Evolving varietal and quality distinctiveness of Australia's wine regions

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Abstract

In an ever-more-competitive global market, vignerons compete for the attention of consumers by trying to differentiate their product while also responding to technological advances, climate changes and evolving demand patterns. In doing so, they increasingly highlight their regional and varietal distinctiveness. This paper examines the extent to which the mix of winegrape varieties in Australia differs from the rest of the world and differs across wine regions within the country, and how that picture has altered over the first decade of this century. It reports varietal intensity indexes for different regions, indexes of similarity of varietal mix between regions and over time, and quality indexes across regions and varieties within Australia. The study is based mainly on a new global database of vine bearing areas circa 2000 and 2010, supplemented by a more-detailed database for Australia. It reveals that the varietal distinctiveness of Australia vis-à-vis the rest of the world, and varietal differentation between regions within the country, are far less than for other countries – a pattern that has become even more pronounced since 2000. It concludes that there is much scope for Australia's winegrape plantings to become more diversified as producers respond to market and climate changes.

Keywords: terroir, varietal intensity index, varietal similarity index, regional quality index

JEL codes: D24, L66, Q13

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I. Introduction

Australia's vignerons have faced a multitude of challenges over the past decade. At the same time the globalization of the world's wine markets has encouraged wine consumers to seek new types of wines, and has generated many new wine consumers. Attracting and retaining consumer attention requires producers to be forever looking for new ways to differentiate their product. Traditionally the Old World has emphasized regional differences and has restricted both the range of varieties grown in each region and the use of varietal labelling on bottles. In Australia and other New World countries, by contrast, differentiation had been mainly through varietal labeling, although gradually more emphasis is being given also to regional and even single-vineyard labelling.

In addition to striving to differentiate their product, producers are also well aware of the impact climate changes (higher temperatures, more extreme weather events) are having on their winegrapes (Jones, Reid and Vilks 2012, Moriondo et al. 2013). Adaptation strategies include switching to warmer-climate or more-resilient grape varieties, and sourcing more from regions with a higher latitude or altitude to retain the firm's current mix of grape varieties. Especially in regions and sites whose varietal comparative advantages are still unclear, winegrowers are continually searching for attractive alternative varieties that do well in climates similar to what they expect theirs to become in the future.

These marketing and climate adaptation needs are generating a rapidly growing demand for information on what winegrape varieties are grown where and how those patterns are changing over time. Certainly there are great books available on both the varieties and wine regions of major supplying countries, including the latest seminal ones by Robinson, Harding and Vouillamoz (2012) and Johnson and Robinson (2013). Yet none of those resources provides enough empirical information to get a clear view of the

relative importance of the various regions and their winegrape varieties in the global vineyard.

To respond to the need for more-comprehensive empirical information, a global database for 2000 and 2010 has recently been compiled (Anderson and Aryal 2013). The 2010 database includes more than 600 regions in 44 countries, thereby covering 99 percent of global wine production; and it includes more than 2,000 varieties, of which almost 1,300 are 'primes' and the rest are their synonyms (according to Robinson, Harding and Vouillamoz 2012). To make the data more digestible, various summary charts and tables have been published in a 700-page volume (Anderson 2013).

This paper draws on that newly compiled global database plus additional new Australian data to generate several indicators that capture changes over the first decade of this century in the varietal mix in Australia and its wine regions vis-a-vis the rest of the world. It builds on an earlier study of more-limited data for 2000 by Anderson (2010) in several ways: it has global data for 2010 as well as 2000 plus new Australian data for 2013; it includes more than 30 additional countries in the global set; it is far more detailed in terms of having three times as many regions and five times as many varieties, thereby capturing more of the diversity of the world's vineyards; and it has removed spurious differences in varietal mixes resulting from different varietal names being used in different regions for what have been shown recently to be DNA-identical varieties (thanks to the painstaking scientific work that led to the 2012 book by Robinson, Harding and Vouillamoz).

The paper is structured as follow. Section II defines several indicators that are useful for analyzing the varietal and quality distinctiveness of wine regions/countries. Section III describes the global and Australian databases to be analyzed. A set of empirical pictures of the changing varietal distinctiveness of Australia's wine regions is presented in Section IV, both for the decade to 2010 and more recently in the case of emerging varieties. Section V then analyzes regional and varietal quality differences within Australia, as reflected in winegrape prices paid by wineries. The final section discusses possible extensions of the analysis and implications for grapegrowers and wineries.

III. Indicators of Varietal and Quality Distinctiveness

To assist in digesting large databases, it is helpful to summarize these types of data through calculating various indexes. In addition to regional and varietal shares, we define here a varietal intensity index and a varietal similarity index. We also define a regional quality index and a varietal quality index, using winegrape price as a proxy for quality.

A. Varietal Intensity Index (VII)

A Varietal Intensity Index is defined as a variety's share of a region's winegrape area divided by that variety's share of the global winegrape bearing area. The Varietal Intensity Index is thus a complement to share information in that it indicates the importance of a variety in a region not relative to other varieties in that region but rather relative to that variety in the world.

Specifically, define f_{im} as the proportion of bearing area of grape variety m in the total winegrape bearing area in region or country i such that the proportions fall between zero and one and sum to one (i.e., there is a total of M different grape varieties across the world, and $0 \leq f_{im} \leq 1$ and $\Sigma_m f_{im} = 1$). For the world as a whole, f_m is the bearing area of grape variety m as a proportion of the total global winegrape area, and $0 \leq f_m \leq 1$ and $\Sigma_m f_m = 1$. Then the Varietal Intensity Index, V_{im} for variety m in region i, is:

$$(1) \qquad V_{im} = f_{im} / f_m$$

B. Varietal Similarity Index (VSI)

An Index of Varietal Similarity has been defined by Anderson (2010) to measure the extent to which the varietal mix of one region or country matches that of another region or country or the world. It can also be used to compare the varietal mix of a region or country over time. In defining the index, Anderson (2010) borrows and adapts an approach introduced by Jaffe (1986) and Griliches (1979). That approach has been used

subsequently by Jaffe (1989), and by others including Alston, Norton and Pardey (1998) and Alston et al. (2010, Ch. 4), to measure inter-firm or inter-industry or inter-regional technology spillover potential.

The mix of grape varieties is a form of revealed preference or judgement by vignerons about what is best to grow in their region. That judgement is affected by not only terroir but also past and present economic considerations, including current expectations about future price trends plus the sunk cost that would be involved in grafting new varieties onto existing rootstocks or grubbing out and replacing existing varieties.

The vector of grape varietal shares defined above, $f_i = (f_{i1}, \ldots, f_{iM})$, locates region i in M-dimensional space. Noting that proximity is defined by the direction in which the f-vectors are pointing, but not necessarily their length, Jaffe (1989) proposes a measure called the angular separation of the vectors which is equal to the cosine of the angle between them. If there were just two varieties, m and n, and region i had 75 percent of its total vine area planted to variety m whereas only 45 percent of region j was planted to variety m, then their index of regional similarity is the cosine of the arrowed angle between the two vectors (Figure 1). When there are M varieties, this measure is defined as:

$$\omega_{ij} = \frac{\sum_{m=1}^{M} f_{im} f_{jm}}{\left(\sum_{m=1}^{M} f_{im}^2\right)^{1/2} \left(\sum_{m=1}^{M} f_{jm}^2\right)^{1/2}}, \tag{2}$$

where again f_{im} is the area of plantings of grape variety m as a proportion of the total grape plantings in region i such that these proportions fall between zero and one and sum to one (i.e., there is a total of M different grape varieties across the world, and $0 \leq f_{im} \leq 1$ and $\Sigma_m f_{im} = 1$). This makes it possible to indicate the degree of varietal mix "similarity" of any pair of regions. The index also can be generated for each region relative to the average of the world's N regions, call it ω. In short, ω_{ij} measures the degree of overlap of f_i and f_j. The numerator of equation (2) will be large when i's and j's varietal mixes are very similar. The denominator normalizes the measure to be unity when f_i and f_j are identical. Hence, ω_{ij} will be zero for pairs of regions with no overlap in their grape

varietal mix, and one for pairs of regions with an identical varietal mix. For cases in between those two extremes, $0 < \omega_{ij} < 1$. It is conceptually similar to a correlation coefficient. Like a correlation coefficient, it is completely symmetric in that $\omega_{ij} = \omega_{ji}$ and $\omega_{ii} = 1$. Thus the results can be summarized in a symmetric matrix with values of 1 on the diagonal, plus a vector that reports the index for each region relative to the global varietal mix.

C. Regional and Varietal Quality Indexes (RQI and VQI)

To capture differences in the wineries' perception of the quality of the grapes delivered, bearing in mind consumers' willingness to pay for their wines, we generate two price-based indexes.

The overall quality of all winegrapes in region i, as perceived by wineries in the light of consumer willingness to pay, is indicated by the average winegrape price in that region, P_i, as a proportion of the national average winegrape price, P, across all varieties. We call that the Regional Quality Index, RQI_i, where

(3) $RQI_i = (P_i/P)$.

The simplest index of quality of different varieties is the ratio of the national average price for variety m to the national average price of all winegrape varieties. We call that the Varietal Quality Index, VQI_m, where

(2) $VQI_m = (P_m/P)$.

III. Data

Data on bearing area of winegrapes are available by variety and region for most key wine-producing countries. In the case of the European Union countries, plantings in several member countries are available from one source (Eurostat 2013), while for other countries they are typically available online from a national wine industry body or national statistical agency. The United States and Canada are key exceptions, where data

are collected at the state/provincial level and only for those with significant wine production.

The years chosen correspond to the most-recent decadal agricultural census periods of the European Union, which were 1999 or 2000 and 2009 or 2010. For the non-EU countries data have been sought for the earlier year in the Northern Hemisphere and the latter year in the Southern Hemisphere. Inevitably not all other countries or regions had data for exactly those vintages, but in most cases the data refer to vintages that were only 6 months apart.

The raw data have been compiled by Anderson and Aryal (2013), and various indicators from that database have been assembled in comprehensive tables and figures in Anderson (2013). Appendix Table 1 lists the countries included, which collectively account for all but 1 percent of global wine output.

Of the 44 countries included in Appendix Table 1, reliable area data for 2000 were unavailable for nine of them (China, Japan, Kazakhstan, Mexico, Myanmar, Peru, Thailand, Turkey, and Ukraine). The combined share of global wine production of those nine countries in 2000 was only 1.6% (compared with 5.1% in 2010), but their varietal contributions are included as a group (called "Missing 9 in 2000") by assuming each of them had (i) the same varietal distribution in 2000 as in 2010 and (ii) a national area that was the same fraction of its 2010 area then as was its national wine production volume. As well, the global bearing area of the world's 50 most important varieties in 1990 has been estimated using data in Fagen (2003).

The number of winegrape regions within each country for which bearing area data are available varies greatly across the sample of 44 countries (Appendix Table 1). Nor is the number the same for each country in the two chosen years, which means that some regional detail is necessarily lost through aggregation when we seek to compare varietal mixes of each region in the two sample years. Nonetheless, even for that comparative exercise there are more than 400 matching regions globally in the 2000/2010 pair of years.

The extent of varietal coverage varies by region within each country as well as by country and over time. For each region the residual "Other varieties" category was sometimes specified as red or white winegrapes but, where it was not, we apportioned it

to red or white according to the red/white ratio for that region's specified varieties. Globally the share of the winegrape bearing area that is not specified by variety is less than 6%.

In short, the global database on which this paper draws involves two years (2000 and 2010, plus some 1990 data), more than 600 regions (in 44 countries), and almost 1300 varieties. Such a large three-dimensional database potentially has 1.6 billion numbers in its cells (many of which are zeros). It can be sliced in any of three ways: across regions/countries, years, or varieties.

As well, supplementary data for Australia have been assembled by drawing on ABS (2012), www.wineaustralia.com and the Phylloxera Board (2013). Those data are as recent as 2013 and include production volume and average price by variety and region (and from which yield/ha and value of production have been calculated). Those additional data are needed to calculate the regional and varietal quality indexes.

IV. Australia's Varietal Distinctiveness

What insights for the grapegrower and winemaker in Australia can be drawn from these data? The following three sub-sections begin to address that question in terms of the varietal distinctiveness of Australia's vineyard plantings vis-à-vis the rest of the world's, the varietal differences between regions within the country and their changing varietal intensities, and the emerging varieties that are adding to the diversity of Australia's vineyards.

A. National varietal distinctiveness

The Varietal Similarity Index or VSI between Australia and the world was 0.45 in 2000, but it rose to 0.62 by 2010, indicating a substantial drift in Australia's varietal mix toward the world aggregate mix. Meanwhile, the average of the VSIs for all other countries in the sample is much lower and hardly changed, at 0.35. In other words, Australia was much less distinct than the average country in its varietal mix in 2000, and its distinctiveness

became even less so by 2010.[1] Since France is the country whose varietal mix is most similar to the world mix, this means in effect that Australia has become more like France: the two countries had a VSI of 0.47 in 2000 and 0.58 in 2010.

A key reason for Australia's varietal mix becoming more like the global mix has to do with Shiraz, or Syrah as it is called in most other parts of the world. The popularity which Australia brought to Syrah in the 1990s has led to many other countries expanding their plantings of this variety. In 1990 there were barely 35,000 bearing hectares, making it 35th in the area ranking of all winegrape varieties globally. But by 2000 there were 102,000 hectares, and by 2010 that had risen to 186,000, bringing Syrah to the 6th position on that global ladder and less than one-third below the areas of the two now-most-widespread varieties, namely Cabernet Sauvignon and Merlot. Over the decade to 2010, the Syrah area grew more than either Cabernet or Merlot – in fact only Tempranillo expanded faster globally (Figure 2). Certainly Australia contributed to that expanding area of Syrah, but expansion was even greater in France and Spain. There were also large plantings in other key New World wine countries, and in Italy and Portugal (Figure 3). As a result, Australia is no longer as globally dominant in this variety: its share of the global Syrah area has dropped from 29% in 2000 to 23% in 2010 – even though Syrah has increased its share of Australia's own vineyards over that decade, from 22% to 28% (the next-nearest countries being South Africa and France, with 10% and 8% of their vineyards under Syrah, respectively).

A further reason Australia's varietal mix has become more like the world's has to do with the large declines in some of the main varieties traditionally used for producing non-premium wines in the Old World (Airen, Grasevina, Mazuelo), none of which are grown in Australia. And three other low-valued traditional varieties that have declined globally, Garnacha Tinta, Sultaniye and Trebbiano, have also declined in Australia, again contributing to Australia's lack of distinctiveness vis-à-vis the rest of the world.[2]

This is not to say that Australia is not highly ranked in terms of the global bearing area of certain varieties. On the contrary, in addition to some unique varieties developed in this country such as Tarrango, Table 1 reveals that among the varieties whose share of

[1] New Zealand, by contrast, had a VSI with the world of 0.34 in 2000, which fell to 0.30 by 2010.
[2] Two-thirds of what has disappeared as a winegrape in Australia since 2000 is Sultaniye, whose area globally fell by three-quarters over the 2000-10 period.

winegrape area in Australia exceeds that of the world (i.e., they have a VII > 1) there are ten in which Australia ranks 2nd, five in which it ranks 3rd, and three in which it ranks 4th globally. Australia also ranks in the top five for a further eight varieties whose VII is less than one.[3] But other key wine-producing countries also rank highly for handfuls of varieties, so Australia is not unusual in this respect either.

B. Regional differences within Australia

Varietal differences between regions within Australia also are more muted than is the case within other countries – notwithstanding the very large differences in growing conditions across Australia. Bear in mind that it is possible for the VSI for a country vis-à-vis the world to be high but the VSI of each region in that country vis-à-vis the world to be low. In France for example, where each region is required by law to grow only a small number of varieties that have been designated as most suitable for that region, the average of its regional VSIs of 0.29 is well below France's national VSI in 2010 of 0.72 vis-a-vis the world's varietal mix (which is the highest in the world, because so many other countries have adopted varieties from France's various diverse regions). In Australia, however, the average of its regional VSIs in 2010of 0.53 is not much below Australia's national VSI of 0.62, and it is almost double the average regional VSI of other countries in the sample (including New Zealand's, which is 0.37). Moreover, in 2010, of the 3 most-similar regions in the world to each of Australia's 94 regions according to the VSI, less than 7% were non-Australian regions. In New Zealand, by contrast, more than two-thirds of the 3 most-similar regions to each of its ten regions were in other countries.

It is true that some regions in Australia have managed to pull away from the pack and so are more differentiated from the national mix now than in 2000. However, a little over one-fifth of Australia's 74 regions in the database, comprising 40% of the national winegrape area in 2010, changed their varietal mix hardly at all (the VSI of their mix in 2010 vis-à-vis 2000 was 0.97 or higher). For another one-fifth of Australia's regions, accounting for 22% of the national area, their VSI was 0.95 or 0.96; and for yet another

[3] Dolcetto (2nd), Nebbiolo and Monastrell (3rd), Touriga Nacional and Tribidrag (4th), and Chenin Blanc, Cot and Tempranillo (5th).

one-fifth (18% of the area) their VSI was between 0.91 and 0.94. Thus it was for just Australia's remaining regions (slightly less than one-fifth of the total number and the national area) that the VSI between their varietal mix in 2000 and 2010 was less than 0.91.

The Varietal Intensity Index or VII provides another way to check on the altered varietal distinctiveness of regions. That index is the ratio of the regional to global shares of the area under a particular variety. Figure 4 shows, for each of three red and three white varieties, the five Australian regions with the highest VIIs. In the case of red varieties, for example, the five most-intense regions all have VIIs above 3 but they are all lower in 2010 than in 2000. In the case of whites there are a few regions where the VII has risen, but certainly not a majority. For Australia as a whole, for all the varieties that had a VII above one in 2010, as many as two-thirds of them had a higher VII in 2000 (Table 1).

C. Emerging varieties in Australia

What about the increased plantings of so-called emerging or alternative varieties that are diversifying Australia's vineyards? If we focus on those varieties not in the world's top 20 list, and which have expanded from less than 200 bearing hectares in Australia in 2000, there are ten in the database whose areas have grown significantly since then. But in aggregate those ten raised their share of Australia's total area by only 1.7%. The eight varieties whose area in Australia expanded most over the first decade of this century (see Figure 5) are, apart from Viognier, all in the top 20 globally.

Since there is a total of less than 50 varieties separately identified in the Australian official data though, that list excludes many of the small emerging varieties that are collected in a residual 'Others' category. Even so, that 'Others' category accounted for just 5% of Australia's total area in 2000 and for only 1.6% by 2010, which means the main varieties have expanded much more than lesser alternative ones. As noted above, the share for Syrah alone rose 6 percentage points over that decade, while Chardonnay's rose 5 points and the shares of Sauvignon Blanc and Pinot Gris each rose 2 points.

Fortunately the Phylloxera Board of South Australia has a much more-detailed dataset for that state, and it reveals another dozen varieties that have shown some growth between 2006 and 2012. The ABS (2012) also has provided some more varieties in its latest release, also for 2012. These data, shown on the right-hand side of Table 2, refer to planted area rather than bearing area, and so provide a better indicator of recent changes since newly planted vines take three years to bear. But even these data reveal that emerging varieties make up only a small fraction of 1% of the national area.[4]

V. Regional and Varietal Quality Differences within Australia

That Australian winegrape regions vary substantially in terms of average winegrape prices received by growers is apparent from estimates of the Regional Quality Index, defined as the average winegrape price in a region (across all varieties) as a proportion of that average price nationally. Winegrapes from the hot irrigated regions of the Riverland, Riverina, Murray Darling and Swan Hill, which comprise nearly three-fifths of the national crush volume, received on average just 62% of the national average price in 2001, whereas regions with a warm (cool) climate received on average 42% (57%) above the national average price that vintage. Those differentials were muted at that time by the excess demand for winegrapes when wineries were rapidly expanding. By the time the global financial crisis hit in 2008, however, there were excess supplies of many types of winegrapes, and so those differentials widened as the national average price dropped. In 2010, the average winegrape prices in the hot, warm and cool regions were 57%, 154%, and 191% of the national average, which had fallen in nominal AUD by two-fifths over that decade (from $941 to $557 per tonne – see Appendix Table 2). By 2013 that national average price was one-tenth lower again and price dispersion was even wider, ranging from $320-360 in the hot-climate regions to more than seven times that (almost $2500) in cool Tasmania and Mornington Peninsula (Figure 6(a)). The dispersion is almost as wide even for just Shiraz winegrapes (Figure 6(b)). This increase in regional price dispersion between 2001 and 2013 is clearly visible in the histograms of Figure 7.

[4] For more on these and other emerging varieties in Australia, and on which firms have planted them, see Higgs (2010) and his updates at www.vinodiversity.com.

Given that different varieties grow better in some regions than others, and that consumer tastes differ across varieties and over time, it is not surprising that there is also considerable dispersion in the national average prices by variety. In 2001 the difference between the lowest and highest varietal prices was more than six-fold, and it shrunk very little by 2010 despite the two-fifths fall in the nominal average price for all varieties. The ranking from lowest- to highest-priced varieties changes a lot over that decade though (Appendix Table 3). This reflects the fact that the mixes of varieties in all three climate zones in Australia have altered considerably. Figure 8 shows that the range in 2013 from lowest-priced to highest-priced, even for just the main varieties, was four-fold, but it is six-fold if minor varieties such as Pinot Meunier are included. Moreover, for each variety there is a wide spectrum of prices across and even within regions. As Figure 6 reveals, the cross-regional range for Shiraz prices is almost as large as that for the all-variety average regional prices, even though data are not available for including some of the highest-priced cool regions with emerging Shiraz vineyards. Notwithstanding that data limitation at the highest prices, an increase in varietal price dispersion between 2001 and 2013 is clearly visible in the histograms for the Varietal Quality Index in Figure 9.

VI. Summary and implications

The above data reveal three things about Australia's vineyard. First, Australia's mix of winegrape varieties is not very different from the rest of the world's and, since 2000, it has become even less differentiated. One reason is that even though its signature variety, Shiraz, has expanded its share of Australia's vineyard, that variety's importance has expanded even faster in numerous other countries. Australia's mix is now closer to that of France, since France is the closest to the global mix.[5] Whether that is a good thing commercially is unclear. Perhaps Australian producers benefit enough by emulating France's varietal mix to offset any economic downsides, for example from being less

[5] In 2000 Australia had a higher share of its winegrapes under varieties of French origin than any other country other than New Zealand and South Africa (74%), and in 2010 its share was even higher at 88%, just below China, Chile and New Zealand. Between 2000 and 2010 the winegrape area devoted to varieties of French origin rose from 26% to 36% globally: from 20% to 27% in the Old World and from 53% to 67% in the New World's vineyards (Anderson 2013, Tables 21 and 22).

differentiated from the world mix, or from growing varieties that may be less than ideal for the terroir of Australia's various regions.

Second, even though there are very large differences in growing conditions and especially climates across Australia, cross-regional varietal differences within Australia are much less than is the case within other countries. Perhaps this is a consequence of producers finding it easier to market well known 'international' (mostly French) varieties than trying to differentiate their offering and region with less-familiar varieties. But it does suggest there is plenty of scope to explore alternative varieties in the various regions of Australia – which is something grapegrowers are doing in any case as they consider ways to adapt to climate changes.

And third, the global database, together with more-recent and more-detailed national data, reveal that Australia's various regions to date have made only a little headway in diversifying their vineyards – despite much discussion of alternative or emerging varieties in the media and at conferences. Hopefully this new resource on global varieties will be of some assistance to producers as they contemplate the next stages of varietal development of their vineyards.

This paper leaves open the question of *why* particular varieties have been produced at various times in Australia's various regions. To what extent is the varietal mix driven by what grows best in each location (the terroir explanation)? Gergaud and Ginsburgh (2008) argue that terroir has not been the main explanation even in Bordeaux. Is the increasing concentration on major 'international' varieties partly a result of producers in newly expanding wine-producing regions finding it easier to market them because of France's strong reputation with those varieties? Might part of the explanation also be that those key varieties do well in a wide range of growing environments, or have been found to be desirable for blending with other varieties that grow well in the same regions? These and other centripetal forces during the first decade of this century apparently have dominated possible centrifugal forces mentioned in the Introduction (intensifying competition from abroad, consumer demand for novel offerings). It will be interesting to see whether the latter are strong enough to dominate the former over the next decade so as to differentiate Australia's regions more and thereby reverse the trend of the past decade.

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Figure 1: Angular separation between two regions, each growing two grape varieties

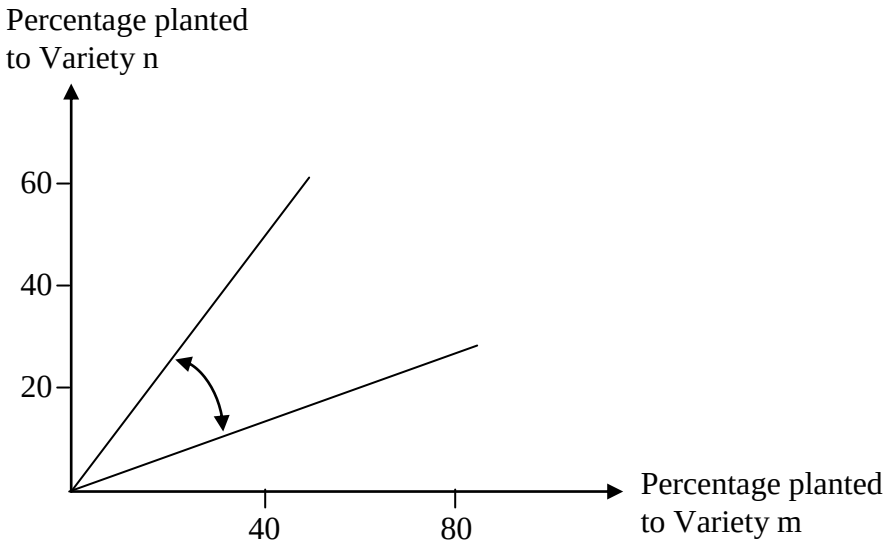
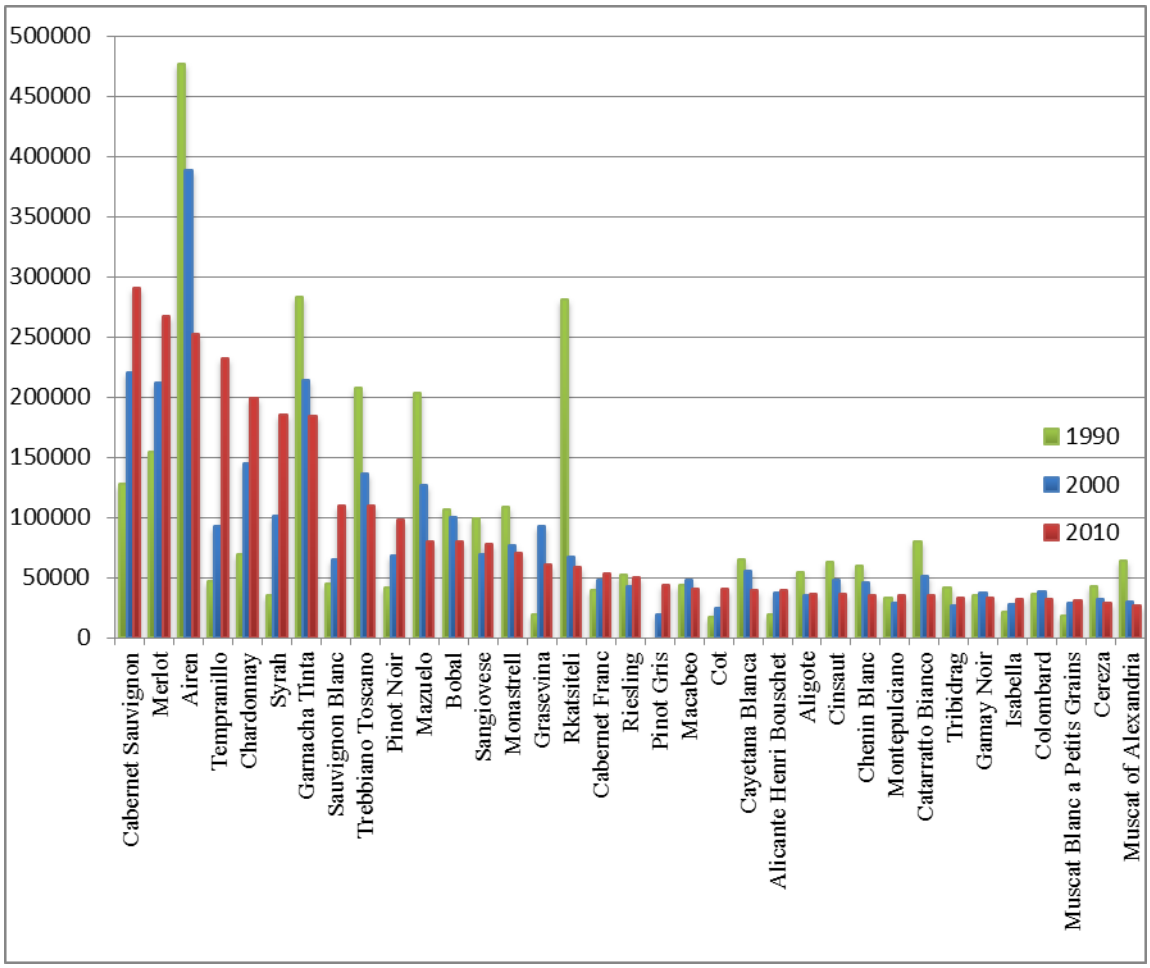


Figure 2: World's top 35 varieties in 2010, compared with 1990 and 2000

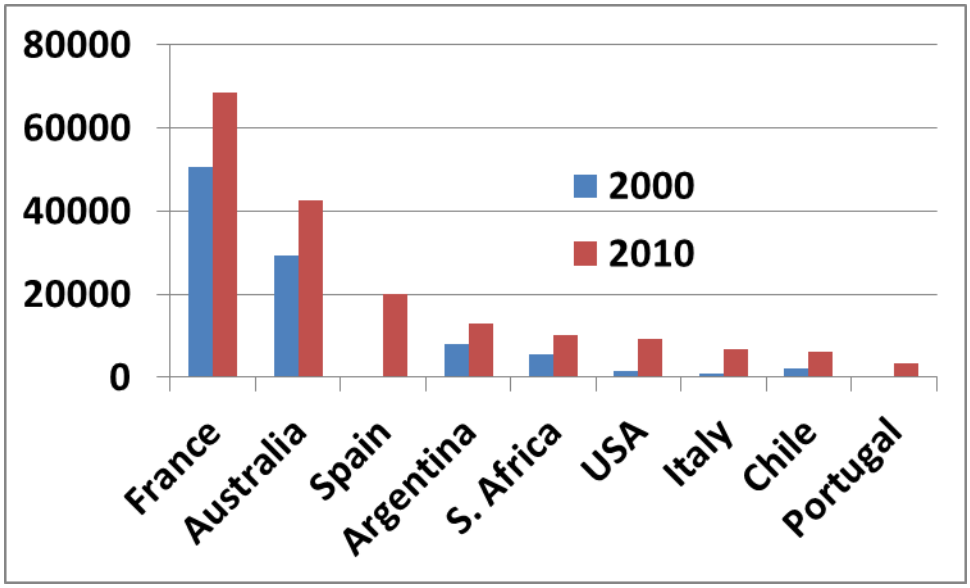
(hectares)



Source: Anderson (2013, Chart 12).

Figure 3: Bearing area of Syrah, key producing countries, 2000 and 2010

(hectares)



Source: Anderson (2013, Tables 27 and 30).

Figure 4: Australian regions with largest Varietal Intensity Index relative to global average, 2001 and 2010

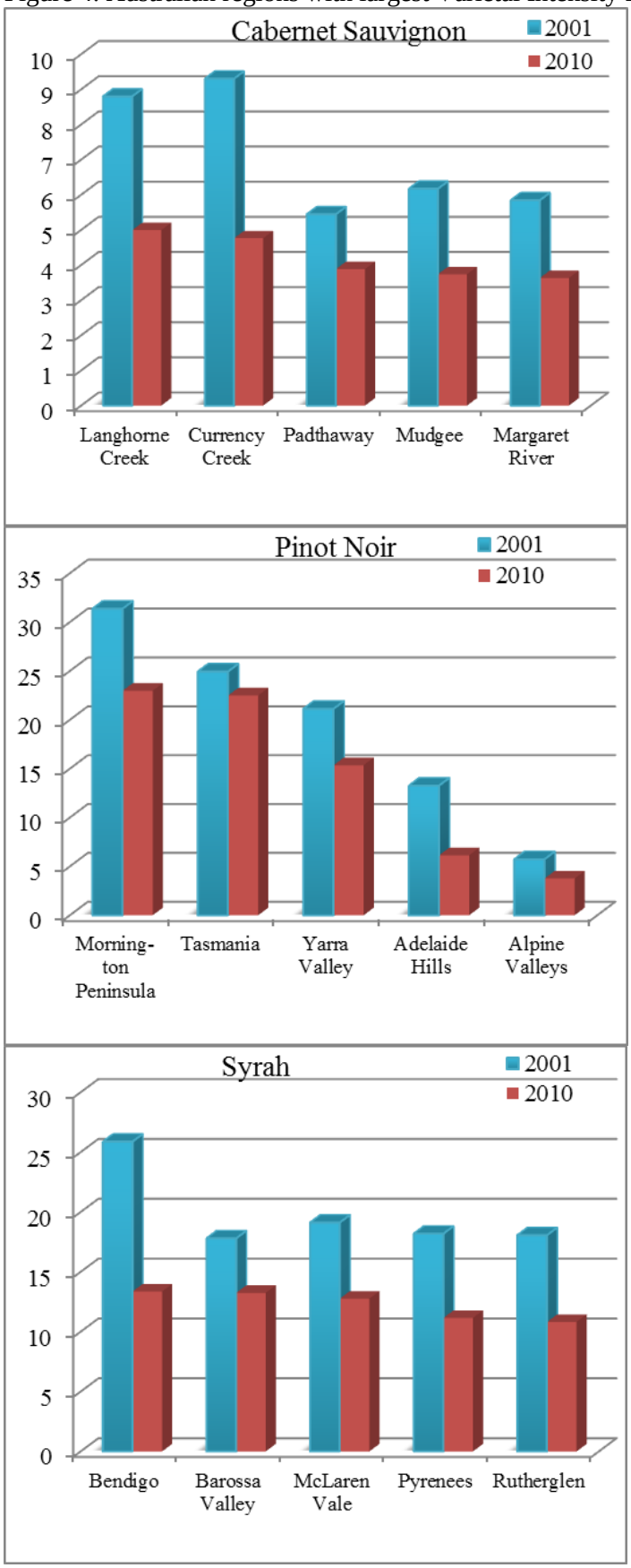
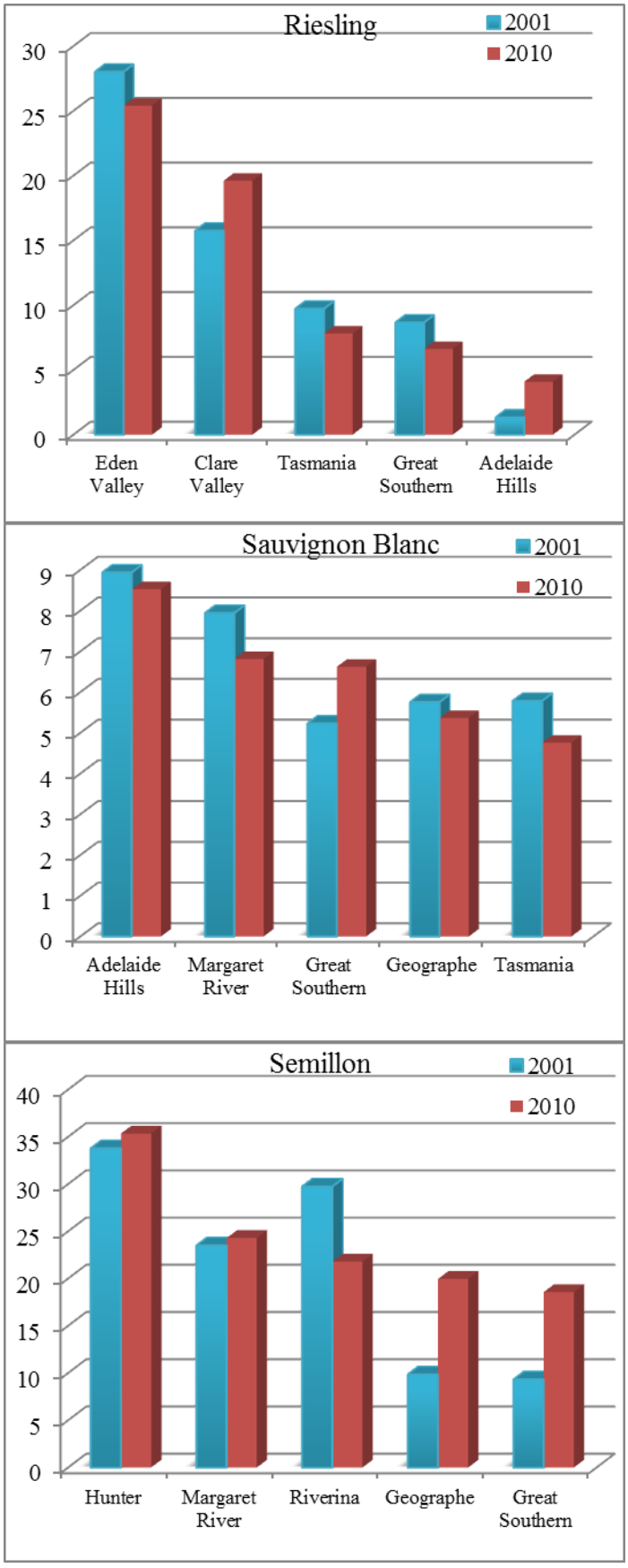


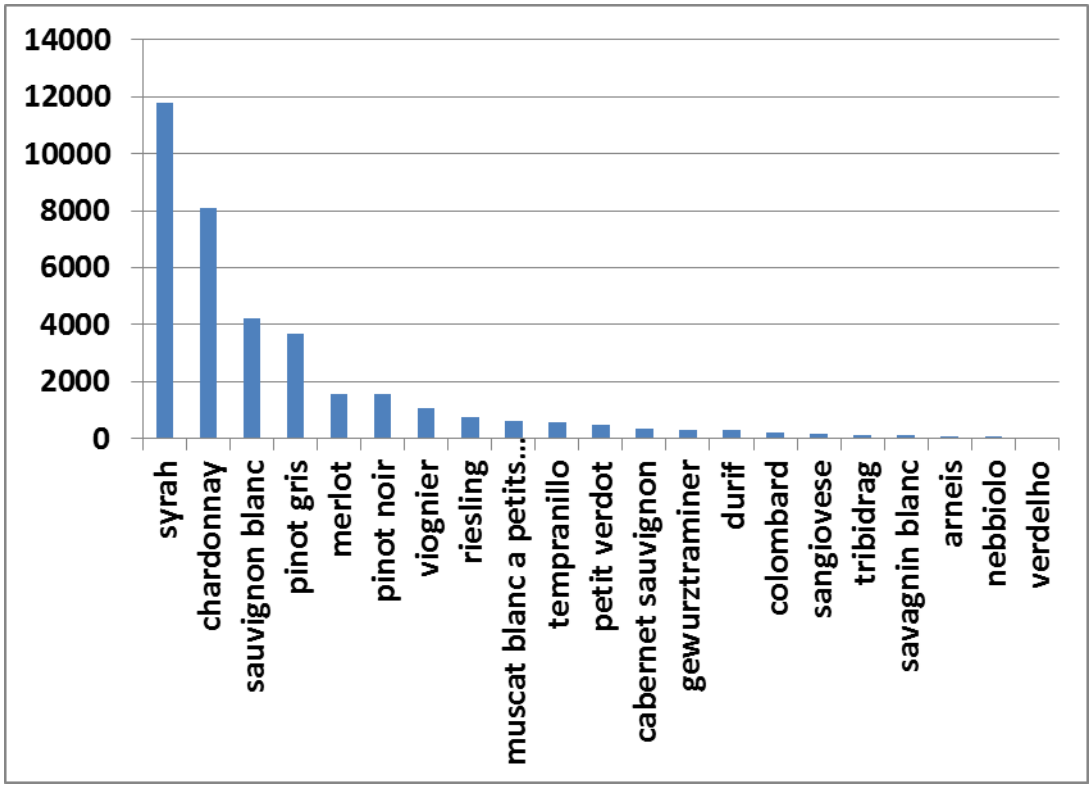
Figure 4 (continued): Australian regions with largest Varietal Intensity Index relative to global average, 2000 and 2010



Source: Derived from Anderson (2013, Section VI).

Figure 5: Increase in bearing area by variety, Australia, 2001 to 2012

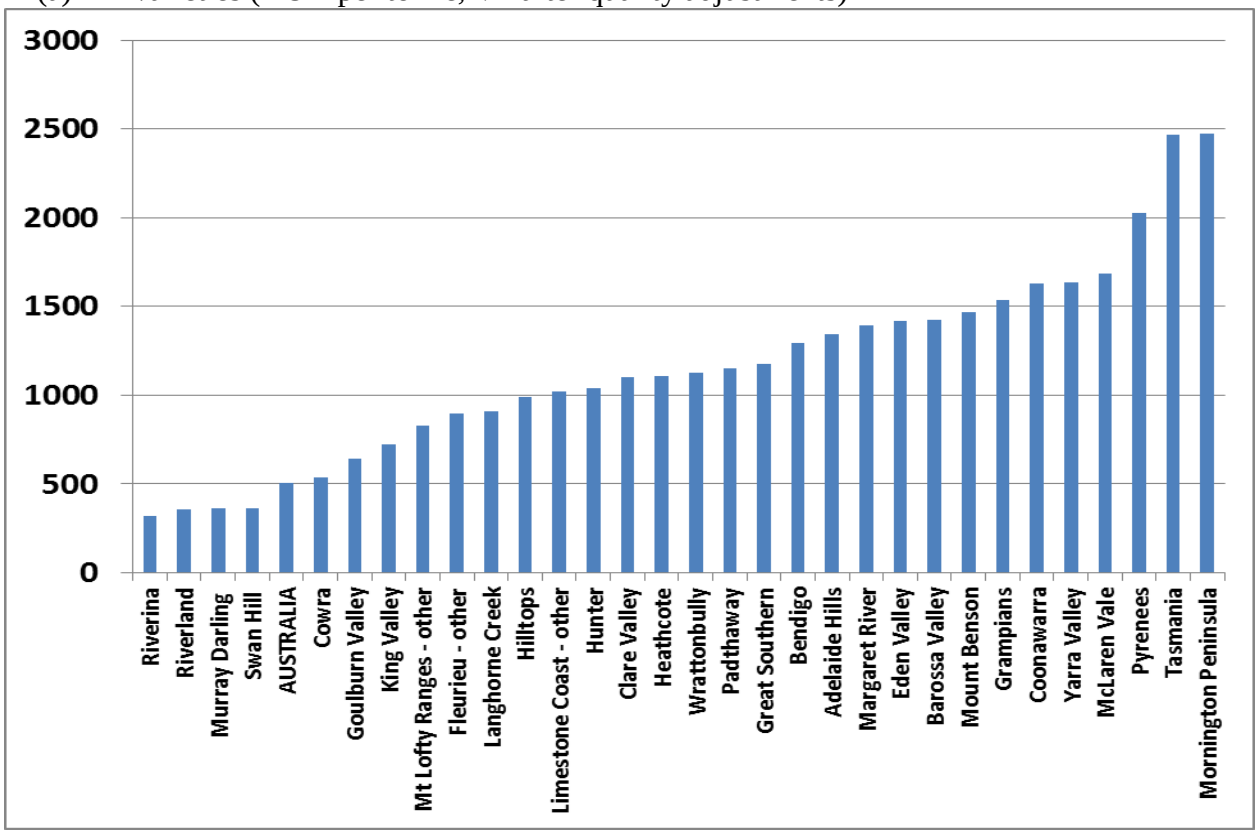
(hectares)



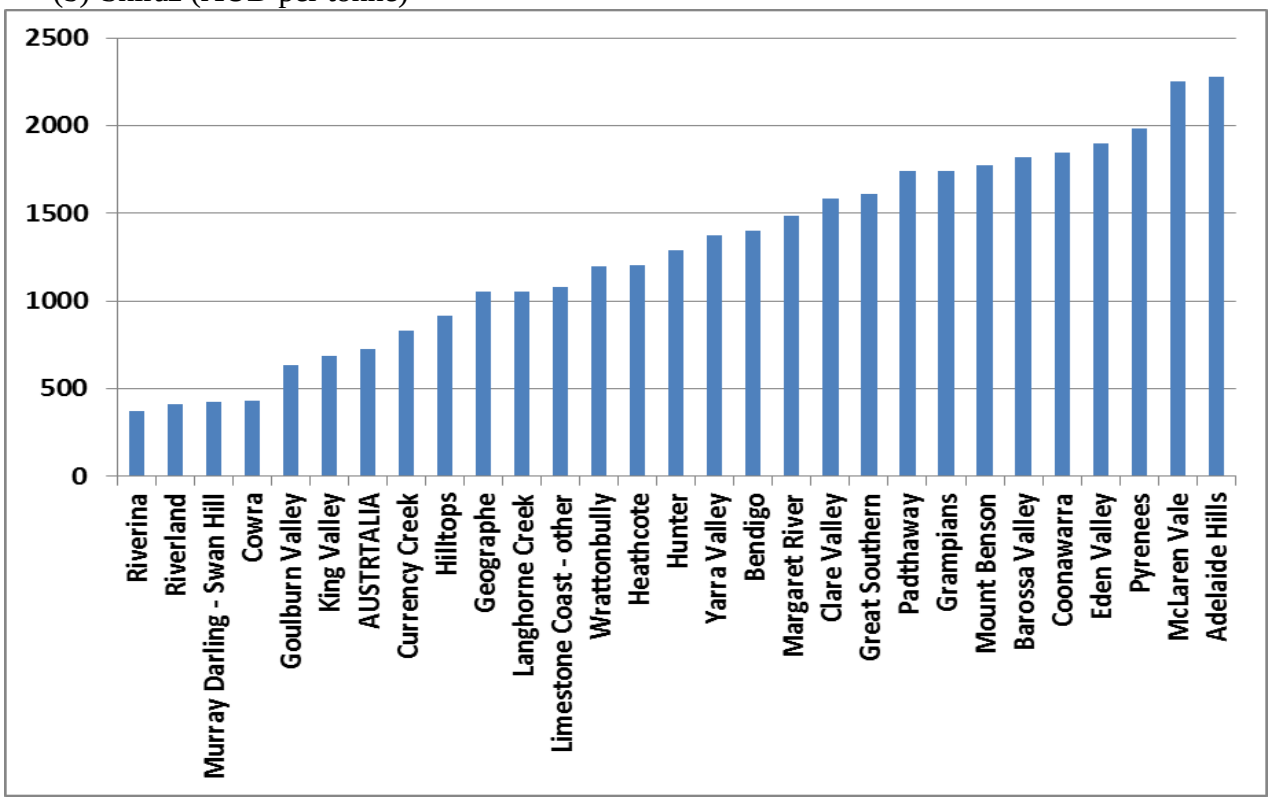
Source: Derived from Anderson and Aryal (2014) and ABS (2012).

Figure 6: Average price of winegrapes, by region, Australia, 2013

(a) All varieties (AUD per tonne, V2 after quality adjustments)

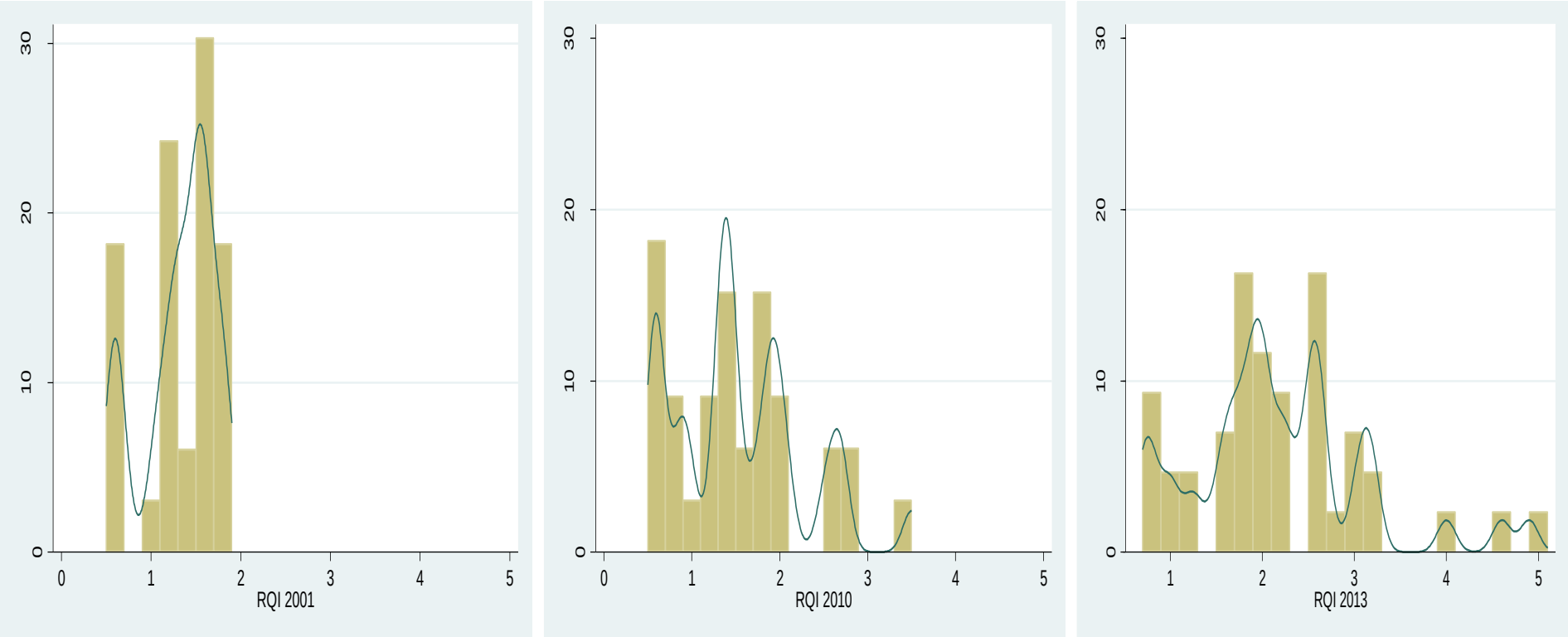


(b) Shiraz (AUD per tonne)



Source: Derived from Anderson and Aryal (2014), drawing on WINEFACTS data at www.wineaustralia.com, accessed 21 January 2014.

Figure 7: Regional Quality Index[a] dispersion, Australia, 2000, 2010 and 2013

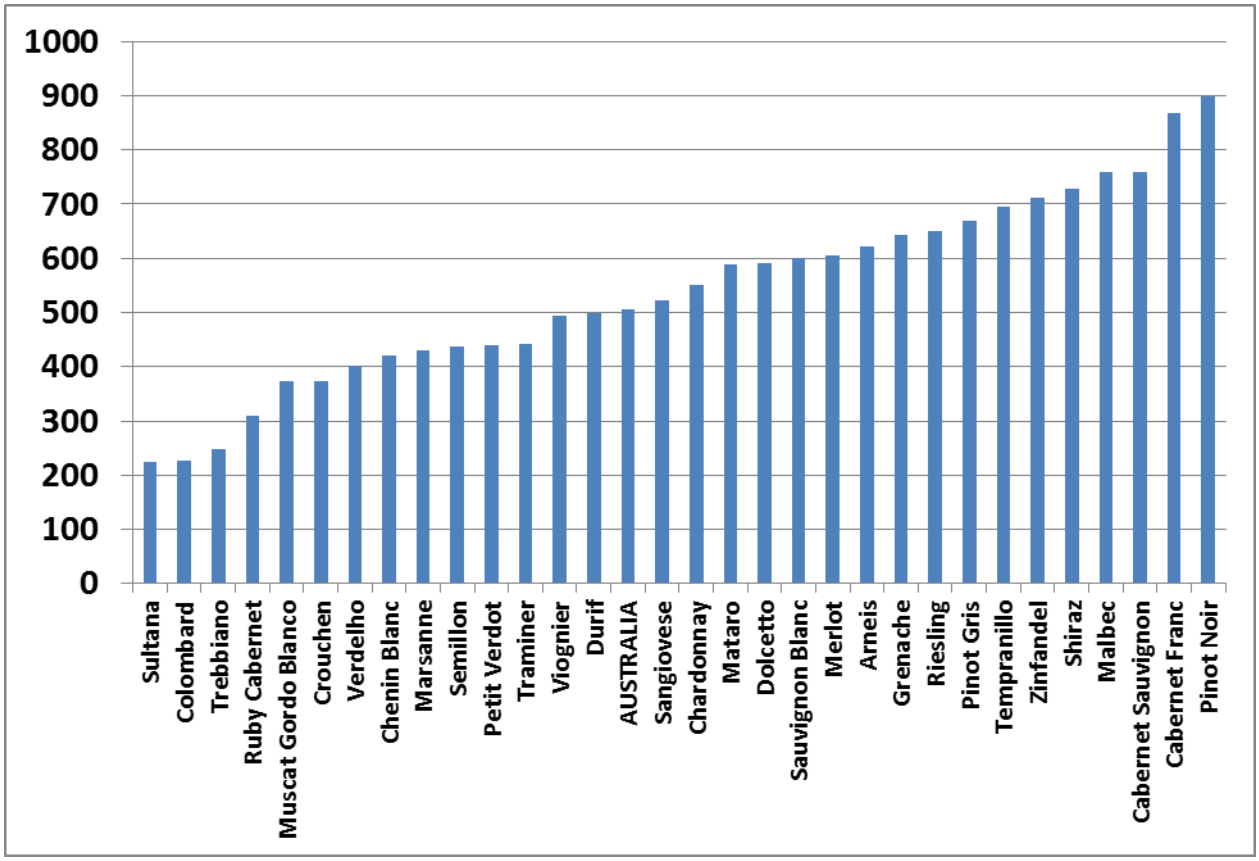


[a] The Regional Quality Index is defined as the ratio of the regional average price for all varieties to the national average price for all winegrapes.

Source: Derived from Anderson and Aryal (2014), drawing on WINEFACTS data at www.wineaustralia.com, accessed 21 January 2014.

Figure 8: National average prices of main winegrape varieties,[a] Australia, 2013

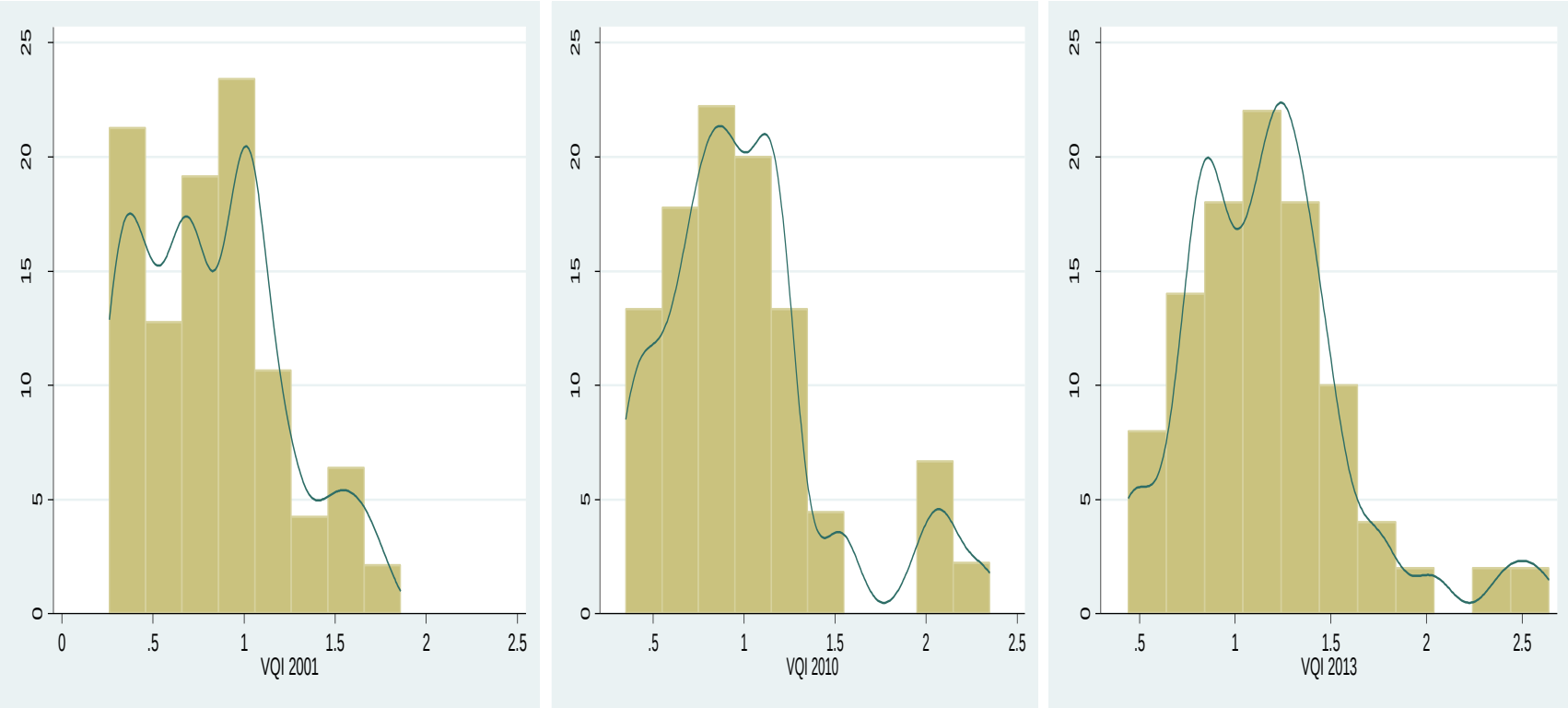
(AUD per tonne)



[a] These are the varieties with the largest bearing area in Australia, using the varietal names most commonly used in Australia (as distinct from the prime varietal names used in Appendix Table 3).

Source: Derived from Anderson and Aryal (2014), drawing on WINEFACTS data at www.wineaustralia.com, accessed 21 January 2014.

Figure 9: Varietal Quality Index[a] dispersion, Australia, 2000, 2010 and 2013



[a] The Varietal Quality Index is defined as the ratio of the national average price for a variety to the national average price of all winegrape varieties.

Source: Derived from Anderson and Aryal (2014), drawing on WINEFACTS data at www.wineaustralia.com, accessed 21 January 2014.

Table 1: Varietal Intensity Index and varietal area shares,[a] Australia, 2000 and 2010

	National share, %, 2010	Global share, %, 2010	Aust.'s global rank, 2010	VII 2010	*VII 2000*
Tarrango	0.0	100.0	1	30.3	*37.4*
Verdelho	1.0	76.6	1	23.2	*29.5*
Muscat a Petits Grains Rouge	0.2	37.5	2	11.4	*28.4*
Semillon	4.0	27.6	2	8.4	*9.3*
Syrah	28.1	23.0	2	7.0	*10.4*
Petit Verdot	0.8	17.0	2	5.1	*18.2*
Ruby Cabernet	0.6	16.8	3	5.1	*12.2*
Chardonnay	18.3	14.0	3	4.2	*4.4*
Marsanne	0.2	13.7	2	4.1	*5.3*
Arneis	0.1	13.6	2	4.1	*n.a.*
Crouchen	0.1	13.1	2	4.0	*1.6*
Sultaniye	0.3	12.6	3	3.8	*26.8*
Viognier	0.9	12.3	2	3.7	*1.4*
Durif	0.3	11.7	2	3.6	*5.6*
Cabernet Sauvignon	17.1	9.0	4	2.7	*4.2*
Riesling	2.7	8.2	3	2.5	*2.7*
Muscat of Alexandria	1.3	7.8	6	2.4	*3.2*
Pinot Gris	2.2	7.6	3	2.3	*n.a.*
Colombard	1.5	6.9	4	2.1	*1.8*
Sauvignon Blanc	4.3	5.9	7	1.8	*1.5*
Gewurztraminer	0.5	5.8	6	1.8	*1.8*
Pinot Noir	3.1	5.4	6	1.6	*2.0*
Savagnin Blanc	0.1	5.0	5	1.5	*n.a.*
Roussanne	0.1	4.8	4	1.4	*n.a.*
Muscadelle	0.0	4.1	2	1.2	*3.4*
Merlot	6.6	3.8	8	1.1	*1.4*
Other varieties	5.5	n.a.	n.a.	n.a.	*n.a.*
TOTAL	100.0	3.3	8	n.a.	*n.a.*

[a] Includes all varieties in Australia that had a Varietal Intensity Index (VII) above one in 2010.

Source: Anderson (2013).

Table 2: Emerging winegrape varieties in Australia, 2001 to 2012[a]

	Bearing area (hectares)		**Total area** (including newly planted, hectares)		
	Australia		**Australia**	**South Australia**	
	2001	2010	2012	2006	2012
Arneis		153	81	12	18
Barbera	103	116	104	25	32
Dolcetto		154	124	20	18
Durif	181	417	500	17	37
Nebbiolo	50	98	122	39	47
Roussanne		83		18	27
Savagnin Blanc		94	140	13	56
Tempranillo	41	476	712	169	301
Tribidag (Zinfandel)		149	104	36	33
Viognier	117	1402	1197	506	521
SUB-TOTAL	**492+**	**3142**	**3081+**	**855**	**1090**
% of total	***0.4%***	***2.1%***	***2.1%***	***1.2%***	***1.4%***
Aglianico				1	10
Alicante Henri Bouschet				12	15
Alvarinho				4	15
Fiano			107	10	36
Graciano				7	14
Gruner Veltliner			18	0	16
Lagrain				16	17
Montepulciano			49	3	28
Nero d'Avola			33	1	25
Sagrantino				5	11
Saperavi				6	6
Vermentino			93	5	48
SUB-TOTAL			**300+**	**70**	**241**
% of total			***0.2%***	***0.1%***	***0.3%***
TOTAL	**130,602**	**151,788**	**148,509**	**72,720**	**76,533**

[a] Blank spaces mean data are unavailable, rather than zero. For a much longer list of emerging varieties, see Higgs (2010).

Source: Anderson and Aryal (2013, 2014), ABS (2012) and Phylloxera Board of SA (2013).

Appendix Table 1: Number of regions and prime varieties, by country, 2000 and 2010

	2000		*2010*	
Country	*No. of regions*	*No. of varieties*	*No. of regions*	*No. of varieties*
Algeria	1	8	1	8
Argentina	3	31	28	111
Armenia	1	6	1	6
Australia	76	43	94	40
Austria	4	33	4	35
Brazil	1	19	1	101
Bulgaria	1	21	6	16
Canada	1	20	2	76
Chile	8	38	9	54
China			10	17
Croatia	1	7	13	72
Cyprus	1	2	1	15
Czech Rep.	1	10	2	32
France	29	285	45	96
Georgia	1	21	1	21
Germany	13	68	13	91
Greece	13	60	13	56
Hungary	1	32	22	137
Italy	103	323	110	397
Japan			5	15
Kazakhstan			6	15
Luxembourg	1	11	1	10
Mexico			5	17
Moldova	1	39	1	39
Morocco	1	8	1	8
Myanmar			1	11
New Zealand	10	22	11	45
Peru			4	30
Portugal	9	80	9	266
Romania	1	18	8	25
Russia	1	11	2	55
Serbia	1	4	1	4
Slovakia	1	11	6	35
Slovenia	1	6	10	21
South Africa	9	68	9	68
Spain	36	159	36	150
Switzerland	18	51	18	58
Thailand			1	13
Tunisia	1	9	1	9
Turkey			7	35
Ukraine			1	22
United Kingdom	1	9	1	44
United States	61	84	89	129
Uruguay	1	8	1	41
"Missing 9 in 2000"	1	101	na	na
Sample total	**414**	**1018**	**611**	**1289**

Source: Anderson (2013).

Appendix Table 2: Price, yields, and regional quality indexes, Australian regions, 2001 and 2010

	Region[a]	Price (AUD/t)		Yield (t/ha)		Area %		Production volume %		Production value %		RQI	
		2001	2010	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010
H	Riverland	658	301	16.8	16.6	14.0	13.2	22.1	21.7	15.5	11.7	0.7	0.5
H	Riverina	497	350	12.4	12.2	9.5	13.3	11.0	16.0	5.8	10.1	0.5	0.6
H	Murray Darling - VIC	562	310	12.5	16.1	12.0	5.5	14.1	8.8	8.4	4.9	0.6	0.6
H	Murray Darling - NSW	562	310	13.1	19.9	4.3	4.3	5.2	8.5	3.1	4.7	0.6	0.6
C	Limestone Coast - other	1474	962	11.4	8.1	5.8	6.5	6.1	5.3	9.6	9.1	1.6	1.7
W	Barossa Valley	1429	1057	8.3	7.0	5.9	6.4	4.6	4.4	7.0	8.4	1.5	1.9
H	Swan Hill (VIC)	562	310	8.1	17.0	2.9	2.5	2.2	4.3	1.3	2.4	0.6	0.6
W	Langhorne Creek	1429	742	12.7	8.9	2.9	3.9	3.4	3.5	5.2	4.6	1.5	1.3
W	Padthaway	1488	781	12.0	9.7	2.5	3.3	2.8	3.2	4.4	4.5	1.6	1.4
W	McLaren Vale	1681	1176	10.2	7.3	3.6	4.3	3.4	3.1	6.2	6.5	1.8	2.1
C	Adelaide Hills	1673	1100	8.7	8.7	1.4	2.5	1.1	2.2	2.0	4.3	1.8	2.0
W	Margaret River	1525	1426	7.2	6.4	2.6	3.2	1.7	2.0	2.8	5.2	1.6	2.6
W	Clare Valley	1424	1028	6.8	5.6	2.8	3.2	1.8	1.8	2.7	3.2	1.5	1.8
C	Yarra Valley	1654	1492	7.6	6.4	1.6	1.6	1.1	1.0	1.9	2.7	1.8	2.7
W	Hunter	1256	839	6.7	4.0	3.0	2.3	1.9	0.9	2.6	1.4	1.3	1.5
W	Eden Valley	1544	1106	7.7	6.5	0.9	1.3	0.7	0.8	1.1	1.6	1.6	2.0
W	Goulburn Valley	1268	813	9.0	7.2	0.8	1.1	0.7	0.8	1.0	1.1	1.3	1.5
W	Mudgee	1206	473	7.3	2.7	1.6	2.2	1.1	0.6	1.5	0.5	1.3	0.8
C	Mt Lofty Ranges - other	1166	774	10.4	6.8	0.4	0.9	0.4	0.6	0.5	0.8	1.2	1.4
W	Currency Creek	1429	796	9.8	9.2	0.7	0.6	0.7	0.5	1.0	0.7	1.5	1.4
W	Orange	1408	702	9.0	3.6	0.8	1.0	0.6	0.4	1.0	0.5	1.5	1.3
W	Rutherglen	1307	748	6.2	6.3	0.6	0.6	0.4	0.4	0.5	0.5	1.4	1.3
W	Cowra	1114	527	10.5	3.6	1.2	0.9	1.2	0.3	1.4	0.3	1.2	0.9
C	Alpine Valleys	1058	779	10.5	6.0	0.6	0.5	0.6	0.3	0.7	0.4	1.1	1.4
C	Mornington Peninsula	1756	1928	6.7	5.1	0.3	0.5	0.2	0.2	0.4	0.9	1.9	3.5
H	Swan Hill (NSW)	562	310	7.4	12.0	0.4	0.2	0.3	0.2	0.2	0.1	0.6	0.6
W	Bendigo	1268	1054	5.3	4.1	0.5	0.5	0.2	0.2	0.3	0.4	1.3	1.9
W	Southern Fleurieu	1620	1380	6.0	7.6	0.3	0.3	0.1	0.2	0.2	0.5	1.7	2.5
C	Grampians	1346	1492	4.2	5.4	0.3	0.3	0.1	0.2	0.2	0.5	1.4	2.7
C	Hilltops	914	757	5.1	4.3	0.3	0.3	0.1	0.1	0.1	0.2	1.0	1.4
C	Mount Benson	1474	1045	11.4	7.3	0.2	0.2	0.2	0.1	0.4	0.2	1.6	1.9
W	Fleurieu - other	1620	582	8.7	8.2	0.4	0.1	0.3	0.1	0.5	0.1	1.7	1.0
W	Other regions	1073	526	6.6	5.9	15.1	12.4	9.4	7.3	10.7	6.9	1.1	0.9
	Total	**941**	**557**	**10.7**	**10.1**	**100**	**100**	**100**	**100**	**100**	**100**	**1.0**	**1.0**
	Sub-totals:												
C	Cool regions	1481	1065	9.7	7.5	11.8	14.6	10.7	10.9	16.9	20.7	1.57	1.91
W	Warm regions	1335	853	8.3	6.5	45.1	46.4	34.4	29.6	48.7	45.4	1.42	1.52
H	Hot regions	588	317	13.6	15.4	43.1	39.0	54.9	59.5	34.3	33.9	0.62	0.57

[a] Regions are designated climatically as either Hot, Warm or Cool, according to their mean January temperature: H = hot (above 23.2°C); W = warm (between 20.0 and 23.2°C); and C = cool (below 20.0°C).

Source: Anderson and Aryal (2014).

Appendix Table 3: Price, yield, production and varietal quality indexes, key varieties, 2001 & 2010

	Price (AUD/t)		Yield (t/ha)		Production volume (%)		Area (%)		Production value (%)		VQI	
	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010
Syrah	1238	664	10.6	9.5	22.4	26.3	22.4	28.1	28.1	30.2	1.26	1.15
Chardonnay	987	520	14.2	10.7	17.6	19.4	13.2	18.3	17.7	17.5	1.00	0.90
Cabernet Sauvignon	1252	640	10.0	8.2	17.9	14.0	19.1	17.1	22.8	15.5	1.27	1.11
Merlot	1086	549	10.5	10.5	5.8	6.8	5.9	6.6	6.4	6.5	1.10	0.95
Semillon	732	447	13.5	12.5	6.4	5.0	5.0	4.0	4.7	3.9	0.74	0.77
Sauvignon Blanc	1063	690	9.7	11.1	1.8	4.7	2.0	4.3	2.0	5.6	1.08	1.19
Muscat of Alexandria	369	275	19.6	23.8	3.5	3.2	1.9	1.3	1.3	1.5	0.38	0.48
Colombard	380	204	21.7	20.8	2.8	3.0	1.4	1.5	1.1	1.1	0.39	0.35
Pinot Noir	1563	898	9.2	8.8	2.1	2.7	2.5	3.1	3.4	4.2	1.59	1.55
Pinot Gris	1426	709		11.9		2.6		2.2		3.1	1.45	1.23
Riesling	1001	721	8.6	8.2	1.9	2.2	2.4	2.7	2.0	2.7	1.02	1.25
Petit Verdot	988	351	8.5	15.5	0.4	1.2	0.6	0.8	0.4	0.8	1.00	0.61
Verdelho	874	408	10.1	9.3	0.9	0.9	1.0	1.0	0.8	0.7	0.89	0.71
Ruby Cabernet	651	251	12.8	13.9	2.2	0.9	1.9	0.6	1.5	0.4	0.66	0.43
Viognier	1451	561	5.3	8.8	0.0	0.8	0.1	0.9	0.1	0.8	1.47	0.97
Garnacha Tinta	883	629	10.5	6.5	1.6	0.7	1.6	1.2	1.5	0.8	0.90	1.09
Gewurztraminer	676	503	8.3	10.8	0.3	0.6	0.4	0.5	0.2	0.5	0.69	0.87
Chenin Blanc	519	425	16.5	12.5	1.0	0.4	0.6	0.4	0.5	0.3	0.53	0.74
Monastrell	693	484	12.3	7.9	0.8	0.4	0.7	0.5	0.6	0.3	0.70	0.84
Muscat Blanc a Petits Gr.	450	362	11.5	10.1	0.2	0.4	0.2	0.4	0.1	0.2	0.46	0.63
Sangiovese	978	555	8.9	8.5	0.2	0.3	0.3	0.4	0.2	0.3	0.99	0.96
Durif	680	430	8.3	10.5	0.1	0.3	0.1	0.3	0.1	0.2	0.69	0.74
Cabernet Franc	1110	627	8.3	5.2	0.4	0.2	0.6	0.4	0.5	0.2	1.13	1.09
Tempranillo	962	683	5.1	6.2	0.0	0.2	0.0	0.3	0.0	0.2	0.98	1.18
Sultaniye	312	216	7.2	6.1	5.3	0.2	7.9	0.3	1.7	0.1	0.32	0.37
Cot	1042	658	10.0	7.2	0.3	0.2	0.3	0.2	0.3	0.2	1.06	1.14
Crouchen	451	423	16.9	25.1	0.1	0.2	0.1	0.1	0.1	0.1	0.46	0.73
Dolcetto				11.6		0.1		0.1				
Muscat a Petits Gr. Rouge	922	450	4.2	7.2	0.1	0.1	0.3	0.2	0.1	0.1	0.94	0.78
Marsanne	819	619	10.5	6.8	0.2	0.1	0.2	0.2	0.1	0.1	0.83	1.07
Arneis				9.6		0.1		0.1				
Trebbiano	350	316	10.7	11.3	0.5	0.1	0.5	0.1	0.2	0.0	0.36	0.55
Tribidrag	1195	686		5.6		0.1		0.1		0.1	1.21	1.19
Savagnin Blanc		531		8.6		0.1		0.1		0.0		0.92
Barbera	605	220	7.8	6.7	0.1	0.1	0.1	0.1	0.0	0.0	0.61	0.38
Tarrango	653	272	22.2	9.3	0.2	0.0	0.1	0.0	0.1	0.0	0.66	0.47
Muscadelle	747	471	8.2	6.7	0.1	0.0	0.2	0.0	0.1	0.0	0.76	0.82
Roussanne	1600	1139		4.8		0.0		0.1		0.1	1.63	1.97
Nebbiolo	1011	1220	3.3	4.0	0.0	0.0	0.0	0.1	0.0	0.1	1.03	2.11
Touriga Nacional	1017	874	9.4	6.0	0.0	0.0	0.1	0.0	0.1	0.0	1.03	1.51
Doradillo	259		19.7		0.4		0.2		0.1		0.26	
Palomino Fino	272	358	13.3		0.1		0.1		0.0		0.28	0.62

Appendix Table 3 (continued): Price, yield, production and varietal quality indexes, Australian key varieties, 2001 and 2010

	Price (AUD/t)		Yield (t/ha)		Production volume (%)		Area (%)		Production value (%)		VQI	
	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010
Afus Ali	260		3.4		0.1		0.3		0.0		0.26	
Pedro Ximenez	302		10.1		0.1		0.1		0.0		0.31	
Canada Muscat	516		9.1		0.0		0.0		0.0		0.52	
taminga	321		9.0		0.0		0.0		0.0		0.33	
Fiano		1337										2.31
Vermentino		614										1.06
Korinthiaki			2.1		0.1		0.6					
Pinot Meunier	1715	1201	10.2		0.1		0.1		0.1		1.74	2.08
Mazuelo	428		5.2		0.0		0.1		0.0		0.43	
Tannat		505										0.87
Other reds	738	712	2.4	7.2	0.5	0.5	2.2	0.8	0.4	0.7	0.75	0.93
Other whites	587	535	3.8	12.2	1.0	1.0	2.8	0.8	0.6	0.9	0.60	1.23
Total	**984**	**578**	**10.7**	**10.1**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**1.0**	**1.0**
Sub-totals:												
All reds	1081	638	9.9	9.1	56	55	60	61	67	61	1.10	1.10
All whites	740	466	11.7	11.6	44	45	40	39	33	39	0.75	0.81

Source: Anderson and Aryal (2014).