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US Dollar Appreciation and the Spread of Pierce's Disease: Effects on the World Wine Market

Glyn Wittwer and Kym Anderson

School of Economics and
Centre for International Economic Studies
Adelaide University SA 5005 AUSTRALIA

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Adelaide University

SA 5005, AUSTRALIA

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Glyn Wittwer and Kym Anderson

The one thing that is certain about the wine market is that there will always be great uncertainty about the future. Apart from weather affecting the vintage, there are the vagaries of international markets that are becoming ever-more important to Australian producers with the inexorable rise in the share of their production that is exported. To help reduce that uncertainty about export markets, a group at Adelaide University's Centre for International Economic Studies has built an economic model of the world's wine markets. The present article, together with one to follow in the next issue of this *Journal*, illustrate its usefulness by examining what happens when those markets are shocked. Two shocks are considered here: one recent (US dollar appreciation), the other prospective (a hypothetical spread of Pierce's Disease to the Napa Valley in California).

In both cases the model results generated are in some senses counter-intuitive. One might expect both events to favour Australian wine producers at the expense of US producers. It turns out, however, that there are several indirect effects that can more or less than offset the more obvious direct effects. Explaining why the model produces such outcomes helps to understand the intricacies of the forces at work in a global market that is becoming steadily more integrated.

The paper is structured as follows. It begins with a description of our world wine model, which is used to project the global market for both premium and non-premium wine from 1999 to 2005 assuming no shocks other than the coming into full production of recent vineyard plantings in Australia and elsewhere.[1] That base case projection is then compared with situations where (a) the US dollar strengthens relative to its 1999 level, and (b) Pierce's Disease spreads from southern to northern California to the extent that US premium winegrape output falls by one-tenth. Some qualifications and areas for further modelling analysis are

[1] For details, see Wittwer, Berger and Anderson (2001).

discussed in the concluding section.

The Model of World Wine Markets

The model includes six intermediate inputs (chemicals, water, premium grapes, multipurpose grapes, non-premium wine, and other) and five outputs (premium winegrapes, multipurpose grapes, premium wine, non-premium wine and non-beverage wine products). In its present form the model divides the world into ten regions (to be further disaggregated later this year): Western European wine Exporters (WEE), United Kingdom (UK), Germany (GER), Other Western Europe (OWE), Central & Eastern Europe (CEE), United States & Canada (USC), Australia (AUS), New Zealand (NZ), Other Southern Hemisphere wine Exporters (OSE), and the Rest of the World (ROW).

Given the importance of distinguishing between the expanding premium and shrinking non-premium segments of the world wine market, a crucial part of database preparation was to estimate this split (details are in the Appendix). The resulting 1999 data were used as the base from which projects forward the world wine market to 2005 using the model (see below).

On the demand side, each region's supply is differentiated from the wine of each other region, so no region's domestically produced wine product is a perfect substitute for wine imported from other regions. For example, if the price of French wine on the world market falls sharply, this will induce only a partial switch by Australia consumers towards consumption of French wine since they are imperfect substitutes.

On the supply side, the model assumes that most factors used in grape and wine production are fixed. This is reasonable for the medium term, given the large fixed costs and partly irreversible nature of vineyard and winery investments. Labour is a mobile factor within each region but human capital is fixed, and all factors are assumed to be immobile internationally. Since there is only a limited degree of mobility in the version of the model used here, this implies that in response to external shocks, most comparative static adjustments are through price (including changes in factor rewards) rather than output changes. For modelling in the longer term, we can alter these assumptions to allow more intersectoral and international mobility of productive factors.

Effects of a real appreciation of the US dollar

To capture the effects of a real appreciation of the US dollar, a negative shock is imposed on real overall expenditure in regions other than the one involving the United States (USC), which is hit with a positive shock. The rationale for this treatment of a real appreciation is that we expect it to result in a larger US trade deficit than otherwise. This in turn implies that for a given level of output in the United States, aggregate US consumption increases with its dollar's appreciation (we assume, for illustrative purposes, by 4 per cent) while consumption elsewhere decreases (we assume by 2 per cent, which means that aggregate global expenditure remains roughly constant).

The first point to note is that the percentage change in the US consumer price of imported wine arising from a real currency appreciation will be much smaller than the percentage US dollar appreciation. This is because taxes, wholesale and retail margins and any on-premise markup will be in US dollars -- and the unit value of wine at producer prices is less than half its retail unit value.

A real appreciation raises prices of non-traded goods and services relative to prices of internationally traded products. One might expect this to penalise US wine producers through a loss of competitiveness relative to importers. Certainly our results do suggest US exports of premium wine decrease and imports replace some domestic-sourced wine. But a real appreciation increases domestic spending for a given level of income. This has a positive effect on the US demand for not only imported but also domestic wine. More than that, the positive domestic spending effect on domestically produced wine is large enough to outweigh the loss of international competitiveness for the US wine industry, according to our model results reported in the first parts of Tables 1 to 4.

In US dollar terms, producer prices in USC rise, while those elsewhere fall (Table 1). But given that in each region many inputs are locally sourced and therefore denominated in local currency units, a sustained US appreciation could benefit producers in other regions too. That is, their returns could rise in local currency units even if they fall in US dollar units.

The bilateral trade matrix in Table 2 reveals that USC imports of wine increase (by 16 per cent), while USC exports decrease (by 22 per cent). For other wine exporters, their export volumes rise slightly but there is a diversion in their exports of premium wine from Western

Europe to North America.

Table 3 shows a decomposition of output. This is based on the market-clearing assumption of the model that total output equals total sales. Given this, we can attribute output to a decomposition of different types of sales, namely, sales in the local market, import replacement and export sales. In Australia, New Zealand and the regions of Western Europe, the negative effect on local wine sales of their devaluation against the US dollar (because of the negative spending effect of lower real incomes) slightly outweighs export growth in our model results, causing output to decline slightly.

If Australian exporters take advantage of the strong US currency to promote sales in USC, this could have a greater effect on wine sales than indicated in the small changes recorded in Tables 2 and 3. Shifting preferences arising from successful promotion can have a significant effect on returns to producers. To the extent promotion resulting in an established presence in a particular market is irreversible, consumers in USC may continue to purchase imported wine following any future reversal of the US dollar appreciation. For this reason, the benefits from exporting more to the US market following a US dollar appreciation may be somewhat greater than we have modeled; but the opposite effects from a subsequent devaluation may be more muted.

A further qualification on the outcome we have modeled concerns globalization of the wine industry. Multinational wine companies will adjust global investments in response to changes in cost relativities, as may arise from a strengthening US dollar, so as to maximise net returns. In the above scenario, we have assumed a short- to medium-term time horizon in which primary factors in each industry (vineyards, winery equipment) are fixed. By relaxing that assumption to allow investments to be diverted in response to differences in cost relativities, both between wine and other industries within countries, and between countries, the modeled outcomes of a real appreciation of the US dollar would alter somewhat from that presented above. In particular, a sustained US dollar appreciation might lead to an increase in the amount of investment by Australian wine companies in the US industry, for example, thereby increasing US output at the expense of Australian output.

Effects of a hypothetical spread of Pierce's Disease in California

The Californian wine industry has coped with Pierce's Disease for over a century, with severe

losses being confined to the Los Angeles basin in the 1880s, the 1930s and the 1940s (WIC 2000). The latest outbreak, which again had been confined initially to Southern California, is however more ominous. This is because it is spread by a new vector (the glassy winged sharpshooter) that is far more mobile than its predecessor (see, for example, Scott and De Barro 2000; Smart 2000). The government and industry have responded by allocating around $40 million for disease management research in response to the current outbreak, but that may be too late to halt its spread to the Napa and Sonoma counties where most of the premium grapes are grown in the US.

To simulate a possible spread north, we examine the impact in 2005 of an illustrative 10 per cent reduction in USC premium grape output and a loss of 10 per cent in premium wine processing total factor productivity, as compared with base case. One effect is to raise producer prices for grapes in the USC region by about one sixth. Because of the large share of USC in global wine output (about one-tenth), prices for premium wine rise elsewhere too, but by much lesser percentages than in the US because they are imperfect substitutes for US wine, especially in the US market (lower half of Table 1). Notice that even though winegrapes are not traded between countries, there is sufficient substitution of imported wine for domestically produced wine in USC for producer prices for grapes elsewhere in the world to rise as well. Exports of wine from all non-USC regions expand, while USC's wine exports fall and its imports rise (right-hand side of Table 2). The outbreak of Pierce's Disease has a negative effect on wine consumers globally, through rising wine prices. Consequently, the local market downturn in sales depresses output in each region, while the export contribution is positive in all regions other than USC (see lower half of Table 3).

The loss to consumers from Pierce's Disease is also evident in Table 4. One surprising result is that grape producers in USC experience an overall income gain despite the output loss. This is because of the sharp price increases. The model estimates that the aggregate global loss from such a shock would exceed $220 million per year and that the US loss alone would be about $190 million -- many times the recently announced increase in investment in research on the disease. The estimated net gain to Southern Hemisphere wine-exporting countries (where producers gain more than consumers lose) could of course quickly turn to a net loss if Pierce's Disease were to spread from the US to their vineyards.

These results depend partly on our choice of economic behavioural parameters within our model, and on the assumption that processing capacity in the wine industry does not change.

If, for example, we were to assume that fixed factors in wineries were to decline by the same proportion as winegrape output, projected returns to fixed factors in grape production in USC would be lower while returns to wineries would be higher. As with the US dollar appreciation scenario, altering the assumptions about the fixity of primary resource allocation within and between countries would alter the above distribution of gains and losses from an outbreak of Pierce's Disease.

Another long-run issue has to do with the continuity of investments in the US industry in both winegrapes and wine processing. That will depend on whether Pierce's Disease is brought under control without excessive costs. In the circumstance that the disease does have a severe effect on Californian winegrape productivity but is confined to the US, wine companies would receive a clear signal to invest in vineyards and processing capacity in other nations. Ultimately, this would diminish the impact of the disease on consumers worldwide. To see by how much, wesimulated a five per cent reduction in capital in US premium wine processing in response to the disease, and a corresponding increase in capital among other New World processors (in addition to the medium-term Pierce's disease scenario). The impact of the disease in this longer-term setting is to diminish USC producer price for premium winegrapes by 13 per cent, and to increase such prices in other New World regions. Australia's premium winegrape producer price in this case rises by 22 per cent, instead of just 4 per cent as reported in Table 1. Growers globally still experience an increase in returns, but more of the increase now goes offshore rather than being concentrated among those US growers unaffected by the disease. Consumers would still lose but by less as a result of the reallocation.

Another possibility we could explore with further modeling is what would happen if the disease were to spread to other continents. The costs of producing wine and hence its price would rise globally with diminishing productivity and the rising costs of combating the disease.

Conclusions

The above results are of course not predictions, but simply projections of what is possible under certain assumptions. Both the underlying data and the parameters used in the world wine model need refinement as better data and estimates become available. Even in its present form, though, the model is useful, for example in pointing to indirect effects of shocks that are

often not taken into account when less formal methods of analysis are used.

In the first scenario, if as assumed a real appreciation of the US dollar against other currencies increases aggregate consumption in USC and reduces it elsewhere, our results suggest this is not unequivocally good news for wine producers in other regions and bad news for those in USC. On the contrary, US producers may gain through a positive expenditure effect in the US. Whether the impact on producers elsewhere is positive depends on their degree of export orientation: the higher it is, the more likely sales growth to USC will outweigh the negative impact on local sales of domestic wine because of lowered real incomes. In the case of Australia and New Zealand, our results suggest the loss of local sales could slightly exceed the gain in export sales (top half of Table 3).

In the second scenario, the harm to US producers from a spread of Pierce's Disease in California would be offset somewhat by a larger rise in producer prices in USC than elsewhere (because of the assumption of imperfect substitution in consumption between domestic and foreign wine). Wine imports do dampen the increase in USC prices while raising prices elsewhere, but only to a modest extent. Hence those US grapegrowers still able to produce some grapes get a lager price per tonne, which would contribute towards the cost of replacing vineyards destroyed by the disease.

Needless to say there are many other scenarios that might be run with this model. In the next issue of the *Journal* we look at a couple more: the effects that higher barriers to premium wine imports by the European Union could have, and the way in which the benefits of productivity growth in wine retailing could spread through the supply chain.

Table 1: Producer price change from shocks
(% change from base year 2005, in 1999 constant US dollars)

1. Real $US appreciation	**AUS**	**WEE**	**GER**	**OWE**	**CEE**	**USC**	**OSE**	**NZ**	**ROW**	**World**
Premium grape	-0.5	-1.8	-1.9	-1.7	-2.4	1.1	-0.6	-0.9	0.3	-1.0
Multipurpose grapes	-2.6	-2.7	-1.8	-3.0	-1.9	0.8	-3.5	-2.3	-3.5	-2.6
Premium wine	-0.6	-1.1	-1.1	-1.1	-1.8	1.0	-0.8	-0.9	-1.2	-0.3
Nonpremium wine	-1.6	-1.6	-1.5	-1.7	-1.8	0.1	-1.6	-1.8	-1.9	-1.3
2. Pierce's Disease in the US										
Premium grape	4.0	6.1	6.0	5.6	1.8	15.8	5.4	4.1	4.8	7.6
Multipurpose grapes	5.4	2.1	2.2	1.9	1.1	18.3	1.9	0.5	2.3	4.3
Premium wine	4.1	3.5	3.4	3.4	1.2	8.4	3.9	4.0	3.5	4.6
Nonpremium wine	3.3	3.0	3.1	2.9	2.3	6.5	3.0	3.3	2.7	3.5

Source: Authors' model results.

Table 2: Change in bilateral premium wine trade volumes between major exporters and importers from shocks
(% change from base year 2005)

1. Real $US appreciation						*2. Pierce's Disease in US*				
Sales to:	**UK**	**GER**	**WEN**	**USC**	**Total exports**	**UK**	GER	**WEN**	**USC**	**Total exports**
From:										
AUS	-4	-7	-6	12	**1**	-2	-6	-4	10	**2**
WEE	3	-1	1	19	**4**	4	0	3	16	**5**
GER	3	-2	1	19	**4**	5	-1	4	17	**6**
USC	-22	-23	-23	3	**-22**	-33	-33	-33	-8	**-32**
OSE	-1	-5	-3	15	**2**	-1	-3	-1	13	**4**
NZ	0	-4	-2	16	**1**	1	-3	-1	12	**2**
WORLD	**-2**	**-2**	**-3**	**16**	**-1**	**-1**	**-2**	**-2**	**14**	**0**

Source: Authors' model results.

Table 3: Decomposition of change in volume of premium wine output from shocks
(% change from base year 2005)

1. Real $US appreciation	**AUS**	**WEE**	**GER**	**OWE**	**CEE**	**USC**	**OSE**	**NZ**	**ROW**	**World**
Local Market Growth	-0.6	-1.2	-1.3	-1.5	-1.6	3.7	-0.8	-0.7	-1.8	-1.8
Import Substitution	0.0	0.0	0.3	0.9	0.2	-1.9	0.0	0.0	2.1	2.1
Export	0.6	0.9	0.7	0.3	0.1	-1.5	0.8	0.5	0.1	0.1
Total	-0.1	-0.2	-0.3	-0.3	-1.3	0.3	-0.1	-0.2	0.5	0.5
2. Pierce's Disease in the US										
Local Market Growth	-0.5	-0.9	-0.9	-1.1	-0.3	-2.7	-0.6	-0.6	-1.3	-1.3
Import Substitution	-0.1	0.0	0.2	1.1	0.6	-4.6	0.0	-0.1	3.0	-1.0
Export	1.2	1.7	1.7	1.0	0.4	-2.7	2.1	1.4	0.2	0.5
Total	0.6	0.8	1.0	1.1	0.7	-10.0	1.5	0.7	1.8	-1.8

Source: Authors' model results.

Table 4: Distribution of returns arising from shocks
(change from base year 2005, constant 1999 US million dollars)

3. Real $US appreciation	**AUS**	**WEE**	**UK**	**GER**	**OWE**	**CEE**	**USC**	**OSE**	**NZ**	**ROW**	**World**
Grape growers	-9	-226	-1	-12	-24	-107	79	-149	0	-1035	**-1484**
Winemakers	-17	-125	-1	-14	-19	-29	56	-26	-2	-7	**-184**
Consumers	-4030	-27126	-9201	-10471	-13366	-9796	131470	-8847	-668	-46311	**1654**
Total	**-4056**	**-27477**	**-9203**	**-10497**	**-13409**	**-9932**	**131605**	**-9022**	**-670**	**-47353**	**-14**
4. Pierce's Disease in the US											
Grape growers	37	428	2	36	33	64	1063	114	2	674	**2453**
Winemakers	95	333	1	39	44	32	-54	99	6	19	**614**
Consumers	-82	-695	-182	-219	-324	-113	-1198	-143	-7	-326	**-3289**
Total	**50**	**66**	**-179**	**-144**	**-247**	**-17**	**-189**	**70**	**1**	**367**	**-222**

Source: Authors' model results.

Appendix: Constructing the 1999 database for the world wine model

Production, consumption and trade data

The starting points for constructing a global database are the historical statistics compiled by Berger, Anderson and Stringer (1998) and Berger, Spahni and Anderson (1999) that are based on FAO, OIV and (for trade data) UN sources. These relate to wine as a single commodity for years up to 1997. The challenge was to disaggregate those available data into premium and non-premium segments and to update them to 1999. Necessarily this task involves not only official statistics but also judgments by informed industry participants and observers. The resulting database for 1999 is considered to be representative of markets in that year, but is still subject to revision as new information comes to light, with 23 per cent of the value and 60 per cent of the volume of world wine production in the non-premium category in 1999 (similar to the Rabobank estimates in Geene et al. 1999).

Disaggregated data for the Australian region were drawn from two official agencies (ABS 1999, 2000 and AWEC 2000) and from a recent thesis by Wittwer (2000). ABS data for Australia distinguish between premium and non-premium wines by container, with premium wines referring to those distributed in bottles of 1.5 litres of less. We have amended this slightly so that two-litre casks also are categorised as premium wine. Among the other Southern Hemisphere exporters, there are sufficient New Zealand industry data to estimate disaggregated production and sales, with non-premium production now being a small proportion of the total (WINZ 2000). South African data indicate that a larger proportion of production is of non-premium quality than in other New World regions (SAWIS 2000). Estimates of the split between premium and non-premium production for the remaining Southern Hemisphere exporters are based on Jenster, Jenster and Watchurst (1993), but updated to reflect an increasing proportion of premium wine in total production in the New World.

The industry in a number of European nations is classified by quality, but such classifications vary from country to country. The publication by Onivins (1998) provides some indicators of the quality split of consumption and production in France. Geene et al. (1999, Figure 2.10) provides a split between premium and other table wine for EU-12 consumption based on European Commission data. The premium proportion has been adjusted downwards in our database because, according to Geene et al., this category may include some wine

inappropriately classified as premium.

Aggregate per capita wine consumption is much lower in North America than in Western Europe, but the premium proportion of the total is higher. Data in WIC (2000) indicate that until 1999, the volume of North American exports exceeded that of Australia. But the unit value and total value were substantially lower. US producers, particularly premium suppliers, have been able to rely mostly on an ever-growing domestic market for increased sales, in contrast to Southern Hemisphere producers.

The 1999 data used for Central and Eastern Europe, as for the Rest of the World, are based on the authors' best guesses of trends in the latter 1990s based on available OIV and FAO statistics.

Price data

Some indicative winegrape price data are readily available for Australia (PISA 1996; PGIBSA 2000), South Africa (SAWIS 2000), the United States (WIC 2000) and New Zealand (WINZ 2000). We assume that winegrapes account for approximately 25 per cent of the costs of wine production (based on discussions with Winemakers' Federation of Australia). Otherwise, prices are based to a considerable extent on UN unit value trade data, as in Berger (2000). Onivins (1998) and Geene et al. (1999) also provide some guidance in estimating producer prices for winegrapes and wine.

Tax data

A careful compilation of wine consumer and import tax rates in all the key wine countries has been prepared by Berger and Anderson (1999). Our task was simply to update that set of tables using the same sources. An important feature of the tax data base is that ad valorem and volumetric tax rates are separately included, since changes in the latter (and hence a switch from one form to the other) affect the premium and non-premium markets to different extents.

Transport and retail margins

We assume that transport costs for domestic wine sales are equal to 15 per cent of the producer price for premium wine and (reflecting its lower unit value) 20 per cent for non-premium wine. The corresponding transport costs assumed for imported wine are 25 per cent for premium and 30 per cent for non-premium wine. Based on discussions with the

Winemakers' Federation of Australia, retail margins at liquor stores are assumed to be 33 per cent of the tax-inclusive wholesale price for premium wine and 25 per cent for non-premium wine. But since approximately one-fifth of wine consumption is on licensed premises with mark ups typically exceeding 100 per cent, the overall retail margins are assumed to be 46 per cent for premium and 40 per cent for non-premium wine.

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1. **Anderson, Kym and Robert Osmond**, "How Long Will Australia's Wine Boom Last? Lessons From History" August 1998. (Since published in *The Australian Grapegrower and Winemaker* 417: 15-18, September 1998.)

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