	Wine CES = 4.0
Beer	-1	-1	-1
Spirits	-2	-2	-1
Wine	1233	912	637
Total tax	**1230**	**909**	**635**

Source: Authors' model simulation results

[a] Showing sensitivity to change in the elasticity of substitution in consumption between wine types from the default value of 2.0. LAL = litres of alcohol.

Table 7: Sensitivity analysis of effects on the volumes of sectoral outputs and domestic wine consumption from a switch to a volumetric wine tax at the beer rate of $40.82/LAL[a]

(percent)

(a) Sectoral output volume

	Wine CES = 0.5	Wine CES = 2.0 [default value]	Wine CES = 4.0
RTDs	-0.15	-0.08	-0.03
Beer premium	-0.05	-0.05	-0.04
Beer non-Premium	-0.05	-0.05	-0.05
Spirits	-0.20	-0.18	-0.18
Grapes	-1.2	-0.16	0.45
Wine non-premium	-13.66	-33.2	-45.11
Wine comm premium	-4.79	-13.4	-20.46
Wine super premium	0.65	15.0	28.40
Total Wine	**-3.22**	**-1.9**	**0.55**

(b) Volume of domestic wine consumption

	Wine CES = 0.5	Wine CES = 2.0 [default value]	Wine CES = 4.0
Non-Premium	-27	-65	-88
Commercial-Premium	-12	-26	-48
Super-Premium	1	26	52
Total Wine	**-7.2**	**-4.0**	**-1.5**

Source: Authors' model simulation results

[a] Showing sensitivity to change in the elasticity of substitution in consumption between wine types from the default value of 2.0. LAL = litres of alcohol.

Appendix Table 1: Value added by grapes and wine sub-sectors, by region, Australia, 2005-06

(A$million)

	Grapes	Non-premium wine	Commercial premium wine	Super premium wine	Climate zone
RoNSW	17	24	58	75	Warm
NwcstlNSW	5	0	25	33	Warm
HunterBalNSW	5	0	11	14	Warm
CentTbleNSW	2	0	4	5	Warm
OrangeNSW	1	0	2	2	Warm
STblelndNSW	2	1	2	3	Warm
LMrmbNSW	16	36	42	5	Hot
MrryDrlngNSW	11	5	5	1	Hot
RoVIC	63	0	125	162	Warm
YarraRngVic	7	0	11	27	Cool
MorningtnVic	3	0	8	10	Cool
WCentrlHLVic	2	0	7	9	Cool
WOvnsMrryVic	6	7	16	21	Warm
EOvensMurVic	1	1	2	3	Cool
SWGoulbuVic	2	1	3	4	Warm
WstMalleeVIC	3	1	1	0	Hot
EMalleeVic	20	3	4	1	Hot
DrlngDwnsQld	2	2	4	6	Warm
RoQLD	7	10	24	32	Hot
RoSA	10	13	32	41	Warm
SAdelaideSA	23	0	76	98	Warm
BarossaSA	25	0	60	156	Warm
MtLoftRanSA	6	0	6	16	Cool
FleurieuSA	10	0	9	11	Warm
LwrNthSA	11	1	10	26	Warm
RiverLndSA	38	30	35	5	Hot
UpperSESA	9	0	14	18	Warm
LowerSESA	7	0	14	18	Cool
NMetroWA	1	2	6	7	Hot
RoWA	16	13	31	40	Warm
VasseWA	14	0	23	60	Warm
KingWA	6	0	9	24	Warm
TAS	7	0	14	18	Cool
NT/ACT	1	1	3	4	Warm
TOTAL, Australia	**357**	**124**	**686**	**965**	
WINE CLIMATIC ZONES					
Hot	95	85	111	44	
Warm	229	65	519	805	
Cool	35	1	66	106	

Source: Database of the ORANIG06-WINE model

Appendix Table 2: Shares of non-premium, commercial premium and super premium wine in the gross value of Australian wine production, by region, 2005-06 (percent)

	Non-premium (%)	Commercial premium (%)	Super premium (%)	Climate zone
RoNSW	20	39	41	Warm
NwcstlNSW	6	56	38	Warm
HunterBalNSW	6	56	38	Warm
CentTbleNSW	11	89	0	Warm
OrangeNSW	1	50	49	Warm
STblelndNSW	20	39	41	Warm
LMrmbNSW	72	28	0	Hot
MrryDrlngNSW	31	69	0	Hot
RoVIC	8	43	49	Warm
YarraRngVic	1	6	93	Cool
MorningtnVic	0	5	95	Cool
WCentrlHLVic	0	49	51	Cool
WOvnsMrryVic	20	39	41	Warm
EOvensMurVic	20	39	41	Cool
SWGoulbuVic	20	39	41	Warm
WstMalleeVIC	31	69	0	Hot
EMalleeVic	31	69	0	Hot
DrlngDwnsQld	20	39	41	Warm
RoQLD	20	39	41	Hot
RoSA	0	49	51	Warm
SAdelaideSA	1	23	76	Warm
BarossaSA	1	33	67	Warm
MtLoftRanSA	1	13	86	Cool
FleurieuSA	1	60	40	Warm
LwrNthSA	0	35	65	Warm
RiverLndSA	20	80	0	Hot
UpperSESA	4	47	50	Warm
LowerSESA	1	20	79	Cool
NMetroWA	0	65	35	Hot
RoWA	0	65	35	Warm
VasseWA	0	15	85	Warm
KingWA	0	32	68	Warm
TAS	0	1	99	Cool
NT/ACT	20	39	41	Warm
TOTAL, Australia	**12**	**37**	**51**	
WINE CLIMATIC ZONES				
Hot	40	50	10	
Warm	7	38	55	
Cool	2	18	81	

Source: Anderson et al. (2009) and database of the ORANIG06-WINE model

Appendix Table 3: Cost structure of wine production in Australia, 2005-06

(percent)

	Labour	Capital	Grapes	Inter-mediate inputs, land, and other costs	Total
Non-Premium	6	19	6	69	100
Commercial-Premium	9	22	15	54	100
Super-Premium	12	26	13	49	100
TOTAL Wine	**10**	**24**	**13**	**53**	**100**

Source: Database of the ORANIG06-WINE model

Appendix Table 4: Alcohol tax revenue, Australia, 2005-06

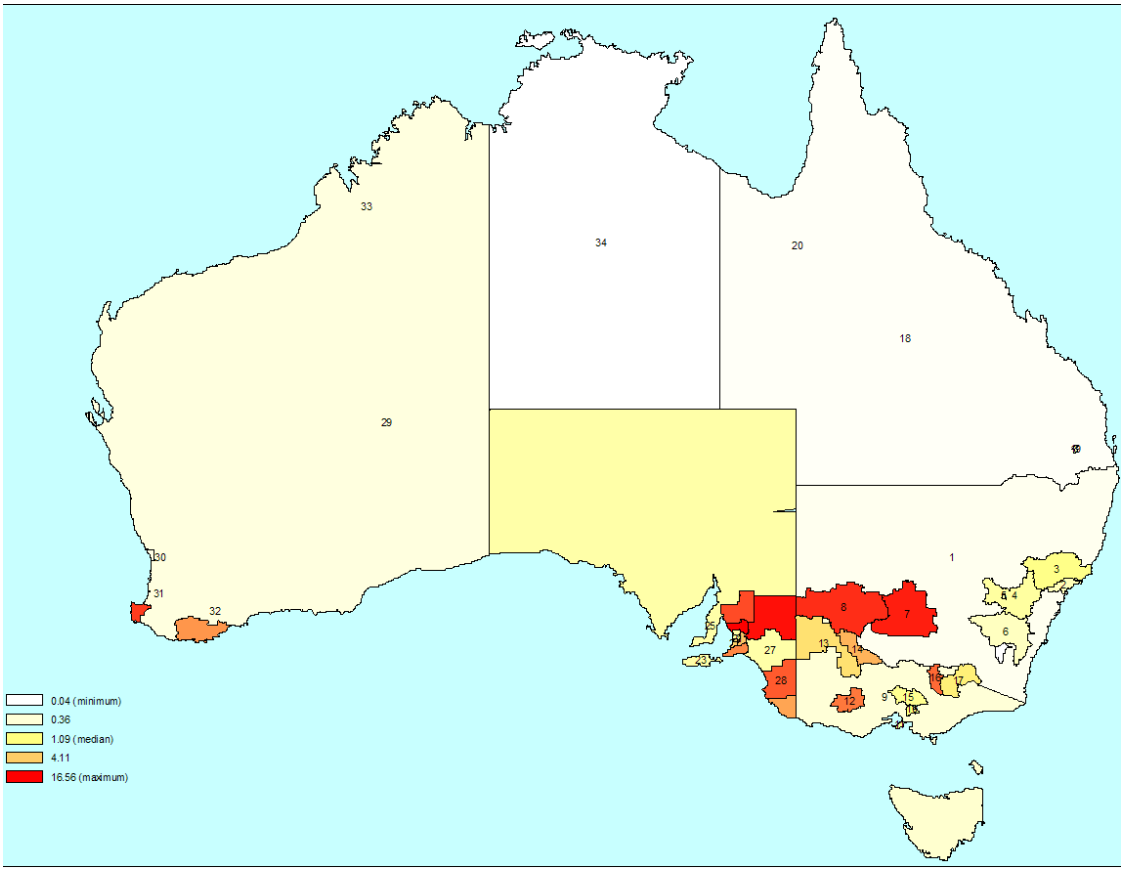
(A$million)

Beer	1966
Spirits and Ready To Drinks	1775
Wine	893[a]
Total alcohol taxes	4634[a]

Source: Database of the ORANIG06-WINE model

[a] This does not exclude what was repaid to small wineries as a rebate.

Appendix Figure 1: Grape and wine value-added as a share of regional GDP (%), 2005-06



Source: Database of the ORANIG06-WINE model