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Wine on the Web

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Dipl. agr. oec. Susanne Stricker

aus Kiel

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Dekan: Prof. Dr. F. Taube

Erster Berichterstatter: Prof. Dr. R.A.E. Müller

Zweiter Berichterstatter: Prof. Dr. C.-H. Hanf

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List of abbreviations

ACT	Australian Capital Territory
ANOVA	Analysis of Variance
AWBC	Australian Wine and Brandy Corporation
BAS	Business Activity Statement (Australian GST)
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CGI	Common Gateway Interface
EIU	Economist Intelligence Unit
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross Domestic Product
GST	Government Sales Tax
HTML	Hyper Text Markup Language
ha	Hectares
ISC	Internet Software Consortium
ISO	International Organization for Standardization
IT	Information technology
MAT	Moving annual total
MLE	Maximum Likelihood Estimation
Mt	metric tons
NSW	New South Wales
NT	Northern Territory
OLS	Ordinary Least Squares
PERL	Practical Extraction and Reporting Language
PHP	PHP Hypertext Preprocessor
PPP	Purchasing Power Parity
QLD	Queensland
SA	Southern Australia
TAS	Tasmania
URL	Universal Resource Locator
US	United States of America
VIC	Victoria
WA	Western Australia
WET	Wine Equalization Tax
Web	World Wide Web

1 Introduction

1.1 Motivation of research

Digital information technology has diffused into most business sectors at impressive speed since the Internet was opened for commercial use in 1995. This enabled electronic commerce (e-commerce), the buying and selling of goods and services on the Internet, especially the World Wide Web (Web) [OECD, 2003]. E-commerce is not a rigidly defined set of Web applications but is still evolving. The introduction of e-commerce into agriculture and the food industry is a continuous process rather than a single event. Where, which and at what speed e-commerce practices are evolved and adopted in the complex agricultural and food industry and what impact the transition towards e-commerce will have on farms, firms, supply chains, and agricultural markets is therefore impossible to predict with any accuracy.

Since innovations spread unevenly and because not all branches in agriculture and the food industry are intensively interconnected, the introduction of e-commerce in one section of agriculture or the food industry is, however, likely to have strong immediate impacts initially mainly in the section where it is applied but not in other branches of agriculture or the food industry. However, loose relationships between the various subsectors and markets in agriculture provide opportunities for learning. Lessons learned during the transition towards e-commerce in one branch of agriculture where e-commerce has been embraced early may provide insights useful to entrepreneurs and policy makers with interest and responsibilities in other branches of agriculture and the food industry where e-commerce is adopted later. The wine industry was identified as an early adopter of e-commerce and is therefore chosen as a case for an agricultural industry with a differentiated product produced by small- and medium sized firms.

Using the wine industry as a case for an agricultural industry with a differentiated product marketed by a mixture of small and medium firms, this study will contribute to a better understanding of how changes in transfer costs, especially search costs brought about by the Internet will affect wineries' marketing practices and competition among wineries.

At this time, e-commerce in the wine industry is used as an additional advertising and marketing channel. Falling costs for computer hardware, rapidly growing bandwidth for data transmission, strong network externalities, and the relentless exploitation of

technological advances for commercial purposes by innovative entrepreneurs will drive the diffusion of e-commerce into the wine industry in the near future, strengthening its position as an important marketing instrument. The adoption and use of e-commerce applications by wine producers and wine sellers, for example wine catalog retailers, was subject to earlier research [Stricker, 2001]. This study focuses on wine producers because developments in the wine industry may be indicative for other sectors of the agricultural and food industries.

The scientific interest in early e-commerce transition studies arises from the opportunity that the transition provides for adapting economic theories to take account of this new phenomenon. Such economic theories are required to guide coherent description of e-commerce activities and business relationships, and for predicting likely future developments and impacts.

Development of e-commerce is likely to be affected by many external factors. Some of the economic factors of interest are the policy and regulatory environment of the industry where e-commerce is introduced, costs of Internet access, and the size distribution of potential adopters in an industry. The relevance and impact of these factors are impossible to identify empirically unless there is substantial variation in them. The requisite variation is unlikely to obtain in studies limited to a single country, but may be found in studies covering several countries with different size distributions of firms, legal and regulatory environments, and different stages of Internet diffusion. Therefore, this thesis analyzes how wineries from Australia, California and Germany use the Internet to promote their businesses. Differences in the utilization of the Internet between countries will be explained in terms of structural and institutional characteristics of the industries in the three countries as well as in terms of the countries' e-commerce readiness.

For several reasons the wine industries of Australia, California and Germany are excellent candidates for a comparative study of the early transitions of agriculture towards e-commerce:

- (1) Wine is a highly differentiated, internationally traded experience product with intense competition on major export markets.
- (2) Early adoption of e-commerce occurred in the wine industry soon after the Internet was opened for commercial use. For example, Virtual Vineyards opened its website as early as 1995, that is shortly after the Web was opened for commercial use

[Aplin, 1999]. E-commerce is therefore likely to be more advanced in the wine industry rather than in other agricultural industries.

- (3) The wine industries are large, and their wine exports are significant. Australia, California and Germany belong to the World's seven largest wine producers [FAO, 2003], as well as to the World's seven largest wine exporters [Winetitles, 2003c].
- (4) The industries are characterized by a mixture of small and large producers and marketing channels differ. California's 850 wineries are predominantly family owned and operated businesses [Wine Institute, 2003b]. A small number of large wineries, such as Ernst & Julio Gallo, Robert Mondavi, Beringer Wine Estates and Sebastiani Vineyards have established brands that are well known at home and abroad and they market their product through established retail channels. Many of the smaller wineries are unknown but to a small band of cognoscenti and they sell wine directly to consumers. The wine industry in Germany is also characterized by many small wine producers, who often market their wines themselves. In contrast to the industry in California, however, there are no large wineries with well established brands and 18 percent of wine is sold directly from the cellar to the consumer making Germany the country with the highest share of direct sales of wine in Europe [Pomarici, 1999]. The organization of the Australian wine industry is more similar to the California than to the German industry.
- (5) The regulatory environments differ. The marketing activities of the small wineries in California, which do not have extensive distribution channels, are obstructed by wine shipment regulations of most states in the US and only 12 states allow free trade of wine over state borders [Wine Institute, 2003c]. In Germany, in contrast, the production of wine is subject to elaborate European Union (EU) and national regulations but the trade of wine is free within the EU. Australian wine trade suffers from complex tax laws [Australian Taxation Office, 2003b].
- (6) There are likely to be significant differences in the e-commerce readiness of the wine industries in the three countries. In particular, the California wine industry is likely to benefit from the head start in Internet diffusion and the lower PC and Internet access costs.

To determine how the Internet affects wineries' direct marketing activities, transaction cost theory will serve as a frame to identify the cost-relevant components of transfer costs

buyers and sellers face when involved in a winery direct marketing transaction. It is then discussed how the Internet affects these components especially in comparison to conventional marketing channels. Finally, this study will provide baseline information for future studies of e-commerce practices by the wine industry.

1.2 Outline

The motivation of research can be summarized by 5 central questions:

- (1) How do wineries use the Internet to market their wines?
- (2) Are there differences depending on the wineries' characteristics?
- (3) Are there interregional differences?
- (4) What are the determinants for these differences?
- (5) What are the implications for other agricultural and food industries?

To provide answers to these questions, this thesis is organized into six chapters. Chapter two characterizes the wine industries of the three countries. This is to serve as baseline information about the determinants of differences in regional wine marketing activities. The third chapter summarizes the e-commerce literature and transaction cost theory that is relevant for the study of direct marketing of wine. This chapter includes the determination of the e-commerce readinesses of the three regions. Chapter 4 presents the hypotheses tested in empirical research. Also, the fourth chapter contains the methods of empirical research, as well as methods of statistical data analysis used for testing these hypotheses. Chapter five presents the results of the winery e-commerce surveys in two parts. First, descriptive results are presented comparing each of the regions. The second part of chapter five presents the tests of the hypotheses. The study closes with a summary in chapter six.

2 The wine industries of Australia, California, and Germany

For many centuries wine was very much a European product. Today more than three-quarters of world wine production, consumption and trade occur in Europe, the other quarter is shared by a handful of “New World” countries once settled by Europeans. In the late 1980s Europe accounted for almost all wine exports (96 percent in terms of value) and for three quarters of all global wine imports. Within the last 20 years, however, California and several countries of the southern hemisphere (Australia, Argentina, Chile, South Africa, and New Zealand) have begun to challenge Europe’s prevalence. From 1988 to 1999 this group’s combined share in the value of world wine exports grew from 3 to 16 percent. That change was accompanied by the rapid growth of area under vines and wine production in Australia and California [Anderson and Norman, 2001].

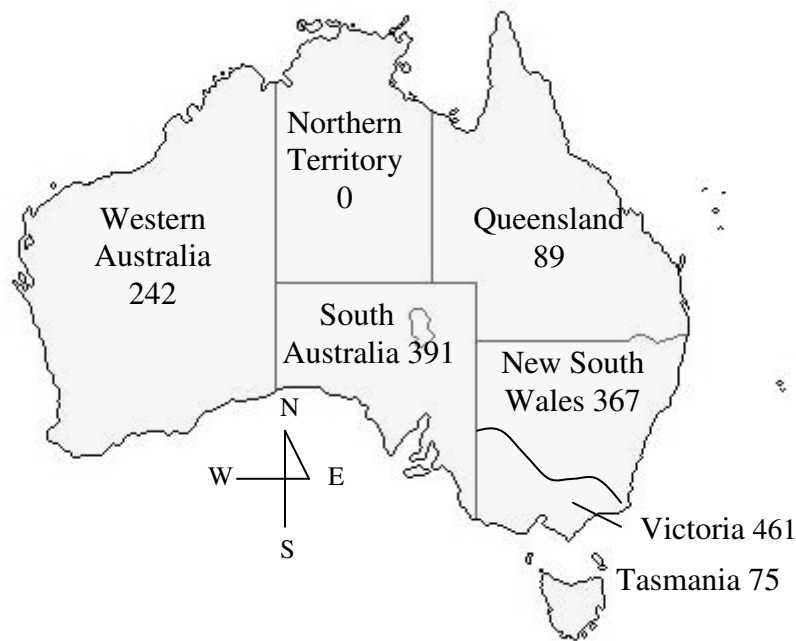
Differences in the use of the Internet and its applications are assumed to be conditional on the characteristics of the wine industries. Therefore, the wine industries are described and compared in this chapter. First, the regional industry structures in terms of producers and wine growing regions are presented. Then, current wine production and the development of wine production over the last forty years are described. Key statistics concerning wine consumption are summarized in the third subsection of this chapter, followed by a summary of central statistics concerning wine trade. The last subsection of this chapter reports national market regulations in each of the three regions.

2.1 Industry structure

2.1.1 Australia’s wine industry

As of 2003 there are 1,625 wine producers in Australia plus five major wine groups, an increase of 11 percent from the year 2002. The 1,625 wine producers in Australia are spread across six of the seven Australian states (see Figure 1).

Figure 1: Map of Australia with number of wineries, by state, 2002



Victoria has by far the most wineries, followed by South Australia and New South Wales. A complete list of the development of number of wineries by state from 1983 to 2003 is provided in Attachment 5. The net increase in the number of wine producers in the year 2001 was 160, in the past 10 years the number of wine producers grew by about 80 per year. Since 1994, when there were 802 wine companies in Australia, the number of wineries has doubled [Winetitles, 2003c].

The industry is dominated by five large wine groups Southcorp Wines, McGuigan Simeon Wines, Beringer Blass, BRL Hardy, and the Orlando Wyndham Group (see Table 1). The total vineyard area of the five largest Australian wine companies together represents 16 percent of total national winegrape area. Together Southcorp Wines and BRL Hardy account for almost half of all sales of branded wine within Australia [Winetitles, 2003c].

Table 1: Australia's ten largest wine producers by vineyard area, 2002

Rank	Wine Company	Area [ha]	Share in total area [%]*
1	Southcorp Wines	8,102	5.1
2	McGuigan Simeon Wines	4,600	2.9
3	Beringer Blass	3,500	2.2
4	BRL Hardy	2,400	1.5
5	Orlando Wyndham Group	2,200	1.4
6	FABAL Wines	1,073	0.7
7	Riverina Estate	1,060	0.7
8	Reynolds Wines	1,025	0.6
9	McWilliam's Wines	950	0.6
10	Wingara Wine Group	720	0.4

*share of 158,594 hectares total vineyard area

Source: [Winetitles, 2003c]

Three fifths (59 percent) of all grapes crushed in Australia in 2003 were red grape varieties, 41 percent were white. The most popular red varieties are Shiraz, Cabernet Sauvignon, and Merlot, together accounting for 84 percent of all red grapes crushed in Australia in 2003. The most important white grape varieties are Chardonnay, Semillon and Colombard, together accounting for 62 percent of all white grapes crushed. In Australia the most popular grape varieties by far is Shiraz, accounting for 27 percent of all grapes harvested, followed by Cabernet Sauvignon (16 percent), Chardonnay (15 percent), Semillon and Merlot (each 6.4 percent) [Winetitles, 2003c].

2.1.2 California's wine industry

Wine is grown in California in five main regions: North Coast, Central Coast, Central Valley, Sierra Nevada, and South Coast, with each region comprising several counties (see Figure 2). In 2002 California had 847 commercial wineries, most of which are family-owned and operated businesses [Wine Institute, 2003b]. Attachment 2 provides a complete list of the number California wineries by county as well as a classification of counties into State Grape Crush Districts.

Figure 2: Map of California with number of wineries by growing regions and counties



In the year 2002, the largest 25 wineries shipped 90 percent of all California wine to markets worldwide [eresonant.com, 2003b]. E. & J. Gallo Winery is, by far, the largest winery in the USA, it accounts for 30 percent of California’s wine production, followed by the Canandaigua Company (16 percent), the Wine Group (12 percent), Beringer Wine Estates and Robert Mondavi, (5 percent each). The five largest producers together account for two-thirds of the volume of wine produced in the USA [Rural Migration News, 2003].

Many of the small wineries are unknown but to a small band of cognoscenti and they sell their wine directly to consumers.

Similar to Australia, almost three fifths (58 percent) of all grapes crushed in California in 2002 were red varieties, 42 percent were white varieties. The most popular red varieties are Cabernet Sauvignon, Zinfandel and Merlot, together accounting for 47 percent of all red grapes crushed in 2002. The most widely grown white grape variety in California is Chardonnay, accounting for 14 percent of all grapes harvested, followed by Zinfandel (10.3 percent), Cabernet Sauvignon (9.4 percent), Colombard (8.8 percent) and Merlot (each 7.5 percent) [California Agricultural Statistics Service, 2003b].

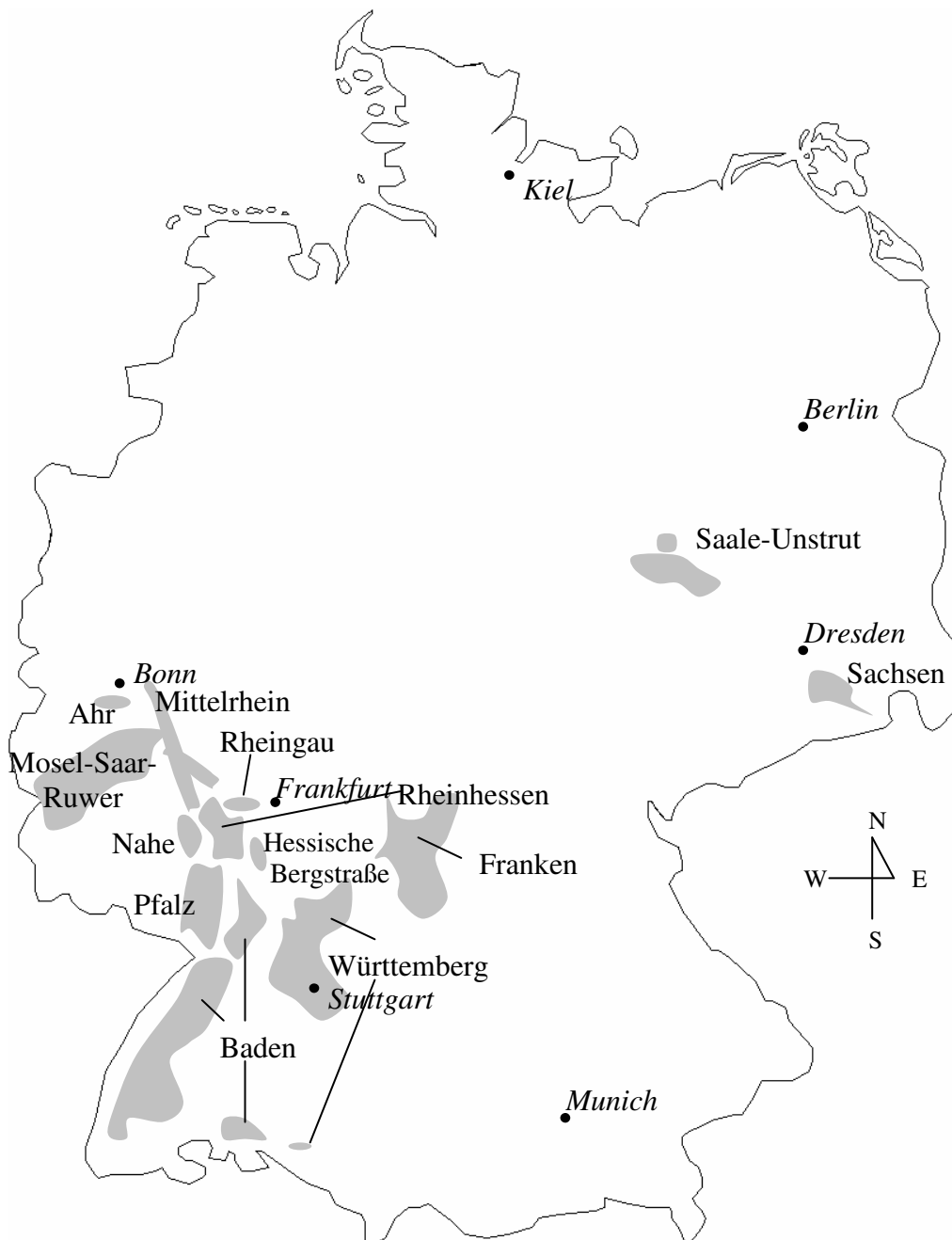
2.1.3 Germany's wine industry

There are 13 Wine growing regions in Germany (see Figure 3). Almost all wine growing regions are located in south-western Germany. Two, Saale-Unstrut and Sachsen are located in eastern Germany. These are among the most northerly wine regions of the World.

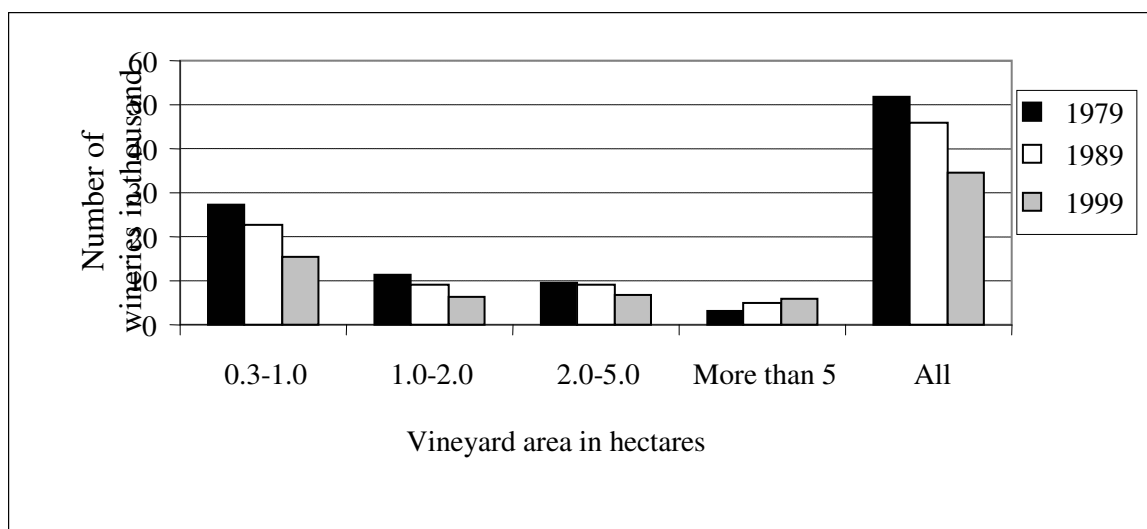
Almost three fourths (71 percent) of German vineyard area is planted with white grape varieties, over half of which are Müller-Thurgau and Riesling [Deutsches Weininstitut, 2003d]; 29 percent are planted with red grape varieties, Pinot Noir (Spätburgunder) is the dominating red wine variety, and 10 percent of all vineyards are planted with Pinot Noir. Dornfelder and Portugieser rank second among the red grape varieties with each accounting for 5 percent of Germany's total vineyard area.

Marketing arrangements differ significantly among the wine growing regions in Germany. In the two most southerly regions, Baden and Wuerttemberg, most of the wine is produced and marketed by cooperatives whereas cooperatives play a minor role in the other areas. In most areas, direct marketing dominates the sales of bottled wine, whereas in the Mosel region a sizable share of production is marketed through commercial wine merchants. In Germany there are also some large wine trading houses, but in contrast to Australia and California, there are none that dominate nationally and there are no very large wineries with well established brands. Attachment 3 provides an overview over the grape varieties grown in the individual areas and about the marketing arrangements in these areas.

Figure 3: Map of Germany and its wine growing regions



Many, mostly smaller vintners in Germany, make wines and are not able to sell their wines at prices that cover production costs. As a result, more commercially viable producers are overtaking the smaller wine makers [Deutsche Welle, 2002]. The number of wineries has dramatically fallen over the past 30 years. Germany had over 50,000 producers in 1979. By 1999 that figure had fallen to 34,440 [Statisches Bundesamt, 2001], 45 percent of these had less than 1 hectare of vines, and 63 percent had less than 2 hectares.

Figure 4: Development of number of wineries by winery size class in Germany, 1979, 1989, and 1999

Source: [Bundesministerium fuer Ernährung Landwirtschaft und Forsten, 2003]

Concentration marks the German wine growing industry, in all size categories, with the exception of wineries in the largest size category (more than 5 hectares) the number of wineries continuously dropped since 1979 (see Figure 4). Not even every fifth (17 percent) wine grower in Germany has more than 5 hectares of vines, but together these growers operate 61 percent of the total German viticultural area. The number of wineries with more than 5 hectares of vineyard area grew by 18 percent in the decade from 1989 to 1999. Attachment 4 gives an overview over the number of German wineries by wine growing region in 1979, 1989, 1999 and an estimate for 2003.

2.2 Wine production in Australia, California and Germany

In 2002 France, Italy and Spain, the World's largest wine producers, together accounted for almost half of the World's wine production. The USA and by implication California is the fourth largest wine producer in the World, they account for 9.5 percent of the volume of global wine production. Since there are no statistics for California wine production, data for the USA are used instead. This is reasonable, since over 90 percent of the wine produced in the USA is produced in California and California's production alone would be enough to rank this state fourth in the World [eresonant.com, 2003a]. Australia is the World's fifth largest wine producer, Germany the seventh largest (see Table 2). Together, Australia, the USA and Germany account for 18 percent of global wine production.

Table 2: The World's seven largest wine producers and their share in World wine production, 2002

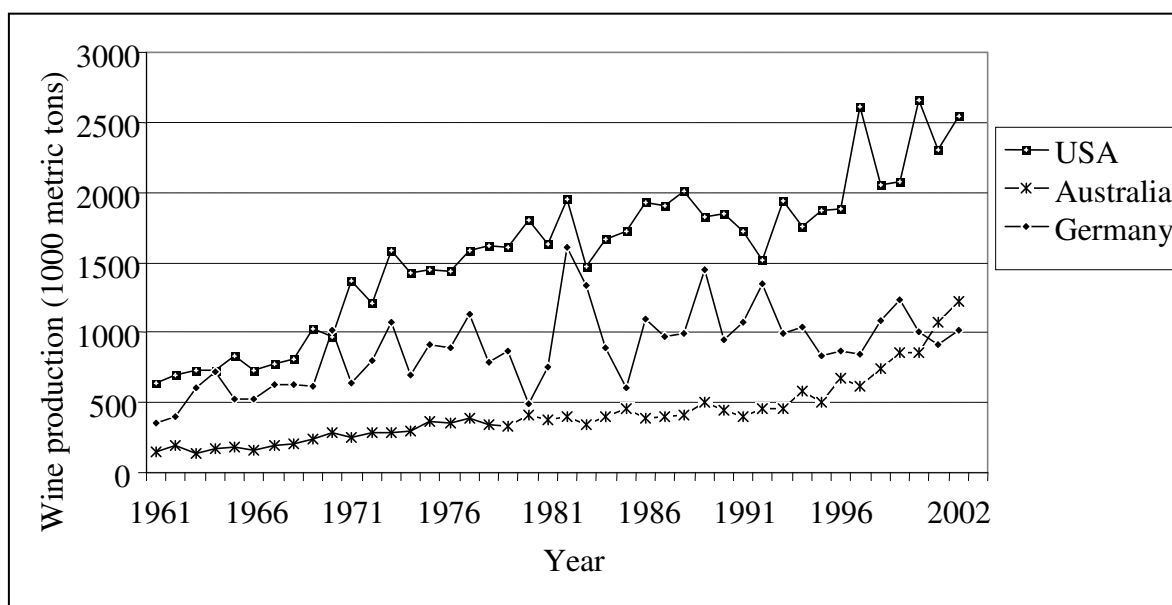
	Wine production [million tons]	Share in World wine production [%]
France	5.2	19.4
Italy	4.5	16.7
Spain	3.4	12.9
United States of America	2.5	9.5
Australia	1.2	4.6
Argentina	1.2	4.5
Germany	1.0	3.8

Source: [FAO, 2003]

Australia and California used to be insignificant wine producers, but this has changed during the last decade. Before 1970 Australia accounted for less than one percent of World wine production, in 2002 her share reached almost 5 percent of global wine production, overtaking Germany in terms of volume of wine produced (see Figure 5) [Winetitles, 2003c]. In 1961 Germany held a share of 1.7 percent in global wine production, this share more than doubled to reach 3.8 percent in 2002. However, today, in terms of wine production, Germany is the smallest of the three regions studied.

The USA has always been the largest wine producer of the three. In 1961 the USA held a share of 3.2 percent in global wine production. This share grew to about 8 percent of global wine production in 2002, when the United States produced 2.5 million metric tons of wine [FAO, 2003].

Figure 5: Development of the volume of wine production in Australia, the USA, and Germany, 1961-2002

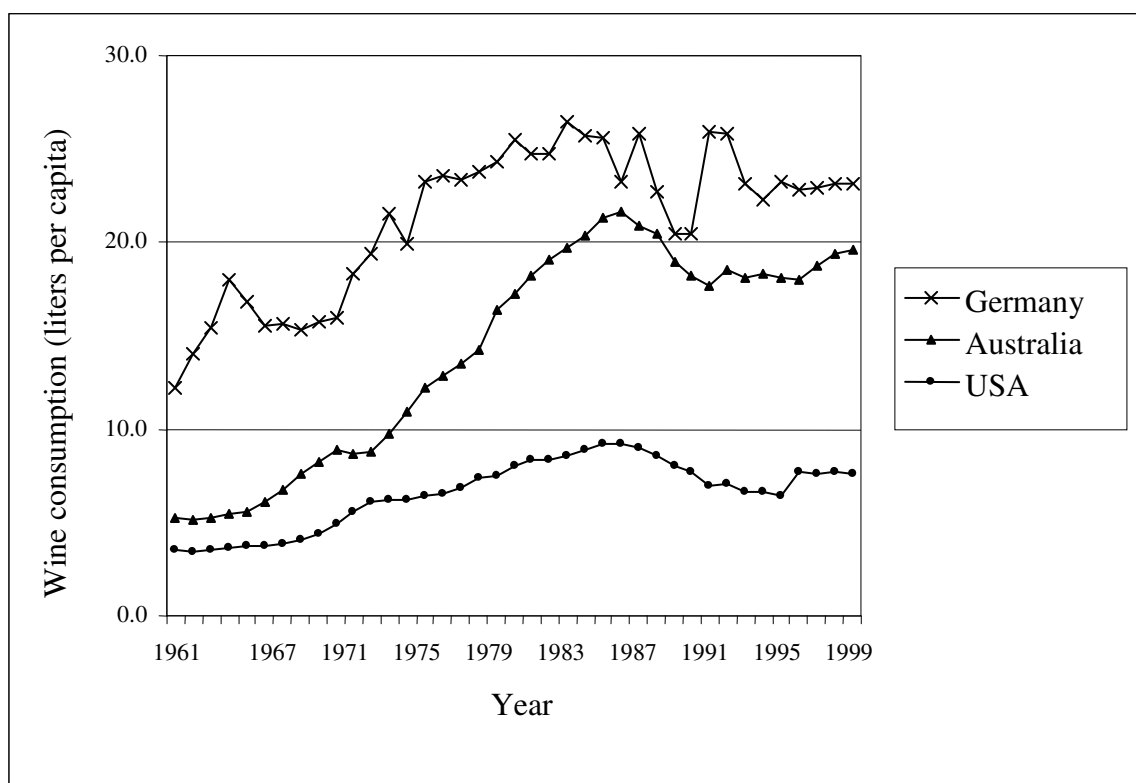


Source: [FAO, 2003]

2.3 Wine consumption in Australia, California and Germany

Total World wine consumption decreased marginally from 2001 (21,936 million liters) to 2002 (21,892 million liters). Following France and Italy, in 2002, the USA is the third-largest wine consuming nation, accounting for almost every tenth (9.7 percent) liter of wine consumed in the World. Germany is the World's fourth largest wine consuming nation, 9 percent of all the wine consumed in the World are consumed there. Germany's fourth rank is remarkable, considering that the US-population is over three times as large as the German population. Australia is not among the World's ten largest wine consuming countries, accounting for only 1.9 percent of World wine consumption [Winetitles, 2003c].

The three countries differ markedly with regard to per capita wine consumption. Germans drink the most wine per capita, with annual wine consumption almost doubling from 12.2 liters per capita in 1961 to more than 23 liters in 1999. Australians are, however, catching up, their annual per capita wine consumption almost quadrupled from 5.4 liters in 1961 to 19.6 liters in 1999. Per capita wine consumption in the USA grew from 3.6 liters per year in 1961 to 7.6 liters per year in 1999 (see Figure 6). In the same period, the average annual World per capita wine consumption dropped from 7.1 liters in 1961 to 4 liters in 1999 [Anderson and Norman, 2001].

Figure 6: Development of per capita wine consumption in Australia, the USA and Germany, 1961-1999

Source: [Anderson and Norman, 2001]

Even though wine consumption per capita has grown in each of the three regions, they are not among the World's ten largest wine consuming nations. France leads with its inhabitants consuming over 60 liters per capita annually. German citizens are the World's 15th largest per capita wine consumers, Australia 18th largest, and the US-population is the World's 28th largest wine consumer in terms of annual per capita consumption [Anderson and Norman, 2001].

2.4 Wine exports and imports of Australia, California and Germany

In the past, wine producing countries consumed most of their own production and little was exported. Of late, wine is becoming much more of an internationally traded product. Today, every fourth liter of wine produced is sold internationally, even though global wine consumption has been declining by 1.5 percent per year over the 1990s. [Anderson and Norman, 2001]. Anderson, Norman and Wittwer [2003] predict that the share of production that is exported will continue to rise, reaching 28 percent by 2005 in volume

terms. All three countries belong to the World's largest wine exporting countries. Australia is the World's fourth largest wine exporter, following Italy, France, and Spain. The USA are sixth largest, Germany ranks seventh (see Table 3).

Table 3: The World's seven largest wine exporters and their share in World wine exports, 2002

Country	Wine exports [million liters]	Share of World exports [%]
Italy	1,380	26.5
France	1,580	22.9
Spain	990	14.4
Australia	380	5.5
Chile	310	4.5
USA	300	4.3
Germany	240	3.5
World	6,897	

Source: [Winetitles, 2003c]

2.4.1 Australia

Until the 1990s Australia's wine exports were small. In the first half of the 1980s Australia accounted for as little as 0.2 percent of the volume of global wine exports, the same as its share of global wine imports. The import share has changed little, while the export share has grown to 5.5 percent of volume of wine exports in the World. Australia's wine exports grew more than three times faster than the global average: Australia accounts for annual growth rates of 16 percent in terms of volume and 19 percent in terms of value [Anderson and Norman, 2001].

In 2002, Australia's wine exports accounted for more than half (53 percent) of total wine sales, compared with less than 3 percent in 1984. Whereas domestic sales have been stable, export sales have been rising steadily during the last two decades. 2002 was the first year when Australian export sales were higher than domestic wine sales. Today, nearly 1.7 million bottles leave Australia every day supplying 104 international markets. The United Kingdom is, by far, the most important export market for Australian wine. While wines with an average price of 2.50 Euros per liter are exported to the United Kingdom, wines exported to the United States have an average price of 3.70 Euros per liter (Table 4).

Table 4: Volume, value and prices of Australian wine exports, by country of destination, 2002

Country of Destination	2002			Change in average price from 2001 [%]
	Volume [million liters]	Value [million €]	Average price €/liter	
United Kingdom	216	539	2.50	+0.4
United States	120	443	3.70	+6.7
New Zealand	27	56	2.10	-2.9
Canada	22	90	4.10	+8.0
Germany	16	32	2.10	-19.4
World	471	1368	2.90	+3.6

Source: [Winetitles, 2003c]

The volume of wine imported to Australia increased by 24.9 percent from 2001 to 2002 reaching 14.5 million liters (see Table 5), which is roughly equivalent to the amount Australia exports to Germany (see Table 4). The value of wines imported grew by 27.5 percent to reach AUS \$ 115.6 million (= € 69.7 million). Compared to domestic wine, imported wines account for a very small share of 4.1 percent of the market in 2002, having grown from 3.5 percent in 2001. The average retail price of imported wine per liter increased from AUS \$ 7.67 (= € 4.63) in 2001 to AUS \$ 7.83 (= € 4.73) in 2002 [Winetitles, 2003b].

34.4 percent of the volume of all wine imported to Australia originates from Italy. The highest share in value (37.6 percent) was held by French wines, achieving the highest average price of AUS \$ 15.98 (= € 9.55) [Winetitles, 2003b].

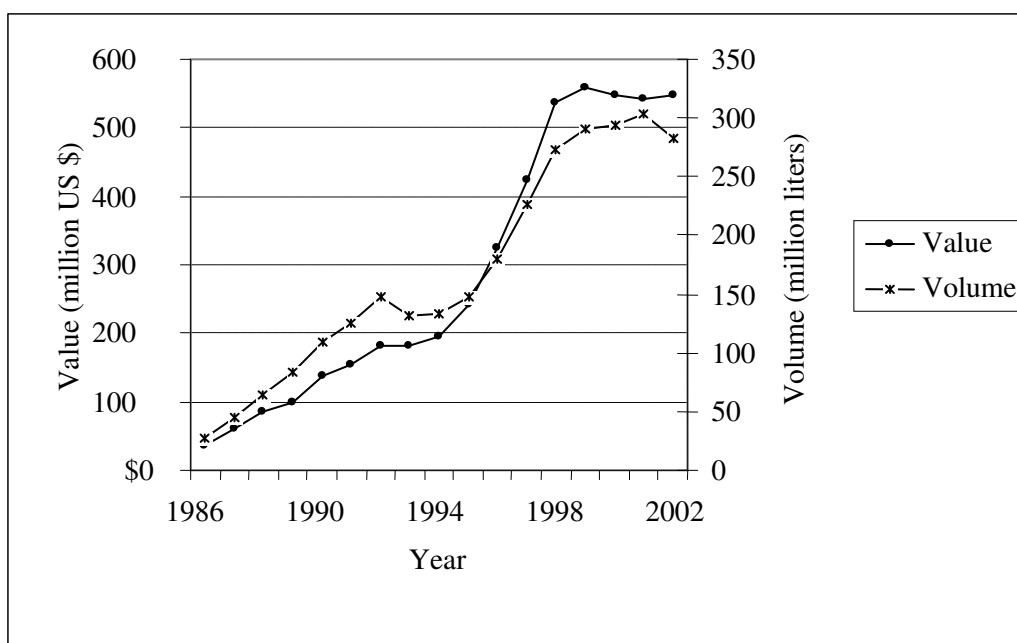
Table 5: Volume, value and prices of Australian wine imports, by country of origin, 2002

Rank	Country	Quantity ['000 liters]	Value [€ '000]	Price [€/liter]
1	Italy	4,983	14,885	2.99
2	France	2,716	25,940	9.55
3	New Zealand	3,894	20,826	5.35
4	Portugal	484	1,225	2.53
5	Greece	407	581	1.43
6	Spain	386	1,334	3.46
7	Germany	371	1,081	2.92
8	Chile	264	773	2.93
9	United States	239	525	2.19
Total wine imports		14,479	69,075	4.77

Source: [Winetitles, 2003b]

2.4.2 California

Following almonds and cotton, wine is California's third most important agricultural export commodity in terms of value [Bervejillo and Sumner, 2003]. United States wineries exported 283 million liters in 2002, of which 95 percent originate from California. In 2002, for the first time since the beginning of the '90s, the volume of exports declined, 7 percent from 2001, returning a revenue of US \$ 549 (= € 450.6) million to US wineries. The causes for the decline in 2002 are unfavorable dollar exchange rates that also caused foreign wines to pour onto the US market [Wine Institute, 2003a] and the 9.6 percent increase in domestic wine prices that occurred between 2001 (US \$1.77 = € 1.63 per liter) and 2002 (US \$ 1.94 = € 1.78 per liter) [California Wine Export Program, 2003]. From 1986 both volume and value of wine exports grew considerably. Export volume increased from 27.6 million liters in 1986 to more than ten times as much today (283 million liters). Until 1992 the value of US wine exports grew faster than the volume exported (see Figure 7), then export volumes took a dip reaching the 1992 level in 1995.

Figure 7: Development of volume and value of US wine exports, 1986-2002


Source: [Wine Institute, 2003d]

Since 1995, both volume and value of USA wine exports grew rapidly until 1999, growth of value exceeding growth in volume since the mid '90ies [Anderson and Norman, 2001].

The US exported wine to 107 countries in 2002 [California Wine Export Program, 2003], the most important markets for US wine exports in terms of value were the United Kingdom, Canada and Japan, which together accounted for almost three fourths (73.4 percent) of the value of all US wine exports (see Table 6).

Table 6: Value of US wine exports, by country of destination, 2002

Rank	Country	Value [€ million]	Change from 2001 [%]
1	United Kingdom	189	+12
2	Canada	92	-3
3	Japan	79	+50
4	The Netherlands	53	-23
5	Belgium-Luxembourg	19	-32
6	France	13	+92
7	Germany	12	-13
Total US wine exports		541	+2

Source: [Wine Institute, 2003a] and [California Wine Export Program, 2003]

Every fourth bottle of wine consumed in the USA is imported from abroad [Rural Migration News, 2003]. The volume of wine imports increased 15 percent from 2001 to reach 610 million liters in 2002, a 40 percent increase from 1999. In terms of value, imports have increased by only 22 percent from US \$ 2.27 billion (= € 2.09 billion) in 1999 to US \$ 2.77 billion (= € 2.55 billion) in 2002, the increase from 2001 to 2002 alone was 18 percent. This represents an average annual increase of 7.3 percent between 1999 and 2002 [California Wine Export Program, 2003].

Italy has the largest market share in terms of volume, selling 182.9 million liters to the USA in 2002. Australian imports grew by 124 percent since 1999 now exporting 109 million liters to the USA, replacing France in second place for the first time ever. Together Italy (37 percent) Australia (21 percent) and France (18 percent) account for 76 percent of all wine imports to the USA in terms of volume. Other wine exporters to the USA are Chile, Spain, and Germany in places four through six in terms of volume [California Wine Export Program, 2003]. In terms of value, Italy, France, and Australia jointly account for 81 percent. Italy taking place one (33 percent) followed by France (28 percent) and Australia (21 percent). Places four through six in terms of value of wines imported to the US are taken by Chile, Spain, and Germany [California Wine Export Program, 2003].

2.4.3 Germany

Germany exported 221 million liters worth about € 348 million in 2001. While the value increased by 3.3 percent from 2000 (€ 337 million), the volume of wine exported decreased by 1.7 percent compared with the previous year, in which 225 million liters were exported. Similar to Australia and the US, the most important export market for German wine in 2001 in terms of volume and value is the UK. The second most important export market for German wine is the USA, followed by Japan, and the Netherlands. The more expensive wines are exported to the US and Japan, while predominantly cheaper wines are exported to the UK, the Netherlands, Sweden and France (see Table 7).

Table 7: Volume, value and prices of German wine exported, by country of destination, 2001

Country	2001		
	Volume [million liters]	Value [€ billion]	Price €/liter
United Kingdom	919.5	106.8	1.16
USA	136.3	40.8	2.99
Japan	94.3	30.9	3.27
The Netherlands	268.1	30.3	1.13
Sweden	116.3	18.6	1.60
France	98.0	13.0	1.33

Source: [Deutsches Weininstitut, 2003b]

As well as for the USA, Italy has the largest share (35 percent in terms of value) of the German import market for wine. In terms of value, 80 percent of the wine imported to Germany originates from the top three suppliers Italy, France and Spain. Fourth, fifth, and sixth most important wine importers to Germany are the USA (3.5 percent market share worth € 69 million), Chile (2.7 percent worth € 53.6 million), and Australia (2 percent worth € 40 million) [Statisches Bundesamt, 2003].

2.5 Regulatory environments

The regulatory environments of the three regions observed in this study are of interest because they potentially affect the development of trade, especially the use of the Web for trading wine. California wineries, for example, are subject to complex wine trade laws that are remnants of the prohibition while wine trade is free within the European Union.

2.5.1 Australian market regulations

The Australian wine market underlies complex tax laws. The three main issues are the Wine Equalization Tax (WET), subsidies provided by the states, and the Australian Capital Territory (ACT) wine producer rebate. Wine producers have to collect WET from their distributors. Although wine bought at a price which includes WET does not have a liability to WET when sold in retail, the tax is usually included in the wine price and therefore indirectly passed on to consumers. The WET on wholesale sales is 29 percent of the selling price of the wine. In addition, the Government Sales Tax (GST) of 10 percent is then

calculated on the price including the WET. Exports of wine are not subject to WET [Australian Taxation Office, 2003b].

The states provide subsidies for all direct-marketing winemakers. The subsidy is 15 percent of the wholesale value of cellar door, mail order, or Internet sales to consumers. To further assist small winemakers that market their wine directly, the Commonwealth provides an additional 14 percent tax-rebate on cellar door, mail order and Internet sales made by the winery directly to the consumer. The rebate is 14 percent of the taxable value used to calculate the WET on rebateable dealings. This rebate is likely to favor Internet wine sales.

The tax-rebate can only be claimed by wine producers registered for GST and holders of an appropriate ACT license under the Liquor Act of 1975. Wholesalers or any other resellers are not eligible for the ACT rebate. The claimable amount is limited to AUS \$ 45,000 (= € 26,917) per fiscal year, this means that the ACT rebate can be applied to retail sales values of wine up to AUS \$ 300,000 (= € 179,449). The combination of the state subsidy and the ACT rebate means that cellar door sales up to a wholesale value of AUS \$ 300,000 per year are effectively WET free. The ACT rebate does not apply to Internet wine sales where a commission is payable to a third party. [Australian Taxation Office, 2003a].

2.5.2 United States market regulations

Every bottle of wine sold in the US must contain the following information: brand name, class or type of wine, alcohol content, net volume content, and the name and address of the bottling firm. Many wineries also provide information about grape variety, vintage, and appellation of origin [Bombrun and Sumner, 2003]. The Wine Institute [Wine Institute, 2003e] provides a detailed library of federal laws on wine labeling.

Unlike most other consumer goods that are shipped across state borders, interstate alcohol shipments in the United States underlie an extremely stringent legal framework, known as the ‘three-tiered’ system, which comprises manufacturing, wholesaling and retailing. The Virginia statute is stated here as an example of the ban of vertical integration: “The General Assembly finds that it is necessary and proper to require a separation between manufacturing interests, wholesale interests and retail interests in the production and distribution of alcoholic beverages in order to prevent suppliers from dominating local markets through vertical integration and to prevent excessive sales of alcoholic beverages

caused by overly aggressive marketing techniques. (VA Cods Sec. 4.1-215.C)” This direct shipment ban is not unique to the state of Virginia, as of September 2003, 25 states allowed interstate direct shipments of wine under certain conditions, while 27 prohibited it, seven states even classifying direct wine shipments as a felony. Attachment 1 provides a complete state-by-state list of the direct wine sales laws in the USA.

Even if consumers potentially benefit from cost savings or larger variety they face when shopping online for wine, the current regulatory and legal regime that governs electronic commerce in the United States may affect the degree to which consumers can actually realize these benefits [Wiseman and Ellig, 2003]. In this context, consumer concerns, mainly those concerning prices and variety are balanced against the goals of public policy. The main argument of proponents of these laws is that the economic harm to consumers is slight, and that these laws are necessary to promote temperance, collect alcohol taxes and to prevent underage drinking. Opponents hold against that economic harm to consumers is significant and that less restrictive policies than banning direct shipment could be enforced to collect taxes and prevent underage drinking.

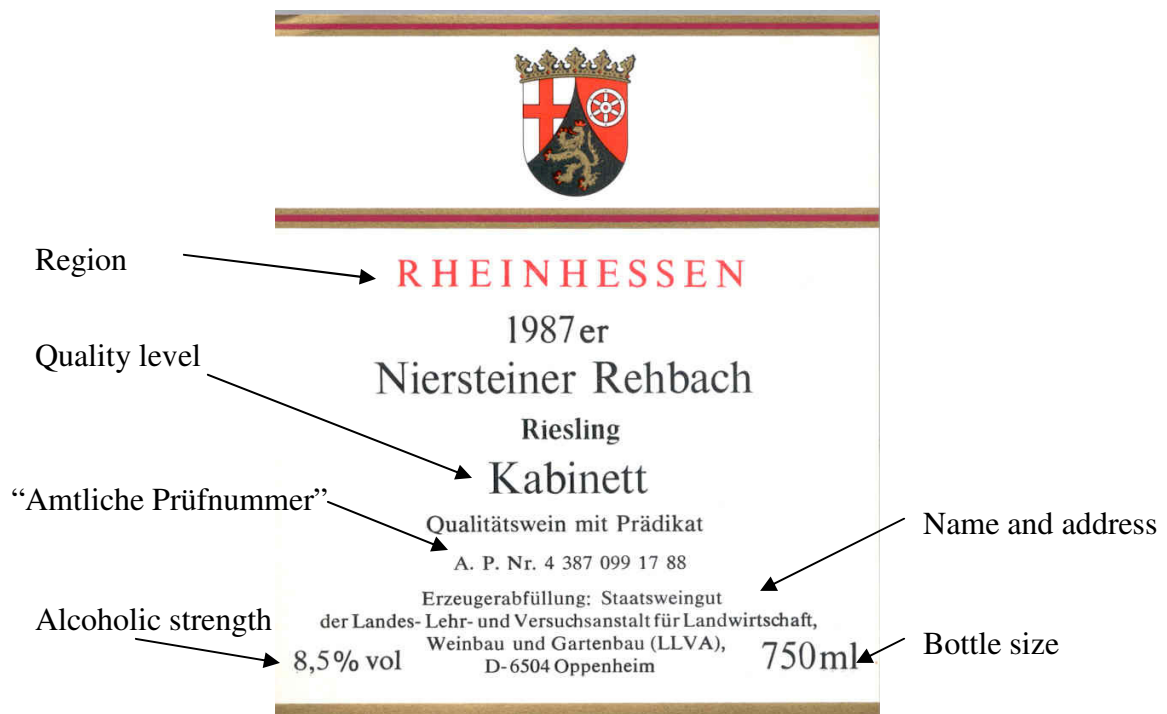
Despite a wide field of arguments on both sides, with one exception, no substantial analysis has been made that would allow to actually determine the impact of alternative policies on consumers. The exception is the study of Wiseman and Ellig (2003). Drawing on price data from online wine retailers and bricks-and-mortar wine retailers in northern Virginia, they found that by forbidding online wine purchases from out-of-state sellers, Virginia’s direct shipment ban reduces the variety of wines available to consumers and it did not allow Virginia consumers to buy many premium wines online at lower prices.

2.5.3 German market regulations

Provisions concerning vine growing, wine making and wine marketing are subject of various European and German -federal as well as state- directives, decrees, and laws. Wine authorization regulates the organization of the wine market, vineyard census, wine varieties, quality attributes for quality wines and much more [Flitsch, 1994]. For consumers the most relevant issue of the German wine law are the quality attributes of the wines, some of which have to be shown on the labels of the bottles (see Figure 8). The wine producer must state the following on the label:

1. the specific wine growing region: one of the 13 designated regions in Germany;
2. quality level of the wine;
3. “Amtliche Prüfnummer” (i.e. organoleptic testing) a serial number received during official quality control and tasting;
4. alcoholic strength;
5. name and address of producer / bottler;
6. bottle size in liter.

Figure 8: A German wine label showing mandatory quality information



Consumers of German wine are well familiar with the mandatory quality information and judge the wines by this information. For direct marketing wine on the Web, this means by displaying the label information, potential consumers are well informed about what they are buying.

3 Transaction costs in e-commerce

Thomas Watson, an erstwhile chairman of IBM, reportedly said in 1943: ‘There is a World market for maybe five computers’. In a similar vein electronic commerce pundits, such as Kevin Kelly [1998] and Don Tapscott [1996], predicted ‘frictionless’ commerce, and they questioned established economic concepts and theories [Mueller, 2001b]. Economists indeed have found lowered ‘friction’ in many dimensions of Internet competition, but there are still many sources of ‘friction’ creating heterogeneity among Internet retailers selling homogeneous commodities [Brynjolfsson and Smith, 2000]. Moreover, economic laws have stayed the same as the Internet has diffused into everyday business life, and they are likely to also hold in the future [Shapiro and Varian, 1998]. The microeconomic tools that have been previously used to analyze the impacts of technological change, such as the telephone, are equally applicable to the business World that is now adopting e-commerce [Borenstein and Saloner, 2001].

E-commerce is understood as any kind of business transaction, in which the participants use the Internet for prearranging, negotiating and following through on a transaction [Müller, 2002]. As elsewhere in the economy, the e-commerce bloom in agriculture went along with the e-commerce stock market boom of the late 1990s. A host of websites grew rapidly to provide marketing services to farmers or to use Web technology to market farm products [Mueller, 2001a]. However, many of these businesses in agriculture, as elsewhere, had no business model that was operational and profitable and they failed [Williams, 2001]. While share-prices of dotcoms have fallen, e-commerce has continued to grow, and it may have a lasting effect on most economic activity and still warrants research attention. The aim of this study is to determine the impact of the Internet on wineries’ direct marketing activities (winery-to-consumer e-commerce). Therefore the focus of the theoretic framework lies on business-to-consumer (b2c) e-commerce.

This chapter is organized into four main sections. First, the effects of the introduction of e-commerce on a winery’s relevant market for bottled wine are presented in a model. The transaction cost reduction through e-commerce incorporated in this model is then discussed in the second main section using transaction costs theory. Central economic principles that economists found to best characterize the central impacts of the Internet and that are of relevance to marketing wine on the Internet are discussed in the third section. In order to be able to participate in e-commerce, the circumstances have to be favorable, a country has

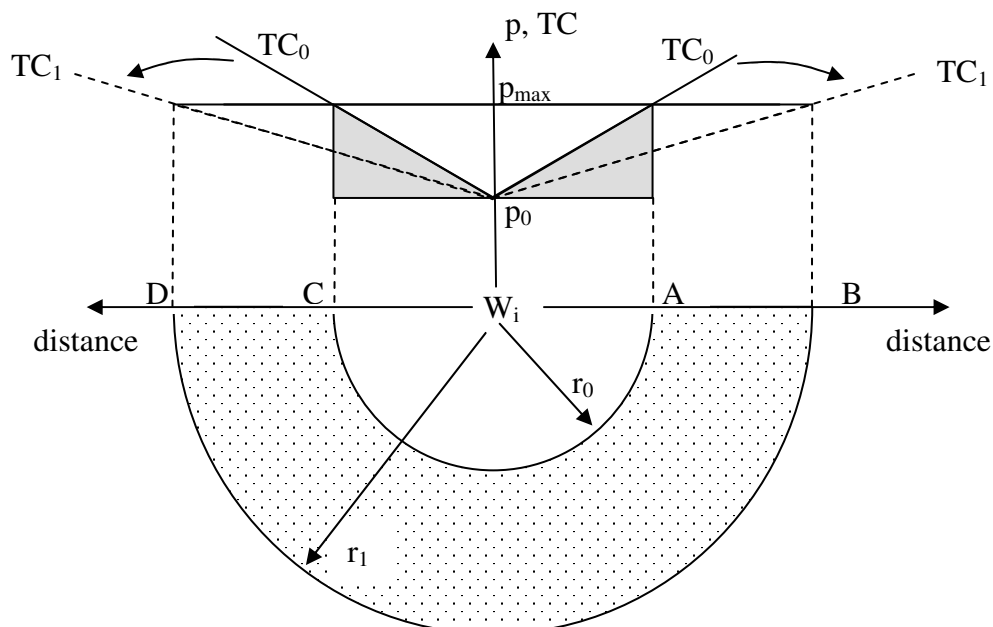
to be 'ready'. Therefore the e-readinesses of Australia, California and Germany are determined and compared in the fourth and final subsection of this chapter.

3.1 What happens to the winery's relevant market after the introduction of e-commerce?

Offering wine on the Internet extends the geographic reach of a winery's market. Figure 9 illustrates this fact by depicting distance against price and transfer costs. Transfer costs are the sum of transaction costs and transportation costs [Hirshleifer, 1973]. Point W stands for the geographic location of the winery. The price a winery charges per bottle of wine sold directly at its location is p_0 . The maximum price a consumer is willing to pay is p_{\max} . This price includes transfer costs TC. Transfer costs increase with distance, primarily because of increasing transport costs and increasing costs of communication [Fink et al., 2002]. Wine is sold until: $p_0 + TC_0 = p_{\max}$. Consumers further away than 'A', respectively 'C' will not buy wine from the winery because the price they would have to pay is larger than p_{\max} .

The maximum price p_{\max} consumers are willing to pay leads to a geographic radius r_0 around the winery W_i indicating the area of the relevant market when wine is sold conventionally, represented by the inner semi-circle at the bottom of Figure 9.

Figure 9: Broadening of the relevant wine market for direct marketing wine

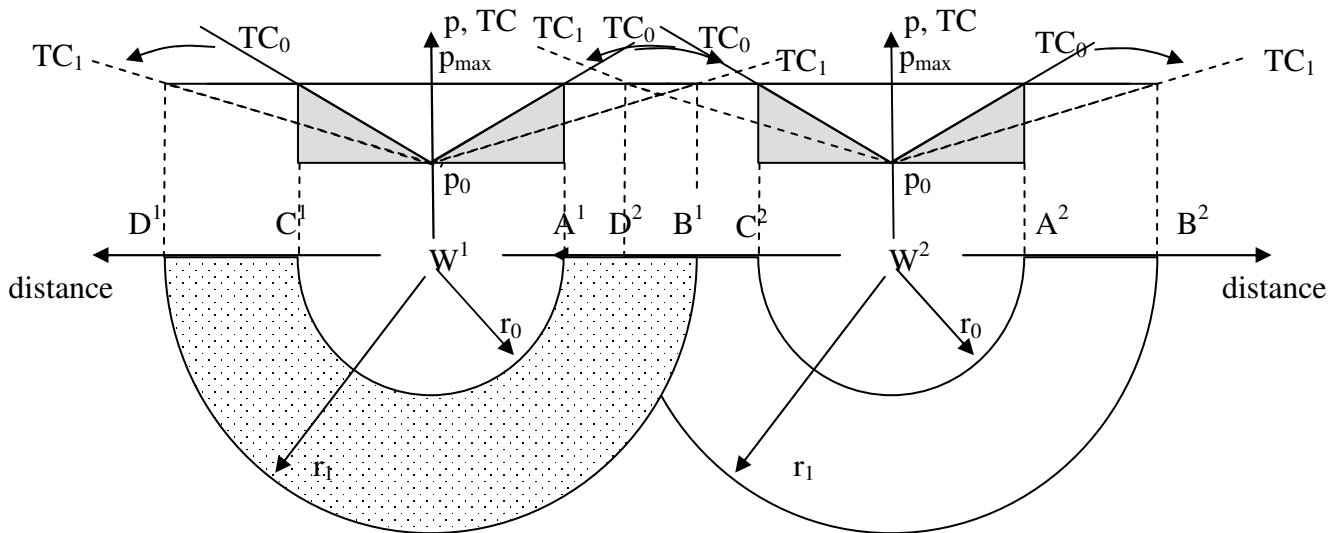


The introduction of the Internet into wine marketing is captured by the transaction cost curve TC_1 (see Figure 9). It could be argued that the TAC-curves actually do not turn around the origin but shift parallel, because the transaction cost reduction through using the

Internet does not increase with increasing distance from the winery. The part of the transfer costs that increases with distance are the transport costs and these are unaffected by e-commerce because wine can not yet be sent as bits through the Internet. Whether the transaction cost curves shifts or turns, the transaction cost reduction brought about by using the Internet leads to a larger relevant market for directly marketed wine. The larger radius r_1 indicates the larger market reach of selling wine on the Web.

When market reach is extended, the relevant markets of individual wineries may overlap and increased competition may result. Figure 10 shows that two wineries, which served disjunct markets initially (see A^1 and C^2) may become competitors by adopting e-commerce (see B^1 and D^2).

Figure 10: Increased competition by broadened relevant markets for direct marketing wine



It is assumed here that p_{max} stays the same, as the reach of a winery broadens. Actually, if the price rises, falls or stays the same depends on the market activities of the demand and supply side, the slope of the demand and supply curves indicating their elasticities and the amount of additional supply and demand coming to the relevant market with the adoption of e-commerce.¹

¹ Attachment 6 contains a formal model of hedonic pricing, determining the impact of transaction cost reduction brought by through the Internet on the prices and qualities of wines traded.

The model displayed above assumes the reduction of the sum of buyer's and seller's transfer. The components of transfer costs, transaction costs and trading costs are discussed in detail in the following section, showing why sum of buyer's and seller's trading costs is reduced when buying and selling wine on the Web. In addition, the economic principles of the Internet that are of relevance to winery-to-consumer e-commerce are discussed in the following section.

3.2 The Internet, transfer costs, and product pricing

Apart from production costs and prices, sellers and buyers incur costs when transacting. Total costs incurred by buyers of wine are given by:

$$C_{ijk}^B = p_{ijk} + TAC_{ijk}^B + TPC_{ijk}^B \quad \forall i=1,\dots,n; j=1,\dots,m; k=1,\dots,K.$$

with:

C_{ijk}^B = buyer i's costs when transacting with seller j using sales channel k

p_{ijk} = the price a buyer i has to pay to seller j using sales channel k

TAC_{ijk}^B = transaction costs of buyer i buying from seller j using sales channel k

TPC_{ijk}^B = transport costs of buyer i when transferring the physical product from seller j when sold over sales channel k

Buyers may have to pay transportation costs for the delivery of the product, or the costs of delivery may be shared between buyer and seller. Therefore, both buyer's and seller's transfer costs have a component accounting for transportation costs:

$$C_{jik}^S = TAC_{jik}^S + pc_j + TPC_{jik}^S \quad \forall i=1,\dots,n; j=1,\dots,m; k=1,\dots,K.$$

with:

C_{jik}^S = seller j's costs when transacting with buyer i using sales channel k

TAC_{jik}^S = transaction costs of seller j selling to buyer i using sales channel k

pc_j = production costs of winery j; they are independent of sales channel k and buyer i

TPC_{jik}^S = transport costs of transferring the physical product from seller j to buyer i when sold over sales channel k

Since the total costs C_t of transacting partners determine which sales channel is used, these costs are summarized in the following equations:

$$C_k = C_{ijk} + C_{jik}$$

which turns into:

$$C_k = p_{ijk} + TAC_{ijk}^B + TAC_{jik}^S + pc_j + TPC_{ijk}^B + TPC_{jik}^S \quad \forall i=1,\dots,n; j=1,\dots,m; k=1,\dots,K.$$

Production costs pc_j are assumed to be independent of the channel over which the wine is sold and therefore are not discussed further. Relevant for the wine industry are the effects of e-commerce on transfer costs and on product pricing. If the sum of price and transfer costs ($p_{ijk} + TAC_{ijk}^B + TAC_{jik}^S + TPC_{ijk}^B + TPC_{jik}^S$) is significantly lower for one channel (e.g. e-commerce) than for any other channel then, other things equal, buyers and sellers choose the channel with the lower total costs. Of course, the buyers' preferred channel need not be the same as the sellers' preferred channel, but in a competitive market, the channel with the lowest trading costs for both buyers and sellers will prevail.

3.2.1 E-commerce and transaction costs

A transaction involves the processes of preparation, negotiation and follow through of the mutual trade of property rights [Williamson, 1985]. Transaction costs are the costs that parties incur in the process of agreeing and following through on a bargain [Mankiw, 1997], or, more general: "the costs of exchanging ownership titles" [Demsetz, 1968], "the costs of running the system: the costs of coordinating and of motivating" [Milgrom and Roberts, 1992, p. 29].

Coase [1937] introduced transaction costs into economic theory, but he did not clearly distinguish specific transaction cost items. To allow empirical identification, transaction costs are often disaggregated according to certain phases of the transaction. Dahlmann [1979] for example, disaggregates transaction costs into (i) search and information costs, (ii) bargaining and decision costs, and (iii) policing and enforcement costs. Milgrom and Roberts [1992] distinguish between two subsets of transaction costs: coordination and motivation costs, where the coordination costs comprise similar items as Dahlman's transaction costs. Motivation costs, in contrast, arise from imperfect and asymmetric information and from imperfect commitment in market transactions, they belong to the 'following through' part of a transaction. North [1990] chooses an approach similar to that of Milgrom and Roberts [1992], he distinguished between the costs of measurement, the costs of enforcement and costs of policing contracts. Measurement costs arise from valuing

the multitude of separate attributes that constitute performance while holding constant the costs of enforcement [North, 1990]. When buying wine the consumer values attributes constituting performance such as vintage, appellation, contents of alcohol etc..

To compare transaction costs occurring in e-commerce with transaction costs occurring in conventional sales channels, costs are split into their components according to the approach of North [1990] and then each component is discussed. Sometimes, transaction cost components are obviously not saved but passed from buyers to sellers or vice versa, making it necessary to analyze total transaction costs. Total transaction costs using a sales channel k (TAC_k) are the sum of all buyers' and sellers' transaction costs using that sales channel:

$$TAC_k = TAC_{ijk}^B + TAC_{jik}^S$$

Buyer's and seller's transaction costs, in turn, are the sum of various transaction cost components. These transaction cost elements are grouped into three central categories: (i) measurement costs, (ii) costs of negotiating, and (iii) follow through costs.

3.2.1.1 Measurement Costs

Virtually no commodity offered for sale is free from the costs of measuring and valuing its attributes. Both buyers and sellers face costs in determining unique differences in product quality [Barzel, 1982]. The main costs of measuring and valuing a product's attributes are search costs. Buyers' search costs comprise two parts: finding potential sellers and measuring product attributes. When having found one or more potential seller, buyers choose from available product offerings, considering factors such as product characteristics and prices asked. Before buying, potential consumers may measure and compare the valuable attributes of what is being exchanged across the identified potential sellers. In doing so, buyers face search costs, including the opportunity costs of time along with associated expenditures such as commuting expenses, telephone calls, computer fees and so on [Bakos, 1998]. A way to measure buyers' search costs is to take the numbers of sellers approached as an approximate, the major costs being those of time [Stigler, 1961]. The costs of time are not equal for all buyers; time will be more valuable to a person with a higher income, which in turn, is more likely to buy higher priced wines. Theoretically, the optimal amount of search is found when expected marginal returns of search are equal to search costs [Stigler, 1961]. In e-commerce more sellers can be contacted within a given time, reducing search costs in comparison to conventional commerce [Varian, 2001]. This

leads to an increase in the number of sellers considered by a given buyer, especially in markets with differentiated products [Bakos and Brynjolfsson, 1997].

Buyers benefit from shopping online, but there are also substantial benefits for sellers [Vulkan, 2003]. Sellers' search costs may arise from monitoring the market and contacting buyers. These costs include the costs of market research to determine buyers' tastes, advertising and other marketing expenditures to make the product known, and on managerial decisions on which price to ask. Menu costs are the costs of making price changes. In conventional stores menu costs primarily result from physically re-labeling products on shelves, while menu costs in electronic markets result from changing the price in a database. Brynjolfsson and Smith [2000] find that prices on the Internet are adjusted more often and in smaller steps than in conventional markets and conclude that menu costs must be significantly lower on the Internet than in conventional stores.

A problem when contacting buyers is the information overload. A seller has to locate, filter and communicate what is useful for the buyer [Shapiro and Varian, 1998]. The Internet offers opportunity to contact a large number of potential buyers at low costs, relative to other media, again reducing sellers' search costs.

3.2.1.2 Costs of Negotiating

When there are several buyers and sellers on each side of the transaction, it might pay to negotiate with several parties, before deciding on which one to contract with. This, in turn, is aligned with costs [Dahmann, 1979]. If the search was successful and the contracting partners are in contact, they have to negotiate on the exchange opportunity that may be present. They make a contract. A contract is the mutual exchange of promises with the expectation that the promises will be kept. Even the simplest exchange involves a contract. Each of the involved parties abandons rights over what they wish to sell in order to acquire the rights over the thing they wish to buy [Hicks, 1969]. Negotiation costs result from negotiating and completing a contract aligned to a transaction [Müller, 2002]. A negotiation is facilitated when buyers and sellers are well informed and able to communicate widely and nearly instantaneously.

Negotiation costs depend on the dimensions of a transaction. Five kinds of transaction attributes play a major role: (i) specificity, (ii) frequency, (iii) complexity, (iv) ability to measure performance, and (v) path dependence [Milgrom and Roberts, 1992]. Negotiation

costs increase with the degree of specificity, complexity and path dependence and decrease with transaction frequency and the ability to measure performance.

Costs of negotiating vary with the seller's business model, when there are fixed prices, costs of negotiating over prices are zero, while there may still be other things to negotiate. Flexible pricing such as auctions or highest bid-pricing can involve substantial costs of negotiating, mainly opportunity cost of time. Intermediaries may reduce costs of negotiating by offering their services.

In direct marketing of wine, the negotiation costs do not play a major role because the sellers usually post fixed prices. This is similar for direct marketing wine through conventional channels or over the Internet. The costs of negotiating are the same, no matter whether wine is sold on- or offline.

Costs resulting from imperfect commitment to a transaction already arise in negotiation but become actual costs after the transaction is conducted and therefore are discussed as 'follow through costs'.

3.2.1.3 Follow through costs

It may happen that the things to be exchanged, or some of them, are not physically present at the time the agreement to exchange is made [Hicks, 1969]. An example is ordering wine from a winery for home delivery. At the time the contracting parties, in this case the vintner and his customer agree on the exchange, the wine is still in the vintner's wine cellar. Thus the bargain has three central components: the making of the agreement, delivery one way (delivery of the good), and delivery the other way (payment). The agreement itself is no more than a promise to deliver, making it necessary to have some reasonable assurance that this promise will be kept [Hicks, 1969]. Follow through costs arising involve two central components: first, the coordination of payment and delivery, and second, the monitoring and enforcement of negotiated contracts. The costs of coordinating payment and delivery are likely to be reduced when the Internet is used. Payment may be made easier using digital money, and costs of coordinating delivery may be reduced when the services of a logistics service provider are integrated into e-commerce transactions. Although the costs of coordinating the follow through part of an e-commerce transactions are likely to be reduced, compared to transactions conducted conventionally, costs of monitoring and enforcing contracts may be higher in e-commerce transactions [Williams, 2001].

Costs of monitoring and enforcing contracts can emerge from two factors: (i) informational incompleteness and asymmetries, and (ii) imperfect commitment. Costs of the first kind arise when parties involved in a transaction do not have all the relevant information needed to determine whether or not the terms of an agreement are acceptable or are actually being met [Milgrom and Roberts, 1992]. There may be misunderstanding between the parties on what was promised. It may be that, what the seller had planned and expected to deliver is not what the buyer had planned and expected to receive [Hicks, 1969]. This may lead to contractual breakdowns, such as the refusal of cooperation, or the demand for renegotiation [Williamson, 2002]. Conducting a transaction over the Internet may lead to a loss of some of this information, worsening adverse selection in electronic markets and leading buyers of higher (unobserved) quality to withdraw from the market [Garicano and Kaplan, 2000]. Since wine is a highly standardized commodity, its quality attributes can be represented over the Internet at least as well as in a supermarket, where consumers rely on abstract information rather than their own tasting experiences [Bombrun and Sumner, 2003]. Therefore, costs resulting from informational incompleteness are unlikely to be higher when wine is traded over the Internet compared to conventional channels. Rather, it may be lower because, on the Internet, more information about its quality can be communicated than is possible to communicate by means of a label on a bottle.

Costs associated with imperfect commitment derive from the inability of people to follow through on the promises they have once made [Milgrom and Roberts, 1992]. Breaching some or all promises by either party of a contract causes losses to the other party, and disputes over the validity of the reason for non-performance may further reduce the value of the transaction to the buyer, the seller, or both. Opportunistic behavior damages a trader's reputation, but the damage is light if traders are difficult to identify. And here lies an important weakness of the Internet, which vastly extends the reach of a business into unfamiliar markets. E-commerce traders therefore may have to expend additional effort to secure the transactions conducted on the Web [Williams, 2001]. Some examples for secure transactions are public key encryption and digital message certification to identify trading partners, or the reputation managers used by some public e-commerce auctioneers. The identities of traders serve to lower the costs of exchange [Barzel, 1985]. In any case, the effort expended to avoid damage from imperfect commitment reduces and may even outweigh any savings in information costs from e-commerce trading.

3.2.2 E-commerce and transportation costs

A transaction has three central components: movement of the physical product, movement of money and movement of information [Müller, 2002]. The distinctive characteristics of the Internet make it a separate channel for communication of two of these three components: distribution of information and money (in its digital form). While almost any information can be transferred as bits, not all products can be digitized. Usually transport costs occur when moving the physical product to the new owner. When buying a good in the retail channel, the buyer does not encounter transportation costs, apart from transporting it home from the supermarket, where the buyer may have had to go for grocery shopping anyway. In e-commerce, usually consumers have to pay for delivery on top of the posted price. This is a factor that may obstruct e-commerce. A survey among e-shoppers showed that three out of four e-shoppers have placed products in an online shopping cart but abandoned it and did not completed their purchase because they considered “shipping costs too high” [Ernst&Young, 2001].

A product’s suitability for e-commerce depends on its attributes. Poor candidates for Internet sales are products with high volume-to-value-ratio, perishable products, products providing instant gratification and experience products [Liebowitz, 2002]. Inherently digital products are well suited for Internet-sales. Examples are computer programs, photographs, digital magazines, music and newspapers and other information products.

The ability of digital information technology to process and store large amounts of data allows for Internet retailers to nearly have unlimited ‘virtual inventory’. Using centralized warehouses and drop-shipping agreements with distributors, they can offer a larger product variety than conventional retailers. While some of these products may be available by special order in conventional stores or in specialty stores, search and transaction costs associated with finding these products conventionally are prohibitively high for most consumers [Brynjolfsson et al., 2003].

Transportation costs play a major role in wine marketing. As a rule of thumb, the revenue from a bottle of wine is distributed as follows: 10 percent go to the grape grower, 30 percent to the winery, 40 percent to transporters, wholesalers and retailers, and 20 percent for taxes [Wittwer et al., 2002]. The empirical evidence on international wine sales on the Web can be summarized in two points: increases in shipping costs outweigh any savings in buying costs and they prevent international consumer market integration. Buying and

selling wine on the Web therefore is still a national, not an international option [Stricker et al., 2003].

3.2.3 Product pricing

Product pricing on the Internet can be characterized by three aspects: (i) price discrimination, (ii) price dispersion, and (iii) prices in comparison to conventional sales channels. In marketing goods and services over the Internet, price discrimination is important for two reasons, first high fixed-, low marginal costs may lead to significant market power; and second, information technology makes detailed analysis of consumer behavior possible. This allows for price discrimination that is difficult to carry out on a large scale and undetected by buyers [Varian, 2001]. Clemons, Hann and Hitt [2002] and Odlyzko [1996] provide empirical evidence that price discrimination is widely practiced in Internet sales.

Price dispersion, defined as the ratio between the highest and lowest price for a homogeneous product across several sellers, arises from high search costs and of imperfectly informed consumers. Price dispersion can be taken as a measure of ignorance in the market [Stigler, 1961]. On the Internet, where search costs tend to be lower and buyers may be better informed about prices, price dispersion should be lower on the Internet than on comparable conventional markets. Existing empirical evidence reported by Bailey [1998] and Brynjolfsson and Smith [2000] does, however, not support this expectation. The authors reason their findings to several attributes, including market immaturity and heterogeneity in retailer attributes such as trust and awareness.

When comparing prices on the Internet to prices in conventional sales channels, the interaction of lowered buyer search costs and increased product differentiation make a definite statement about where “better” prices are offered impossible. While lower buyers’ search costs increase the availability of price information and thus lead to increasing price competition among sellers [Bakos, 1997], product differentiation leads to increased seller profits which may partially or totally offset the price competition induced by lowered buyer search costs. Empirical research comparing online and offline prices lead to different results. Brynjolfsson and Smith [2000], for example, compared 41 Internet and conventional retail outlets selling books and CDs. They found prices on the Internet to be 9-16 percent lower than in conventional outlets – even after accounting for shipping and handling, delivery and sales tax. Bailey and Brynjolfsson [1997] inspected 52 online and

offline retailers for the prices of 337 unique titles of books, music CDs and software. They did not find much evidence that prices in online channels are significantly lower than those in conventional channels.

3.3 Economic principles of the Internet

3.3.1 Information attributes

The economics of a physical product and the economics of information are fundamentally different. When a physical product is sold, the seller ceases to own it. When information is sold, the seller still possesses this information and can possibly sell it again. Information can be replicated at almost zero cost without limit, while a physical product can be replicated only through the expense of manufacture [Evans and Wurster, 2000].

In the information economy, owners of goods and services are no longer able to easily and cheaply exclude others from using their commodity because it can be copied and distributed at almost no cost. Excludability is the ability of sellers to make consumers pay for the product they sell and thus become buyers [DeLong and Froomkin, 1999]. This means that the seller has property rights on the good and can prevent the buyer from using this good, unless he pays for it [Mankiw, 1997].

Information has increasing returns: money is spent on information once, afterwards the information attained can be reused at zero additional cost forever. Every time the information is reused the average cost per use decreases [Evans and Wurster, 2000].

3.3.2 Intermediaries

“An intermediary is an economic agent that purchases from suppliers for resale to buyers or that helps buyers and sellers meet and transact” [Spulber, 1996]. An intermediary in any market may reduce transaction costs by performing four functions: (i) product aggregation, (ii) pricing, (iii) search, and (iv) trust. First, through the aggregation of products, intermediaries are able to realize economies of scale. They can share the fixed costs of transactions, such as the costs to set up and maintain their websites, over more products and product groups. Second, the pricing role greatly depends on the nature of the product and on the level of competition. When selling homogeneous product the intermediary will lose market share if he tries to charge higher prices than competitors. When products are more heterogeneous, intermediaries benefit from higher price mark-ups, because

competitors may not be selling the product. Third, an intermediary can reduce consumer search costs by making information more accessible and understandable. At last, intermediaries ensure trust by monitoring and preventing buyers and sellers' opportunistic behavior. Authentication, the ability to ensure that the transacting partners really are who they say they are, allows intermediaries to create value by ensuring trust. [Bailey, 1998].

It has often been argued that 'friction-free' e-commerce allowed buyers and sellers to directly transact with each other bypassing intermediaries, leading to 'disintermediation' [Bailey and Brynjolfsson, 1997]. Tapscott [1996, p. 56] opined that: 'Middleman functions between producers and consumers are being eliminated through digital networks.' These hopes are based on mistaking the reduction of transaction costs with their total elimination [Müller, 2002]. Bailey and Bakos [1997] concluded their study of market intermediaries in thirteen industries with the observation that contrary to the predictions of disintermediation, electronic markets do not seem to result in the elimination of intermediaries, but they require intermediation services that are different from those in the traditional physical market.

A survey of wineries and wine merchants finds the same to be true for the wine industries of Australia, California and Germany. There has not been a drastic move towards wineries marketing their own wine on the Web within the last three years. Hence, the question is not whether agricultural market intermediaries will vanish as e-commerce spreads but how intermediaries adapt to the changes in their market environment [Stricker et al., 2003].

3.3.3 Sales channel conflicts

A sales channel is the way a manufacturer or seller delivers his good or service to its customers [Chaffey et al., 2000]. If transfer costs are significantly lower for one channel than for another then, other things equal, buyers and sellers choose the channel with the lower costs. Buyers and sellers can have different channel-specific transaction costs and thus make different channel choices [Ward, 2001]. Today, since many manufacturers sell their products through various channels simultaneously, channels are sometimes competing to reach the same customers creating channel conflicts [Bucklin et al., 1997].

Goolsbee [2000] and Ward [2001] both find the Internet sales channel to be a significant competitor to conventional sales channels such as retail stores, catalog sales and home shopping. Business-to-consumer Internet sales were pioneered by Internet companies that solely sold their products or services using the Internet such as Amazon.com. Retailers

with existing marketing channels first watched the development and added an Internet channel later on. While Internet pure-players continued to grow, conventional retailers began to notice channel conflicts, the Internet channel becoming a competitor to the physical channel [Smith et al., 1999].

Channel conflicts are not likely to last forever. As Internet markets mature, Internet retailers will either manage their channels simultaneously or will reduce the number of sales channels they use. Not all retailers will choose the same action. Rather, different business models will evolve depending upon market- and firm-level characteristics [Smith et al., 1999], challenging entrepreneurs to innovate.

Surveying Australian, California and German wineries, found the development of Web sites from selling towards pure advertising and marketing purposes within the last three years. Especially Australian wineries stopped offering their wines on their websites and continued to use their websites only for marketing activities [Stricker et al., 2003]. It is plausible that these firms hesitate to encourage direct sales in fear of channel conflicts.

3.4 E-commerce readiness and use in Australia, California and Germany

The OECD defines e-commerce readiness as: “preparing the technical, commercial and social infrastructure necessary to support e-commerce” [OECD, 2000a]. Clearly the wine industries of Australia, California and Germany are not at the same level of e-commerce adoption. The reasons can be many, but probably e-commerce readiness (e-readiness) of the regions studied can explain some of the differences in e-commerce adoption. Therefore, e-commerce readiness of Australia, the United States as an indicator for California, and Germany is analyzed and compared in this section.

The Economist Intelligence Unit (EIU) has ranked sixty countries according to their levels of connectivity and ‘strong online business culture’. The EIU organized nearly 100 quantitative and qualitative criteria into six distinct categories, and then calculated the e-readiness rankings. The six categories (and their weight in the model) are: (i) connectivity and technology infrastructure (25 percent); (ii) business environment (20 percent); (iii) consumer and business adoption (20 percent); (iv) social and cultural environment (15 percent); (v) legal and policy environment (15 percent); and (vi) supporting e-services (5 percent). By these criteria, the US (and by implication California) ranked first among all countries from 2000 until 2002, in 2003 the US ranked third, after Sweden and Denmark.

Germany ranked 13th in 2000 and 2003, Australia ranked 16th in 2000 and 9th in 2003 (see Table 8).

Table 8: E-readiness ranking of the Economist Intelligence Unit, 2000-2003

<i>Country</i>	Rank			
	2000	2001	2002	2003
Sweden	2	6	4	1
Denmark	12	9	7	2
Netherlands	5	10	2	3
UK	6	3	3	3
US	1	1	1	3
Finland	3	8	10	6
Norway	4	5	11	7
Switzerland	10	11	4	8
Australia	16	2	6	9
Canada	7	4	9	10
Hong Kong	9	13	13	10
Singapore	8	7	11	12
Germany	13	12	8	13

Source: [EIU, 2003]

E-commerce requires buyers and sellers to be connected to the Internet, which in turn depends on the availability, quality, and prices of Internet services. E-commerce readiness of a country, region, or industry is therefore described in terms of measures such as Internet infrastructure, -access and -use, as well as the capacity and cost of data communication lines [OECD, 2000b]. For some of these measures official statistics exist. For most, however, official statistics are unavailable, their order of magnitude must be gleaned from various studies, reports, and data collected by private research enterprises.

Table 9: Indicators of e-commerce readiness in Australia, the United States, and Germany

	AUS	USA	GER
Infrastructure			
Internet hosts per thousand inhabitants 2002 ⁽¹⁾	130	373	31
PCs per 100 inhabitants 2002 ⁽¹⁾	52	63	44
Households owning a PC [%] ⁽²⁾	65	67	47
Access			
Internet user [% of population] ⁽²⁾	72	78	58
Households with Internet Access [%] ⁽²⁾	54	60	43
Use			
Online buyers [% of online population] ⁽²⁾	18	32	13
Premium wineries with an own website [%] ⁽³⁾	90	100	70
Pricing			
Internet access 40 hours at peak times [\$US PPP] ⁽⁴⁾	32.5	23.2	37.7

Sources:

⁽¹⁾ [ITU, 2003]⁽²⁾ [NOIE, 2003]⁽³⁾ [Stricker et al., 2003]⁽⁴⁾ [OECD, 2003]

The quantitative indicators of e-commerce readiness reported in Table 9 confirm that the USA, and by implication California, lead in all aspects of e-commerce readiness. Australia is following closely behind, leaving Germany lying back in almost all indicators. This implies that California and Australian wineries are more likely to earlier use the Internet to market their wines than German wineries.

4 Hypotheses, data collection, and analysis

4.1 Research hypotheses

Before data are collected, it is necessary to define the questions to be asked. These questions are summarized in this chapter. The theory of transaction costs and the main principles of e-commerce with importance for studying the adoption of e-commerce were summarized in the previous chapter. Transaction cost theory and Web wine marketing were then merged into a theoretic model of hedonic pricing (see Attachment 6). The hypotheses pinpointed in this chapter are derived from this model, from theory summarized in chapter three and from the study of wine market development in the three regions over the past years.

The hypotheses can be divided into three main parts: (i) hypotheses about the relevance of winery size in the adoption of Web-wine marketing, (ii) hypotheses considering the adoption of the Web for direct marketing and promoting diversification activities, and (iii) hypothesis about product pricing and the use of the Web for direct marketing wine.

4.1.1 The relevance of winery size in the adoption of Web-wine-marketing

Hypothesis 1: The size of a winery determines its e-commerce participation.

The investment into a company website belongs to fixed costs of wine marketing. Larger wineries therefore have the advantage of economies of scale. Some wineries are bound to be too small to justify an investment into a professionally designed website. This is true for a large share of German wineries. The Australian and California wine industries have larger shares of larger wineries (see chapter 2.1) and they can be expected to use the Web more intensely than German wineries. Also the head start of California in terms of e-commerce readiness (see chapter 3.4) is expected to enforce the use of the Web by California wineries.

For determining e-commerce participation, the wineries are asked whether they have a website for their wineries. To determine the winery's size, the vineyard area in hectares, respectively acres and the winery's workforce (full-time and seasonal) are taken as measures for winery size.

A logistic regression of the probability of a winery having its own website in dependence of its size is to be calculated testing hypothesis one. An upstream factor analysis of winery size variables into one single factor representing winery size could be necessary in order to control for multicollinearity caused by correlation of the variables measuring winery size. Interregional differences are accounted for by inserting dummy variables.

Hypothesis 2: Larger wineries will adopt websites earlier.

In addition to the first hypothesis, this hypothesis is to additionally test the impact of the time of adoption. Due to economies of scale experienced by larger wineries, it is expected that they will adopt new communications- and information technology earlier than smaller wineries. To test this hypothesis, the wineries will be asked if they have set up a website for their wineries business, and if yes, when this website was set up. Since interregional differences are likely to occur, dummy variables representing the county a winery is located in, is to be considered in the model.

To estimate the impact of the time of adoption e-commerce for the wineries business it will be necessary to use the event-history method, this method will be explained in the third part of this chapter.

Hypothesis 3: Larger wineries use the Internet more intensively for commercial purposes.

Again, larger wineries are assumed to profit more from using the Internet more intensively, because they are able to experience a degression in fixed costs. The intensity of Internet use is to be determined asking for the use of two dimensions: the frequency of Internet use for business purposes, and the intensity of information and product provision. To determine the frequency of a winery's Internet use, the wineries participating in the survey are asked if they use the Internet at all for business purposes, then they are asked about how often they use online banking, email and information retrieval for business purposes. To determine the intensity of a winery's information and product provision the wineries are asked how often they update their websites and how many different wines they offer for sale. The size of the winery is to be determined as before.

To test hypothesis 3 statistically, linear regression models with the intensity of Internet use as dependent variable and winery size and country dummy variables as independent variable are to be estimated. The intensity of Internet use is represented by the above named variables.

4.1.2 Hypotheses considering the adoption of the Web for direct marketing and for promoting diversification activities

Hypothesis 4: The probability of a wine to be shipped internationally directly to consumers rises with its price.

Informal interviews conducted in Germany and California prior to the survey indicated that wineries did not have much experience in international winery-to-consumer direct sales. If wineries had sent their wines directly to consumers abroad, they had not done so very frequently. The main reason stated hindering international direct trade, were transportation costs.

The reduction of transaction costs brought about by the Internet is, at least partially, offset by transportation costs. A theoretic model (see Attachment 6) of hedonic pricing of wine marketed on the Web or conventionally finds that higher priced wines are more likely to be traded over the Internet.

Along the lines of the finding of this model, it is assumed that the probability for a winery to ship wine internationally directly to consumers is influenced by the price of the wine. The lower the ratio of bulk to value, the higher is the probability for it to be shipped directly to consumers in a foreign country.

To test this hypothesis the wineries are asked whether they have conducted international direct shipments within the last three years and how often they have shipped wine abroad. To calculate an average price the wineries are asked to split the volume of all bottled wine they sold in 2002 into price ranges. An average price is then derived from this information.

To test the hypothesis and to determine the impact of average selling prices of bottled wine on the probability of conducting international direct to consumer sales, a logistic regression in which the probability of shipping is estimated as dependent on average prices of bottled wines sold within the year prior to the survey.

Hypothesis 5: A winery website does not increase the volume of direct marketing sales.

Informal interviews conducted in Germany at the end of the year 2001 and in California at the beginning of the year 2002, suggested that a winery website does not increase the volume of a winery's direct sales. Many of the wineries, especially those in Germany, stated that their websites had not increased the volume of their direct sales. For Australian and California wineries, a possible reason for this is assumed to be the fear of sales channel

conflicts. These occur, when a winery offers the same wines on the Web that it also sells to its distributors. This could upset the end-customers, who may find out that they could have bought the same wine directly at the winery for a lower price or vice versa. In Germany, sales channel conflicts are not an important obstacle for direct sales over a winery's website, because many wineries sell all their bottled wine directly and channel conflicts cannot arise. To test this hypothesis, wineries offering their wines for sales on their websites will be asked if this has increased the volume of their direct-marketing sales.

Hypothesis 6: The Web supports the use of tourism activities provided by the wineries.

On the Web many potential customers can be reached at low costs. Wineries incur fixed costs when setting up and operating their websites, but marginal costs for reaching additional customers are close to zero. From informal interviews we learned that wineries do not consider wine sales as the Internet's main advantage, but its use for promoting the wineries activities and facilities and for providing additional customer service, such as congratulating customers to their birthdays or anniversaries.

Many German wineries provide accommodation as part of their wineries business, many promote accommodation on the Web. Even very small wineries that do not have a website of their own, promoted their accommodation facilities over the websites of others, for example those of regional tourism associations. Almost all wineries that were informally interviewed prior to the survey, claimed that promoting accommodation on the Web increased their bookings considerably.

To test this hypothesis, the wineries were asked which tourism facilities they provide as part of their winery's business and which facilities they promote on the Web. Wineries were asked when they first started to promote their tourism activities or facilities on the Web, and also whether their tourism business has intensified since it is promoted on the Web. Due to the differences in the countries e-commerce readiness there could be regional differences in the impact of the Web promotion on tourism business. To control for these, dummy variables representing the countries the wineries are located in are included in the regression to test for regional distinctions. In addition to this regression, chi-squared tests for contingency tables comparing, by each activity or facility, those wineries which state that promoting their tourism activities or facilities on the Web to those that do not. The chi-squared tests are sufficient for testing the hypothesis, the regression is necessary to control for regional distinctions.

4.1.3 Product pricing and the use of the Web for direct marketing wine

Hypothesis 7: The price of a wine determines where it is sold – expensive wines are more likely to be sold on the Web than cheap wines.

Introducing transaction costs into Rosen's [1974] model of hedonic pricing (see Attachment 6) resulted in the hypothesis that higher priced wines are more likely to be sold on the Web than through conventional channels. Personal interviews with California and German wineries indicated that selling the same product line online and through conventional channels could generate sales channel conflicts. A sales channel conflict occurs when a winery sells the same wines on the Web and also through other channels, e.g. to distributors who distribute them through the retail channel (see 3.3.3). California wineries in particular, which have to rely on distributors to sell their wine because of the three-tiered-system, face this problem. A possible solution is to sell a selection of higher quality wines at higher prices on the website. It is possible to sell a selection of cheap wines, but small ordering values, higher geographic reach (see 3.1) and thus low bulk-to-value-ratio (see 3.2.2) would not result in much success from this strategy.

To test the different product lines offered on the Web and through other channels, wineries are asked to divide the total volume of all bottled wines and the volumes of bottled wines they sold on the Web in 2002 into certain price ranges. Average selling prices, on the Web and through other channels are calculated from this information for each answering winery. T-tests comparing the mean price of Web-offering wineries to all wineries for each region can then be calculated to determine if the mean prices of wines sold on the Web are significantly higher than the average price of all wines offered for sale.

4.2 Survey design and operationalization

There are many advantages as well as disadvantages of online surveys to conventional mail surveys. These are not discussed here in detail, since there are many textbooks for example by Theobald [2001] or Möchhalften [2000] covering this topic. The main reason this survey was conducted online are costs. Since the survey is to be conducted on three continents, postal charges for sending a written questionnaire to potential respondents would be prohibitive. In addition, response rates can be a problem in international surveys via conventional mail [Aaker et al., 1998]. The following two subsections describe (i) how the sample was drawn and (ii) the operationalization of the survey.

4.2.1 The sample

Wineries from Australia, California and Germany are to be surveyed. It is appropriate to practice stratified sampling since these are three distinct groups of wineries and together they represent the universe about which information is to be attained. The basic idea is to divide a heterogeneous universe into homogeneous subdivisions (strata) [Cochran, 1953].

Generally, in stratified sampling, the universe N is divided into subpopulations of N_1, N_2, \dots, N_L units. These subpopulations are non-overlapping and together they cover the total universe:

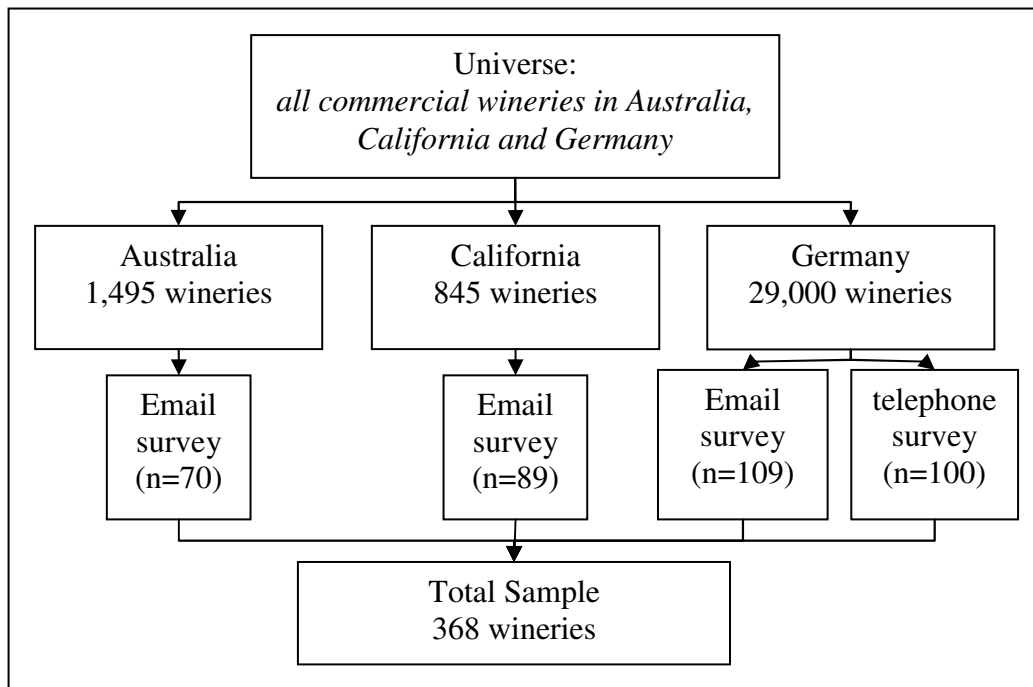
$$N_1 + N_2 + \dots + N_L = N$$

The subpopulations are called strata. A sample is drawn independently from each stratum. The sample sizes are denoted with $n_1, n_2, \text{ and } n_3$. Stratification is a very commonly used technique, mainly for two reasons: (i) it is used when data of known precision for certain subdivisions (Australia, California and Germany) is wanted and (ii) it delivers a gain in the precision of estimates of characteristics of the whole universe [Cochran, 1953].

In this survey the universe of all Australian, California and Germany wineries is divided into three strata, Australia, California and Germany. It is assumed that German wineries having an own website are part of a group of wineries that are commercially viable and are expected to continue running their businesses over the next 5 to 10 years. To account for this assumption, the German population is divided into two substrata, an online and a telephone survey (see Figure 11).

4.2.1.1 Address sources

The names and email addresses for the Australian wineries were taken from the Australian & New Zealand Wine Industry Directory database [Winetitles, 2003a]. The email addresses for California wineries were obtained from the Wines & Vines Wine Industry Directory [Wines & Vines, 2003]. Additionally, if the directories did not list an email address, the Web was searched for the winery's homepage in hope to find an email address. The 588 email addresses of German wineries were obtained from the Web database of the Germany Wine Institute [Deutsches Weininstitut, 2003e].

Figure 11: Overview of the sampling procedure

4.2.1.2 Invitation emails

The email messages inviting the wineries to participate were sent to the German wineries from an email address in Germany and from an U.S. email to the Australian and California wineries. Common Gateway Interface (CGI) scripts were programmed to coordinate the display of the questionnaires and data storage. CGI is a scripting language used to write gateway scripts, these scripts are most commonly used when Web-servers interact dynamically with users [UC Berkeley Library, 2003]. The script for the German part of the survey was run from the Web-server of the University of Kiel and from the Web-server of the University of California at Davis for the Australian and California parts of the survey.

4.2.1.3 Responses

The survey returned 371 usable answers, yielding an average response rate of 16 percent. There is bound to be self-selection in the online samples. There are three main reasons for self-selection: (i) non-availability of potential respondents, (ii) insufficient online-skills on behalf of the potential survey participants, and (iii) intentional non-response [Bosnjak, 2001]. Wineries are considered non-available either if they actually did not receive the email inviting them to participate in the survey or if they did not notice the invitation. While non-availability due to delivery failures can be measured counting delivery failure notifications, non-responses due to unnoticed invitations, insufficient online skills and

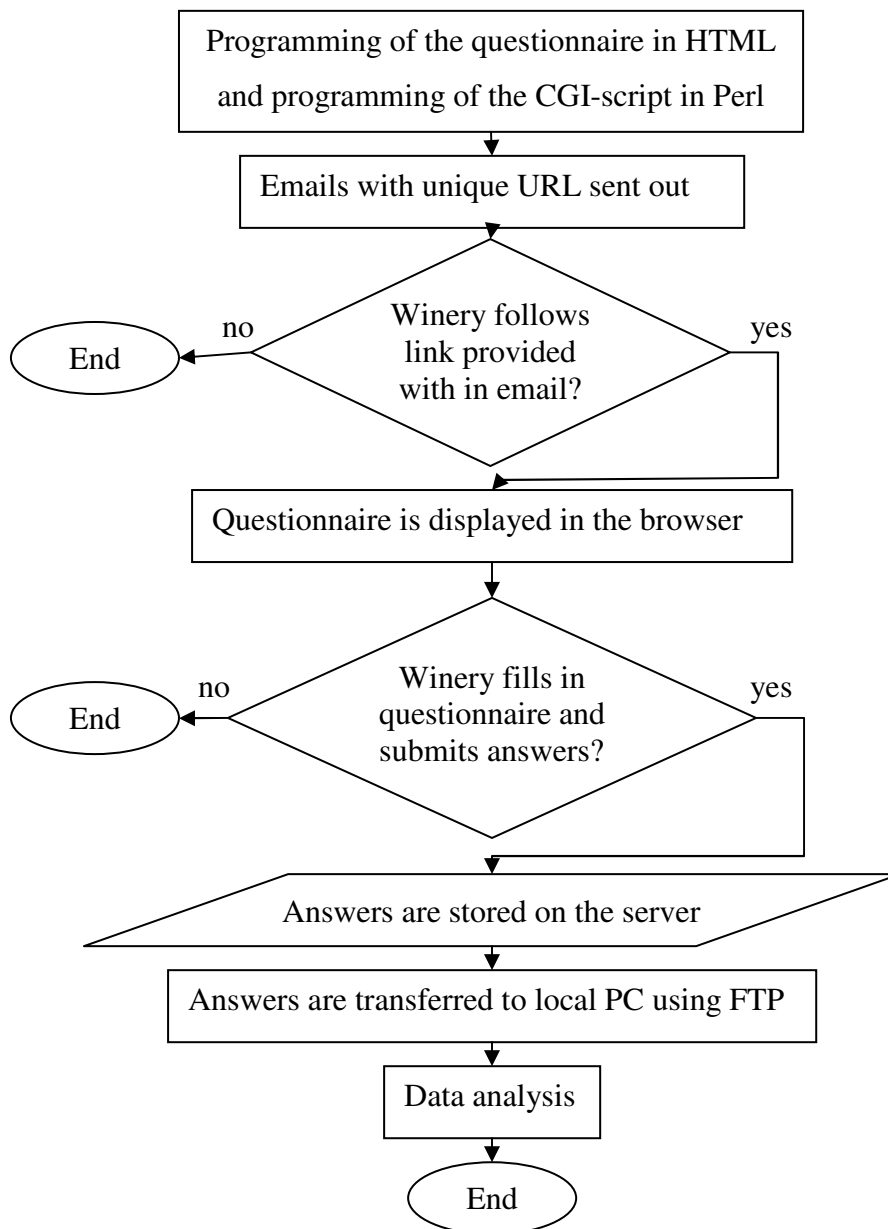
intentional non-responses can not be measured. Due to intentional non-responses by uninterested wineries, wineries that were interested in information technology and related fields are possibly overrepresented in the sample. For Australia and California this bias is likely to be small because of the large shares of wineries already having an email address and a winery own website, underling their interest in information technology. The bias among German wineries answering online is likely to be rather large because German wineries lag behind Australian and California wineries in terms of adoption of information technology. To control for this self selection bias, a control group of 100 German wineries was surveyed per telephone, making possible a comparison of already Web- participating wineries and a random sample of all wineries.

The telephone numbers of German wineries were taken from an address CD-ROM [KlickTel GmbH, 2001], from which all entries listed under 'winery' were extracted. Some wineries had double entries, for example home and cell phone numbers or fax and telephone numbers listed. To ensure that every winery is only represented once, double entries and fax-numbers were filtered, resulting in usable 7,749 telephone numbers. Using the 'random number' function in Microsoft Excel, a random number was assigned to each telephone number. After having sorted by random number the wineries were called. Because of unavailable wineries, wineries refusing to answer and wineries out of business, 862 numbers were used in order to attain 100 usable responses.

4.2.2 The online questionnaire survey

The online questionnaire survey proceeded in three steps. First, the questionnaire had to be designed and then programmed using Hyper Text Markup Language (HTML). Then a Common Gateway Interface (CGI) script was designed and programmed that runs from a Web-server and coordinates data output and storage. At last, the script had to be transferred onto the server and the results had to be retrieved from the server. Figure 12 gives an overview over the activities involved in the online questionnaire survey.

Figure 12: Activities involved in the online questionnaire survey



4.2.2.1 Questionnaire design and programming

Three questionnaires, one each for Australia, California and Germany were programmed in HTML (see Attachments 8, 9 and 10). The first draft of the questionnaire was programmed using the survey generator software ‘survgen.exe’, which can be downloaded from <http://online-forschung.de>. There are many survey generators available on the Web². After inspecting individual survey generators, survgen.exe was used because of its functionality,

² Inserting ‘survey generator’ into the Internet search engine ‘google’ (Sept. 2003) returns 2,090 hits. Inserting the German counterpart ‘Fragebogengenerator’ returns 391 hits.

simplicity of use and because it was free of charge. After having used survgen.exe to program the frame of the questionnaire, the HTML-editor ‘Hotmetal’ was used to edit the code generated by survgen.exe.

Using HTML, any type of question that can be asked in a written questionnaire, can also be asked online. It is possible to ask open questions by inserting fields in which the respondents type in their answer (see question 1 in Figure 13), or make them select their answers from provided lists. From these lists, the respondent can either select a single value (radio buttons – see question 2 in Figure 13) or several answers may be selected (check-boxes – see question 11 in Figure 13).

Figure 13: Questions showing open questions, radio buttons, and check-boxes

1 How large is your vineyard area in acres?

acres

2 Does your winery buy grapes from other wineries or do you sell grapes to other wine producers?

(Please mark one)

- yes, we buy grapes from other producers
- yes, we sell grapes to other wineries
- yes, we both sell and buy grapes to or from other producers
- none of the above

11 Which wine-related tourism activities / facilities do you currently provide as part of your winery's business and which of these do you promote on the Web?

please mark the appropriate - several answers are possible

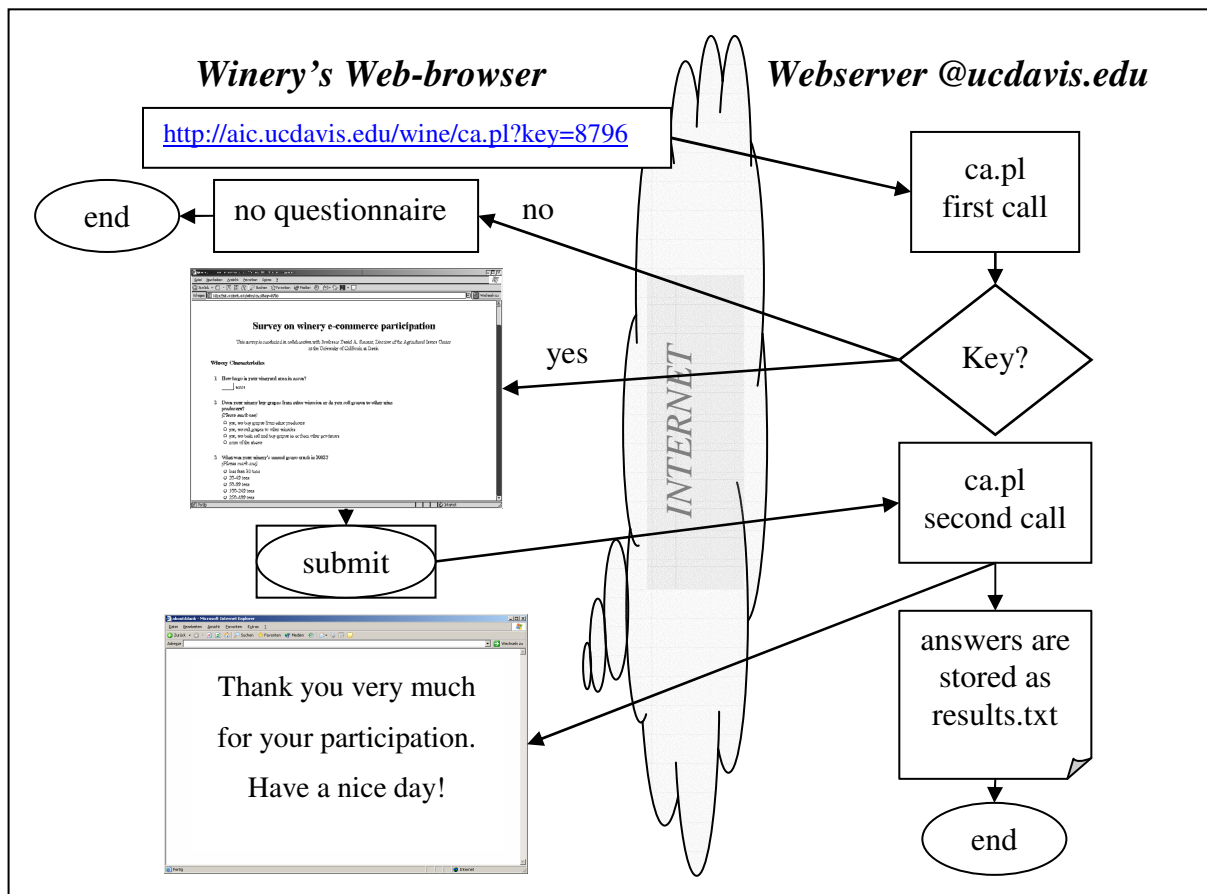
tourism activity / facility	offered	promoted on the Web
winery tours	<input type="checkbox"/>	<input type="checkbox"/>
wine tasting	<input type="checkbox"/>	<input type="checkbox"/>
accommodation	<input type="checkbox"/>	<input type="checkbox"/>
restaurant/café	<input type="checkbox"/>	<input type="checkbox"/>
BBQ	<input type="checkbox"/>	<input type="checkbox"/>
others - please specify: <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

When programming the questionnaire, it is important to assign a unique name to each variable-field, irrespective whether it is an open-field, a radio-button, or a check-box. The CGI script processes and stores these data using these variable names.

4.2.2.2 The CGI script

A CGI script was programmed, which runs from a Web-server, displays the questionnaire, and stores the data the respondents generate when answering the Web-questionnaire. Attachment 7 shows a program listing of the script and explains the central commands of the script. The CGI script is programmed in Perl. There are several other languages available for programming CGI-scripts (e.g. PHP), but Perl was chosen because it is easy to learn, making it the most often used computer language for programming CGI-scripts [UC Berkeley Library, 2003]. Figure 14 shows the actions that the CGI script initiates.

Figure 14: What happens on the winery’s browser and on the Web-server during the survey?



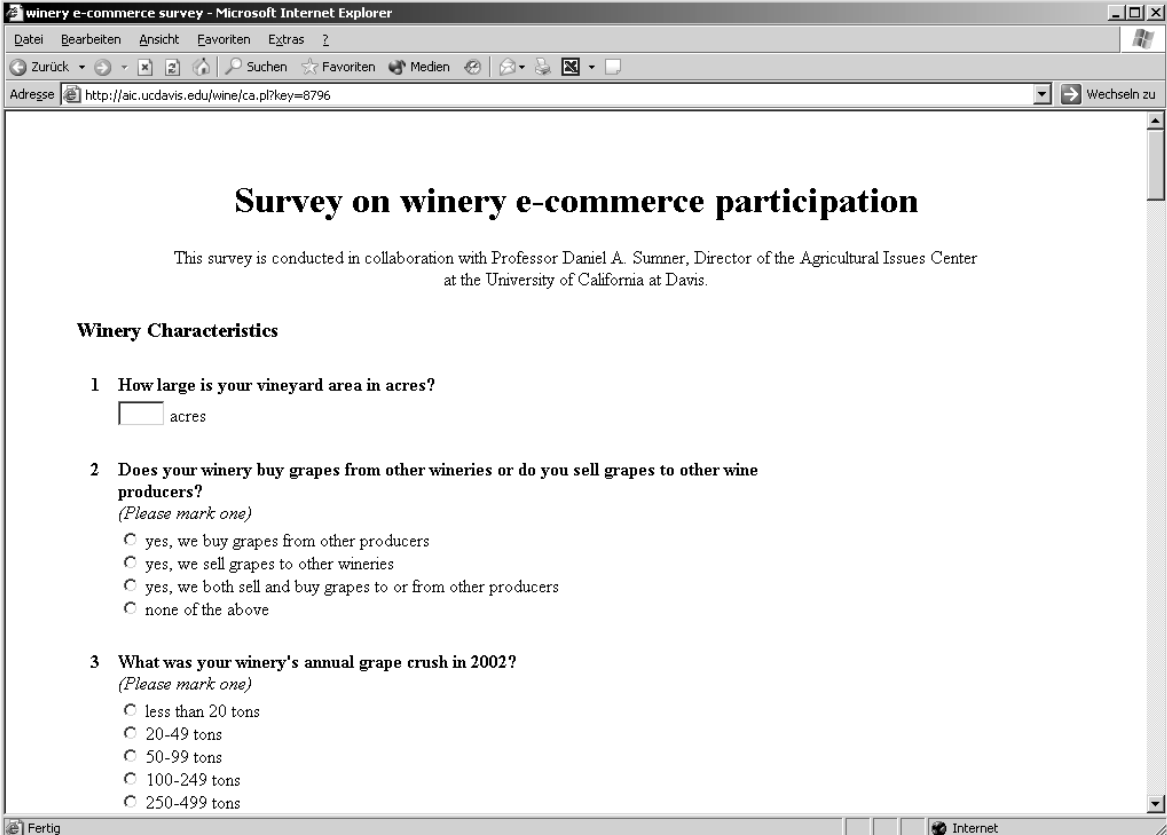
Each winery received an email inviting it to follow a link containing a unique key, e.g.: <http://aic.ucdavis.edu/wine/ca.pl?key=8796>. The key is used to identify individual wineries so that reminders could be emailed avoiding duplicate answers.

After the winery has clicked on the link provided in the email received, the script named 'ca.pl' is called. If the URL contains a valid key, the HTML code is transferred to the winery's Web browser displaying the questionnaire. The winery then fills in the questionnaire and transfers the answers by pressing the 'submit' button at the end of the page. This calls up the CGI-script a second time, which now stores the data provided by the winery in the results file, and provides feedback to the survey participant.

4.2.2.3 Data transfer and storage

The CGI script is transferred to the Web-server using FTP, which is also used to download the results from the server. Here ws_ftp was used, a freeware program that can be downloaded from www.ipswitch.com. After the script was loaded onto the server, it was tested for errors. After debugging, the emails inviting the wineries to participate in the survey were sent out. Each winery received an email inviting it to follow a link containing a unique key, e.g.: <http://aic.ucdavis.edu/wine/ca.pl?key=8796>. The key is used to identify individual wineries so that reminders could be emailed avoiding duplicate answers.

Figure 15: Screenshot of the questionnaire for California wineries



The screenshot shows a Microsoft Internet Explorer browser window titled "winery e-commerce survey - Microsoft Internet Explorer". The address bar displays "http://aic.ucdavis.edu/wine/ca.pl?key=8796". The main content area features the following text:

Survey on winery e-commerce participation

This survey is conducted in collaboration with Professor Daniel A. Sumner, Director of the Agricultural Issues Center at the University of California at Davis.

Winery Characteristics

1 How large is your vineyard area in acres?
 acres

2 Does your winery buy grapes from other wineries or do you sell grapes to other wine producers?
(Please mark one)

- yes, we buy grapes from other producers
- yes, we sell grapes to other wineries
- yes, we both sell and buy grapes to or from other producers
- none of the above

3 What was your winery's annual grape crush in 2002?
(Please mark one)

- less than 20 tons
- 20-49 tons
- 50-99 tons
- 100-249 tons
- 250-499 tons

The browser's status bar at the bottom shows "Fertig" and "Internet".

When a respondent follows the link provided in the email inviting him to participate, it is taken to the questionnaire Web page (see Figure 15). The URL including the winery's unique key is shown in the address field of the browser.

The CGI script reads the key and activates the HTML document, displaying the questionnaire in the responding winery's browser. Without the key in the URL, the browser will not display the questionnaire (see Figure 14). If a valid key is delivered the script generates the questionnaire and sends it to the winery's browser. After the winery has answered all the questions on the questionnaire, the respondent clicks on the 'submit' button, activating the script a second time. The script then stores the results in the file results.txt file and thanks the winery for its participation.

The results file contains one line per answering winery, starting with the key, followed by the winery's answers that are separated by tabs in the data file. This file can be transferred from the Web-server to the researchers' PC by again using the ftp-program. Then the file can be transferred to any software used for data analysis.

4.3 Methods of data analysis

The methods used to test hypotheses are chi-squared test for contingency tables, analysis of correlation and variance, t-test comparing means, principal components factor analysis, linear and logistic regressions, and the event history analysis. Only logistic regressions and the event-history analysis are described here. The remaining methods are the subject of many statistical textbooks (for example Greene [2003], Aaker et al. [1998], Lehmann et al. [1998], and Backhaus et al. [2000]).

4.3.1 Logistic regressions

Logistic regressions are used when the probabilities for objects to belong to one of two distinct groups are to be calculated [Lehmann et al., 1998]. An example is the question whether or not a firm has adopted a new information technology (IT) for its business use. Using logistic regression, probabilities between 0 and 1 of having adopted the new IT can be calculated for all possible values of the independent variables.

Logistic regressions are similar to ordinary least squares regressions; the difference is that the dependent variable in linear regressions is continuous, while it is dichotomous in logistic regressions [Lehmann et al., 1998]. Estimating binary (0/1) dependent variables

using the linear regression model has two weaknesses: First, the linear regression allows probability estimates to fall outside the range from zero to one over which probabilities are defined, and second, it assumes that the dependent variable is normally distributed. Binary variables are however, not normally distributed, and therefore the inference tests and standard errors of the linear regression are wrong [Cramer, 1991].

The logistic regression avoids both problems by estimating a non-linear function of probabilities and using maximum likelihood estimation (MLE) instead of ordinary least squares (OLS). The following likelihood-function (L) is estimated using the Newton-Raphson-Algorithm:

$$L = \prod_{y_i=1} p(y_i = 1) \prod_{y_i=0} 1 - p(y_i = 1)$$

$$\text{with } p(y_i = 1) = \frac{1}{1 + e^{-(\alpha_0 + \beta_1 x_{i1} + \dots + \beta_j x_{ij} + \dots + \beta_k x_{ik})}}$$

where:

$p(y_i=1)$ is the probability for the dependent variable y to have the value 1

x_{ij} are object i 's value at independent variable j .

The above function estimates the coefficients β_j for which the probabilities of correctly classifying the observations into the two groups (0/1) of the dependent variable are maximal. The theoretical maximum of this function is one, where all probabilities are equal to one. Maximum likelihood is calculated stepwise, calculating a series of weighted regressions analyses. It is also commonly referred to as 'iteratively reweighted least squares' [Christensen, 1990]. If the residuals are normally distributed a probit analysis is calculated, if they follow the binominal distribution, for example in the case of a binary dependent variable, the "logit" (*logistic probability unit*) is calculated:

$$\text{Logit} = \ln\left(\frac{p(y_i = 1)}{(1 - p(y_i = 1))}\right) = \alpha_0 + \beta_1 x_{i1} + \dots + \beta_j x_{ij} + \dots + \beta_k x_{ik}$$

In most situations, analyses based on logits and probits give similar results [Norusis, 1993]. The logit is the log odds of the event to happen. The logistic regression is named after this logit [Krafft, 1997]. In logistic regressions, the dependent variable can either be binary

(two categories) or multinomial (more than two categories). The binary and multinomial methods are very similar, while some measures of fit are different. In this study, only binary logistic regressions are used. The independent variables may be measured on an ordinal or a metric scale. Ordinal variables with g categories are transferred into $g-1$ dichotomous variables. Then, for each $g-1$ category, an individual estimator is calculated. Only one estimator is necessary for metric variables [Backhaus et al., 2000].

The statistical literature suggests that at least 50 observations are necessary to obtain usable results in binary logistic regressions. The minimum number of observations required depends on the number of categories of the dependent variable. The higher the number of categories, the higher is the minimum number of observations. In the case of a binary dependent variable at least 25 observations are needed per category. If observations are not evenly distributed between the categories, the number of observations should be raised until the smallest category has at least 25 observations [Backhaus et al., 2000].

Before interpreting the results of an estimation, the quality of the model has to be evaluated. This is usually done in two steps: (i) the model is checked for its fit, and (ii) the coefficients of the independent variables are checked for their significance. The next two subsections describe these two steps.

4.3.1.1 Measures of fit of the model

When building a statistical model, an overall test of the hypothesis that all estimated coefficients are equal to zero is to be conducted [Norusis, 1993]. The fit of the model to the observed data has to be inspected before the coefficients can be interpreted. The usual measures known from linear regression analysis can not be used, because logistic regressions rely on maximum likelihood estimation. Instead of minimizing the squared deviations (least squares), logistic regressions maximize the ‘likelihood’ that an event will occur [Hair et al., 1998]. There are a variety of measures of fit for logistic regressions, each covering a different section of statistical significance. When using the logistic regression procedure the user should narrow down to the measures that are usually reported in his area of research [Cramer, 1991]. Below the most commonly used measures of fit of a logistic regression are explained:

1. *The -2 Log Likelihood or “deviance”:*

$$-2LL = -2 * \log(\text{Likelihood})$$

A likelihood of 1 indicates a perfect relation between the parameters, and yields a deviance of zero. Bad fits cause a high deviance. The likelihood is logarithmized and multiplied with -2 , because then the calculated values are nearly chi-square distributed with $(n-k)$ degrees of freedom, with n being the number of observations and k the number of parameters [Krafft, 1997]. Therefore the deviance is a test of the null-hypothesis that the model is a perfect fit. This measure has been criticized, because the distribution of the observations into the categories of the dependent variable are not taken into account [Backhaus et al., 2000].

2. *Likelihood Ratio (LR) Test:*

$$\text{LR-Test} = -2*(LL_0 - LL_1)$$

with:

LL_1 = natural logarithm of the likelihood in the calculated model

LL_0 = natural logarithm of the likelihood in the naive model

This test which is also known as ‘Model chi-square’ relies on the absolute difference of the naive (all parameters are zero and probabilities of all states equal to $\log(\beta_0)$) model LL_0 and of the restricted model LL_1 (model with the estimated parameter values). This difference is asymptotically chi-square distributed and can be tested against the null-hypothesis that the parameters of the model are not significantly different from zero. High values of the test statistic and associated low significance levels indicate that the coefficients significantly differ from zero. The substance but not the form of this test closely resembles the F-test for testing the significance of a linear regression [Krafft, 1997].

3. *McFadden’s R²*

McFadden’s R^2 is defined as: $R^2 = 1 - \frac{LL_1}{LL_0}$

with:

LL_1 = natural logarithm of the likelihood in the calculated model

LL_0 = natural logarithm of the likelihood in the naive model

The values of the deviances of the calculated and naive model can be used to calculate McFadden’s R^2 . Due to the characteristics of the logistic regression McFadden’s R^2 is usually lower than the R^2 of a linear regression, because the observed values of the

dependent variable are either 0 or 1 and the predicted dependent variable is calculated as a probability between 0 and 1. Models with McFadden’s R²-values between 0.2 and 0.4 are considered as good [Krafft, 1997]. In logistic regressions with a constant parameter and only one independent variable, a value of 0.1 is considered as ‘realistic’ [Menard, 1995]. Table 10 gives an overview over the measures of fit presented in this chapter and associated values indicating a good fit of the model to the data observed.

Table 10: Overview over measures of fit for logistic regressions

Measures	Values indicating “good” fit
Deviance (-2LL)	-2LL near 0; level of significance near 100%
Likelihood-Ratio-Test	High chi ² -value, level of significance <5%
McFadden’s R ²	“good” if > 0.2

4.3.1.2 Measures of fit of the parameter estimates $\hat{\beta}_j$

Similar to testing the slope coefficients in a linear regression with a t-test, the parameters of a logistic regression are tested for their significance using the Wald-test [Hair et al., 1998]. The null-hypothesis is tested, that a particular β_j is equal to zero, meaning that the independent variable j has no influence on the probability that the dependent variable equals 1. The Wald-statistic is calculated as follows:

$$W = \left(\frac{\hat{\beta}_j}{s_{\hat{\beta}_j}} \right)^2$$

with: $s_{\hat{\beta}_j}$ = standard error of $\hat{\beta}_j$ (j=0,1,2, ..., k)

W, in turn is asymptotically chi-square distributed. Therefore the test is against a tabulated chi-square -distribution with one degree of freedom [Backhaus et al., 2000].

4.3.1.3 Interpreting the parameter estimates $\hat{\beta}_j$

Coefficients $\hat{\beta}_j$ estimated in binary logistic regressions can not be interpreted in the same way as the coefficients of linear regression models, where the estimate $\hat{\beta}_j$ measures the effect of a one-unit change of the independent variable j on the dependent variable. The

direction of the impact of the independent variables x_j on the probabilities $p(y_i=1)$, however, can be interpreted directly from the calculation of the logistic regression.

Negative values of $\hat{\beta}_j$ result in decreasing probabilities of the dependent variable to be equal to one, and positive $\hat{\beta}_j$ indicate increasing probabilities of the dependent variable to be equal to one.

Interpretation beyond the direction of interaction requires some mathematical transformation. An example may illustrate the transformation required: $\hat{\beta}=0.76$, indicates that when the independent variable increases by one unit, the log-odds increase by 0.76. To determine the effect of a one unit change of the independent variable on the odds of the event to happen, $\hat{\beta}$ has to be raised to the power of e ($e^{\hat{\beta}} = 2.138$). For every unit increase of x_1 , the odds of the dependent variable to be equal to 1 increase by 2.138. The probability for the dependent variable to be equal to one, rises with x_1 , this increase is not linear. By rearranging the logit (left hand side of the equation below) for $p(y_i=1)$:

$$\ln\left(\frac{p(y_i = 1)}{(1 - p(y_i = 1))}\right) = \alpha_0 + \beta_1 x_{i1} + \dots + \beta_j x_{ij} + \dots + \beta_k x_{ik}$$

results in:

$$p(y_i = 1) = \frac{1}{1 + e^{-(\alpha_0 + \beta_1 x_{i1} + \dots + \beta_j x_{ij} + \dots + \beta_k x_{ik})}}$$

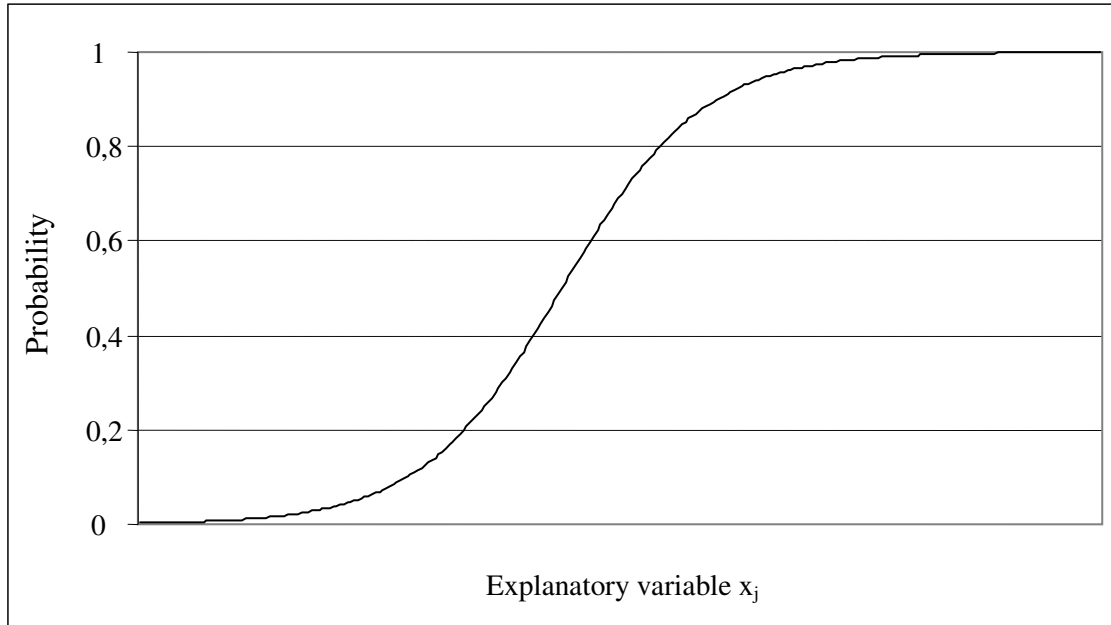
the estimated probability is:

$$\hat{p}(y_i = 1) = \frac{1}{1 + e^{-(\hat{\alpha}_0 + \hat{\beta}_1 x_{i1} + \dots + \hat{\beta}_j x_{ij} + \dots + \hat{\beta}_k x_{ik})}}$$

Using this transformation makes it possible to calculate an exact probability of the dependent variable for all possible values of the explanatory variables x_{ij} (see Figure 16). The curve resembling the relationship between the probability and the explanatory variable is S-shaped. It is very similar to the curve obtained when the cumulative probability of the

normal distribution is plotted. The probability estimates will always lie between zero and one, respectively between zero and one hundred percent [Norusis, 1993].

Figure 16: Probabilities $p(y_i=1)$ for the dependent variable to be true, depending on the explanatory variable x_j



To determine the effects of a one unit change of x_j on $p(y=1)$, a particular value for x (usually \bar{x}) is chosen and the change of the probability is calculated [Brüderl, 2000]:

$$\hat{p}(y = 1 | \bar{x} + 1) - \hat{p}(y = 1 | \bar{x}) = \frac{1}{1 + e^{\hat{\alpha} + \hat{\beta}(\bar{x} + 1)}} - \frac{1}{1 + e^{\hat{\alpha} + \hat{\beta}(\bar{x})}}.$$

4.3.2 Event history analysis

When studying the adoption of new technology, logistic regressions which were described in the previous section are often used to determine whether an individual has or has not adopted a new technology within a given time. The dependent variable can either be equal to one (the individual has adopted) or zero (the individual has not adopted). This approach does not consider the time at which an individual has actually adopted the new innovation. The study of wineries adopting a website for their business is to serve as an example here. If the period of observation is, for example from 1995 to 2003, firms that can be considered as early adopters already implement the new innovation in 1995, while the late ones adopt in 2003. In logistic regressions early adopting wineries and wineries belonging to the late adopters would deliver the same information, the dependent variable having a

value of 1 in both cases. In event history models, the point of time when the firm has adopted the new technology can be taken into account when estimating the probabilities for the dependent variables. Therefore, event-history analysis can be seen as an extension of logistic regressions when studying the adoption of new technology, because it can not only be used to calculate the probability of an event to happen, but it also considers the point in time when this event happens.

An event is defined as a qualitative change in a variable that occurs at a specific point in time [Allison, 1984]. The best way to study events and their causes is to collect event history data. The simplest form of an event history is a longitudinal record of when a certain event happened to a set of individuals. In the above example, wineries might be asked not only if they have a website for their business, but also for the year when they set up their website. Although event history data is well suited to study the causes of events to happen, two features – censoring and time-varying explanatory variables- may cause major problems when used in standard statistical procedures such as multiple linear regression models or logistic regression models. Censored data occur when the event has not occurred to the individual within the observed period [Collett, 1994], for example a winery that has not set up a website for its business within the observed period (until 2003). Using standard methods on event history data can lead to severe bias of the parameter values or loss of information [Allison, 1984].

4.3.2.1 Historic origins of event history analysis

The available literature on Event History Analysis is a joint stream of three fields: biomedicine, engineering, and social sciences. Demography studies (see [Pollard et al., 1981] for an overview), where life tables were at the center of attention are the earliest roots of event history analysis. While life tables have been used since the middle of the eighteenth century, more modern methods for event history analysis were not actively pursued until the late 1950s and early 1960s. Cox's [1972] partial likelihood method, which will be discussed in detail later in this section, was built on the fundamental concepts of life tables. Since the center of attention in biomedicine is the survival of individuals, much of the literature on event history analysis was published as 'survival-' or 'lifetime analysis' [Allison, 1984].

Engineers face the problem of analyzing data of the breakdown of machines and electronic components. The methods developed by engineers were first published as 'reliability' or

'failure time' analysis (see [Kalbfleisch and Prentice, 1980] for an overview) but merged into a single literature stream with biomedical literature at the end of the 1980s [Allison, 1984].

Social scientists were largely unaware of these concerns. The tradition of applying the theory of Markov processes to social science data emerged in the late 1960s and early 1970s (see [Singer and Spilerman, 1976]). A turning point was the introduction of explanatory variables into continuous-time Markov models by Tuma [1976]. Tuma's innovation closed the gap to what had already been developed in biomedicine and engineering [Allison, 1984].

4.3.2.2 Cox's regression model

While biostatisticians favor nonparametric approaches, engineers and social scientists favor the approach of parametric models which make an assumption about the distribution of time until an event occurs [Allison, 1984]. The most common distributions used are the exponential, Weibull and Gompertz distributions. Kalbfleisch and Prentice [1980] give an overview over other distributions that can be used.

When theory does not offer strong arguments for a parametric approach, a semi-parametric approach that determines a functional form, but does not exactly specify an exact distribution to the point of time at which an event occurs, is useful [Blossfeld and Rohwer, 1995]. In Cox's proportional hazard model, the dependent variable is the hazard rate, which is the probability that an event will occur to a particular individual at a particular point in time [Allison, 1984]. This model is semiparametric and it is a major bridge between the approaches of biostatisticians and engineers, respectively social scientists. Cox's model is parametric in the sense that it specifies a regression model with an exact functional form. It is nonparametric because it does not specify an exact distribution to the distribution of event occurring over time. Due to this fact, Cox's model is very general and nonrestrictive, making it popular in literature, it is cited over a hundred times annually in scientific literature [Allison, 1984]. In this study, this approach is used because the theory of adoption and diffusion of information technology does not suggest that it is reasonable to assume any of the above mentioned distributions for the point of time of an event to occur. This makes it possible to estimate the model without making an assumption about how the hazard rate depends on time. Researchers' experience with these models however,

has shown that the parameter estimates are not terribly sensitive to the choice of the hazard function [Allison, 1984].

The regression models proposed by Cox can be written in several ways [Norusis, 1993]. With the hazard rate $h(t)$ as the dependent variable Cox's regression model can be written as:

$$h(t) = [h_0(t)] * e^{(\beta_1 * x_1 + \dots + \beta_k * x_k)}$$

where $h_0(t)$ is any function of time and x_1 to x_k are the explanatory variables. These can either be continuous or categorical variables. The hazard rate $h(t)$ is the product of two component pieces (i) the baseline hazard function $h_0(t)$, and (ii) $e^{(\beta_1 * x_1 + \dots + \beta_k * x_k)}$. The baseline function does not depend on the explanatory variables, it only depend on time. Therefore, it can be seen as similar to the constant term in multiple regressions, which can be quantified as the effect assuming that all explanatory variables are equal to zero [Norusis, 1993]. The second component $e^{(\beta_1 * x_1 + \dots + \beta_k * x_k)}$ depends on the individual values of the explanatory variables and the associated regression coefficients [Hosmer and Lemeshow, 1999]. While logistic regressions are estimated on the base of maximum likelihood, Cox regressions are calculated on the base of partial likelihood, which is similar to maximum likelihood. The method relies on the fact that the likelihood function for data arising from the proportional hazards model can be factored into two parts. Partial likelihood simply discards the first factor ($h_0(t)$) and treats the second factor as if it where an ordinary likelihood function, maximizing it using the Newton-Raphson-Algorithm (see 4.3.1) [Allison, 1984].

4.3.2.3 Measures of fit of the model and of the parameters estimates β_k 's

Since Cox regression models depend on maximizing the partial likelihood function, comparing changes in the values of the $-2 \log$ likelihood ($-2LL$) for different models is the basis for a range of tests. The test statistics of these tests are all asymptotically chi-square distributed making it necessary to watch out for sufficient sample sizes. While the results of these test are largely the same [Kiefer, 1988], the likelihood-ratio test is most widely used because it delivers a better fit to the chi-square distribution when sample sizes are smaller [Allison, 1995].

The likelihood-ratio test (also see 4.3.1) for the hypothesis that all parameters in the model are equal to zero is obtained by comparing the $-2 \log$ likelihood ($-2LL_0$) of the naive

model, where all parameters are zero, to the $-2 \log$ likelihood ($-2LL_1$) of a model that contains the parameters of interest. The difference $-2*(LL_0 - LL_1)$ is asymptotically chi-square distributed, where the degrees of freedom is the difference in number of parameters between the two models [Norusis, 1993].

Similar to parameter testing in logistic regression, parameter values are tested for significance using the Wald statistic (see 4.3.1). Another indicator that an estimated parameter is significantly different from zero is its 95 percent confidence interval. Confidence intervals for e^β can be calculated by finding the confidence intervals for β and then raising the lower and upper limits by the power of e. If the 95 percent confidence interval does not include the value of 1, the null hypothesis that the parameter value is equal to zero can be rejected [Norusis, 1993].

4.3.2.4 Interpreting the parameters estimates β_k 's

Basically there are no differences in the interpretation of the results of parametric and semiparametric models [Allison, 1995]. Because Cox's models are log-linear, regression coefficients give information about the direction and strength of change in the logarithmized hazard rate at a one unit increase of an independent variable [Allison, 1984]. The change of the hazard rate at a one unit change of the independent variable can be calculated as follows:

$$\Delta h(t_i | X_t) = (e^{\beta_i} - 1) * 100$$

This is a relative change, meaning the change of the hazard rate is given in percent. Changing several independent variables simultaneously does not have an additive but a multiplicative effect [Blossfeld et al., 1989]:

$$\Delta h(t_i | X_t) = (e^{\beta_i} * e^{\beta_j} - 1) * 100$$

If there are dummy or categorical variables in the equation the parameter is to be interpreted as a change in relation to a reference category.

To give information about the absolute strength of the impact of the independent variable, this interpretation is only little intuitive. Similar to logistic regressions, the estimates for baseline hazard rates as well as the results of the partial likelihood estimation can be used to calculate individual probabilities for events to happen at particular times.

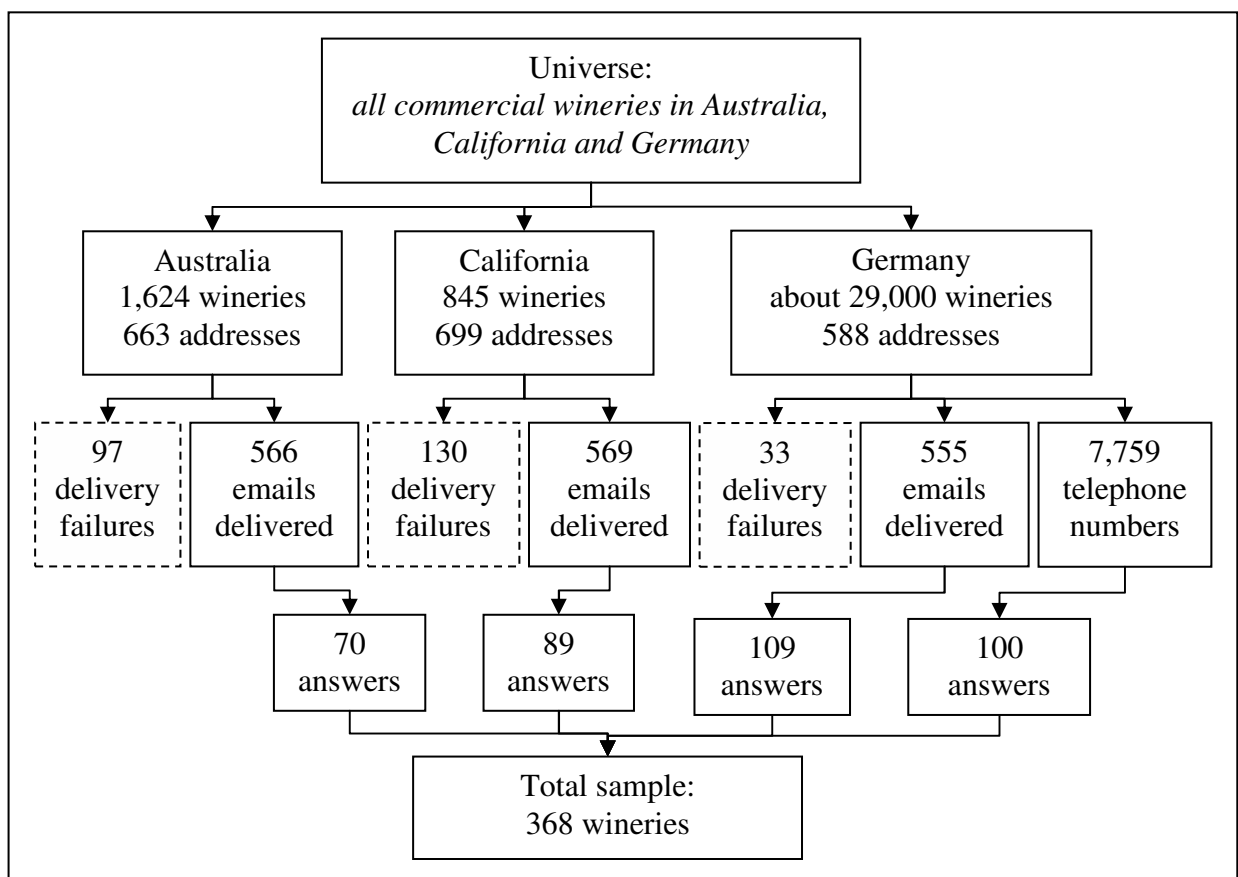
5 Results and implications

This chapter first describes the survey results and then the hypotheses formulated in chapter four are tested, using multivariate statistical methods. To give an overview over the data collected, response rates are reported and survey results are presented.

5.1 Response rates

In total, 1,690 wineries in Australia, California and Germany were contacted by email between June 17th and July 18th 2003. Two emails were sent out, reminding those who had not returned a questionnaire.

Figure 17: Survey response rates



In total, 368 usable answers were returned (see Figure 17). The delivery of 260 emails failed, probably because of incorrect addresses. The overall response rate of the online survey is 16 percent. The response rate was highest in Germany, where every fifth (20 percent) winery contacted returned a usable questionnaire. Of all California wineries contacted, 16 percent participated in the survey. The response rate was lowest among

Australian wineries; only 13 percent of wineries contacted returned usable questionnaires. For the telephone survey in Germany public wineries were randomly selected from wineries, listed in the public phone book, until 100 usable answers were obtained. This target was achieved when 862 wineries were contacted.

The 70 Australian wineries participating in the survey represent 4.3 percent of all wineries in Australia. Slightly more than every tenth (10.5 percent) California winery participated in the survey. The 209 responding German wineries account for about 1 percent of the roughly 29,300 farms with wine growing in Germany in 2003 (see Attachment 4).

5.2 Survey results

The results of the 32 questions asked in the four questionnaires (see Attachments 8, 9 and 10) are presented here. The descriptive results are presented in four groups: (i) winery characteristics, (ii) wine marketing practices, (iii) winery website, and (iv) Internet use. When a relationship of the observed variable to any other variable is assumed, its statistical significance is tested using either correlation analysis, an independent samples t-test, Pearson's chi-squared test for contingency tables, or an analysis of variance, as appropriate.

5.2.1 Winery characteristics

Winery sizes in terms of vineyard area differ considerably across regions (see Table 11). As expected, wineries in California are largest, with an average size of 151 ha, followed by Australia (108 ha) and -far behind- Germany (16 ha). In Australia and California there are large differences between the arithmetic means and the medians in vineyard area, indicating a small number of wineries there are very large, and many wineries are rather small. In Germany this gap is much smaller, which is plausible considering the industry structure, even large German wineries are small in comparison to Australian and California wineries. The largest California winery in the survey (5,261 ha) accounts for 2.4 percent of California's total vineyard area of 225,000 ha. The largest Australian winery in the sample (5,000 ha) accounts for 3 percent of Australia's total vineyard area of 160,895 ha, and she is Australia's second largest winery in terms of vineyard area. The largest German winery (168 ha) answering the survey, in contrast, accounts for only 0.2 percent of Germany's total vineyard area of 105,000 hectares.

Table 11: Mean, median, minimum, and maximum of vineyard area in hectares, by region (n=361)

Region	Number of wineries	Mean [ha]	Median [ha]	Min [ha]	Max [ha]
Australia	69	108.1	10	0	5,000
California	85	150.6	18	0	5,261
Germany total	207	16.3	8.5	0.5	168
Germany online	107	23.8	11	1	168
Germany telephone	100	8.3	6.5	0.5	40
All	361	65.5	10	0	5,261

The 853 California wineries listed in the Wines & Vines Winery Directory [2003] have an average vineyard area of 83 hectares, but half have only 22 ha or less of vineyard area. In the sample, half of the California wineries grow grapes on less than 18 ha, indicating that larger wineries are slightly overrepresented in the survey. Ten wineries, two from Australia and eight from California, indicated that they had no vineyards. These wineries specialize in wine making, buying their grapes from grape growers. The means and medians of vineyard area differ considerably between the two German subsamples. The independent samples t-test was used to compare mean vineyard area of German wineries, surveyed on the Web and on the telephone. Results show that wineries surveyed online are significantly (at the 1 percent-level) larger than those surveyed on the phone.

Considering the wineries' workforces reveals that California wineries are, by far, the largest on average. Table 12 gives an overview of the number, mean, and median of full time employees and of the seasonal workers of the responding wineries.

Table 12: Mean and Median of workforces, by region

Region	Number of full time employees			Number of seasonal workers		
	Number of wineries	Mean	Median	Number of wineries	Mean	Median
California	89	18.5	5	84	14.2	5
Australia	70	8.8	3	64	8.0	4
Germany total	208	3.8	2	203	7.1	4
Germany online	108	5.9	3	103	9.8	6
Germany telephone	100	1.7	2	100	4.4	3
All	367	6.9	2	351	9	5

California wineries on average employ 18.5 permanent full time workers and 14.2 full-time-equivalent seasonal workers during vintage. The mean of full time employees and number of seasonal workers are significantly different between the two German subsamples (t-tests comparing means are significant at the 1 percent-level).

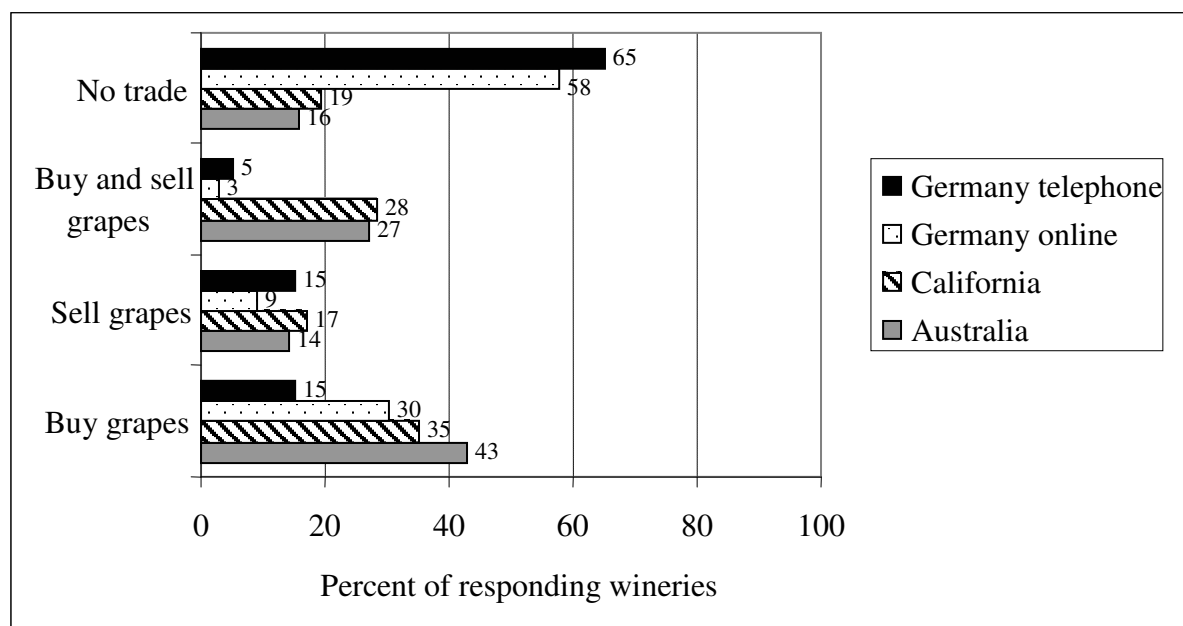
Most wineries (92 percent) in all three regions are family owned and operated businesses (see Table 13). The share of family owned wineries is highest in the German telephone subsample (97 percent) and lowest in the Australian subsample (84 percent).

Table 13: Relative frequencies of family owned wineries, by region

Region	Number of all wineries	Number of family owned wineries	Share of family owned wineries [%]
Australia	70	59	84.3
California	88	79	91.9
Germany total	209	196	93.8
Germany online	109	99	90.8
Germany telephone	100	97	97.0
All	367	334	91.0

Looking at grape buying and selling practices shows significant differences (chi-squared test for contingency tables significant at 1 percent-level) between Australia and Germany as well as between California and Germany, while Australia and California do not differ significantly (see Figure 18).

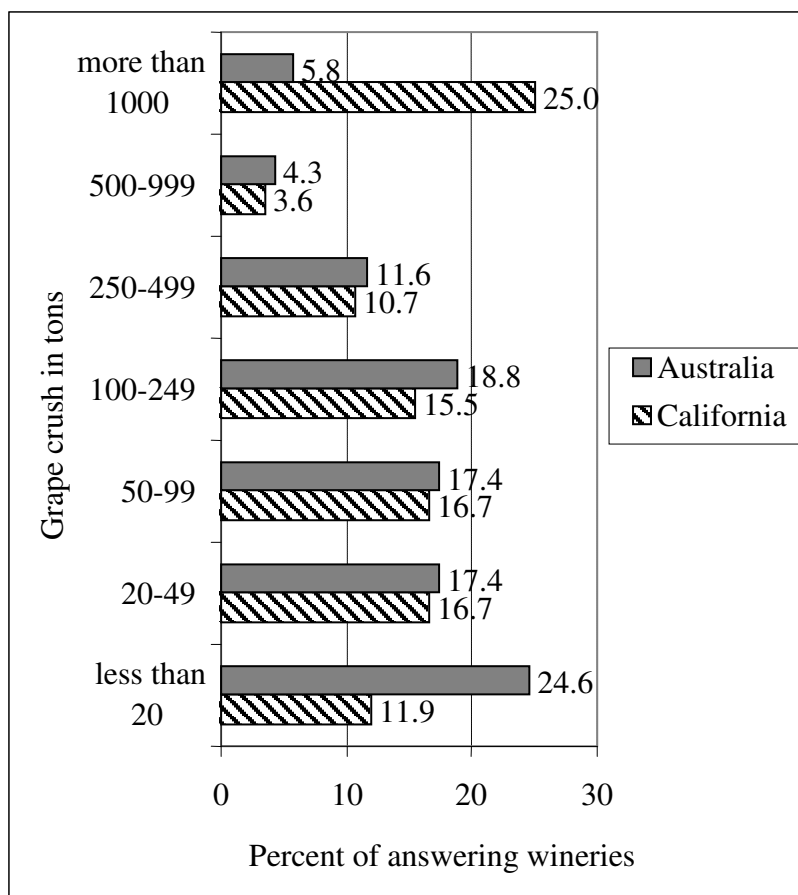
Figure 18: Relative frequencies of grape trading practices, by region (n=367)



In Germany most wineries neither buy nor sell grapes, with the percentage of wineries that do not buy grapes being even higher among the relatively small wineries surveyed per telephone compared to the larger wineries surveyed online (see Figure 18). Surprisingly, the share of German wineries that were surveyed by telephone and that sell grapes is rather large (15 percent), compared to those surveyed online (9 percent). The result is, however, plausible. Many small wineries in Germany belong to winery cooperatives, to which they sell grapes. In Australian and California the patterns of buying and selling practices are similar. In both regions, many wineries buy and sell grapes, less than every fifth winery (16 percent in Australia, 19 percent in California) does not engage in the grape trade.

Australian and California wineries are also similar with regard to the volume of their annual grape crush (see Figure 19).

Figure 19: Annual grape crush of answering wineries in Australia and California, 2002 (Australia n=69, California n=84)

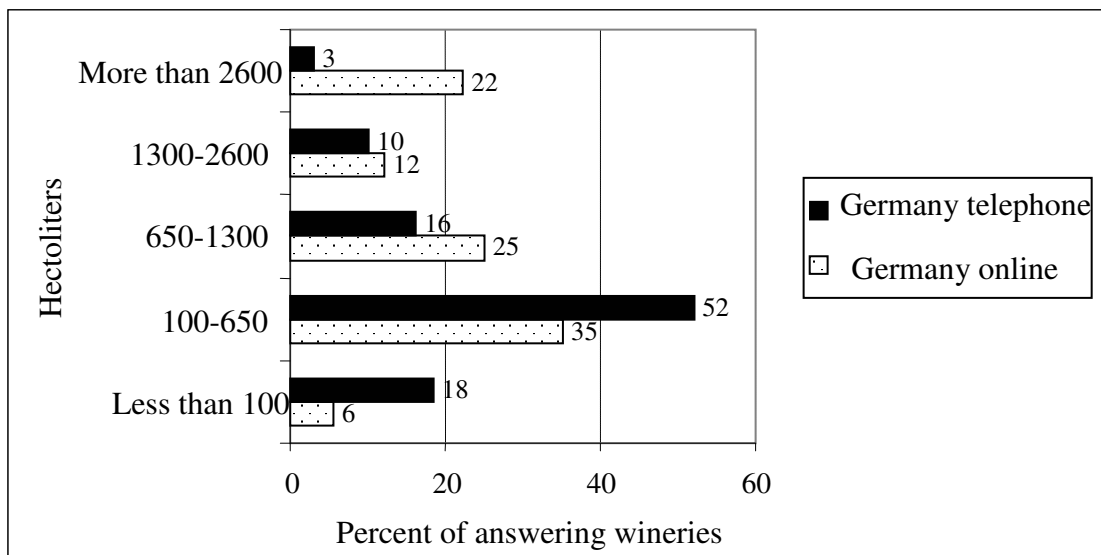


Exceptions are the smallest and largest categories. While every fourth of Australian wineries is a ‘micro’ winery, crushing less than 20 tons per year, every fourth California winery is very large, crushing more than 1,000 tons annually.

Annual casegood production is highly correlated to a winery's annual grape crush (Spearman's $r = 0.81$, significant at the 1 percent-level). On average, Australian wineries sell 70,903 cases of wine per year, while California wineries sell 62,850 cases. The difference is not significant when tested in a one way ANOVA with annual casegood production as the dependent variable and country as factor. The median for annual casegood production of California wineries is 7,000 cases, while the median for Australian wineries is only 3,500 cases. The high mean and, in comparison to California wineries, relatively low median of Australian wineries, in terms of annual casegood production, indicate a higher degree of concentration in the industry.

In Germany, a frequently used statistic characterizing winery size is the volume of must or juice processed annually (Figure 20). By this measure, the wineries surveyed online are, at average, again larger than the wineries participating in the telephone survey. While more than two out of three (70 percent) wineries surveyed on the telephone process less than 650 hectoliters of wine must per year, three out of every five wineries responding online process more than 650 hectoliters of wine must per year.

Figure 20: Distribution of German sample wineries by volume of must processed, 2002 (n=206)



Volume of must does not readily translate into weight of grapes crushed. Depending on the must concentration, it takes between 115 and 150 kilograms of grapes to produce 100 liters of wine juice [Seiter, 2003]. Therefore, wineries that process more than 2,600 hectoliters of must are roughly equivalent to between 300 and 390 tons of grapes and are comparable in size with wineries in the fifth size category in Australia and California (see Figure 19).

Again, by this measure of winery size, wineries in Germany are on average much smaller than wineries in Australia or California.

5.2.2 Winery location

When comparing the distribution of all Australian wineries onto the regions of Australia with the distribution of the wineries in the sample, a similar picture emerges (see Table 14). Wineries from Victoria and Western Australia are slightly overrepresented, while wineries from South Australia and Tasmania are underrepresented.

Every third (33 percent) respondent winery from Australia is located in Victoria. Among the respondents from Victoria, 17 percent are from Yarra Valley, 13 percent from Bendigo, and 70 percent from ‘other’ parts of Victoria.

Table 14: Geographic distribution of Australian wineries in the sample compared to all Australian wineries, by state (n=70)

State	Number of wineries	Share of all wineries [%]	Number of wineries in the sample	Share of wineries in the sample [%]
New SouthWales / Australian Capital Territory	367	22.6	16	22.9
Victoria	461	28.4	23	32.9
Queensland	89	5.5	3	4.3
South Australia	391	24.1	11	15.7
Northern Territory	0	0	0	0
Western Australia	242	14.9	15	21.4
Tasmania	75	4.6	2	2.9
Total	1,624	100	70	100

Source: [Winetitles, 2003c]

More than half (57 percent) of the wineries from California participating in the survey are from Sonoma (30 percent) or Napa (27 percent) counties. Every tenth (10 percent) responding winery is from San Luis Obispo or Santa Barbara County. 9 percent are from the San Francisco bay area, 8 percent from the Sierra Foothills.

The geographic distribution of all 847 California wineries and the distribution of the responding wineries again into the state grape crush districts are quite similar (see Table 15). The geographic distribution of respondent wineries in the sample is a good match of all wineries, in terms of number of winery by state grape crush district.

Table 15: Geographic distribution of California wineries in the sample compared to all California wineries, by state grape crush district (n=88)

California Grape Crush Districts	Number of wineries	Share of all wineries [%]	Number of wineries in the sample	Share of wineries in the sample [%]
Napa	232	27.4	24	27.3
Sonoma/Marin	180	21.3	26	29.5
San Luis Obispo County/Santa Barbara	105	12.4	9	10.2
San Francisco Bay Counties	81	9.6	8	9.1
Sierra Foothills	56	6.6	7	8.0
Mendocino/Lake	47	5.5	6	6.8
Southern California	36	4.3	1	1.1
Monterey/San Benito	30	3.5	2	2.3
Fresno/Madera/Tulare	25	3.0	0	0
Sacramento Valley/Northern Cal. to Oregon Border	19	2.2	1	1.1
Lodi/Woodbridge	14	1.7	3	3.4
Solano/Clarksburg	11	1.3	0	0
Kern	6	0.7	1	1.1
Stanislaus/Merced	5	0.6	0	0
Total	847	100	88	100

Source: [eresonant.com, 2003b] and own research

An exception are wineries from Sonoma and Marin, which are overrepresented in the survey (see Table 15). While almost 30 percent of the respondent wineries are from Sonoma or Marin, only one in five (21 percent) of wineries in California is located there.

The geographic distribution of wineries into the 13 German wine growing regions is, with one exception, similar between the estimated distribution (see Table 16 and Attachment 4 for details) and the online surveys; wineries from Wuerttemberg are however, clearly underrepresented in the online sample. The distribution of wineries responding on the telephone by wine growing regions is, with three exceptions, similar to the overall distribution. Exceptions are wineries from Baden, Pfalz and Rheinhessen. While Baden wineries are underrepresented in the telephone survey, wineries from Pfalz and Rheinhessen are overrepresented in the telephone survey (see Table 16). Additionally, wineries from the Mosel-Saar-Ruwer region are slightly overrepresented in both surveys.

Table 16: Geographic distribution of German wineries in the sample compared to all German wineries, by growing region (n=209)

Wine growing region	All German wineries*		Online survey		Telephone survey	
	Number of all wineries	Share of wineries [%]	Number of wineries in the sample	Share of wineries [%]	Number of wineries in the sample	Share of wineries [%]
Ahr	235	0.8	2	1.8	3	3.0
Baden	6,850	23.4	19	17.4	5	5.0
Franken	2,881	9.8	16	14.7	11	11.0
Hessische Bergstraße	149	0.5	2	1.8	0	0
Mittelrhein	231	0.8	1	0.9	2	2.0
Mosel-Saar-Ruwer	4,185	14.3	22	20.2	22	22.0
Nahe	820	2.8	3	2.8	3	3.0
Pfalz	3,975	13.6	16	14.7	20	20.0
Rheingau	637	2.2	11	10.1	8	8.0
Rhein Hessen	4,264	14.5	12	11.0	22	22.0
Saale-Unstrut	85	0.3				
Sachsen	85	0.3	1	0.9	0	0
Wuerttemberg	4,910	16.8	4	3.7	4	4.0
Total	29,307	100	109	100	100	100

*estimates for 2003 according to a linear trend from 1979 to 1999 (see Attachment 4)

Australian and California wineries were asked to indicate the value of their wine sales. Case studies showed that German wineries do not instantly know the value of their wine sales, but they may know their profits. German wineries were therefore asked for their profit in the year 2002. Most of German wineries (72 percent) refused to answer this question, while only few wineries from Australia (6 percent) and California (8 percent) kept silent about the value of their wine sales (see Table 17 and Table 18).

Every fourth German winery (25 percent) answering this question indicated that the winery did not return a profit in 2002, every fifth winery (21 percent) claimed to have made a profit above € 70,000 in 2002; the profits of the remainder (54 percent) fall somewhere between € 10,000 and € 70,000 in 2002.

Four out of five Australian wineries reported sales of less than a 1.5 million Aus \$ in 2002, equivalent to about 1 million US \$. Every fifth winery sold wines worth more than 1.5 million Australian dollars (see Table 17).

Table 17: Frequencies of Australian wineries surveyed by value of wine sales in 2002 (n=66)

Value of wine sales	Number of wineries	Share of wineries [%]
less than Aus\$100,000	16	24.2
Aus\$100,000 - Aus\$250,000	13	19.7
Aus\$250,000 - Aus\$500,000	8	12.1
Aus\$500,000 - Aus\$1,000,000	13	19.7
Aus\$1,000,000 - 1,500,000	3	4.5
more than Aus\$1,500,000	13	19.7

Compared to the Australian wineries surveyed the value of wine sold by California wineries are, by far higher. Here, the value of wine sold in 2002 by more than half (55 percent) of the wineries is less than a million US\$, while almost every fifth (17 percent) winery, sold wines worth more than seven million US\$ (see Table 18). For both, Australia and California, the value of a winery's wine sales correlates significantly with its vineyard area in hectares (Spearman's Rho is 0.7 for California and 0.54 for Australia, both correlation coefficients are significant at the 1 percent-level).

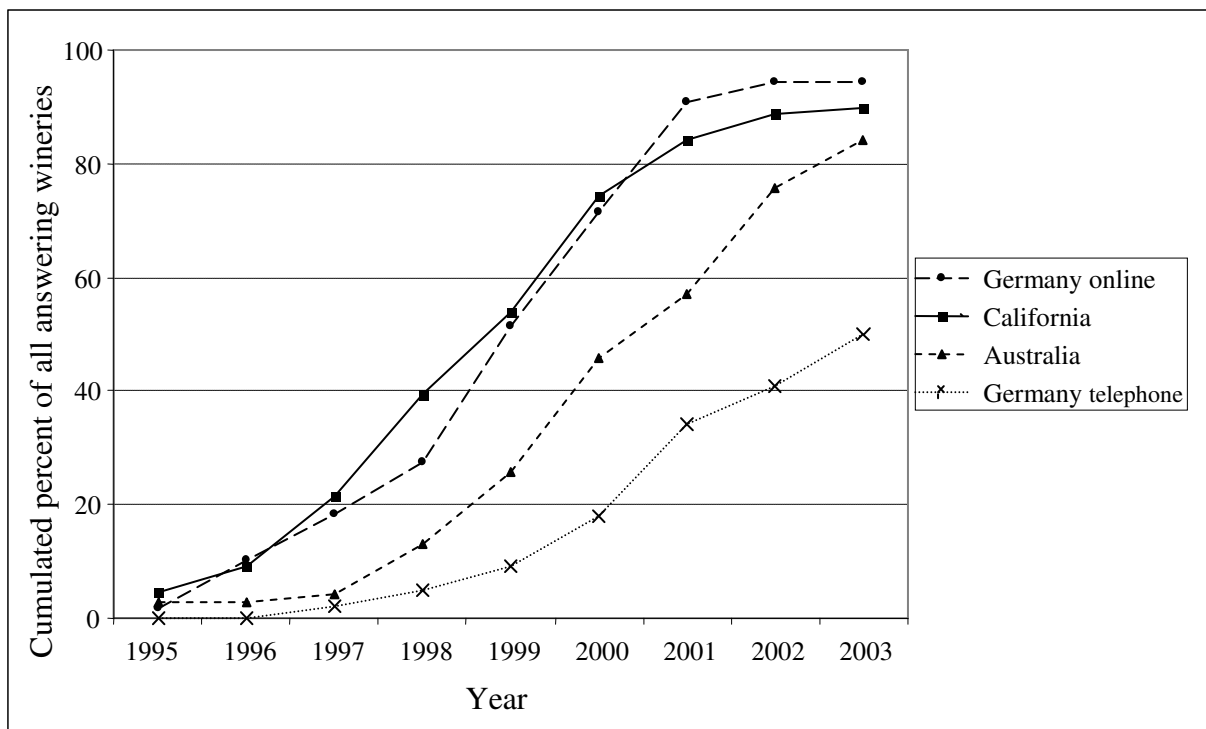
Table 18: Frequencies of California wineries surveyed by value of wine sales in 2002 (n=82)

Value of wine sales	Number of wineries	Share of wineries [%]
less than US\$100,000	4	4.9
US\$100,000 - US\$250,000	16	19.5
US\$250,000 - US\$500,000	13	15.9
US\$500,000 - US\$1,000,000	12	14.6
US\$1,000,000 -3,000,000	15	18.3
US\$3,000,000 - 7,000,000	8	9.8
more than US \$ 7,000,000	14	17.1

5.2.3 Winery website

Most wineries in all regions (Australia 87 percent, California 98 percent and Germany 75 percent) have their own websites. The results differ significantly between the subsamples, while almost all (96 percent) wineries surveyed on the Web have an own website, only half (51 percent) of the wineries surveyed on the telephone have their own website (chi-squared test for contingency tables significant at the one-percent level). Figure 21 shows the development of the cumulated share of wineries that operate a website.

Figure 21: Cumulative share of wineries with websites, by region, 1995 - 2003 (n=368)



In all three regions, the first wineries started to set up a website for their winery in 1995, the first German winery surveyed on the telephone set up a website in 1997. California wineries are the earliest adopters of winery websites but were overtaken by German wineries surveyed on the Web between 2000 and 2001. More than half of all German and Californian wineries from the online survey had adopted Websites for their winery's business by 1999, while Australian wineries did not reach this level until 2001. German wineries surveyed on the telephone lag behind, they have just reached the 50 percent level in 2003. The shares of wineries using websites for their winery's business are very similar among the regions in 2003; this share will surely continue to rise to reach almost one hundred percent soon.

Wineries with a website were asked how frequently they update their sites. Results show that the frequencies of website-updates are quite similar between regions, with the exception of California wineries which update their websites more often than their Australian and German counterparts (see Table 19). Every fifth website of German wineries surveyed on the telephone has not been updated since it was started.

Table 19: Frequency of winery website updates, by region (n=301)

Region	Wineries with websites	Daily [%]	Weekly [%]	Monthly [%]	More than three times a year [%]	Less than three times a year [%]	Not since started [%]
California	83	0	22.9	27.7	32.5	15.7	1.2
Australia	61	0	11.5	24.6	31.1	19.7	13.1
Germany total	157	1.3	10.2	24.2	32.5	24.8	7.0
Germany online	107	1.9	12.1	29.0	33.6	22.4	0.9
Germany telephone	50	0.0	6.0	14.0	30.0	30.0	20.0
All	301	0.7	14.0	25.2	32.2	21.3	6.6

Three fourths (75 percent) of all winery websites (Australia 80 percent, California 79 percent, Germany 72 percent) offer an option for buying wine. German wineries, by far, offer the largest variety of wines on their websites, Australian and Californian wineries offer ten different wines for sale on their websites on average (see Table 20). The number of offered wines differ significantly between Australia and Germany and California and Germany (t-tests for independent sample significant at the 1 percent-level), while they are similar between Australia and California.

Table 20: Mean, minimum, maximum, and median of number of wines offered for sale on the wineries' websites, by region (n=230)

Region	n	Mean	Minimum	Maximum	Median
California	68	10	1	33	8
Australia	50	10	2	65	7
Germany total	112	30	1	110	25.5
Germany online	74	34	8	110	30
Germany telephone	38	22	1	51	20
All	230	20	1	110	15

The number of offered wines implies that German wineries, which are small in relation to Australian and California wineries, produce many more different wines and also offer these for sale on their websites. Australian and California wineries, in turn, specialize on producing larger amounts of an individual variety.

Overall, three out of five (61 percent) of the 233 wineries answering, stated that their websites had increased their direct sales. The results differed significantly (chi-squared test significant at the 1 percent-level) between regions, 84 percent of all California wineries, 56 percent of German wineries (online survey 64 percent, telephone survey 39 percent) and only 43 percent of Australian wineries indicated that the website had increased their direct sales. This implies that wineries having set up their websites earlier more often state that the website had increased their direct sales volumes. The share of wineries answering that their websites had increased their direct sales volume is negatively correlated to the year the website was set up (Pearson's correlation coefficient = -0.232, significant at the one-percent level). While two out of three wineries that had set up their websites by 2000 stated their direct sales volumes to have been increased by the website, only half of the wineries that set up their websites after 2001 stated that it had increased the volume of direct sales.

5.2.4 Wine marketing practices

In this section the marketing practices of the wineries are described and compared using the four categories (i) sales channels, (ii) prices, (iii) wine shipments, and (iv) tourism facilities. These categories were chosen because of their potential impact on the adoption use of e-commerce.

5.2.4.1 Sales channels

California wineries usually use several, on average 5.5 different channels to market their wine. Australian wineries use 4.3 channels on average, and German wineries use 2.5, with the German wineries surveyed online using 3.0 channels, and the smaller wineries contacted by telephone use less than two (1.8) channels. The average number of sales channels used differ significantly (t-test comparing means are significant at the one percent level). Not only the average number of sales channels used differs considerably, but also the frequencies of using the individual sales channels (see Table 21).

Table 21: Frequency of sales channels used by Australian, California and German wineries (n_A=70, n_C=89, n_G=209)

Sales Channel	Australia (n=70)		California (n=89)		Germany total (n=209)		Germany online (n=109)		Germany telephone (n=100)	
	Number of wineries	Share of wineries [%]	Number of wineries	Share of wineries [%]	Number of wineries	Share of wineries [%]	Number of wineries	Share of wineries [%]	Number of wineries	Share of wineries [%]
Retail	55	78.6	80	89.9	31	14.8	20	18.3	11	11.0
Wholesale	56	80.0	77	86.5	34	16.3	23	21.1	11	11.0
Direct marketing	58	82.9	69	77.5	200	95.7	105	96.3	95	95.0
Website	41	58.6	65	73.0	87	41.6	70	64.2	17	17.0
Regular export	40	57.1	41	46.1	62	29.7	41	37.6	21	21.0

The most frequently used channel by Australian and German wineries is the direct marketing channel. The retail channel is used most frequently by California wineries, 90 percent of all California wineries use it. For Australia and California the second most frequently sales channel is selling wine to wholesalers.

Australian wineries show the highest export orientation, with almost three out of five wineries regularly exporting wine. While almost every second California winery regularly exports wine to foreign countries, not even every third German winery regularly exports wine.

Wine sales over the Web is a popular sales outlet, more than half (52.5 percent) of all wineries surveyed use the Web to market their wines. Web wine sales are the fifth most frequently used sales channel in Australia, where it is used by 73 percent of the wineries, and California, where more than half (57 percent) use it to sell wine. In Germany it is the third most frequently used sales channel, where 42 percent of the wineries sell wine on the Web.

Wineries were asked to indicate the share of their bottled wine sales in 2002 that was sold directly to consumers. German wineries widely rely on direct sales, 77 percent of bottled wine is sold directly to consumers. Even though large shares of the Australian and California wineries surveyed use direct marketing sales channels, the relative volumes of wines sold over these channels differ significantly (t-test comparing means are significant at the one percent level). In Australia, less than half (48 percent) of bottled wine sales, in California only every third (32 percent) bottle is sold directly to the consumers.

5.2.4.2 Prices

To provide information about the prices for bottled wine, wineries were asked how in 2002 the volume of all bottled wine they sold, as well as the volume of bottled wine they sold on the Web split into the provided price ranges (see Table 22 - Table 24). The price ranges were specified after surveying wine prices posted by stores, catalog-, and Web retailers. To allow for later comparison, the price ranges for the German questionnaire were chosen similar to those reported in "Deutscher Wein Markt" [Deutsches Weininstitut, 2003c].

Table 22: Distribution of bottled wine sold, by price ranges, all responding Australian wineries and Australian wineries conducting Web sales*, volume, 2002**

Price range (Aus \$ per bottle of wine)	All wineries* [%]	Wineries with Web sales**	
		Offline [%]	Web [%]
less than Aus \$7	3.7	1.9	1.9
Aus\$7-Aus\$13	13.3	12.7	8.3
Aus\$14-Aus\$25	58	59.3	61
More than Aus \$25	25	26.1	28.8

*(n=67); ** (n=47); ***Read as: 13.3 percent of the volume of all bottled wines sold by Australian wineries participating in the survey were sold at prices between Aus \$ 7 and Aus \$ 13, while wineries conducting Web sales sold 12.7 percent of all their bottled wines and only 8.3 percent of the wines they sold on the Web in this price range.

Table 23: Distribution of bottled wine sold, by price ranges, all responding California wineries and California wineries conducting Web sales*, volume, 2002**

Price range (US \$ per bottle of wine)	All wineries* [%]	Wineries with Web sales**	
		Offline [%]	Web [%]
less than US\$7	2.3	0.4	0.3
US\$7-US\$13	20.3	16	11.8
US\$14-US\$25	43.1	43.9	46.9
more thanUS \$25	34.4	39.7	41

*(n=87); ** (n=66); ***Read as: 20.3 percent of the volume of all bottled wines sold by California wineries participating in the survey were sold at prices between US \$ 7 and US \$ 13, while wineries conducting Web sales sold 16 percent of all their bottled wines and only 11.8 percent of the wines they sold on the Web in this price range.

Table 24: Distribution of bottled wine sold, by price ranges, all responding German wineries and German wineries conducting Web sales**, volume, 2002**

Price range (€ per bottle of wine)	All wineries* [%]	Wineries with Web sales			
		Online survey**		Telephone survey***	
		Offline [%]	Web [%]	Offline [%]	Web [%]
up to € 2.49	5.2	3.1	2.7	4	3.4
€ 2.5 - € 4.99	56.6	57.6	57.5	60.3	59.6
€ 5 - € 8.99	27.7	26.7	27.4	27.8	28.4
€ 9 - € 15	8.5	9.7	9.4	7.1	7.9
more than € 15	2.2	2.3	3	0.9	0.7

*(n=202); **(n=67); ***(n=38); ****Read as: 56.6 percent of the volume of all bottled wines sold by German wineries participating in the survey were sold at prices between € 2.5 and € 4.99, while wineries surveyed online, conducting Web sales sold 57.6 percent of all their bottled wines and 57.5 percent of the wines they sold on the Web in this price range. Wineries surveyed on the telephone conducting Web sales sold 60.3 percent of their bottled wines between € 2.5 and € 4.99 and 59.6 percent of the wines they sold on the Web in this price range.

The price ranges reported in Table 22 - Table 24 show that California wines are higher priced than Australian wines, which in turn are higher priced than German wines. In Australia and California, wineries offering their wines for sale on the Web, at average, sell higher priced wines, compared to all wineries in the survey, the difference being higher in California than in Australia. In addition, Australian and California wineries selling on the Web, sell higher priced wines on the Web compared to all other channels. In Germany, there is no major difference between wineries with and without Web sales, in how the volumes of all bottled wines split into the price ranges (see Table 24). Compared to all bottled German wine sold in Germany (see Table 25), the German wineries participating in the survey sell their wines at higher prices.

Table 25: Distribution of all bottled German wine sold in Germany, by price ranges, volume, 2002 (n=17,000)

Price range (€ per liter)	Share of German wine sold in Germany [%]
up to € 2.49	39.9
€ 2.5 - € 4.99	46.8
More than € 5	13.3

Source: [Deutsches Weininstitut, 2003c]

This is not surprising, considering that the price distribution shown in Table 25 is calculated in € per liter and it includes wines sold at discounters who compete with low prices. For example Aldi, the leading German discounter, sells German wine for an average price of € 2.24, while German wines bought directly from a winery cost € 4.19 on average [Deutsches Weininstitut, 2003c].

Three out of four (73 percent) of all German wineries surveyed offer exactly the same wines on the Web as through all other sales channels. In Australia 70 percent of the 47 wineries offering their wines for sale on the Web provide the same product line as in all other channels. In California, only little more than half (52 percent) offer the same product line on- and offline. The larger shares of wineries in Germany and Australia offering the same product lines on- and offline can be reasoned by the higher shares of small wineries solely relying on direct marketing sales channels. The small share of California wineries offering the same product line on- and offline can be reasoned by the fear of sales channel conflicts (see chapter 3.3.3).

5.2.4.3 Wine shipments

Most (87 percent) responding wineries ship wine to buyers. When shipping directly to consumers, most of the Australian (86 percent) and California wineries (87 percent) surveyed send two cases of twelve bottles each or less. The sizes of direct sales are much larger among the German wineries surveyed only 18 percent of the wineries ship less than two cases, only half of the surveyed German wineries, less than four cases per shipment.

Wineries were asked where they sold a higher share of their higher priced wines, per mail order, at the winery, or about the same shares per mail and at the winery. This question did not lead to significant differences between the subgroups of the survey. Almost every second (47 percent) of the 336 wineries answering this question, stated that a higher share of the more expensive wines is sold at the winery, every fifth (20 percent) winery sells more of their expensive wines per mail order, more than every fourth (27 percent) winery stated that the shares of high priced wines were the same in mail order and winery direct sales. Few wineries (5 percent) answered that they did not know where they sold more of their expensive wines. This implies that most wineries do not sell more high priced wine over the Internet, which can be compared to the mail order sales channel.

When asked for their experiences with direct sales to consumer abroad, 38 percent of all wineries (56 percent in Australia, 24 percent in California, and 39 percent in Germany) said that they have shipped wine directly to consumers in foreign countries within the last three years (see Table 26). Few wineries have done this often; a fourth of the wineries have conducted direct international sales less than three times, half of the wineries surveyed, less than eight times within the last three years. In each region, more than half of the wineries indicate that the prices of wines shipped internationally are about the same as prices of wines sold domestically (see Table 26). More Australian and California wineries report that the prices of wines shipped internationally are lower than those of wines sold domestically. German wineries, however, report that prices of wines shipped internationally are higher or much higher than the prices of wines sold domestically.

These results imply that international e-commerce wine sales are not an option to exploit new markets for direct marketing wineries for Australia and California. German wineries, because of their geographic location within the EU, where the trade of wine is free, could benefit from international direct sales.

Table 26: Share of wineries having sold wine internationally directly to consumers abroad and comparison of prices of wines sold internationally and domestically (n=141)

Region	Number of all wineries	Number of wineries having sold wine direct internationally	Share of all wineries [%]	Compared to prices of wines sold domestically, prices of wines shipped internationally are...		
				..lower [%]	...about the same [%]	..higher or much higher [%]
California	89	21	23.6	9.5	76.2	14.3
Australia	70	39	55.7	25.6	61.5	12.8
Germany total	209	81	38.8	3.7	56.8	39.5
Germany online	109	51	46.8	3.9	60.8	35.3
Germany telephone	100	30	30	3.3	50.0	46.7
All	368	141	38.3	10.6	61.0	28.4

5.2.4.4 Tourism

The wineries were asked to identify tourism activities or facilities that they offer, and whether they promote these on the Web (see Attachment 8, Question 11 for a list of these activities or facilities). These activities and facilities were identified by studying winery brochures, directories, and websites. The two most important tourism activities in all three regions are wine tastings and winery tours (see Table 27). Most (87 percent) wineries offer wine tastings at their winery, three out of five wineries (60 percent) also promote these on the Web. German wineries surveyed on the telephone most often offer wine tasting (94 percent), but least often promote these in the Web (46 percent).

Only few (6 percent) of California wineries have a restaurant or a café, compared to Australian and German wineries, where at least every third winery has either a restaurant or a café. Every fourth (25 percent) German winery provides accommodation as part of their winery's business, while only few Australian and California wineries have rooms for rent.

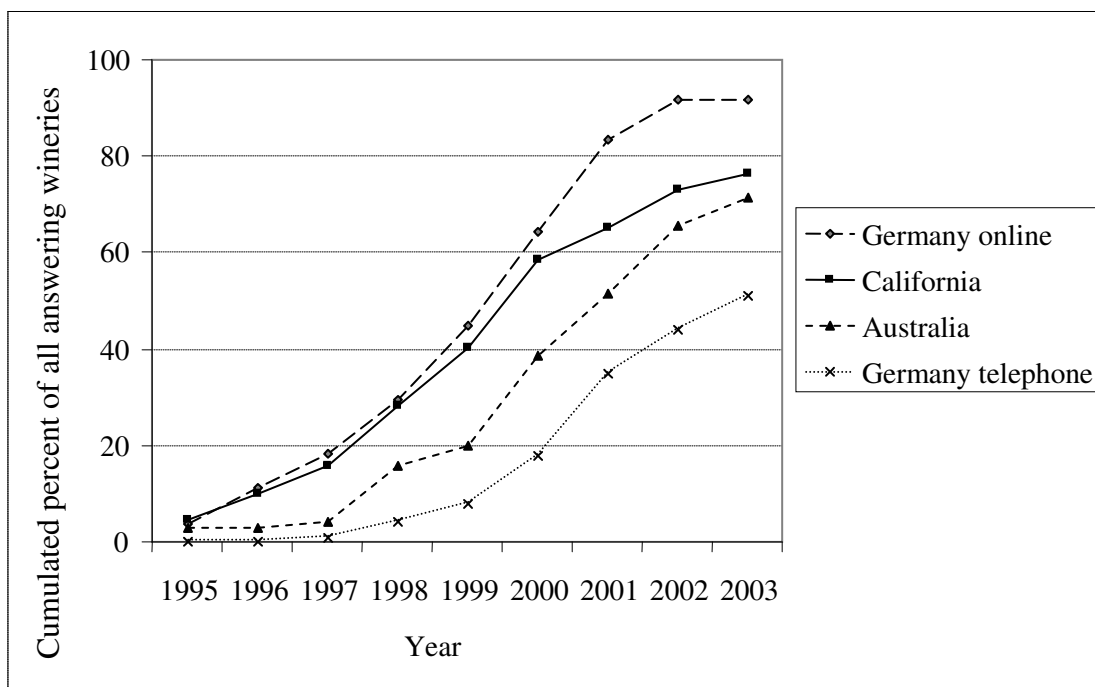
Table 27: Relative frequencies of tourism activities or facilities offered, by region (n=367)

	n	Winery tours		Wine tasting		Accomodation		Restaurant/cafe		BBQ		Others	
		Offered [%]	Promoted on the Web [%]	Offered [%]	Promoted on the Web [%]	Offered [%]	Promoted on the Web [%]	Offered [%]	Promoted on the Web [%]	Offered [%]	Promoted on the Web [%]	Offered [%]	Promoted on the Web [%]
California	89	61.8	40.4	78.7	64.0	6.7	3.4	5.6	5.6	10.1	5.6	27.0	24.7
Australia	69	43.5	27.5	87.0	62.3	7.2	7.2	21.7	18.8	29.0	13.0	18.8	17.4
Germany total	209	81.3	47.4	90.9	59.3	24.9	19.6	31.6	22.5	5.3	2.9	25.0	22.5
Germany online	109	83.5	55.0	88.1	71.6	20.2	20.2	29.4	29.4	3.7	3.7	42.6	38.5
Germany telephone	100	78.8	39.0	94.0	46.0	30.0	19.0	34.0	15.0	8.0	2.0	6.0	5.0
All	367	69.4	42.0	87.2	61.0	17.2	13.4	23.2	17.7	10.0	5.4	24.3	22.1

If the wineries offer other tourism activities than the ones provided in the questionnaire, they were asked to name these. Event hosting was named most often, eleven California, seven Australian and ten German wineries stated that they offer event hosting, such as corporate events or weddings. Additionally, six California wineries offer picnics at the winery. Other activities named most often (12 times) by German wineries were wine festivals celebrating a new vintage.

Figure 22 shows when the wineries surveyed first started to use the Web to promote their tourism activities and the development of the cumulated share of wineries promoting their tourism activities on the Web since then.

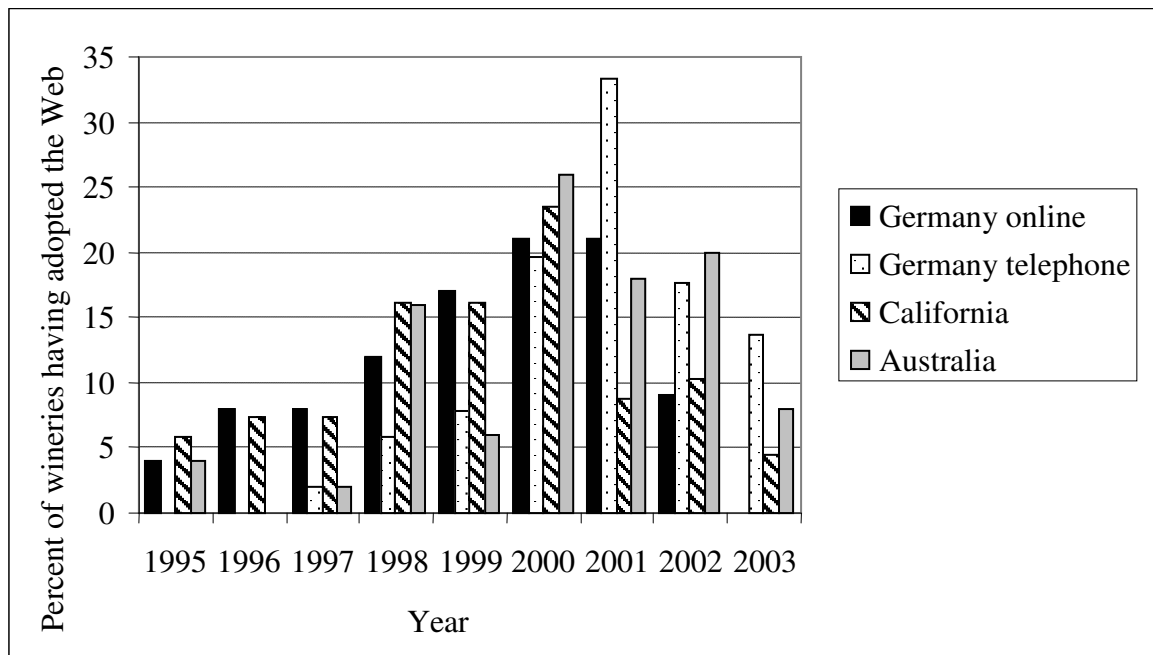
Figure 22: Cumulative share of wineries using the Web to promote tourism activities, by region, 1995 - 2003 (n=269)



In all three regions, wineries started to promote their tourism activities or facilities on the Web in 1995, when the Web became accessible to the public. The first German winery surveyed on the telephone started to use the Web to promote the winery's tourism business in 1997 (see Figure 23). In 2003, most German wineries (92 percent) surveyed online use the Web to promote tourism activities or facilities on the Web. German wineries surveyed on the phone lie far behind, with only half (51 percent) using the Web to promote tourism activities or facilities in 2003. The diffusion of using the Web to promote tourism activities or facilities among California showed parallel development to German wineries surveyed online from 1995 until 2000, from then the diffusion slowed down more among California

than among German wineries surveyed online. Among Australian wineries, the diffusion of using the Web to promote tourism activities started to grow fast since 1999, where only every fifth winery surveyed had used the Web to promote the use of their tourism activities or facilities. Today, more than two thirds (71 percent) of Australian wineries surveyed, use the Web to promote their tourism activities or facilities.

Figure 23: Distribution of the year when the Web was adopted to promote tourism activities or facilities, by region, 1995-2003 (n=269)



The distribution of the year when the wineries started to use the Web to promote their tourism activities or facilities shows a similar development among California and German wineries surveyed online with the exception of the years 1998 and 2000 where a larger share of California wineries adopted the Web (see Figure 23). Australia wineries lagged behind until 1999, large shares of Australian wineries started to adopt the Web to promote their tourism activities or facilities since 2000. German wineries surveyed on the phone can be classified as late adopters compared to all wineries surveyed online. Every third German winery surveyed on the telephone started to use the Web to promote their tourism business in 2001.

Far more than half (65 percent) of all wineries using the Web to promote their tourism business, state that this business has intensified at least somewhat since they promote it on the Web (see Table 28). About every fourth Australian and California wineries could not quantify if the use of the Web to promote tourism activities or facilities had intensified the use of these activities. Only few California wineries (7 percent) stated that promoting

activities or facilities on the Web did not intensify tourism business, while at least every fifth German or Australian winery stated that using the Web intensified the use of the tourism activities or facilities their winery offers.

Table 28: Relative frequency of wineries' experiences with tourism activities, by region (n=270)

	n	Has tourism business intensified since it is promoted on the Web?				
		No [%]	Yes, somewhat [%]	Yes, considerably [%]	Yes, very much [%]	Don't know / can't tell [%]
California	70	7.1	57.1	7.1	2.9	25.7
Australia	49	28.6	40.8	2.0	4.1	24.5
Germany total	151	25.8	54.3	11.3	3.3	4.6
Germany online	100	21.0	57.0	14.0	4.0	4.0
Germany telephone	51	35.3	49.0	7.8	2.0	5.9
All	270	21.5	52.6	8.9	3.3	13.7

5.2.5 Internet use

All wineries surveyed online use the Internet for business purposes, most every work day, while one in every five German wineries surveyed on the telephone never use the Internet for their winery's business (see Table 29).

Table 29: Relative frequency of Internet use for business purposes, by region (n=366)

Region	Number of wineries	Never [%]	Rarely [%]	Several times a week [%]	Every work day [%]	Online all day [%]
California	88	0	2.3	3.4	53.4	40.9
Australia	70	0	0.0	10.0	62.9	27.1
Germany total	208	10.1	11.5	31.3	41.3	5.8
Germany online	108	0	4.6	16.7	67.6	11.1
Germany telephone	100	21.0	19.0	47.0	13.0	0.0
All	366	5.7	7.1	20.5	48.4	18.3

California wineries are the most frequent Internet users, more than half (53 percent) use it every work day, and four out of ten wineries have an online-all-day connection. Australian wineries follow closely behind, nine out of ten wineries access the Internet at least every work day or even have an online-all-day connection. Only little more than three fourths (79

percent) of the German wineries use the Internet every workday or have an online-all-day connection.

Internet banking for business purposes is not very popular among California wineries and Germany wineries surveyed on the telephone, the majorities (each 67 percent) only rarely or never use it. The majority of Australian (70 percent) and German (74 percent) wineries surveyed online, in turn, use Internet banking at least several times per week (see Table 30).

Table 30: Relative frequency of using Internet banking for business purposes, by region (n=364)

Region	Number of wineries	Never [%]	Rarely [%]	Several times a week [%]	Every work day [%]
California	88	39.8	26.1	20.5	13.6
Australia	70	10.0	18.6	50.0	21.4
Germany total	206	31.1	15.0	41.3	12.6
Germany online	106	14.2	12.3	52.8	20.8
Germany telephone	100	49.0	18.0	29.0	4.0
All	364	29.1	18.4	37.9	14.6

All wineries surveyed online use the Internet to send and receive emails, most every work day, while more than one out of three (39 percent) of the German wineries surveyed on the telephone rarely or never send or receive emails (see Table 31).

Table 31: Relative frequency of using the Internet for sending and receiving email, by region (n=366)

Region	Number of wineries	Never [%]	Rarely [%]	Several times a week [%]	Every work day [%]
California	88	0.0	2.3	1.1	96.6
Australia	70	0.0	1.4	11.4	87.1
Germany total	208	10.1	9.6	30.8	49.5
Germany online	108	0.0	1.9	17.6	80.6
Germany telephone	100	21.0	18.0	45.0	16.0
All	366	5.7	6.3	19.9	68.0

California wineries use the Web most frequently to access information for their winery's business, followed by Australian wineries and German wineries surveyed on the Web.

German wineries surveyed on the telephone, again, lay behind those wineries surveyed on the Web (see Table 32).

Table 32: Relative frequency of business information retrieval on the Web, by region (n=366)

Region	Number of wineries	Never [%]	Rarely [%]	Several	
				times a week [%]	Every work day [%]
California	88	1.1	15.9	34.1	48.9
Australia	70	2.9	14.3	45.7	37.1
Germany total	208	15.9	33.7	42.8	7.7
Germany online	108	1.9	33.3	50.9	13.9
Germany telephone	100	31.0	34.0	34.0	1.0
All	366	9.8	25.7	41.3	23.2

Overall, more than half (55 percent) of all wineries surveyed have bought products or services online for their winery's business (see Table 33). Again, California wineries are the most frequent users and almost half (49 percent) of the 'online-buyers' have made more than ten purchases on the Web.

Table 33: Relative frequencies of online purchases and share of wineries having bought products or services online for their winery's business within the year prior to the survey, by region (n=364)

Region	Buying frequencies within the last year					
	n	Online buyers [%]				
			Once [%]	1-5 times [%]	6-10 times [%]	More than 10 times [%]
California	87	79.3	2.9	26.1	21.7	49.3
Australia	70	61.4	18.6	48.9	14.0	18.6
Germany total	207	43.9	13.2	44.0	24.1	18.7
Germany online	107	68.2	12.3	45.2	26.0	16.4
Germany telephone	100	18.0	16.7	38.9	16.7	27.8
All	364	55.8	10.8	38.9	21.2	29.1

All other wineries have bought products and services online for their winery's business one to five times. The largest share of wineries having bought online for their businesses, had bought office supplies (69 percent), and information (60 percent) (see Table 34).

Table 34: Relative frequencies of products and services bought online for the winery's business, by region (n=209)

Region	n	Vine- yard supply [%]	Winery supply [%]	Office supply [%]	Equipment, tools, machinery [%]	Infor- mation [%]	Other [%]
California	70	7.1	22.9	81.4	40.0	52.9	32.9
Australia	44	2.3	40.9	50.0	27.3	50.0	34.1
Germany total	95	12.6	26.3	69.5	31.6	69.1	21.1
Germany online	77	9.1	20.8	72.7	32.5	69.7	23.4
Germany telephone	18	27.8	50.0	55.6	27.8	66.7	11.1
All	209	8.6	28.2	69.4	33.5	59.6	27.8

Interestingly, more than every third German winery surveyed on the telephone and having bought online, bought vineyard supplies, while only little (9 percent) of the German wineries surveyed online bought vineyard supply. This may find its reason in the small number of online buyers among those German wineries surveyed on the telephone (see Table 34).

Considering their head start in using e-commerce, the low shares of California wineries having bought inputs on the Web, in comparison to the shares having bought inputs among Australian and German wineries in the survey, imply that California wineries concentrate on using the Web for marketing their wine, rather than buying input supplies. While Australian and German wineries focus on using the Web for the procurement of input products.

5.2.6 Summary of survey results

The survey of 368 wineries from Australia, California and Germany showed that California wineries are largest and most advanced in terms of e-commerce adoption and use. Australian wineries follow closely behind California wineries according to a wide range of indicators. Considering the rapid development of the Australian wine industry over the past few years, it is reasonable to expect that Australian wineries will soon close the gap to California wineries in terms of e-commerce adoption and use. The two German subsamples, those surveyed online and those surveyed on the phone, differ considerably. In nearly all criteria, those wineries surveyed online are by far more progressive than their counterparts surveyed on the telephone. This implies that German wineries that have

online access and an own website are a suitable group to study commercially viable German wineries.

The distribution of wineries surveyed by regional districts in Australia and California does not differ significantly from the district-distribution of all Australian and California wineries. Figures comparing the distribution of German wineries into the grape growing district were not available, but the distributions are similar between the online- and telephone subsamples.

California wineries are largest in terms of winery area, workforce and amount of grapes crushed annually, followed closely by Australian, leaving German wineries far behind. While German wineries surveyed online are roughly three times as large as those surveyed on the telephone.

Most (62 percent) of German wineries do not trade grapes. In Germany, traditionally wine is made from grapes grown by the winery. More than four out of five wineries from Australia and California trade grapes. To market their wines, California and Australian wineries use almost twice as many channels as German wineries. California wineries focus on the retail and wholesale sales channels, while the direct marketing channel is most frequently used by Australian and German wineries.

Prices of California wines are highest, those of German wines lowest. In Australia and California those wineries offering their wines on the Web, sell higher priced wines compared with all Australian and California wineries surveyed. Also the wines they sell on the Web have higher prices than the wines they sell through the other channels they use to market their wines. In Germany the price ranges of the offered wines do not differ significantly between the online and other channels.

Most (87 percent) wineries surveyed ship wine to their customers. Wine tastings and winery tours are the two most popular wine tourism activities offered in all three regions. More than two thirds of the wineries also promote their tourism activities on the Web, and the shares of wineries using the Web for this purpose continuously rising since 1995. Wineries that use the Web to promote their tourism activities stated that doing so has intensified their tourism business.

Most wineries in all regions maintain a website. California wineries update their websites most frequently, German wineries surveyed on the telephone least often. Three fourths of all wineries offer wines for sale on their websites, the number of wines offered differing

significantly between regions. While Australian and California wineries, on average, offer ten different wines for sales on their websites, German wineries offer 30 different wines. Overall, three out of every five wineries in the survey stated that their websites had increased their direct sales at least somewhat, results differing significantly between regions.

All wineries surveyed online, access the Internet and send and receive emails for their winery's business. California wineries are the most frequent users of all Internet applications with exception of Internet banking. German wineries surveyed on the telephone are the least frequent users. Online banking is not very popular among California wineries and Germany wineries surveyed on the telephone, the majorities only rarely or never use it. The majorities of Australian and German wineries surveyed online use online banking at least several times per week. Overall, more than half of all wineries surveyed have bought products or services online for their winery's business. Again, California wineries are most frequent users, half of the online-buying wineries having bought online more than ten times. Products and services bought online most often are office supplies, information and equipment.

As expected by studying e-commerce readiness (see 3.4), California wineries use the Web most intensively for wine marketing. Wineries from Australia and California focus on using the Web for the procurement of input supplies.

5.3 Hypotheses testing and Implications

In this section the hypotheses which were formulated in chapter 4.1 are tested. Here the hypotheses can be divided into three main parts: (i) hypotheses about adoption parameters considering winery size, (ii) hypotheses about adoption parameters considering marketing practices, and (iii) hypothesis about product pricing as an adoption parameter.

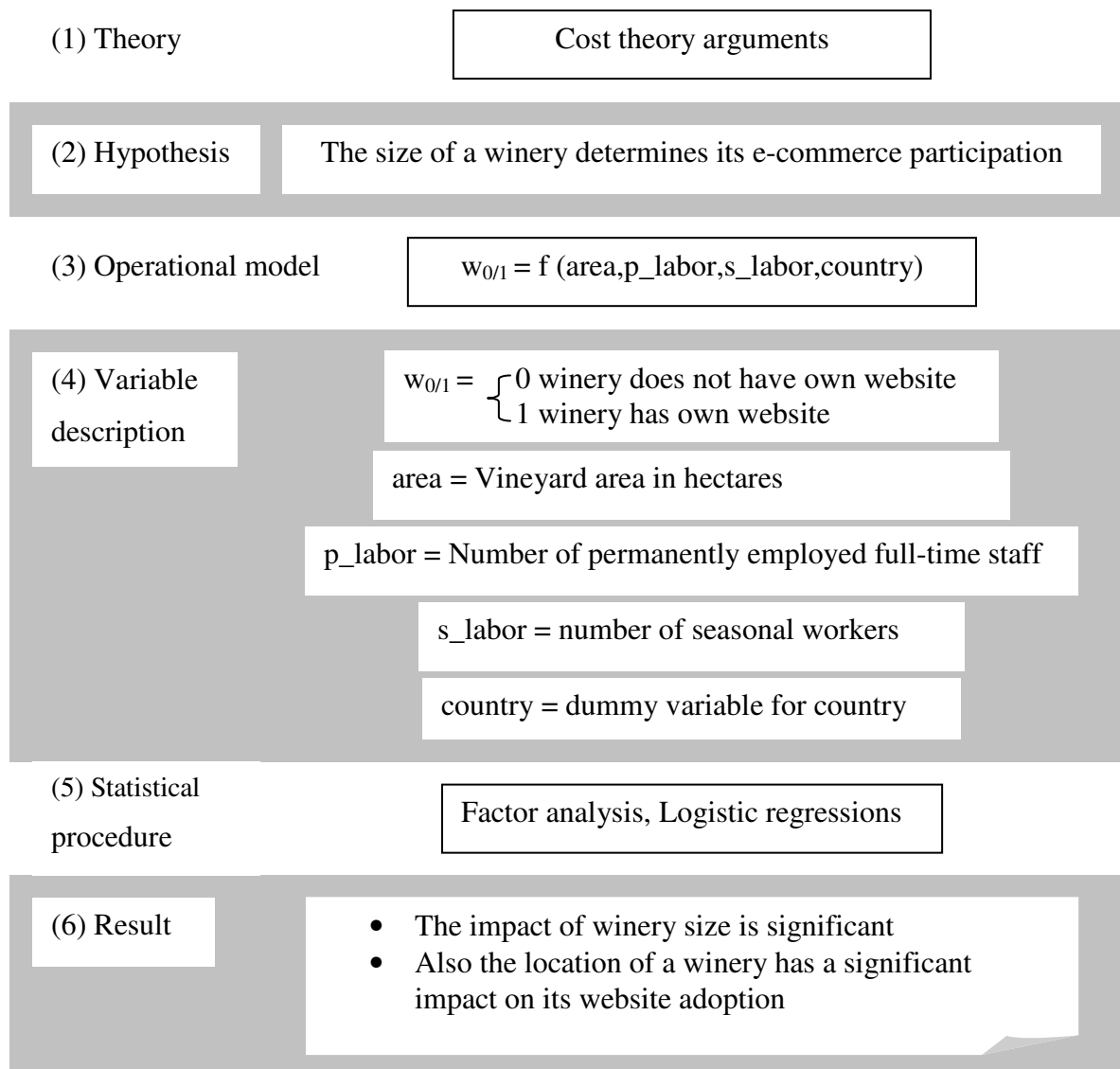
5.3.1 The relevance of winery size in the adoption of Web-wine-marketing

Hypothesis 1: The size of a winery determines its e-commerce participation.

The investment into a company website primarily consists of fixed costs. Larger wineries therefore have the advantage of experiencing economies of scale. Some wineries may be too small to justify an investment into a professionally designed website.

The test of the impact of the winery size on the probability for it to have a website was tested by first estimating the logistic regression model $w_{0/1}=f(\text{area}, p_labor, s_labor)$ to determine the impact of variables representing winery size (see Figure 24 and Table 35) on the binary variable $w_{0/1}$ (winery does not/does have website) representing the probability of the winery to have a website.

Figure 24: Overview of the operationalization, testing and results of hypothesis 1



Model 1 (see Table 35) suggests that only the winery size measured in terms of full-time employees and full-time equivalent seasonal workers has significant impact on the probability for a winery to set up a website for its business. Vineyard area, number of full-time employees and number of full-time equivalent seasonal workers are all correlated significantly positive implying that there is bound to be multicollinearity in the model making it uneligible for interpretation. This problem was solved by merging the variables

measuring winery size into a single factor using the principal components factor analysis. The factor is calculated as follows (using z-standardized variables):

$$F_{wz} = 0.391 * z_area + 0.350 * z_p_labor + 0.408 * z_s_labor$$

Since McFadden's R^2 was very low for model 1 dummy variables representing the regions the answering wineries are located in, were entered into the model: $w_{0/1} = f(\text{area}, \text{p_labor}, \text{s_labor}, \text{country})$. This leads to an increase in the fit of the model measured in terms of McFadden's R^2 (see 'model 2' in Table 35). Models with McFadden's R^2 values of 0.2 or above are to be judged as 'good' [Krafft, 1997].

Table 35: Results of the logistic regressions of winery size and country dummies on the probability for a winery to have a website (n=339)⁽¹⁾

Variables ⁽²⁾	Model 1	Model 2	Model 3
constant	0.529 (4.813)	0.304 (1.484)	2.241** (30.597)
<i>Winery size</i>			
area	-0.002 (0.097)	-0.003 (1.275)	
p_labor	0.194* (6.520)	0.158 (4.623)	
s_labor	0.085* (4.813)	0.092 (5.967)	
<i>Countries</i>			
country=CA (D) ⁽³⁾		2.083** (7.765)	2.123** (8.145)
country=AUS (D) ⁽³⁾		0.561 (1.841)	0.586 (2.081)
F_{wz}			5.325** (11.841)
LL	141.2	134.4	135.9
Likelihood-ratio test	34.16**	47.7**	45.2**
McFadden's R^2	0.108	0.152	0.145
n	339	339	339

⁽¹⁾ Wald-statistics in parentheses

**indicates statistical significance at the one-percent-level and* at the five-percent level.

⁽²⁾ Variables are described in Figure 24

⁽³⁾ Dummy variable =1 if the winery is from this country, otherwise = 0; the reference category is Germany

The survey was conducted in three regions: Australia, California and Germany. Therefore the parameter 'country' has three categories and thus two degrees of freedom. This makes it necessary to insert two dummy variables into the model to represent it. The results are then to be interpreted in relation to the reference category Germany.

Model 2 (see Table 35) is ill suited for interpretation caused by the multicollinearity of the three variables 'area', p_labor' and 's_labor'. Rather model 3 is used for interpretation. It shows that the size of a winery, measured by the factor described above, does have a significant impact on the probability for a winery to have a website. Parameter values of the country dummy for California is very high, leading to large increases in the probabilities for the wineries to have a website if it is located in California in comparison to Germany, which is the reference category in this model. This result underlines the head start of California wineries in e-commerce adoption (see chapter 3.4). Australian wineries are ahead of German wineries (indicated by the positive parameter value for the country dummy variable for Australia), but this position is not significant at the five percent level. The quality of the model, measured in terms of McFadden's R^2 is still low for model 3, implying that variables beyond those included in this model explain a winery's participation in e-commerce. This could be the "e-ability" of the winery's workforce. Younger vintners or vintners with children interested in the Internet and its applications are more likely to use this new marketing channel, than older vintners that are not as familiar with this new medium. Questions measuring this issue were not included in the questionnaire.

From these results it is concluded that winery size has a significant impact on the probability for a winery to have a website. Also, the country where the winery is located determines its participation in e-commerce. The considerable differences in industry structures, marketing practices and e-commerce readiness, between the three regions are represented by dummy variables. The dummy variable representing California showed a significantly positive impact on the probability for the wineries to have a website for business purposes.

The result of testing this hypothesis implies that the assumption that larger enterprises have the advantage of experiencing economies of scale when facing the investment into a company website that primarily consists of fixed costs. Some wineries, as other agricultural enterprises are too small to justify an investment into a professionally designed

website. As the costs decrease over time, the share of agricultural enterprises with websites will continue to grow, and may eventually approach 100 percent diffusion.

Hypothesis 2: Larger wineries will adopt websites earlier.

Hypothesis one tested if winery size had an impact on the probability for a winery to set up a website for its business. The dependent variable was binary, representing whether or not the winery had a website at the time it participated in the survey. In the estimations used to test hypothesis 1, information about the time when the website was set up for the winery's business was not considered. But it is plausible to expect, that wineries that have set up a website for their business in 1995 are more advanced than wineries having set up their websites only recently. To implement the time into the estimation, a Cox Regression model is estimated:

$$h(t) = h_0(t) * e^{\beta_1 * \text{area} + \beta_2 * \text{p_labor} + \beta_3 * \text{s_labor}}$$

Where $h(t)$ is the hazard rate (see chapter 4.2.2). The hazard is the adoption rate per year in which wineries in the survey have set up websites for their business. $h_0(t)$ is the baseline hazard rate and can be interpreted similar to a constant term in a linear regression. It is the proportion of wineries adopting a website for their business in every year ($t=1995-2003$), if the explanatory variables (for example: area, p_labor, and s_labor in model 1) are all equal to zero.

In a second step, dummy variables for the winery's country of origin were included in the model:

$$h(t) = h_0(t) * e^{\beta_1 * \text{area} + \beta_2 * \text{p_labor} + \beta_3 * \text{s_labor} + \beta_4 * \text{country}}$$

In a third step, analog to hypothesis one, the winery size is represented by a factor including the three variables 'area', 'p_labor', and 's_labor':

$$h(t) = h_0(t) * e^{\beta_1 * F_{wz} + \beta_2 * \text{country}}$$

The results of the estimation underline the findings of the first hypothesis (see Table 36). Larger wineries do set up their websites significantly earlier than smaller wineries. Also, interregional differences determine the time of adoption. California wineries significantly earlier adopt websites for their businesses than German wineries. Australian wineries do not significantly differ in point of time when adopting websites from German wineries.

Table 36: Estimation results for Cox model of winery size and country of origin on the hazard ‘setting up a website for the winery’s business’⁽¹⁾

Variables ⁽²⁾	Model 1	Model 2	Model 3
<i>Winery size</i>			
area	0.000 (0.113)	0.00 (0.184)	
p_labor	0.008** (10.027)	0.008** (7.065)	
s_labor	0.006 (1.280)	0.005 (0.994)	
<i>Countries</i>			
country=CA (D) ⁽³⁾		0.307* (4.234)	0.342* (5.415)
country=AUS (D) ⁽³⁾		-0.274 (2.763)	-0.269 (2.704)
F _{wz}			0.280** (26.501)
LL	1293.0	1137.9	1289.0
Overall Chi-square	39.9**	48.4**	45.3**
Likelihood-ratio test	19.1**	29.2**	26.9**
n	269	269	269

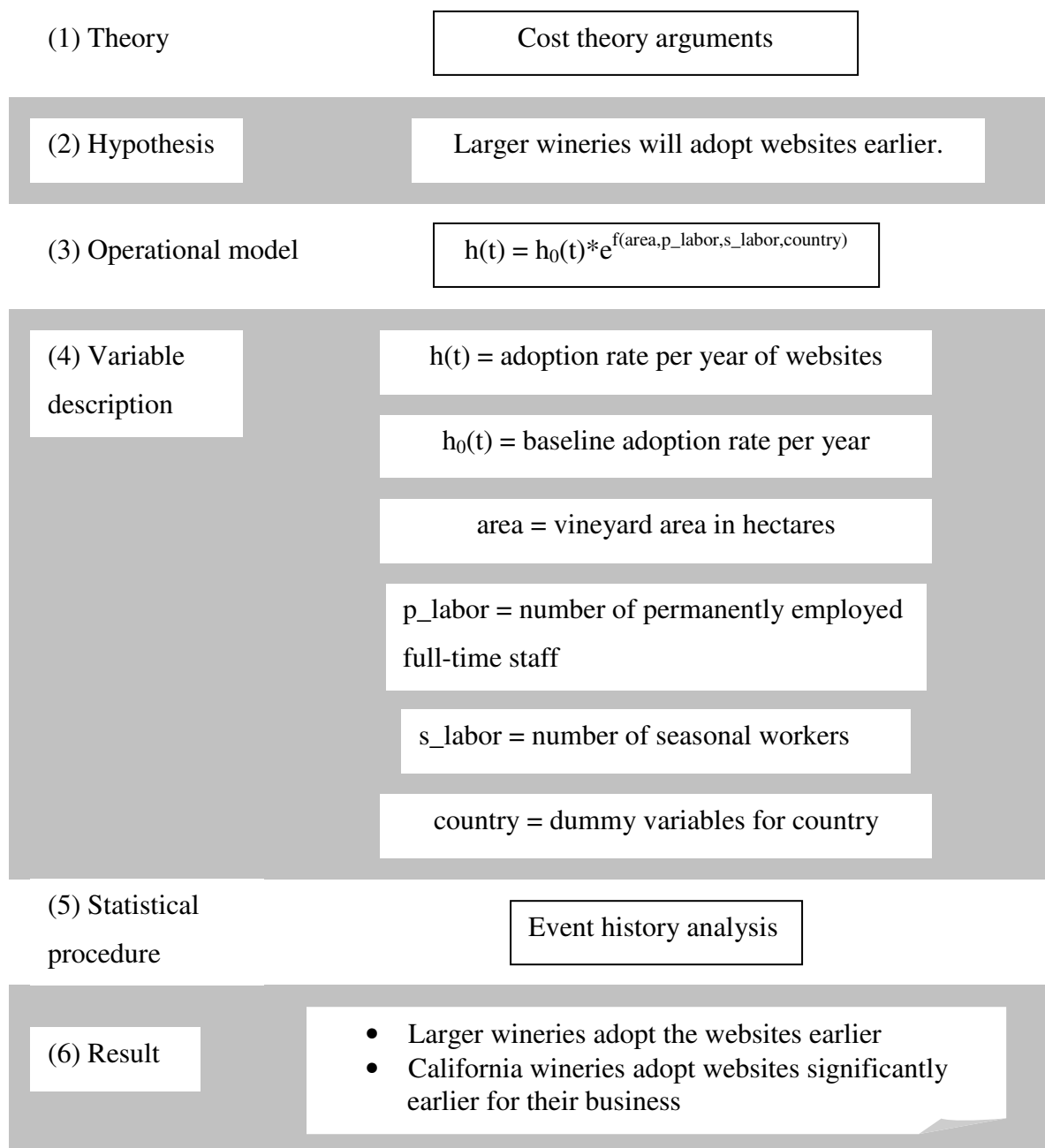
⁽¹⁾Wald-statistics in parentheses

**indicates statistical significance at the one-percent-level and* at the five-percent level.

⁽²⁾Variables are described in Figure 25

⁽³⁾Dummy =1 if the winery is from this country, otherwise=0; reference category is Germany

In this particular case the event-history analysis leads to the same results as the logistic regressions. This has its reason in the large share of wineries that have already adopted the new information technology. When studying the factors with impact of information technology earlier, for example in other industries that are still at a lower adoption level, the event- history analysis method may be better suited to determine factors determining the adoption of new information technology because it also considers the time of adoption.

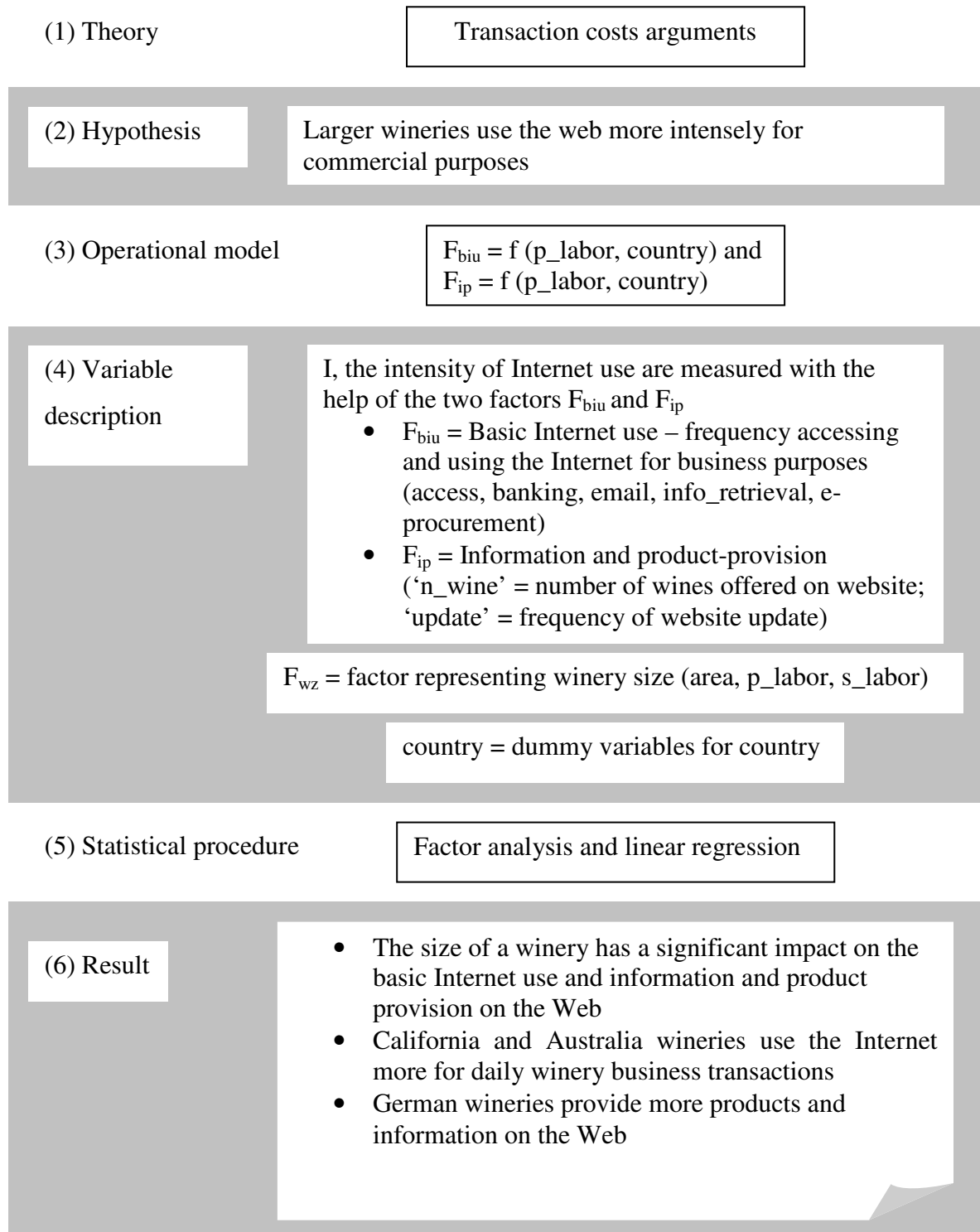
Figure 25: Overview of the operationalization, testing and results of hypothesis 2

Hypothesis 3: Larger wineries use the Internet more intensely for commercial purposes

The intensity of Internet use was determined through two dimensions: (i) basic Internet use for business purposes, and (ii) information and product provision (see Figure 26). In a first step, two factors were extracted, one for each of the two dimensions, using principal components factor analysis. Then the impact of winery size measured in terms of

permanently employed full-time staff (p_labor) and the interregional differences (country) on these dimensions is estimated in a linear regression models (see Figure 26).

Figure 26: Overview of the operationalization, testing and results of hypothesis 3



In order to calculate the first factor (basic Internet use), the following five variables were used: 'access', representing the frequency the winery accesses the Internet for business

purposes; three variables representing how frequently the winery uses Internet banking for business transactions (banking), email (email), and the Web to retrieve information (info_retrieval) for the winery's business; and 'e-procurement' representing the frequency with which the winery had bought products and services online within the year prior to the survey. These variables all are correlated significantly and positively with each other (Spearman's rho is significantly positive at the one percent level for all relationships) and therefore are well suited to be merged into a principal component. The factor for basic Internet use F_{biu} represents the variables as follows:

$$F_{biu} = -3.88 + 0.287*access + 0.181*banking + 0.346*email + 0.306*info_retrieval \\ + 0.137*e-procurement$$

The second factor is used to quantify the information and product provision by the winery, it was estimated using two variables: the number of wines offered on the website and the frequency of updating the wineries website. These variables are correlated significantly and positively (Spearman's rho = 0.165, significant at the five percent level), implying that those wineries offering more different wines update their websites more frequently than wineries offering fewer wines. The factor for information and product provision represents the variables as follows:

$$F_{ip} = -2.726 + 0.039 * n_wine + 0.586 * update$$

After determining the factor scores using the equations just presented, in a second step, regressions models estimating the impact of winery size and country dummy variables on these factors are estimated (see Table 37). Winery size is measured in terms of the factor (F_{wz}) derived in the testing of hypothesis one.

Results show that winery size has a significant impact on the wineries' basic Internet use (F_{biu}) as well as on the information and product provision (F_{ip}). This implies that larger wineries have better technological equipment making frequent use of the Internet possible to aid in everyday business transactions. Also larger businesses invest more money on maintaining the company's website, which enables them to provide more information and also more products.

Also there are significant interregional differences in the intensity of using the Internet for business purposes. Californian wineries use the Internet most frequently, followed by Australian wineries. This may be due to the fact that large amounts of information on the

Web are in English language and thus English speaking Web users profit more from frequently accessing this information.

While Australian and Californian wineries are the most frequent users of the Internet for everyday business transactions, they use the Internet significantly less often than German wineries for providing information and products on the Web. This is shown by the significant and negative estimates for the country dummies in comparison to the reference country Germany. This may result from the fact that Australian and California wineries offer fewer wines online than their German counterparts (see 5.2.3).

Table 37: Results of linear regression of winery size and country dummy variables on factors representing the intensity of Internet use⁽¹⁾

Variable ⁽²⁾	F _{biu} ⁽²⁾	F _{ip} ⁽²⁾
F _{wz}	0.102* (2.067)	0.336** (5.328)
country = CA (D) ⁽³⁾	0.406** (7.966)	-0.364** (-5.494)
country = AUS (D) ⁽³⁾	0.336** (6.757)	-0.398** (-6.281)
R ²	0.24	0.26
F-score	34.3**	24.6**
n	336	209

⁽¹⁾ standardized regression parameters; t-scores in parentheses

**indicates statistical significance at the one-percent-level and* at the five-percent level

⁽²⁾ Variables and factors are described in Figure 26

The significant parameters but poor model fits (low R²) imply that the intensity of Internet use for business purposes does depend on the variables included in the models shown in Table 37, but these are not the main explanatory variables. Other variables that might determine the use of the Internet for business purposes are likely to be the age of the vintner, his education and income. Questions concerning these factors are beyond the scope of this hypothesis.

5.3.2 Hypotheses considering the adoption of the Web for direct marketing and for promoting diversification activities

Hypothesis 4: The probability of a wine to be shipped internationally directly to consumers rises with its price.

Review of transaction cost theory implied that the reduction of transaction costs brought about by the Internet extends the relevant market of a winery (see 3.1). To be able to explain what happens when this relevant market expands over national borders the wineries were asked for their experiences with direct export sales. A theoretic model (see Attachment 6) implied that more expensive wines are more likely to be traded over the Internet. Along the lines of this model, it is expected that the probability for a winery to conduct direct exports rises with the average price of the wine it sells.

Table 38: Wineries with direct wine exports, frequency of direct exports within three years prior to the survey, and average prices of all bottled wines sold in 2002, by region

Region	Wineries with direct wine exports during the last 3 years**		Number of direct export shipments during the last 3 years			Average prices of all bottled wines sold in 2002 [Euro]			
	Number of wineries	Share of all wineries [%]	Number of wineries	Mean	Median	Number of wineries	Min	Max	Mean
Australia	39	55.7	31	18	5	67	3.86	17.69	12.03
California	21	23.6	21	7	4	87	5.06	25.61	17.89
Germany total	81	38.8	73	19	10	202	2.44	15.11	5.62
Germany online	51	46.8	43	17	10	105	2.70	14.40	6.14
Germany telephone	30	30.0	30	22	15	97	2.44	15.11	5.05
All	141	38.3	125	17	8	356	2.44	25.61	9.83

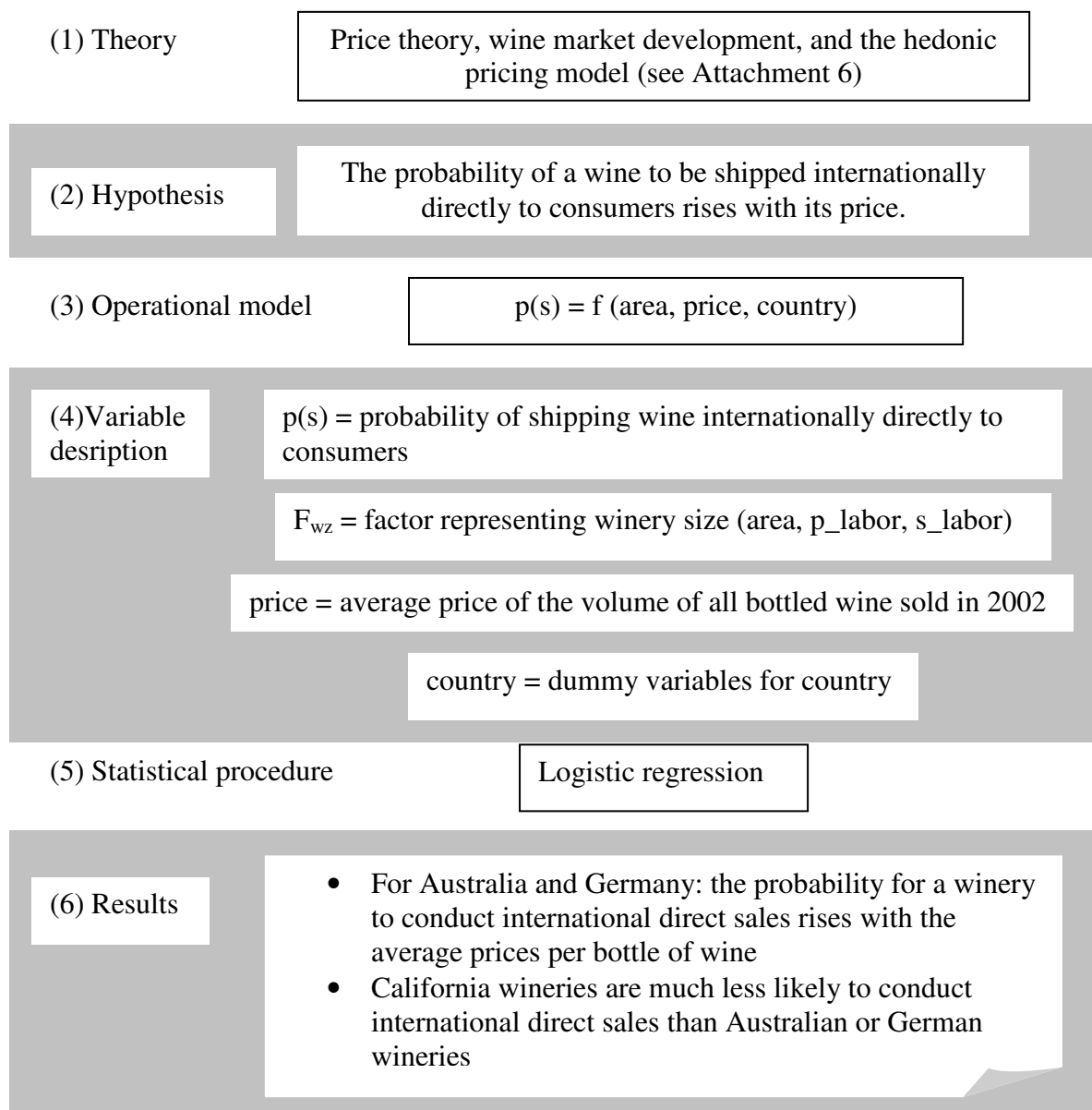
**Chi-squared test for contingency tables significant at the one-percent level

More than two out of five (38 percent) of the wineries surveyed have shipped wines internationally directly to consumers within three years prior to the survey. Although the incidence of exporting wine directly to consumers is high, the frequency of direct sales exports is low, half of all wineries surveyed having exported directly to consumers less than eight times within the last three years (see Table 38).

The shares of wineries having shipped internationally directly to the consumer differ significantly between regions (chi-squared test is significant at the one-percent-level, see Table 38). In comparison to wineries in California and Germany, a larger share of Australian wineries exported wine directly to consumers. This is compliant with the fact that Australian wineries have a rather small domestic market in comparison to California and Germany and thus strongly focus on exporting their wines (see 2.4).

Half of all wineries have conducted international direct marketing less than eight times within the past three years. This indicates that international direct marketing is not very frequently used. Compared to their Australian and California counterparts, German wineries most frequently conducted international direct sales within the last three years. This may be due to its geographic location, in the center of Europe and the European Union where transport distances are short and trade barriers are nonexistent.

To determine the impact of the price per bottle of wine on the probability for the wine to be shipped, a regression models with the explanatory variables 'area', 'price' and country dummy variables, is estimated (see Figure 27).

Figure 27: Overview of the operationalization, testing and results of hypothesis 4

The results of the logistic regression leads to the conclusion that the average price of a winery's bottled wines has a significant impact on the probability for the winery to have exported wine directly (see Table 39). Furthermore, there are significant differences between regions; California wineries are much less likely to ship wines internationally directly to consumers than German or Australian wineries.

Table 39: Results of logistic regressions of average prices of all bottled wines sold in 2002 on the probability of having shipped wine internationally directly to consumers within the last three years⁽¹⁾

Variables ⁽²⁾	Model1	Model 2
Constant	-1.211** (18.897)	-2.056** (24.823)
F _{wz}	0.037 (0.038)	-0.021 (0.010)
price	0.143** (12.238)	0.128** (9.713)
country=CA (D) ⁽³⁾	-2.485** (14.626)	-2.510** (15.121)
country=AUS(D) ⁽³⁾	0.057 (0.018)	0.017 (0.001)
w _{0/1} ⁽⁴⁾		1.178** (9.597)
Log Likelihood	195.0	189.1
Likelihood-ratio test	30.7**	41.5**
McFadden's R ²	0.07	0.100
n	311	310

⁽¹⁾Wald statistics in parentheses

**indicates statistical significance at the one-percent-level and* at the five-percent level

⁽²⁾Variables are described in Figure 27

⁽³⁾Dummy variables = 1 if winery is from this country, otherwise = 0

⁽⁴⁾Dummy variable = 1 if winery has a website, otherwise = 0

From these results, it is concluded that hypothesis 4 is true for Australia and Germany. In these countries the probability that a winery will conduct international direct to consumer sales rises with the price of all bottled wines sold. For California this relation was not significant. Apart from the larger domestic market, one potential reason for the less frequent international shipping habits may be the direct wine shipment laws. Because of these laws California wineries do not have much experience in shipping across state borders and therefore may be more hesitant towards shipping their wines internationally. UPS for example does not deliver alcoholic beverages across state borders.

Even though the model 1 shows significant parameter values, the very low McFadden's R² implies that there are variables beyond those included in the model to test hypothesis 4 that are likely to have a significant impact on the probability of a winery to conduct

international direct sales. Therefore the variable $w_{0/1}$ was included into the model (see model 2 in Table 39), to estimate if participating in e-commerce, measured in terms of having a website, had a major impact on the probability to conduct international direct sales. This variable turns out to have a significant impact on the probability to conduct international direct sales. It is concluded that wineries participating in e-commerce are more direct-export-oriented than those who do not operate a website for their business.

Hypothesis 1 identified that the variable $w_{0/1}$ measuring a wineries e-commerce participation was significantly explained by the winery sized measured in terms of the Factor F_{wz} and interregional differences. Since the winery size did not have a significant impact on the probability to ship wine internationally directly to consumers in Model 1 (see Table 39) and the estimated values of the country dummies did not change dramatically, in this model the variable $w_{0/1}$ accounts for e-commerce participation explained by variables not included in the estimation used to test hypothesis 1.

Hypothesis 5: A winery website does not increase the volume of direct marketing sales.

After some questions about their winery's website, wineries were asked if their website had increased their volume of direct marketing sales. Overall, most wineries (61 percent) answered that their website had increased the volume of their total direct sales. The results differed significantly between regions (see Table 40).

Table 40: Relative frequency of wineries that recognize an impact of their website on the volume of direct wine sales (n=233)

Region	Number of wineries	Website has increased direct wine sales*	
		yes [%]	no [%]
California	67	83.6	16.4
Australia	51	43.1	56.9
Germany total	115	55.7	44.3
Germany online	79	63.3	36.7
Germany telephone	36	38.9	61.1
All	233	60.9	39.1

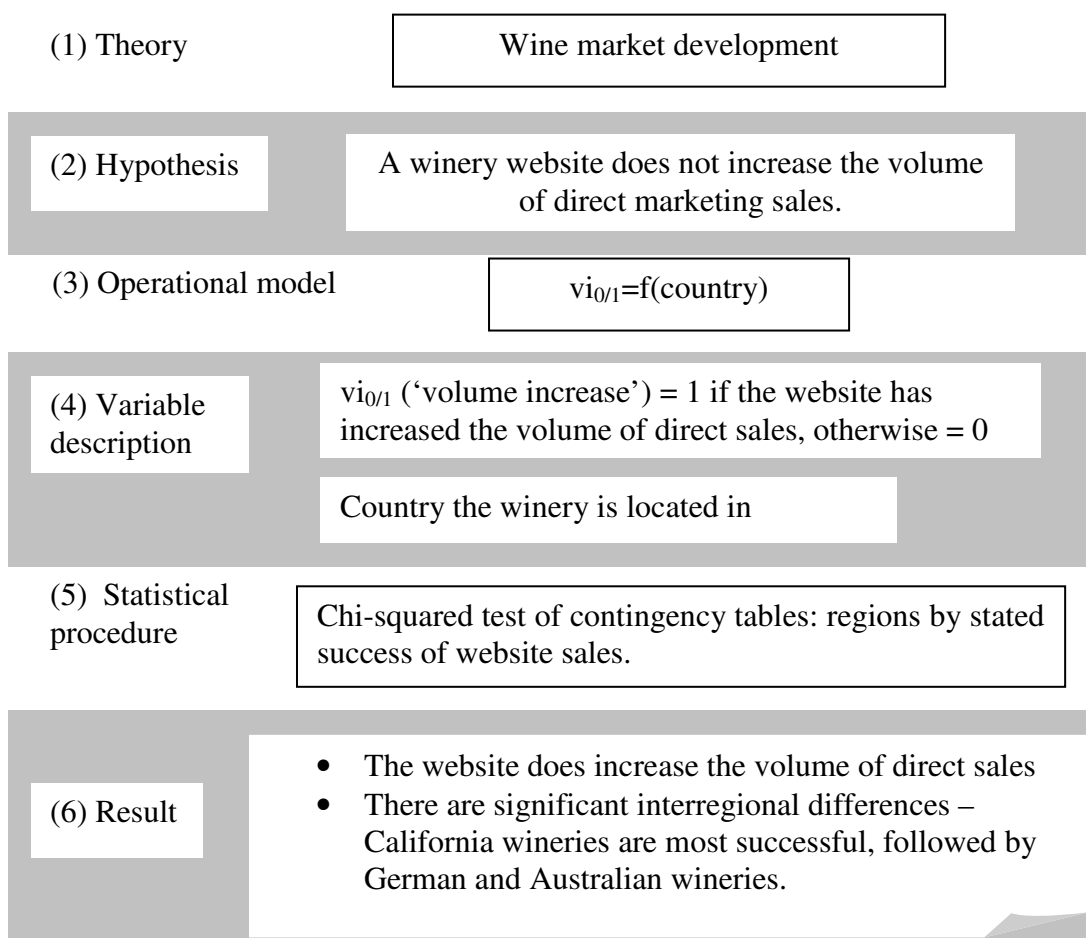
* chi-squared test for contingency tables significant at the one-percent-level

Most California wineries in the sample stated that their website had increased the volume of their direct sales, while only about two out of five Australian and little more than half of all German wineries surveyed stated to have recognized an impact of their websites on the

volume of their direct sales. Overall, the hypothesis that the website does not increase the volume of direct marketing sales can be rejected (see Figure 28).

This hypothesis was derived from case studies among California and German wineries. The German studies were conducted at the end of the year 2001, the California case studies at the beginning of the year 2002. There are two potential reasons why the results of the survey do not confirm those experiences reported by wineries in the case studies: (i) the dates the case studies were conducted and (ii) self selection in the sample. While the case studies were conducted almost two years ago in California and three years ago in Germany, the results from the survey are from the year 2003. With ongoing adoption of the Internet among potential customers, wineries use their websites to sell their wines with increasing success. Self-selection in the sample may however, have resulted in wineries that successfully market their wines on the Web to be overrepresented in the survey. This indicates that the shares of wineries stating the Web to have increased their direct marketing sales volumes could be too high.

Figure 28: Overview of the operationalization, testing and results of hypothesis 5



Beyond the interregional differences used to test of hypothesis 5, it is of interest to identify variables that determine the probability of a website to have increased the winery's direct sales volume. One potential explanatory variable is the e-commerce readiness of the winery. In absence of other indicators the factor F_{biu} , (estimated in a factor analysis, which is described in the test of hypothesis 3) is used here to measure the e-readiness of a winery. In order to calculate the factor (basic Internet use), the following five variables were used: 'access', representing the frequency the winery accesses the Internet for business purposes; three variables representing how frequently the winery uses Internet banking for business transactions (banking), email (email), and the Web to retrieve information (info_retrieval) for the winery's business; and 'e-procurement' representing the frequency with which the winery had bought products and services online within the year prior to the survey. These variables all are correlated significantly and positively with each other (Spearman's rho is significantly positive at the one percent level for all relationships) and therefore are well suited to be merged into a principal component. The factor for basic Internet use F_{biu} represents the variables as follows:

$$F_{biu} = -3.88 + 0.287*access + 0.181*banking + 0.346*email + 0.306*info_retrieval \\ + 0.137*e_procurement$$

To quantify the impact of how frequently the wineries maintain their websites, the variable 'update' is also included into a logistic regression model. Apart from the interregional differences, a winery's e-readiness measured through F_{biu} , and the frequency of updating the winery's website show a significantly positive impact on the probability that the website has increased the direct sales volume (see Table 41).

Again, California wineries are more likely to state that the website had increased their direct marketing sales, underlining their advanced position in terms of e-readiness compared to Australian and German wineries. The parameter value for the California country dummy variable is not significant at the five percent level, but it is significant only at the ten percent level. This implies that the advanced position of California wineries in terms of e-readiness mainly determines their lead in almost all indicators measuring the adoption and use of e-commerce. This information is included in the country dummy variable if no other variable measuring e-readiness (as F_{biu} in this model) is inserted into the models.

Table 41: Results of logistic regression of winery Internet use, website updating frequency and country dummy variables on the probability that the website has increased the volume of direct marketing sales ⁽¹⁾

Variables ⁽²⁾	Model 1
constant	-1.033* (3.756)
F _{biu}	1.042** (15.102)
update	0.378* (6.029)
country=CA (D) ⁽³⁾	0.728 (2.991)
country=AUS(D) ⁽³⁾	-0.859* (5.009)
Log Likelihood	125.1
Likelihood-ratio test	54.7**
McFadden's R ²	0.18
n	227

⁽¹⁾Wald statistics in parentheses

**indicates statistical significance at the one-percent-level and* at the five-percent level

⁽²⁾Variables:

F_{biu} = Factor representing basic Internet use

update = frequency of updating winery's website

⁽³⁾Dummy variables = 1 if winery is from this country, otherwise = 0; reference category is Germany

These results have two implications. First, more frequently updated websites are more successful in terms of increased direct sales. Second, agricultural enterprises can learn from larger firms within their industry as well as from other countries that are at a higher level of e-commerce adoption.

Hypothesis 6: The Web supports the use of diversification activities provided by the wineries.

After checking which tourism activities or facilities they offer and promote on the Web, wineries were asked if their business from these activities had intensified since they promote them on the Web (see Table 42).

Table 42: Impact of promoting tourism activities or facilities on the Web, by region (n=223)

Region	Number of wineries	Since they are promoted on the Web, the use of tourism activities or facilities has**...	
		...increased [%]	... not increased [%]
California	52	90.4	9.6
Australia	37	62.2	37.8
Germany total	144	72.9	27.1
Germany online	96	78.1	21.9
Germany telephone	48	62.5	37.5
All	223	75.1	24.9

** Chi-squared test for contingency tables significant at the one-percent level

Quite a few wineries (14 percent) were not able to determine the success of promoting their tourism activities or facilities on the Web. Three out of four of the remaining 223 wineries answering the question, stated that using the Internet to promote their tourism business has intensified its use, at least somewhat (see Table 42).

Compared to all other tourism activities or facilities offered, a significantly larger share of wineries promoting accommodation on the Web stated that using the Web has intensified their tourism business (see Table 43). This result is intensified considering that only 7 percent of California wineries offer accommodation as a diversification activity, while these more often state that tourism business has intensified since they promote it on the Web (see Table 43).

Table 43: Impact of promoting tourism activities or facilities on the Web, by tourism activity (n=233)

Winery offering tourism activity or facility	Since they are promoted on the Web, the use of tourism activities or facilities has...	
	...increased [%]	... not increased [%]
Winery tours	76.8	23.2
Wine tastings	76.2	23.8
Accommodation	88.7**	11.3**
Restaurant / Café	75.4	24.6
BBQ	61.5	38.5
Others	80.8	19.2

** Chi-squared test for contingency tables significant at the one-percent level

Overall, the hypothesis that the Web supports the use of the wineries' diversification activities is confirmed by these results. Especially those wineries offering accommodation profit from promoting it on the Web. To determine the exact impact on the probability that the website had increased the use of tourism activities or facilities, a logistic regression model with the offered activities and facilities as explanatory variables was calculated. Additionally, variables identified to determine the success of using a website to increase the volume of direct marketing sales (see hypothesis 5) were included into the model (see Figure 29).

Results of the logistic regression show that accommodation (see 'acc' in Table 44) is the only tourism facility significantly increasing the probability that the website increases the use of tourism business. Country dummy variables and the factor representing a winery's e-readiness (F_{biu}) also do not have a significant impact on the Web-induced use of tourism business, indicating that there are no regional distinctions. It is rather the frequency of website updating (see 'update' in Table 44) that also shows significant impact on the success of promoting tourism activities or facilities on the Web. This again implies that company websites that are more frequently updated have a higher positive impact on the company's business.

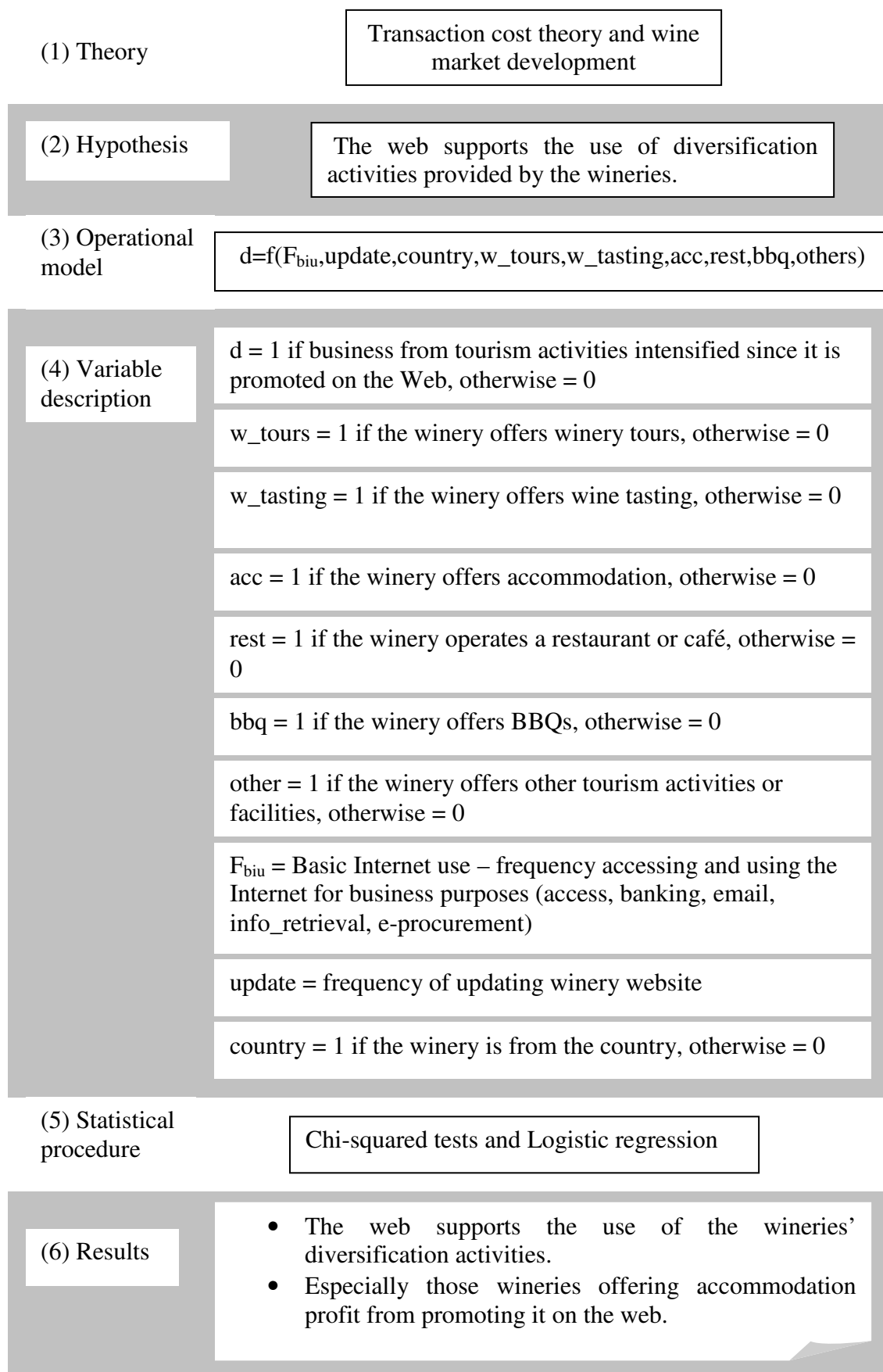
Figure 29: Overview of the operationalization, testing and results of hypothesis 6

Table 44: Results of logistic regression of winery Internet use, website updating frequency, country- and tourism dummy variables on the probability that the website has increased the use of tourism business ⁽¹⁾

Variables ⁽²⁾	Model 1
constant	-1.264 (2.611)
F _{biu}	0.235 (0.797)
update	0.506** (2.611)
country=CA (D) ⁽³⁾	0.953 (2.559)
country=AUS(D) ⁽³⁾	-0.024 (0.002)
w_tours (D) ⁽⁴⁾	-0.074 (0.021)
w_tasting (D) ⁽⁴⁾	0.500 (0.495)
acc (D) ⁽⁴⁾	1.370** (6.791)
rest (D) ⁽⁴⁾	-0.161 (0.154)
bbq (D) ⁽⁴⁾	-0.693 (1.559)
others (D) ⁽⁴⁾	0.445 (1.263)
Log Likelihood	104.5
Likelihood-ratio test	32.9**
McFadden's R ²	0.14
n	218

⁽¹⁾Wald statistics in parentheses

**indicates statistical significance at the one-percent-level and* at the five-percent level

⁽²⁾Variables are described in Figure 29

⁽³⁾Dummy variables = 1 if winery is from this country, otherwise = 0; reference category is Germany

⁽⁴⁾Dummy variables = 1 if winery offers this tourism activity of facility, otherwise = 0

5.3.3 Product pricing and the use of the Web for direct marketing wine

Hypothesis 7: The price of a wine determines where it is sold. High priced wines are more likely to be sold on the Web than cheap wines.

From a hedonic pricing model including transactions costs (see Attachment 6), the hypothesis is derived that wines of higher prices are more likely to be sold on the Web, than wines of low priced wines. In addition, personal interviews with California and German wineries indicated that selling the same product line online and through conventional channel could generate sales channel conflicts. A sales channel conflict occurs when a winery sells the same wines on the Web and also to distributors who distribute them through other channels (see 3.3.3). Especially California wineries which have to rely on distributors to sell their wine because of the three-tiered-system (see 2.5.2) face this problem. A possibility that may solve this problem is to sell a selection of higher quality wines at higher prices on the website.

In the survey, wineries were asked to divide the volume of all bottled wines and the volume of bottled wines they sold on the Web in 2002 into certain price ranges provided in the questionnaire. Assuming the prices are evenly distributed within each price range, the price lying in the middle of this particular range was used to calculate an overall mean price for each winery. Table 45 shows the overall mean prices and the mean prices of wines sold on the Web in 2002 by region. To be able to determine if potential buyers face significantly higher prices when buying wine online, the average prices of all wines sold by the wineries surveyed were calculated for each region. Using a standard t-test, average prices consumers face when buying on the Web were tested against the overall average prices in the regions (see Figure 30). T-scores shown in Table 45 are calculated as follows:

$$t - \text{score} = \frac{\hat{p}_w - p_c}{s_{\hat{p}_w}}$$

where:

\hat{p}_w = average price per bottle of wines sold on the Web

$s_{\hat{p}_w}$ = standard error of \hat{p}_w

p_c = average price per bottle of all wines offered

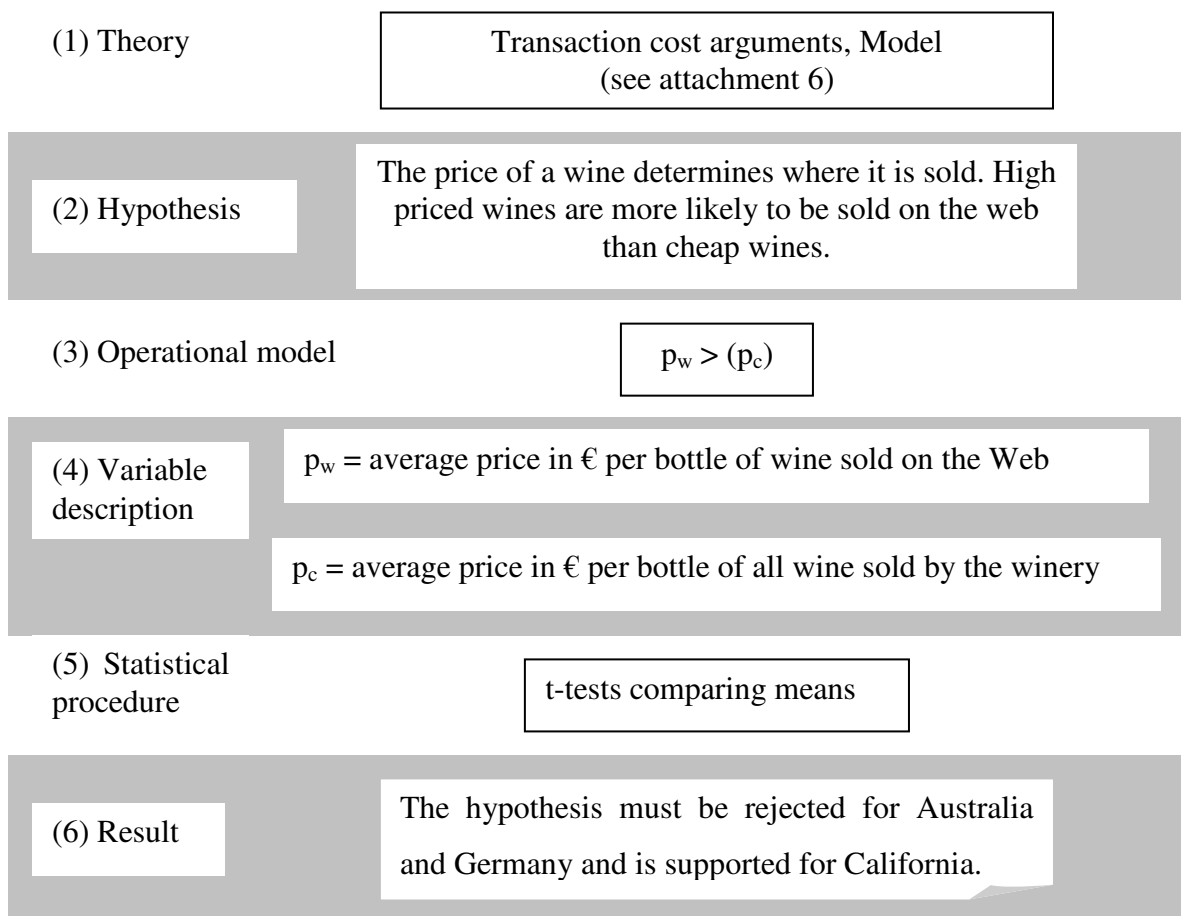
Table 45: Mean prices, t-scores and mean price differences between all wineries and wineries selling wine on the Web, by region

	All wineries		Wineries selling wine on the Web		t-score	Mean difference [€/bottle]
	n	Mean price [€/bottle]	n	Mean price [€/bottle]		
Australia ⁽¹⁾	67	12.03	47	12.68	0.246	0.13
California ⁽²⁾	87	17.89	67	19.34	2.569**	1.45
Germany total	202	5.62	106	5.68	0.277	0.06
Germany online	105	6.14	68	5.84	-0.96	-0.27
Germany telephone	97	5.06	38	5.39	1.252	0.332
All	356	9.82	220	11.34	3.313**	1.52

** indicates statistical significance at one-percent-level

⁽¹⁾ exchange rate \$ 1 Aus = € 0.605383 [Science Made Simple Inc., 2003]

⁽²⁾ exchange rate \$ 1 US = € 0.818566

Figure 30: Overview of the operationalization, testing and results of hypothesis 7

The overall average price of wines sold by the wineries surveyed is € 9.82 per bottle, while the overall average price of wines sold on the Web is € 11.34 per bottle. Overall, the prices of wines sold on the Web are € 1.42 per bottle higher (difference significant at the one-percent level) than wines sold through conventional channels. This finds its reason because the average price per bottle of wine sold by German wineries range from € 2.44 to € 15.11, while average prices per bottle sold by California wineries range from € 5.06 to € 25.61.

The only regions that shows a significant difference between the average price of wines sold on the Web and wines sold through conventional channels is California. Here, a bottle of wine sold on the Web is, at average, € 1.45 more expensive than all wines offered by the California wineries participating in the survey. This is underlined by the fact that three out of four (73 percent) of all German wineries surveyed offer exactly the same wines on the Web as on all other sales channels. In Australia 70 percent of the 47 wineries offering their wines for sale on the Web provide the same product line as in all other channels. In California, only little more than half (52 percent) offer the same product line on- and offline.

Therefore the hypothesis, that expensive wine is more likely to be sold on the Web, than cheap wines must be rejected for Australia and Germany but can be supported for California. A possible reason for this is that California wineries have differentiated their product lines offered on the Web from the product lines offered through conventional channels and therefore do not have to fear channel conflicts.

In addition, California wineries may have recognized that higher priced wines are more likely to be ordered on the Web and have adapted their product line to the demand side. This conforms the general finding in e-commerce trade that products with a lower bulk to value ratio are more likely to be ordered for home delivery because they are worthwhile transporting (see 3.2.2).

6 Summary and conclusions

The Internet, in particular the World Wide Web, has rapidly grown since the end of the 90ies. The openness of the Internet has allowed innovative entrepreneurs and engineers to design new applications which rapidly spread into the agricultural- and food industries as into other industries. A promising application is e-commerce, i.e. the trade of goods and services using the Internet. To be able to better understand the likely impact of the Internet on the agricultural- and food industries, e-commerce adoption and uses in the wine industry is studied here. The wine industry was chosen for study because it was identified as an early adopter of e-commerce. Lessons learned from studying the wine industry may therefore provide useful insights to agricultural entrepreneurs, researchers and policy makers with interest and responsibilities outside the wine industry.

Australia, California and Germany were chosen as countries for study because of their wine industries are among the World's largest in terms of production and exports. Also, the countries and the state provide sufficient variation in economic conditions, political and regulatory environments, e-commerce readiness, costs of Internet access, and the size distribution of their wineries. This variation of economic and of other factors was necessary to empirically assess their joint effects on the adoption and use of e-commerce by wineries.

This book comprises six chapters. After an introduction, the second chapter introduces the wine industries of the three regions. In Chapter 3, transaction cost theory is used to identify factors that potentially explain e-commerce adoption within the wine industry. Hypotheses derived from this theory, are then tested with data obtained from a survey of 368 wineries from the three regions. The technical operationalization of the survey as well as statistical methods used for testing the hypotheses, are described in chapter 4. Chapter 5 presents the results of the survey and of the tests. Also, this chapter discusses the implications of the empirical results found for the agricultural- and food industries.

Transaction cost theory was used to identify factors with importance on winery e-commerce adoption. The general theory was operationalized by delineating the transaction 'a winery marketing its wine directly to consumers' into components aligned with transaction costs for buyers and for seller. Transaction cost theory turned out to be well suited to identify factors potentially determining e-commerce adoption and to formulate hypotheses upon these.

To test these hypotheses Web surveys among wineries were conducted. The technical operationalization consists of two main parts. First, the programming of the questionnaire in HTML, and second, the programming of a CGI script that manages the display of the questionnaire on the participating winery's Web browser and processes and stores the data generated by the respondents.

To analyze these data, several standard uni- and multivariate statistical methods were used. Also an explorative application of an event history analysis was conducted to compare the results of this method to those of binary logistic regressions. In this study the results turned out to be widely the same. This finds its reason in the advanced adoption of e-commerce among wineries. The event history analysis nevertheless was assessed as a suitable method to identify factors with significant impact on the adoption of new information technology at a very early stage.

Together with the Web surveys among wineries from Australia, California and Germany, a telephone survey of a control group of 100 German wineries form the empirical part of this study. In total, 368 wineries responded. All questionnaires had four parts which were largely similar, accounting for regional distinctions. Wineries were asked about their general characteristics, their current wine marketing practices, their website and their use of the Internet for business purposes.

Univariate statistical analysis of survey responses showed, that California wineries are leading in almost all factors potentially determining e-commerce adoption. Australian wineries follow closely behind California wineries according to a wide range of indicators, such as size of the winery (in terms of vineyard area, workforce or amount of grapes crushed) and marketing practices. German wineries usually lag behind. Considering the rapid growth of the Australian wine industry over the past decade, it is reasonable to expect that Australian wineries will soon close the gap to California wineries. The German wineries in the two subsamples, those surveyed online and those surveyed on the phone, differ considerably. Wineries surveyed online are by far more progressive than their counterparts surveyed on the telephone. These wineries, in parts, are similar to California wineries and often showed to be more advanced than Australian wineries as demonstrated by many indicators. This implies that German wineries that have online access and an own website are a suitable group to study commercially viable, competitive German wineries.

Winery size turned out to be a main factor determining the adoption, time of adoption and the intensity of using the Internet and its applications, among them e-commerce. However,

the country where the winery is located conditions e-commerce participation. Compared to German wineries, California wineries are more likely to participate, to earlier adopt e-commerce applications and use these more intensively for their businesses.

Surprisingly, most wineries marketing their wines on the Web stated that doing so had increased their direct marketing sales volumes as well as the use of the diversification activities they offer. There are significant interregional differences in experiencing an increase in direct marketing sales, while the experienced increase in the use of diversification activities showed no regional distinction. Variables determining the success of the website in terms of increasing direct marketing sales volumes are the winery's e-readiness, measured in terms of the frequency of using a selection of Internet applications, and the maintenance of the winery's website. The success of the website in terms of increasing the use of diversification activities was determined by the activity itself, for example wineries offering accommodation on the Web disproportionately profit from doing so, and the frequency with which the winery's website is updated.

It is concluded that every commercially orientated enterprise in the agricultural and food industry is likely to profit from setting up a website for their business. While companies investing more in the maintenance of their company's website, are more likely to recognize a positive impact on their company's business. Therefore businesses should invest not only in setting up their websites but also into maintaining them regularly.

Wineries that do not solely rely on direct marketing, these are in particular larger wineries, could generate a conflict in sales channels when offering the same product lines on the Web that they also sell through distributors. A solution may be to differentiate the product line offered on the Web from the product line offered using other sales channels. California wineries have differentiated their Web- product line, selling only a selection of their higher priced wines on the Web. While neither Australian nor German wineries offer a product line on the Web that has a significantly higher average price than the product line offered offline. In addition, California wineries may have recognized that higher priced wines are more likely to be ordered on the Web and have adapted their product line to the demand side. This confirms the general experience in e-commerce that products with a lower bulk-to-value ratio are more likely to be ordered for home delivery because they are worthwhile transporting [Liebowitz, 2002].

In the future, wineries will continue to adopt e-commerce to promote their business and to market their wines. Finally, these results provide useful information for other parts of the

agricultural- and food industries. Entrepreneurs with a business in an industry that is still at an early stage of e-commerce adoption can learn from the development within the wine industry. Results imply, that entrepreneurs will profit from studying larger competitors within the national industry, as well as those from comparable industries in other countries. For researchers with interest in the adoption of new information technology in the agricultural and food industries, this study provides baseline information about the factors that affect e-commerce adoption.

7 German summary

Seit Ende der 90er Jahre ist das Internet, insbesondere das Web, rasch gewachsen. Dabei ermöglichte die Offenheit des Internet die Entwicklung vielfältiger neuer Anwendungen. Auch in der Agrar- und Ernährungswirtschaft haben sich das Internet und seine Anwendungen zügig ausgebreitet. Eine vielversprechende Anwendung ist der E-Commerce, d.h. der Handel von Gütern und Dienstleistungen über das Internet. Um die Erfolgsaussichten dieser neuen Form des Handels für die Agrar- und Ernährungswirtschaft besser einschätzen zu können, wurden am Beispiel der Weinindustrie die Einflussfaktoren der Adoption des E-Commerce untersucht. Die Weinindustrie wurde gewählt, da sie als Vorreiter im Hinblick auf die Adoption von E-Commerce angesehen werden kann. Die Analyse der Adoption von E-Commerce in diesem Sektor soll Unternehmern und Politischen Entscheidungsträgern mit Verantwortung in anderen Bereichen der Agrar- und Ernährungsindustrie für die Innovationsentscheidung wertvolle Information liefern. Die Entwicklung des E-Commerce wird von vielen externen Faktoren bestimmt, deren Relevanz ohne beträchtliche Variation nicht abgeschätzt werden kann. Aufgrund ihrer geographischen Lage, der unterschiedlichen klimatischen Bedingungen und der weitreichenden Variation in ihren ökonomischen, technischen sowie gesetzlichen Umfeldern, wurden die Weinindustrien Australiens, Kaliforniens und Deutschlands als Analyseobjekte ausgewählt.

Die Arbeit gliedert sich in sechs Teile. Nach einer allgemeinen Einführung in das Thema werden im zweiten Teil die drei Weinindustrien hinsichtlich der Einflussfaktoren auf den E-Commerce vergleichend analysiert. Der dritte Teil beschäftigt sich mit der Transaktionskostentheorie, mit der die Verbreitung des E-Commerce in der Weinindustrie erklärt werden soll. Aus dieser Theorie werden Hypothesen abgeleitet. Diese wurden mit Hilfe von Daten aus einer Web- und einer Telefonbefragung von Weingütern empirisch geprüft. Aus allen Befragungen ergaben sich insgesamt 368 auswertbare Antworten. Die technische Durchführung der Befragungen sowie die statistischen Analysemethoden zur Prüfung der Hypothesen werden im vierten Teil der Arbeit dargestellt. Der fünfte Teil fasst die Ergebnisse dieser Befragungen sowie der Hypothesentests zusammen. Darüber hinaus werden diese Ergebnisse im Hinblick auf Implikationen für die Agrar- und Ernährungswirtschaft diskutiert. Die Arbeit schließt mit einer Zusammenfassung.

Eine Analyse der 368 Antworten von Weingütern ergab, dass Weingüter in Kalifornien hinsichtlich fast aller Faktoren, die die Adoption des E-Commerce bestimmen, führend sind. Bei einer Vielzahl der betrachteten Indikatoren liegt Australien nur knapp hinter Kalifornien, Deutschland in der Regel weit dahinter. Zentrale Ergebnisse sind:

- Die Größe eines Weingutes, gemessen in Fläche und Arbeitskräften, bestimmt maßgeblich die Adoption von E-Commerce und auch die Intensität dessen Nutzung.
- Bei fast allen Adoptionsfaktoren ergaben sich signifikante Unterschiede zwischen den betrachteten Regionen.
- Kalifornische Weingüter differenzieren ihr Angebot im Web hin zu einer Auswahl teurerer Weine.
- Eine Website erhöht das Direktvermarktungsvolumen sowie die Frequenz der Nutzung von Diversifikationsangeboten.
- Websites, die regelmäßig aktualisiert werden, versprechen mehr Erfolg im Hinblick auf Direktvermarktungsvolumen und Nutzung von Diversifikationsangeboten.
- Hohe Transportkosten verhindern größtenteils die Direktvermarktung an Konsumenten im Ausland.

In Anbetracht des raschen Wachstums der Australischen Weinindustrie innerhalb der letzten Jahre ist anzunehmen, dass sich die Lücke zu den kalifornischen Weingütern mittelfristig schließen wird. Aus den Ergebnissen ergibt sich außerdem, dass deutsche Weingüter mit eigener Website eine geeignete Gruppe zur Analyse im Wettbewerb langfristig überlebensfähiger Weingüter darstellen.

Für andere Bereiche der Agrar- und Ernährungswirtschaft, die in der Adoption des E-Commerce noch nicht so weit fortgeschritten sind, können aus den Ergebnissen dieser Untersuchung Schlüsse für die zukünftige Entwicklung gezogen werden. Darüber hinaus implizieren die Ergebnisse, dass ein Unternehmen von der Beobachtung der Aktivitäten von Branchenführern, auch über nationale Grenzen hinaus, wertvolle Informationen für den eigenen Betrieb ableiten kann.

8 Literature

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9 Attachments

Attachment 1 – States and Direct Wine Shipment Laws

Information as of September 2003. Source: www.wineinstitute.org .

Reciprocal States	Direct Shipments Prohibited (Felony)
<ul style="list-style-type: none"> - California - Colorado - Hawaii - Idaho - Illinois - Iowa - Minnesota - Missouri - New Mexico - Oregon - Washington - Wisconsin - West Virginia 	<ul style="list-style-type: none"> - Florida - Georgia (without permit) - Indiana - Kentucky - Maryland - North Carolina - Tennessee
Direct Shipments Prohibited (Non-Felony)	Legal Under Certain Circumstances
<ul style="list-style-type: none"> - Alabama - Arizona - Arkansas - Delaware - Kansas - Maine - Massachusetts - Michigan - Mississippi - New Jersey - New York - Ohio - Oklahoma - Pennsylvania - South Carolina - South Dakota - Texas - Utah - Vermont - Virginia 	<ul style="list-style-type: none"> - Alaska - Connecticut - District of Columbia - Georgia (with permit) - Montana - Nebraska - Nevada - New Hampshire - North Dakota - Rhode Island - Wyoming

Attachment 2 – Commercial brick-and-mortar Wineries in California by county

County	Number of Wineries
Napa County	232
Sonoma County	172
San Luis Obispo County	63
Mendocino County	41
Santa Cruz County	35
Santa Barbara County	35
Monterey County	23
Alameda County	22
Fresno County	19
Amador County	18
El Dorado County	17
Riverside County	16
San Joaquin County	14
Santa Clara County	12
San Diego County	11
San Mateo County	11
Humboldt County	8
Marin County	8
Los Angeles County	7
Nevada County	7
San Benito County	7
Ventura County	7
Yolo County	7
Lake County	6
Calaveras County	6
Kern County	6
Mariposa County	4
Solano County	4
Tulare County	4
Stanislaus County	4
Butte County	3
Tuolumne County	3
Madera County	2
Sacramento County	2
San Bernardino County	2
Contra Costa County	1
Glenn County	1
Lassen County	1

<i>County continued</i>	<i>Number of wineries continued</i>
Merced County	1
Modoc County	1
Placer County	1
Shasta County	1
Trinity County	1
Yuba County	1
Totals	847

Source: [eresonant.com, 2003b]

Definition of California's 17 State Grape Crush Districts

District 1: Mendocino County

District 2: Lake County

District 3: Sonoma and Marin Counties

District 4: Napa County

District 5: Solano County

District 6: Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, and Santa Cruz Counties

District 7: Monterey and San Benito Counties

District 8: San Luis Obispo, Santa Barbara and Ventura Counties

District 9: Yolo County north of Interstate 80 to the junction of Interstate 80 and U.S. 50 and north of U.S. 50; Sacramento County north of U.S. 50; Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen, Tehama, Plumas, Glenn, Butte, Colusa, Sutter, Yuba, and Sierra Counties

District 10: Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne and Mariposa Counties

District 11: San Joaquin County north of State Highway 4; and Sacramento County south of U.S. 50 and east of Interstate 5

District 12: San Joaquin County south of State Highway 4; Stanislaus and Merced Counties

District 13: Madera, Fresno, Alpine, Mono, Inyo Counties; and Kings and Tulare Counties north of Nevada Avenue (Avenue 192)

District 14: Kings and Tulare Counties south of Nevada Avenue (Avenue 192); and Kern County

District 15: Los Angeles and San Bernardino Counties

District 16: Orange, Riverside, San Diego, and Imperial Counties

District 17: Yolo County south of Interstate 80 from the Solano County line to the Junction of Interstate 80 and U.S. 50 and south of U.S. 50 and Sacramento County south of U.S. 50 and west of Interstate 5

Source: [California Agricultural Statistics Service, 2003a]

Attachment 3 – German Wine Growing Regions - Grape Varieties Grown and Marketing Arrangements

Wine Growing region	Grape Varieties	Marketing arrangements
Ahr	[white: 18%; red: 82%]; Spätburgunder (55%), Portugieser (15%), Riesling (9%) as well as Müller-Thurgau, Dornfelder and a small quantity of the specialty Frühburgunder, a red variety.	Most growers are members of the five cooperatives that produce and market about 75% of the region's wine. The State Wine Domain at the 12th-century monastery Kloster Marienthal is the Ahr's largest wine estate. Nearly all of the region's wine is consumed locally or sold to tourists.
Baden	[white 68.5% · red 31.5%]; Müller-Thurgau (30%), Spätburgunder (29%), Grauburgunder, Riesling and Gutedel (ca. 8-9% each) as well as Weissburgunder, Silvaner and Gewürztraminer	Most growers are members of the ca. 100 cooperatives that produce and market about 85% of the region's wine. The regional cooperative cellars in Breisach are the largest in Europe and the fourth-largest in the world. Exports play a minor role. Nearly half of production is sold in supermarkets; the other half in wine shops and restaurants, or directly to final consumers. At 35 liters in 1997, the per capita consumption of wine and sparkling wine in the Baden and Württemberg regions is the highest in Germany.
Franken	[white 92% · red 8%]; Müller-Thurgau (42%), Silvaner (20.5%), Bacchus (11.5%) as well as Kerner, Riesling, Spätburgunder, Scheurebe and a small quantity of the specialty Rieslaner, a white variety.	The regional cooperative cellars in Kitzingen and smaller cooperatives produce and market about 40% of the region's wine, the remainder is handled by private and state-owned estates. Exports play a minor role. Four out of five bottles of Franken wine are consumed within a 250-km/155-mile radius of where it is produced.
Hessische Bergstrasse	[white 92% · red 8%]; Riesling (56%), Müller-Thurgau (11.5%), Grauburgunder (7.5%) as well as Silvaner, Spätburgunder, Kerner and Weissburgunder.	Well over half of the region's wine-growers deliver their grapes to the regional cooperative cellars in Heppenheim. The State Wine Domain in Bensheim is the region's largest vineyard owner. Given the small size of the region, Bergstrasse wines are scarce and almost without exception consumed locally.
Mittelrhein	[white 93% · red 7%]; Riesling (74%), Müller-Thurgau (7.5%), Kerner (5%) as well as the red varieties Spätburgunder and Portugieser.	About one quarter of the region's wine is produced by seven cooperative cellars. As in the Ahr, nearly all of the wine is consumed locally or sold to visitors.

Wine Growing region	Grape Varieties	Marketing arrangements
Mosel-Saar-Ruwer	[white 98% · red 2%]; Riesling (54%), Müller-Thurgau (21%), Elbling (9%) — an ancient variety cultivated by the Romans and because of its pronounced acidity, often used as a base wine for Sekt, Germany's sparkling wine -as well as Kerner, Bacchus and Spätburgunder.	About one fifth of the region's grape harvest is handled by the regional cooperative cellars in Bernkastel-Kues. Overall, the producers of bottled wine are cooperatives (13%), estates (28%) and commercial wineries (59%). The latter also bottle and market a healthy quantity of wines from other German wine-growing regions (e.g. the Pfalz and Rheinhessen) as well as less expensive, imported wines. Much of this production is exported. Nevertheless, direct sales to final consumers is an important sales outlet for smaller growers, who benefit from the region's tourism. Zell, Bernkastel and Piesport are among the few German appellations of origin with a recognition value far beyond their borders.
Nahe	[white 90% · red 10%]; Riesling (26%), Müller-Thurgau (21%), Silvaner (10%) as well as Kerner, Scheurebe, Bacchus and the red varieties Dornfelder, Spätburgunder, Portugieser.	A high proportion of the region's wine is sold directly to consumers by individual estates. The portfolio of the world's largest direct marketing winery, WIV in Burg Layen, includes Nahe wine. There are cooperative cellars in Meddersheim and Bretzenheim (the latter receives members' grapes; the wines are produced and marketed by the Mosel's regional cooperatives cellars), but their role in the Nahe is less significant than that of cooperative cellars in other regions (e.g. Baden, Württemberg, Franken).
Pfalz	[white 79% · red 21%]; Riesling (21%), Müller-Thurgau (19%), Portugieser (10.5%) as well as Kerner, Silvaner, Dornfelder, Scheurebe, Spätburgunder, Morio-Muskat, Weissburgunder and a small quantity of the specialty Gewürztraminer.	About a third of the region's wine is sold directly to consumers and half is marketed through commercial wineries and some two dozen cooperative cellars. The Pfalz is an important supplier of the components for Liebfraumilch, much of which is bottled by large wineries in other regions and most of which is exported.
Rheingau	[white 88% · red 12%]; Riesling (81%), Spätburgunder (10%), Müller-Thurgau (3%) as well as Ehrenfelser, Kerner and Weissburgunder.	Compared with other German wine regions, the Rheingau has a high proportion of full-time wine-growers; sales of bottled, rather than bulk, wine predominate; and much of the region's wine is sold directly to consumers. The region enjoys a broad domestic and international following.

Wine Growing region	Grape Varieties	Marketing arrangements
Rhein Hessen	[white 87% · red 13%]; Müller-Thurgau (22%), Silvaner (12.5%), Riesling (9%) as well as many new crossings, e.g. Kerner, Scheurebe, Bacchus, Faberrebe and Huxelrebe. The most important red varieties are Portugieser, Dornfelder and Spätburgunder.	There are a large number of part-time wine-growers in the region who sell grapes or bulk wine to commercial wineries and producer associations who make and/or bottle and market the wine. Because of the large number of individual sites, about half the region's wine is marketed under the name of a few collective sites (e.g. Niersteiner Gutes Domtal, Oppenheimer Krötenbrunnen). About one third of all Rhein Hessen wine is exported, not least because it is the primary supplier of the components for Liebfraumilch.
Saale-Unstrut	[white 82% · red 18%]; Müller-Thurgau (25%), Silvaner (11%), Weissburgunder (11%) as well as Kerner, Riesling and Traminer (ca. 6% each). Portugieser is the main red variety, followed by Spätburgunder and Dornfelder.	Most of the region's vines are tended by part-time wine-growers who deliver their crop to the regional cooperative cellars in Freyburg. There are 14 private wine estates that produce and sell their own wine. The state-owned cellars "Kloster Pforta," named after the 12th-century monastery between Bad Kösen and Naumburg, is the region's largest estate. The amount of wine produced annually varies tremendously, depending on weather conditions, and nearly all of it is consumed locally.
Sachsen	[white 92% · red 8%]; Müller-Thurgau (21%), Riesling (16%), Weissburgunder (12%), Grauburgunder, Traminer, Kerner, Elbling and Scheurebe, as well as a small quantity of the specialty Goldriesling, are the most important white varieties. Spätburgunder and Dornfelder are the primary red varieties.	Most of the region's vines are tended by part-time wine-growers who deliver their crop to the regional cooperative cellars in Meissen. There are a handful of private wine estates that produce and sell their own wine. The state-owned cellars in historic Schloss Wackerbarth (1730) in Radebeul and the region's oldest estate at Schloss Proschwitz (privately owned) are Sachsen's largest estates. Saxon wines are rarities, available in very limited quantities, and nearly all are consumed locally.
Württemberg	[white 42% · red 58%]; Riesling (24%), Trollinger (23%), Schwarzriesling (16%) as well as Lemberger, Kerner, Müller-Thurgau, Spätburgunder and Silvaner.	Four out of five growers cultivate less than one ha (2.5 acres) of vines. As such, most are members of cooperatives. The regional cooperative cellars in Möglingen process 80% of an average harvest, including the grapes from 36 local cooperatives. An additional 32 local cooperatives make and market their own wine. Exports play a minor role and indeed, very little wine is sold outside of the region. The local inhabitants are thirsty, loyal customers. At 35 liters in 1997, the per capita consumption of wine and sparkling wine in the Baden and Württemberg regions is the highest in Germany.

Source: [Deutsches Weininstitut, 2003a]

Attachment 4 – Number of German wine producers by wine growing region 1979, 1989, 1999 and estimates for 2003.

Wine growing region	1979 ⁽¹⁾	1989 ⁽²⁾	1999 ⁽³⁾	2003*
Ahr	649	519	300	235
Baden	14,735	16,848	8,300	6,850
Franken	3,331	5,017	3,000	2,881
Hessische Bergstrasse	556	505	200	149
Mittelrhein	700	500	300	231
Mosel-Saar-Ruwer	9,244	7,548	5,100	4,185
Nahe	1,156	962	900	820
Pfalz	8,414	6,590	4,800	3,975
Rheingau	1,626	1,291	800	637
Rheinhessen	6,120	4,625	4,700	4,264
Saale-Unstrut	na	na	100	85**
Sachsen	na	na	100	85**
Württemberg	9,407	11,511	5,800	4,910
Germany	55,938	55,916	34,400	29,307

na= not available; * = estimates according to a linear trend from 1979 to 1999; **estimated with the overall linear trend from 1979 to 1999

Sources: ⁽¹⁾ [Bundesministerium fuer Ernaehrung Landwirtschaft und Forsten, 1984]

⁽²⁾ [Bundesministerium fuer Ernaehrung Landwirtschaft und Forsten, 1995]

⁽³⁾ [Statisches Bundesamt, 2001]

Attachment 5 – Number of Australian wine producers by State

Year	New South Wales and Australian Capital Territory	Victoria	Queens- land	Southern Australia	Northern Territory	Western Australia	Tasmania	Total
1983	76	66	15	110	1	73	3	344
1984	126	110	18	146	2	106	7	515
1985	121	109	18	147	2	102	7	506
1986	136	134	26	163	2	125	10	596
1987	128	132	20	159	1	110	12	562
1988	126	138	15	153	1	87	14	534
1989	129	149	15	160	1	86	13	553
1990	144	169	17	171	1	96	22	620
1991	144	177	16	164	1	93	22	617
1992	161	204	19	183	1	108	25	701
1993	159	220	21	188	1	114	34	737
1994	170	243	21	194	1	130	43	802
1995	174	256	21	199	1	143	51	845
1996	178	274	29	211	1	149	50	892
1997	195	279	33	222	1	153	51	934
1998	209	298	38	236	1	160	56	998
1999	241	322	44	257	1	183	56	1,104
2000	273	336	48	275	1	195	69	1,197
2001	293	369	70	308	1	208	69	1,318
2002	331	416	74	353	1	220	70	1,465
2003	367	461	89	391	0	242	75	1,624

Source: [Winetitles, 2003c]

Attachment 6 – Effect of e-commerce on wine marketing activities

Introduction

The goal of this attachment is to find an answer to the following three questions:

- (i) How does e-commerce affect wine marketing activities?
- (ii) Under which circumstances do buyers and sellers use e-commerce?
- (iii) How does buying and selling on the Internet affect the quality and prices of wines traded in the market?

To answer the first question, Rosen's [1974] model of quality choice is used as a starting point and then extended. In particular, transaction costs are incorporated into Rosen's model and then the impact of changes in transaction costs on the qualities traded, brought about by the adoption of e-commerce in the wine market, is determined.

Rosen was concerned with markets for differentiated products when the measure of differentiation is naturally ordered from best to worst. In his first paper [Rosen, 1974] he develops a model of product differentiation based on the hedonic hypotheses that goods are valued for their utility bearing attributes. In his second paper [Rosen, 2002] a similar model is used to answer the question how decentralized markets accommodate the diversity of choices, tastes and productivities that are 'important for economic affairs'. First, Rosen's original model is presented and then extended by incorporating transaction costs. Taking transaction cost into account has trivial consequences unless transaction costs differ among buyers of high and low quality wines. It is argued why it is reasonable to assume that such differences are likely to occur and then shown that qualities traded over the Internet are likely to be higher than the qualities of wines traded through conventional marketing channels.

Rosen's Model

Market prices represent both costs and values for underlying quality attributes of a product. Agents implicitly make a cost-benefit decision to choose their place in the cost benefit spectrum. Buyers compare the market prices of alternative varieties with their relative values in use. Equality in demand and supply represents the market equilibrium price-quality structure.

Rosen assumes a commodity that comes in two different varieties, z_h and z_l , for example wine of high and low quality. All other goods consumed are represented by c . The relative prices of the two wine qualities in relation to the prices of all other goods are p_h and p_l . Buyers and sellers are small in comparison to the total market and individually have no market power.

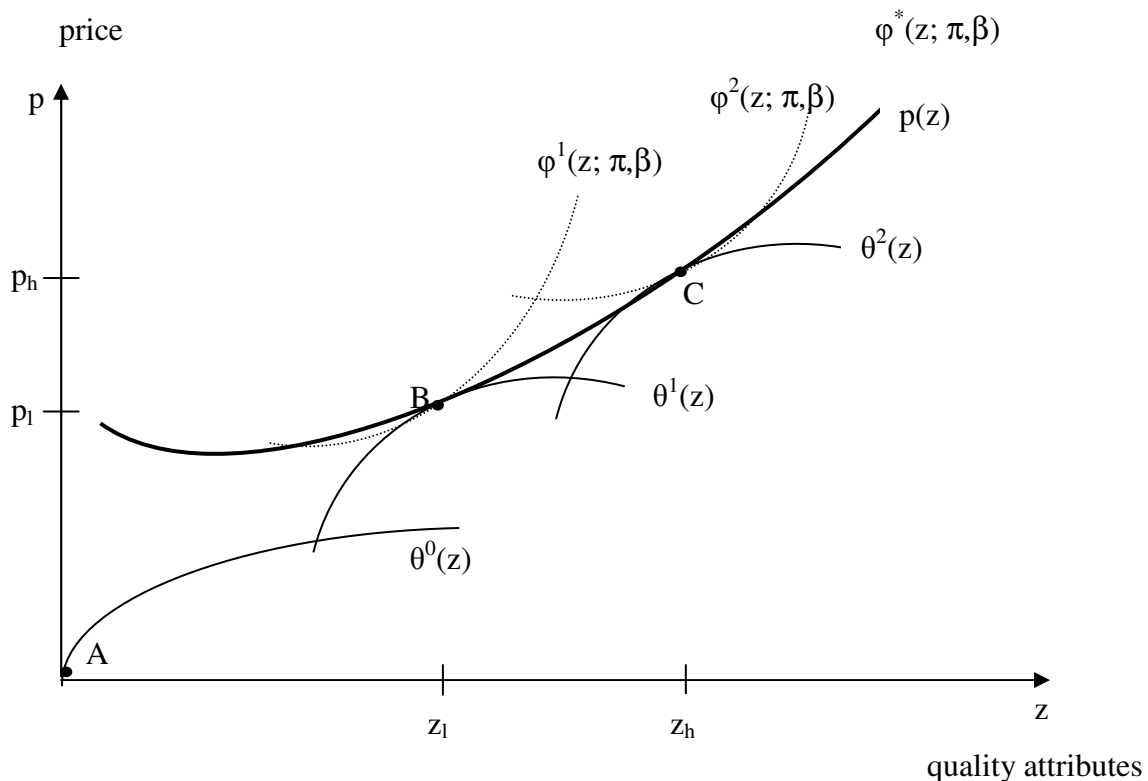
The buyer's side

Suppose a buyer purchases either one unit of high or low quality wine or no wine at all. Buyer's preferences are represented by a utility function $u(c, z)$. The choice set consists of three distinct points in the (p, z) area, as in Figure 31. A buyer is located at point A(0,0), when he purchases no wine at all, at point B(p_l, z_l) if the buyer prefers the low quality wine, and at point C (p_h, z_h) if a buyer prefers wine of high quality to wine of lower quality and to not buying any wine. Higher quality wines must be sold at higher prices than low quality wines or they would dominate low quality wines and drive them out of the market. Therefore, higher z is always associated with higher p if both qualities z_h and z_l are traded on the market. Given that one of the varieties is purchased, a buyer chooses z_h if the benefits of the additional quality exceed the additional costs. Rosen models the actual decision to purchase as a problem that comes in two parts, first the consumer decides which of the offered varieties he prefers most and then he decides to purchase it or do without.

The first part of the problem is equivalent to choosing the maximum of $u(y - p_h, z_h)$ and $u(y - p_l, z_l)$, where y represents income. The added cost of higher quality is $\Delta p = p_h - p_l$. The added benefit can be represented by how much more a consumer is willing to pay for the higher quality, $\Delta\theta$, and is defined as a compensating variation:

$$(1) \quad u(y - p_l - \Delta\theta, z_h) = u(y - p_l, z_l).$$

$\Delta\theta$ is the money premium a person would pay for high quality wine z_h when low quality wine z_l is available at price p_l .

Figure 31: Price quality equilibrium between differentiated buyers and sellers.

Source:[Rosen, 1974]

The optimal choice is z_h , when $\Delta\theta > p_h - p_l$ and z_l otherwise. The second part of the problem is whether or not to purchase wine at all. This is another cost-benefit comparison. Define θ as a compensating variation that equates utility of not purchasing any wine to the utility obtained from the best possible variety:

$$(2) \quad u(y,0) = \max \{u(y - \theta - \Delta\theta, z_h), u(y - \theta, z_l)\}.$$

A buyer purchases none of the varieties z , when $\theta < p_l$ and $\theta + \Delta\theta < p_h$. This can be shown with a spatial bid function $\theta(z)$, defined as the amount a person with income y is willing to pay for alternating varieties with some constant utility index:

$$(3) \quad u(y - \theta(z), z) = \text{constant}$$

$\theta(z)$ is an indifference curve between price p and the measure of quality z . From (3) its derivative $\delta\theta/\delta z = u_z / u_c$ is the marginal rate of substitution between z and c . This is positive and $\theta(z)$ is upward sloping. Diminishing marginal rate of substitution requires that $\theta''(z) < 0$: i.e. the marginal willingness to pay for additional quality is decreasing. The

curves labeled θ^i in Figure 31 illustrate indifference curves for buyers $i = 0,1,2$. Buyers with tastes θ^0 buy no wine at all, because their indifference curve include point A (0,0) and lies completely above all offered combinations of price and quality. Analogously, buyers with tastes θ^1 buy the low quality variety z_l , and buyers with preferences represented by θ^2 buy high quality wine z_h .

The seller's side

The return of selling a variety is the market price. Production is profitable for those sellers whose production costs are below the market price. Let $M(z_i)$ denote the number of units (e.g. cases of wine) produced by an individual seller offering z_h or z_l . Production is assumed to be nonjoint, each firm specializes in the production on either high-quality or low-quality wine, each one acting independently from one another.

A seller's total costs are $C(M, z; \beta)$, derived from minimizing factor costs subject to a joint production function relating M , z , and factors of production. The shift parameter β reflects factor prices and parameters of the production function, which are variables in the cost minimization problem. Assume C is convex with $C(0,z) = 0$, marginal costs C_M of producing more units of a given variety are positive and increasing, and marginal costs of increasing each component of the design C_{z_i} are also positive and nondecreasing. Each seller maximizes profits $\pi = Mp(z) - C(M, z_i)$ by choosing M and z optimally. Sellers are competitors and cannot affect prices by their individual production decisions. At the optimum, marginal revenue equals marginal costs per unit sold.

The return of selling a variety is the market price. Parallel with consumers bid-functions, these choices can be illustrated by a spatial offer function $\varphi(z; \pi, \beta)$ – the locus of all price-quality pairs that lead to the same profit. $\varphi(z; \pi, \beta)$ is the supply price for quality z of an individual seller. Since the production of higher quality wines results in higher production costs $\varphi'(z; \pi, \beta) > 0$. Offer curves are increasing and convex functions of quality characteristics z . Sellers either specialize in producing and selling a single variety or produce several items in a product line. Figure 31 illustrates the case of specialization on the production of a single quality of wine. The curve labeled $\varphi^1(z; \pi, \beta)$ in Figure 31 represents a seller that produces low-quality wines and $\varphi^2(z; \pi, \beta)$ refers to a seller that produces wines of high quality. That is, the two have distinct values of the parameter β . Since $\varphi^1(z; \pi, \beta)$ lies everywhere above point C (z_h, p_h), Seller 1 cannot offer high-quality

wines and return a profit higher than that from selling the low-quality variety. Since $\varphi^2(z; \pi, \beta)$ lies everywhere above point B (z_l, p_l) , seller 2, in contrast, cannot return more profit from offering low-quality wines than from offering wines of high quality. A seller whose spatial offer curve covers both varieties (e.g. $\varphi^*(z; \pi, \beta)$) produces and sells both high- and low-quality wines. He is indifferent between producing the two varieties because they lead to the same profit. For simplicity production is assumed to be nonjoint, excluding this case from the model.

More generally, there is a distribution $G(\beta)$ of β across all potential sellers. Empirically β is anything that shifts costs conditions among wineries. Differences in factor prices are one possibility, differenced in 'technology,' e.g. which sales channel is used, is another.

Equilibrium

In equilibrium a buyer and seller are perfectly matched, when their spatial bid- and offer-functions are tangent to one another, with the common gradient at that point given by the implicit price function $p(z)$. Market clearing prices $p(z)$ are determined by the distributions of consumer tastes and producer costs. Therefore, observations $p(z)$ represent a joint envelope of various bid- and offer functions. Figure 31 shows how the market sustains diversity as an equilibrium phenomenon. Different buyers with differing preferences buy different qualities of wine. Buyers with tastes corresponding to $\theta^1(z)$ buy z_l at price p_l and are supplied by sellers with offer functions according to $\varphi^1(z; \pi, \beta)$. Buyers with tastes corresponding to $\theta^2(z)$ buy z_h at p_h and are supplied by sellers with offer functions according to $\varphi^2(z; \pi, \beta)$. None of the sellers have an incentive to sell to consumers of the other type. Similarly none of the buyers wish to buy their wine from different suppliers. All four types can do no better, given the opportunities available. This ends the review of Rosen's models.

Price quality equilibrium between differentiated buyers and sellers with transaction costs

How can transaction costs be introduced into Rosen's model and what happens when transaction costs are introduced into the model? Basically, the spatial equilibrium depicted in Figure 31 would stay the same. The bid and offer curves then represent different buyers and sellers with the same underlying utility and production functions but different incomes and profits transacting with one another than those in Figure 31.

Buyer's transaction costs

As in the model above, the actual decision to purchase is a problem that comes in two parts, first the consumer decides which of the offered varieties he prefers most and then he decides whether to purchase it or not. Now the first part of the problem is equivalent to choosing the maximum of:

$$(4) \quad u(y - (p_h + t_h), z_h) \text{ and } u(y - (p_l + t_l), z_l),$$

where t_h denotes transaction costs associated with buying high-quality wines and t_l represent transaction costs of buying wines of low quality. If transaction costs are identical for wines of low and high quality, this model is equivalent to Rosen's. With transaction costs included, the added costs of higher quality is $\Delta p_t = (p_h + t_h) - (p_l + t_l)$, which is the same as in Rosen's model if transaction costs are the same with high- quality and low-quality consumers and therefore canceled out.

Equation (4) however gives us room to consider transaction costs that differ between buyers of high- and low-quality wines and are the starting point for variation of transaction costs, especially the reduction of transaction costs brought by through the introduction of e-commerce. It is reasonable to assume that transaction costs of buyers of high-quality wines are higher than transaction costs of buyers of low-quality wines. A major part of buyers transaction costs are search costs, the major part being made up of opportunity costs of time. The additional costs of higher quality $\Delta p_t = (p_h + t_h) - (p_l + t_l)$ are higher than in the model without transaction costs, if t_i is assumed to be correlated to z , meaning that higher-quality consumers incur higher transaction costs than low-quality consumers.

The added benefit can be represented by how much more a consumer is willing to pay for the higher quality, $\Delta\theta$, and is defined as a compensating variation:

$$(5) \quad u(y - p_l - (\Delta\theta + t_h - t_l), z_h) = u(y - (p_l + t_l), z_l).$$

$\Delta\theta$ is the money premium a person would pay for high-quality wine z_h when low-quality wine z_l is available at price p_l . $t_h - t_l$ are the additional transaction costs (compared to t_l) a consumer would face when buying high-quality wine. The optimal choice is z_h , when $\Delta\theta + t_h - t_l > (p_h + t_h) - (p_l + t_l)$ and z_l otherwise.

The second part of the problem is whether or not to purchase wine at all. This is another cost-benefit comparison. Define θ as a compensating variation that equates utility of not purchasing any wine to the utility obtained from the best possible variety:

$$(6) \quad u(y,0) = \max \{u(y - \theta - (\Delta\theta + t_h), z_h), u(y - (\theta + t_l), z_l)\}.$$

A consumer purchases none of the varieties z , when $\theta < p_l + t_l$ and $\theta + \Delta\theta < p_h + t_h$. This can be shown with a spatial bid function $\theta(z)$ (see Figure 32), defined as the amount a person with income y is willing to pay for alternating varieties with some constant utility index:

$$(7) \quad u(y - (\theta(z) + t_i), z) = \text{constant}$$

As in Rosen's model $\theta(z)$ is an indifference curve between price p and the measure of quality z . From (6) its derivative $\delta\theta/\delta z = u_z / u_c$ is the marginal rate of substitution between z and c . This is positive and $\theta(z)$ is upward sloping. Diminishing marginal rate of substitution concludes that $\theta''(z) < 0$: the marginal willingness to pay for additional quality is decreasing.

Seller's transaction costs

A seller's total costs are $C(M, z; \beta)$, transaction costs can be incorporated into the model on the sellers through the parameter β . Transaction costs narrow a seller's profits $\pi = Mp(z) - C(M, z, \beta)$. The seller's supply decision is equivalent to choosing the maximum of:

$$(8) \quad \pi_h = M_h p(z_h) - C(M_h, z_h, \beta_h) \text{ and } \pi_l = M_l p(z_l) - C(M_l, z_l, \beta_l)$$

where π_h and π_l are profits from supplying high- or low-quality wines, M_h and M_l are the amount of high- and low-quality wines supplied and β_h and β_l are factor prices and parameters of the production function underlying when producing high- or low-quality wine. When transaction costs are the same for sellers of high-quality and low-quality wines then profits are affected evenly and the supply decision remains the same. If transaction costs are correlated to the quality of wine supplied, then equation (8) gives room to consider this by varying β_h and β_l .

Price quality equilibrium between differentiated buyers and sellers in e-commerce markets

The buyer's side

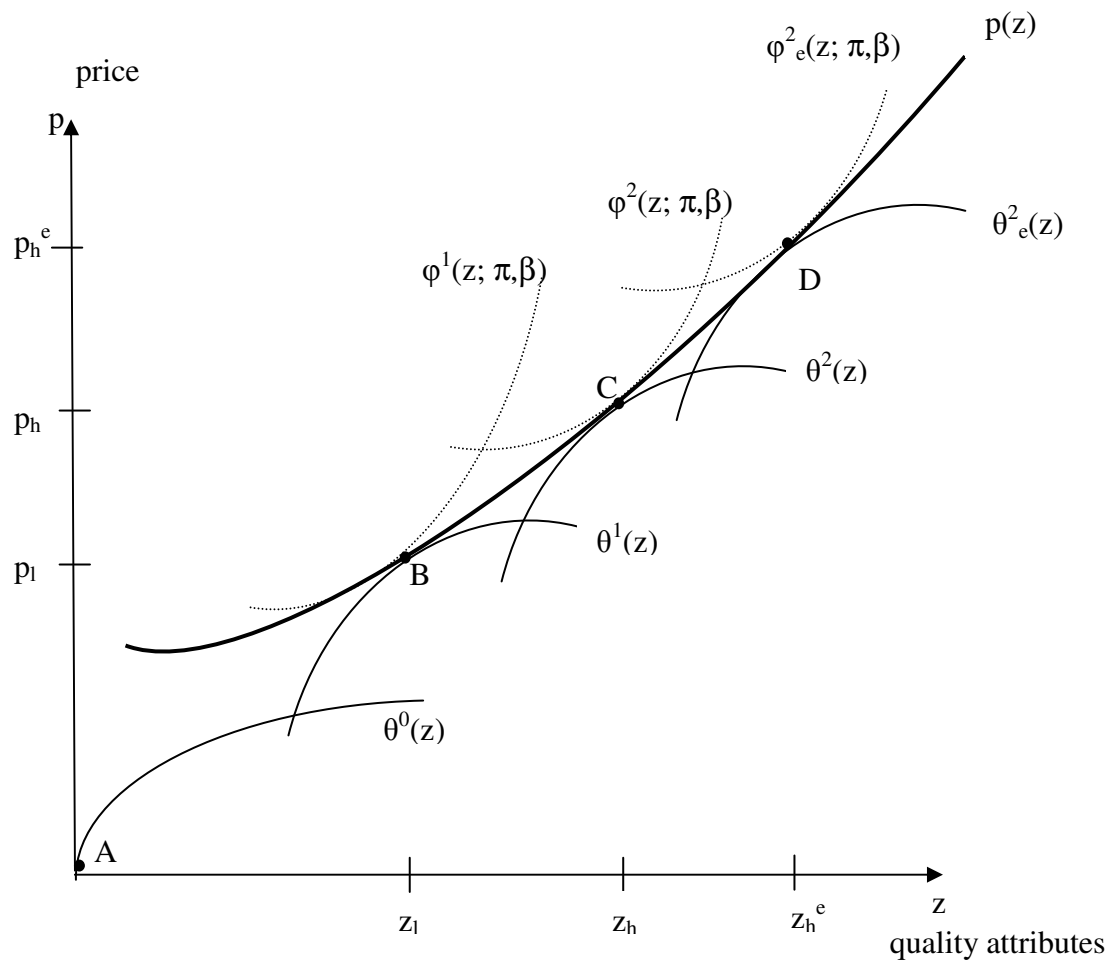
Let us assume the introduction of e-commerce leads to the reduction of t_h , while t_l increase when buying on the web. Several empirical surveys of Internet users have shown that buyers of high-quality products tend to be higher educated and have higher incomes. This means they have higher opportunity costs of time when searching for the product they would like to buy. Buyers of low-quality wines do not invest much time in searching for their wine, they look for the lowest price and pick up the wine during their usual shopping trip. It therefore is reasonable to assume that the introduction of e-commerce does not reduce transaction costs of low-quality wine buyers significantly, because they would have to invest more time searching for their low-quality wine on the Web, as they do when picking it up along the way of their usual shopping trip. Low-quality buyer's transaction cost may even increase when buying on the web because low-quality buyers would have to invest more time and money buying on the web compared to their conventional wine-buying habits. Therefore the introduction of e-commerce does not change their buying behavior. They do not switch sales channels because the transaction costs they have when buying their wine is rather small (they pick it up along the way) and buying their wine over e-commerce would lead to higher transaction costs, respectively to a decrease in their level of utility.

Now the first part of the problem is equivalent to choosing the maximum of:

$$(9) \quad u(y - (p_h + t_h^e), z_h) \text{ and } u(y - (p_l + t_l), z_l),$$

where t_h^e denotes transaction costs associated with buying high-quality wine on the web and t_l represent transaction costs of buying wine of low quality conventionally.

Income elasticity of demand for quality is positive – rising incomes increase the demand for quality and raise average transaction prices. The higher the product value, the higher the amount of search invested in finding the “right” quality. The transaction costs of high-quality wine buyers are lowered significantly through e-commerce because they invest more time in their search - their transaction costs t_h are predominantly made up of search costs (opportunity costs of time). Making price and quality comparison easy, e-commerce reduces the time a high-quality wine buyer must take to find the wine he likes ($t_h^e < t_h$).

Figure 32: Model including transaction cost reductions through e-commerce

The added costs of buying higher quality wines $\Delta p_t = (p_h + t_h^e) - (p_l + t_l)$ decreases through the introduction of e-commerce because t_h^e decreased while p_h , p_l , and t_l stayed the same. This brings consumers of lower quality wines closer to the higher quality. This means some high-end, low-quality consumers may become low-end high-quality consumers.

The transaction cost reduction can be illustrated as an income-effect. High-quality bid functions shift up and to the right as income rises because the willingness to pay for increments of z rises with income while low-quality bid functions stay the same (see $\theta^2_e(z)$ in Figure 32).

The seller's side

The introduction of the sales channel e-commerce affects not only buyer's transaction costs, but also transaction costs of sellers. Just like the buyers of low-quality wines do not profit from transaction cost reductions through the introduction of e-commerce, sellers of low-quality wines do not profit. They do not invest much in marketing their cheap wine anyway, therefore selling their wines on the web would be associated with higher costs. Therefore, the offer function $\varphi^1(z; \pi, \beta)$ is unaffected by e-commerce and seller 1 does not use the sales channel e-commerce. The reduction of transaction costs of selling high-quality wine on the web can be incorporated into the model through variation of the parameter β in the offer functions. The reduced transaction costs of buyers and sellers through e-commerce causes the offer functions to shift upward and to the right.

Conclusions

The introduction of the sales channel e-commerce lead to an increase in transaction costs, both of buyers and sellers of low-quality wines. Therefore neither low-quality sellers nor low-quality buyers use the new sales channel. This is shown by the spatial offer function $\varphi^1(z; \pi, \beta)$ and bid function $\theta^1(z)$ not shifted in Figure 32. For buyers and sellers of high-quality wines, the introduction of the sales channel e-commerce leads to a significant reduction in transaction costs. This causes the high-quality spatial bid function $\theta^2_e(z)$ to shift upward and to the right, as compared to $\theta^2(z)$. Spatial offer functions shift upward and to the right: $\varphi^2_e(z; \pi, \beta)$ instead of $\varphi^2(z; \pi, \beta)$. In total the relevant market is broadened and some low quality buyers become high-quality buyers. Whether the price or quality change in the high-quality section dominates, depends on the elasticities of demand and supply.

Attachment 7 – Program listing: Outline of the CGI-Script

```
1    #!/usr/local/bin/perl
2    use strict;
3    use CGI ('param');
4
5    my ($OK, $key, $acres, $variable1, $variable2, $SEENBUTTON);
6
7    print "Content-Type: text/html\n\n";
8
9    # ----- getting parameters
10   key = param('key');
11   $done = param('done');
12   $acres = param('acres');
13   $variable1 = param('variable1');
14   $variable2 = param('variable2');
15   $SEENBUTTON = param('SEENBUTTON');
16
17   # ----- getting the questionnaire / data storage
18   if ($done)
19   {
20       print <<"END";
21       <H1>Thank you very much for your participation</H1>
22       <P>Have a nice day!
23       END
24
25   # ----- data recording
26   $OK = open(OUT, ">>results.txt");
27
28   if( ! $OK ) {
29       print <<"EOM";
30
31       <H1>Sorry,</H1>
32       <P>the server is currently down. Please try again later.
33       EOM
34       exit;
35       }
36
37   # ----- store file
38   print OUT "$key\t";
39   print OUT "$acres\t";
40   print OUT "$variable1\t";
41   print OUT "$variable2\t";
42   print OUT "$SEENBUTTON\n";
43
```

```
44 # ----- close file
45 close OUT;
46 exit;
47
48 } else {
49     if (!$key) {
50         print <<"END";
51 <H1>please click here:</H1>
52 <A HREF="http://aic.ucdavis.edu/wine/ca.pl?key=21314">here</A>
53 END
54
55 exit;
56 }
57 }
58 print <<"EOM";
59
60 <!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN"
61 "http://www.w3.org/TR/REC-html40/loose.dtd">
62 <HTML>
63     <HEAD>
64         <TITLE>winery e-commerce survey</TITLE>
65         <META CONTENT="Susanne Stricker" NAME="author">
66         <META CONTENT="MSHTML 6.00.2800.1170" NAME="GENERATOR">
67         <META HTTP-EQUIV="expires" CONTENT="0">
68         <META HTTP-EQUIV="Content-Type" CONTENT="text/html;
69 charset=iso-8859-1">
70 <META HTTP-EQUIV="Content-Script-Type" CONTENT="text/javascript">
71 /HEAD>
72 BODY BGCOLOR="#ffffcc">
73     <FORM ACTION="ca.pl" METHOD="POST"><BR><BR> <CENTER>
74 <INPUT TYPE="hidden" NAME="done" VALUE="1">
75 <INPUT TYPE="hidden" NAME="key" VALUE="$key">
76 .
77 .
78 .<HTML>
82
83 EOM
84 exit;
```

A CGI script can be written using any text editor. The main points to be considered when programming a CGI script for use in an online survey can be explained using the outline shown in the above program listing as an example. In order for the script to work properly, the location of the Perl-interpreter on the Web-server has to be specified (see line 1 in the program listing). Usually, the systems administrator or the Internet-provider has this

information. On our server the Perl-interpreter was located at: `/usr/local/bin/perl`. In line 5 all variable names used have been entered. The program listing shows only six of the 73 variables used, leaving the rest out for simplicity. In order for the answers of the questionnaire to be usable by the script, they have to be translated into Perl-variables which is done in lines 10 - 15. Again, the translation is shown for the five example variables only. The values of the Perl-variables are then written into the results file (see lines 38 through 42). The operation `print <<"EOM";` in line 58 tells the server to generate the HTML questionnaire. The HTML code is entered in lines 60 - 78. The program listing does not show the whole HTML code, this would take up about fifty pages and is therefore left out for simplicity. It is important to include two lines after the HTML code with the operations `EOM`, telling the script where the questionnaire ends and `exit;` marking the end of the CGI script. Somewhere in the HTML code the lines 74 and 75 have to be entered. These lines make sure that two variables ('done' and 'key') necessary for the script to run are transferred onto the server and into the data file saving the results [Jellinek and Haemmerle-Uhl, 2001].

Attachment 8 – Questionnaire for Australian wineries**Survey on winery e-commerce participation****Winery Characteristics****1 How large is your vineyard area in hectares?** hectares**2 Does your winery buy grapes from other wineries or do you sell grapes to other wine producers?***(Please mark one)*

- yes, we buy grapes from other producers
- yes, we sell grapes to other wineries
- yes, we both sell and buy grapes to or from other producers
- none of the above

3 What was your winery's annual grape crush in 2002?*(Please mark one)*

- less than 20 tons
- 20-49 tons
- 50-99 tons
- 100-249 tons
- 250-499 tons
- 500-999 tons
- more than 1000 tons

4 Your winery's annual casegood production in the year 2002? cases of 12 bottles each

5 Where is your winery located? (Please check one)**New South Wales**

- Riverina
- Mudgee
- Canberra
- Hunter Valley
- other New South Wales

 Northern Territory **Queensland****South Australia**

- Adelaide Hills
- Adelaide Plains
- Barossa Valley
- Clare Valley
- Coonawarra
- Eden Valley
- McLaren Vale
- Riverland
- other South Australia

 Tasmania**Victoria**

- Bendigo
- Sunrasia
- Yarra Valley
- other Victoria

Western Australia

- Great Southern
- Margaret River
- Pemperton
- Swan Valley
- other Western Australia

6 What is the number of your permanently employed full-time staff?

people

7 How many seasonal workers do you usually employ during vintage?

people (monthly full-time equivalents)

8 Is your winery family owned and operated?

no

yes

9 Please indicate the value of your wine sales for the year 2002?

less than AUS\$50,000

AUS\$50,000 up to AUS\$100,000

AUS\$100,000 up to AUS\$250,000

AUS\$250,000 up to AUS\$500,000

AUS\$500,000 up to AUS\$1,000,000

AUS\$1,000,000 up to AUS\$1,500,000

greater than AUS\$1,500,000

10 Do you regularly export wine to foreign countries?

no

yes

11 Which wine-related tourism activities / facilities do you currently provide as part of your winery's business and which of these do you promote on the Web?

please mark the appropriate - several answers are possible

Tourism activity / facility	Offered	Promoted on the Web
Winery tours	<input type="checkbox"/>	<input type="checkbox"/>
Wine tasting	<input type="checkbox"/>	<input type="checkbox"/>
Accommodation	<input type="checkbox"/>	<input type="checkbox"/>
Restaurant/café	<input type="checkbox"/>	<input type="checkbox"/>
BBQ	<input type="checkbox"/>	<input type="checkbox"/>
Others - please specify: <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

12 If you promote your tourism activities / facilities on the Web - when did you first start doing so?

Please mark the year you started promoting the first tourism activity / facility on the web.

- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003

13 Has your business from tourism activities / facilities intensified since you promote them on the Web?

- no
- yes, somewhat
- yes, considerably
- yes, very much

- don't know / can't tell
- my winery doesn't promote tourism activities / facilities on the web

Current Marketing Practices

14 Which of the following sales channels do you currently use for selling bottled wine? please mark the appropriate - several answers are possible

- retail
- bulk-in-bond
- ship-out-of-state
- export
- casegoods
- wholesale
- website
- tasting room/cellar door
- other - please specify:

15 Approximately how many percent of the volume of all bottled wine you produced did you sell directly to consumers in 2002?

- percent

- 16 How does the volume of all bottled wine you sold in 2002 split into the following price ranges (retail prices per bottle including WET and GST)?**
please make sure these percentages add up to 100%

up to AUS\$7	<input type="text"/> percent
AUS\$7 - AUS\$14	<input type="text"/> percent
AUS\$14 - AUS\$25	<input type="text"/> percent
more than AUS\$25	<input type="text"/> percent
	=100 percent?

Wine shipments

If you do not ship wine directly to consumers please continue with [question 21](#)

- 17 What is the average size of a direct sales shipments?**

cases of 12 bottles each

- 18 Is a higher share of high priced wine sold per mail order or at the winery?**

- per mail order
 at the winery
 about the same shares are sold per mail order and at the winery
 I don't know

- 19 Within the last 3 years, have you shipped wine to a consumer in a foreign country?**

- no
 yes - please indicate how often: times

**20 Which of the following statements accurately describes your situation?
The prices of wines shipped internationally...**

- ...are lower than prices of wines sold domestically
 - ...are about the same compared to prices of wines sold domestically
 - ...are higher than prices of wines sold domestically
 - ...are much higher than prices of wines sold domestically
-

Winery Website

21 Does your winery have its own website?

- no - please continue with [question 27](#)
- yes - since year:

22 How often do you update your winery's website?

- every day
- on a weekly basis
- monthly
- more than three times a year
- less than three times a year
- not since we started it

23 Does your website offer an option for buying wine?

- no - please continue with [question 27](#)
- yes

24 How many different wines do you offer for sale on your website?

different wines

- 25 How does the volume of the wines you sell over the web split into the following price ranges (retail prices per bottle including WET and GST)?**
please make sure these percentages add up to 100%

up to AUS\$7	<input type="text"/> percent
AUS\$7 - AUS\$14	<input type="text"/> percent
AUS\$14 - AUS\$25	<input type="text"/> percent
more than AUS\$25	<input type="text"/> percent
	=100 percent ?

- 26 Has the website increased your direct sales?**

- no
 yes

Internet Use

- 27 How often do you access the Internet (Web, Email or any other Internet service)?**

- never
 rarely
 several times per week
 every work day
 online all day

- 28 Do you use Internet banking for business transactions?**

- never
 rarely
 several times per week
 every work day

29 How often do you use the Internet for sending and receiving email?

- never
- rarely
- several times per week
- every work day

30 How often do you use the Web to retrieve information for your winery's business?

- never
- rarely
- several times a week
- every work day

31 Have you bought products or services online for your winery's business within the last year?

- no
- once
- 2-5 times
- 6-10 times
- more than 10 times

32 Which products or services have you bought online for your winery's business within the last year?

- vineyard supply (harvest bins, pesticides, etc.)
 - winery supply (bottles, labels, cork, etc.)
 - office supply (paper, pencil, floppy disks, etc.)
 - equipment/tools/machinery
 - information
 - other
-

Thank you very much for your time!

If you are interested in a report of the results, please insert your email address below. We also appreciate feedback.

Please submit completed questionnaire by pressing the "send" button.

Attachment 9 – Questionnaire for California wineries**Survey on winery e-commerce participation**

This survey is conducted in collaboration with Professor Daniel A. Sumner,
Director of the Agricultural Issues Center
at the University of California at Davis.

Winery Characteristics**1 How large is your vineyard area in acres?**

acres

2 Does your winery buy grapes from other wineries or do you sell grapes to other wine producers?

(Please mark one)

- yes, we buy grapes from other producers
- yes, we sell grapes to other wineries
- yes, we both sell and buy grapes to or from other producers
- none of the above

3 What was your winery's annual grape crush in 2002?

(Please mark one)

- less than 20 tons
- 20-49 tons
- 50-99 tons
- 100-249 tons
- 250-499 tons
- 500-999 tons
- 1000-2999 tons
- 3000-4999 tons
- 5000-6999 tons
- more than 7000 tons

4 Your winery's annual casegood production in the year 2002? cases of 12 bottles each**5 Where is your winery located? (Please check one)**

- Mendocino/Lake
- Sonoma/Marin
- Napa
- Solano/Clarksburg
- San Francisco Bay Counties
- Monterey/San Benito
- San Luis Obispo County/Santa Barbara
- Sacramento Valley/Northern California to Oregon Border
- Sierra Foothills
- Lodi/Woodbridge
- Stanislaus/ Merced
- Fresno/Madera/Tulare
- Kern
- Southern California

6 What is the number of your permanently employed full-time staff? people**7 How many seasonal workers do you usually employ during vintage?** people (monthly full-time equivalents)**8 Is your winery family owned and operated?**

- no
- yes

9 Please indicate the value of your wine sales for the year 2002?

- less than \$100,000
- \$100,000 up to \$250,000
- \$250,000 up to \$500,000
- \$500,000 up to \$1,000,000
- \$1,000,000 up to \$1,500,000
- \$1,500,000 up to \$ 3,000,000
- \$3,000,000 up to \$5,000,000
- \$5,000,000 up to \$7,000,000
- greater than \$7,000,000

10 Do you regularly export wine to foreign countries?

- no
- yes

11 Which wine-related tourism activities / facilities do you currently provide as part of your winery's business and which of these do you promote on the Web?

please mark the appropriate - several answers are possible

Tourism activity / facility	Offered	Promoted on the Web
Winery tours	<input type="checkbox"/>	<input type="checkbox"/>
Wine tasting	<input type="checkbox"/>	<input type="checkbox"/>
Accommodation	<input type="checkbox"/>	<input type="checkbox"/>
Restaurant/café	<input type="checkbox"/>	<input type="checkbox"/>
BBQ	<input type="checkbox"/>	<input type="checkbox"/>
Others - please specify: <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

12 If you promote your tourism activities / facilities on the Web - when did you first start doing so?

Please mark the year you started promoting the first tourism activity / facility on the web.

- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003

13 Has your business from tourism activities / facilities intensified since you promote them on the Web?

- no
- yes, somewhat
- yes, considerably
- yes, very much

- don't know / can't tell
- my winery doesn't promote tourism activities / facilities on the web

Current Marketing Practices

14 Which of the following sales channels do you currently use for selling bottled wine? *please mark the appropriate - several answers are possible*

- retail
- bulk-in-bond
- ship-out-of-state
- export
- casegoods
- wholesale
- website
- tasting room/cellar door
- other - please specify:

15 Approximately how many percent of the volume of all bottled wine you produced did you sell directly to consumers in 2002?

percent

16 How does the volume of all bottled wine you sold in 2002 split into the following price ranges?

please make sure these percentages add up to 100%

up to \$7	<input style="width: 40px;" type="text"/> percent
\$7 - \$14	<input style="width: 40px;" type="text"/> percent
\$14 - \$25	<input style="width: 40px;" type="text"/> percent
more than \$25	<input style="width: 40px;" type="text"/> percent
	=100 percent ?

Wine shipments

If you do not ship wine directly to consumers please continue with [question 21](#)

17 What is the average size of direct sales shipments?

cases of 12 bottles each

18 Is a higher share of high priced wine sold per mail order or at the winery?

- per mail order
- at the winery
- about the same shares are sold per mail order and at the winery
- I don't know

19 Within the last 3 years, have you shipped wine to a consumer in a foreign country?

- no
- yes - please indicate how often: times

**20 Which of the following statements accurately describes your situation?
The prices of wines shipped internationally...**

- ...are lower than prices of wines sold domestically
- ...are about the same compared to prices of wines sold domestically
- ...are higher than prices of wines sold domestically
- ...are much higher than prices of wines sold domestically

Winery Website**21 Does your winery have its own website?**

- no - please continue with [question 27](#)
- yes - since year:

22 How often do you update your winery's website?

- every day
- on a weekly basis
- monthly
- more than three times a year
- less than three times a year
- not since we started it

23 Does your website offer an option for buying wine?

- no - please continue with [question 27](#)
- yes

24 How many different wines do you offer for sale on your website? different wines

25 How does the volume of the wines you sell over the Web split into the following price ranges?

please make sure these percentages add up to 100%

up to \$7	<input type="text"/> percent
\$7 - \$14	<input type="text"/> percent
\$14 - \$25	<input type="text"/> percent
more than \$25	<input type="text"/> percent
	=100 percent ?

26 Has the website increased your direct sales?

- no
 yes

Internet Use

27 How often do you access the Internet (Web, Email or any other Internet service)?

- never
 rarely
 several times per week
 every work day
 online all day

28 Do you use Internet banking for business transactions?

- never
 rarely
 several times per week
 every work day

29 How often do you use the Internet for sending and receiving email?

- never
- rarely
- several times per week
- every work day

30 How often do you use the web to retrieve information for your winery's business?

- never
- rarely
- several times a week
- every work day

31 Have you bought products or services online for your winery's business within the last year?

- no
- once
- 2-5 times
- 6-10 times
- more than 10 times

32 Which products or services have you bought online for your winery's business within the last year?

- vineyard supply (harvest bins, pesticides, etc.)
 - winery supply (bottles, labels, cork, etc.)
 - office supply (paper, pencil, floppy disks, etc.)
 - equipment/tools/machinery
 - information
 - other
-

Thank you very much for your time!

If you are interested in a report of the results, please insert your email address below. We also appreciate feedback.

Please submit completed questionnaire by pressing the "send" button.

Send

Attachment 10 – Questionnaire for German wineries**Befragung zum Weinhandel im Internet**

Diese Befragung wird durchgeführt von der Christian-Albrechts Universität zu Kiel in Zusammenarbeit mit der University of California.

Merkmale des Weinguts**1 Wie groß ist das Rebland ihres Weingutes?**

Hektar

2 Kaufen oder verkaufen Sie Trauben an oder von anderen Erzeugern?

(Bitte eine Antwort durch anklicken auswählen)

- ja, wir kaufen Trauben von anderen Erzeugern
- ja, wir verkaufen Trauben an andere Weinhersteller
- ja, wir kaufen und verkaufen Trauben von oder an andere Erzeuger
- Nein, wir handeln nicht mit Trauben

3 Wieviele Hektoliter Weinmost haben Sie im Jahr 2002 verarbeitet?

(Bitte eine Antwort durch anklicken auswählen)

- weniger als 100 Hektoliter
- 100-650 Hektoliter
- 650-1.300 Hektoliter
- 1.300-2.600 Hektoliter
- 2.600-3.800 Hektoliter
- 3.800-5.000 Hektoliter
- 5.000-6.400 Hektoliter
- 6.400-9.000 Hektoliter
- 9.000-11.000 Hektoliter
- mehr als 11.000 Hektoliter

4 Wieviel Prozent der Menge Ihres Weines vermarkten Sie in Flaschen?

(Bitte tragen Sie die Prozentzahl in das dafür vorgesehene Feld ein.)

Prozent

5 Zu welchem Weinbaugebiet gehören Sie?

(Bitte eine Antwort durch anklicken auswählen)

- Ahr
- Baden
- Franken
- Hessische Bergstraße
- Mittelrhein
- Mosel-Saar-Ruwer
- Nahe
- Pfalz
- Rheingau
- Rheinhessen
- Saale-Unstrut
- Sachsen
- Wuerttemberg

6 Wieviele Vollzeit-Arbeitskräfte arbeiten in ihrem Weingut?

Personen

7 Wieviele Saison-Arbeitskräfte beschäftigen Sie durchschnittlich pro Monat während der Weinlese?

Personen

8 Ist das Weingut ein Familienbetrieb?

- Nein
- Ja

9 Wie groß war der Gewinn Ihres Weingutes im Jahr 2002?

- es wurde kein Gewinn erwirtschaftet
- 0 bis 10.000 Euro
- 10.000 bis 20.000 Euro
- 20.000 bis 30.000 Euro
- 30.000 bis 40.000 Euro
- 40.000 bis 50.000 Euro
- 50.000 bis 60.000 Euro
- 60.000 bis 70.000 Euro
- mehr als 70.000 Euro
- keine Angabe

10 Exportieren Sie regelmäßig Wein?

- Nein
- Ja

11 Welche der unten aufgeführten Aktivitäten/Einrichtungen bietet Ihr Weingut an und welche werden über das Web beworben?

(Bitte alle zutreffenden ankreuzen - Mehrfachauswahl möglich)

Aktivität / Einrichtung	angeboten	über das Web beworben
Führungen durch das Weingut	<input type="checkbox"/>	<input type="checkbox"/>
Weinproben	<input type="checkbox"/>	<input type="checkbox"/>
Zimmervermietung	<input type="checkbox"/>	<input type="checkbox"/>
Restaurant, Strausswirtschaft, Café	<input type="checkbox"/>	<input type="checkbox"/>
Grillfeste	<input type="checkbox"/>	<input type="checkbox"/>
Andere - bitte angeben: <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

12 Falls Sie die soeben genannten Einrichtungen / Aktivitäten über das Web bewerben, wann haben Sie damit begonnen?

(Bitte das Jahr auswählen, in dem Sie erstmalig eine Aktivität / Einrichtung über das Web beworben haben.)

- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003

13 Hat die Nutzung dieser Aktivitäten / Einrichtungen zugenommen seitdem Sie diese über das Web bewerben?

- Nein
- Ja, ein wenig
- Ja, beträchtlich
- Ja, sehr viel

- keine Ahnung / kann ich nicht sagen
- mein Weingut bewirbt seine Aktivitäten / Einrichtungen nicht über das Web

Weinvermarktung

14 Über welche der folgenden Kanäle vermarkten Sie Ihren Wein?

(Bitte auswählen - Mehrfachantworten sind möglich)

- Lebensmitteleinzelhandel
- über eine Genossenschaft
- ab Hof
- über eine Website
- Weinfachgeschäfte
- Grosshandel
- Aldi
- andere Discounter
- andere - bitte angeben:

15 Wieviel Prozent der Menge Ihres Flaschenweins haben Sie im Jahr 2002 direkt an Endverbraucher vermarktet?

Prozent

16 Wie teilen sich die Menge der von ihnen vermarkteten Flaschenweine in die folgenden Preiskategorie auf?

(Bitte überprüfen Sie, ob die angegebene Prozente sich zu 100% aufaddieren)

bis 2,49 €	<input style="width: 30px; height: 15px;" type="text"/> Prozent
2,50 - 4,99 €	<input style="width: 30px; height: 15px;" type="text"/> Prozent
5,00 - 8,99 €	<input style="width: 30px; height: 15px;" type="text"/> Prozent
9,00 - 15,00 €	<input style="width: 30px; height: 15px;" type="text"/> Prozent
15 € und mehr	<input style="width: 30px; height: 15px;" type="text"/> Prozent
	=100 Prozent?

Weinversand

Falls Sie keinen Flaschenwein direkt an Konsumenten versenden/liefern bitte mit [Frage 21](#) fortfahren

17 Wieviele 6er Kisten umfasst eine durchschnittliche Weinlieferung?

6er Kisten

18 Wird ein größerer Teil der teureren Weine per Versand oder direkt ab Weingut verkauft?

- per Versand / Lieferung
- ab Weingut
- die Anteile sind ungefähr gleich groß
- Kann ich nicht sagen

19 Haben Sie innerhalb der letzten drei Jahre Wein direkt an Endverbraucher exportiert?

- Nein
- Ja - Wie oft?: mal

20 Welche der folgenden Aussagen beschreibt Ihr Weingut am besten? Die Preise der international verschickten Weine...

- ...sind niedriger als die der im Inland verkauften Weine.
- ...sind ungefähr gleich mit den im Inland verkauften Weinen.
- ...sind höher als die der im Inland verkauften Weine.
- ...sind erheblich höher als die der im Inland verkauften Weine.

Weingut Website**21 Hat Ihr Weingut einen eigene Website?**

- Nein - bitte mit [Frage 27](#) fortfahren
- Ja - Seit wann? Jahr:

22 Wie oft wird diese Website aktualisiert?

- täglich
- wöchentlich
- monatlich
- mehr als drei mal im Jahr
- weniger als drei mal im Jahr
- bisher noch nicht

23 Bieten Sie Ihre Weine zum Verkauf über diese Website an?

- Nein - bitte mit [Frage 27](#) fortfahren
- Ja

24 Wieviele verschiedene Weine bieten Sie auf Ihrer Website an?

Anzahl verschiedener Weine

25 Wie teilen sich die Menge der über Ihre Website vermarkteten Flaschenweine in die folgenden Preiskategorien auf?

(Bitte überprüfen Sie, ob die angegebene Prozente sich zu 100% aufaddieren.)

bis 2,49 €	<input type="text"/> Prozent
2,50 - 4,99 €	<input type="text"/> Prozent
5,00 - 8,99 €	<input type="text"/> Prozent
9,00 - 15,00 €	<input type="text"/> Prozent
15 € und mehr	<input type="text"/> Prozent
	=100 Prozent?

26 Hat die Website ihre Direktverkäufe erhöht?

- Nein
 Ja

Internet Benutzung

27 Wie oft benutzen Sie das Internet (Web, Email oder anderer)?

- nie
 selten
 mehrmals pro Woche
 täglich (bzw. an jedem Werktag)
 Standleitung

28 Wie oft benutzen Sie Online- Banking für geschäftliche Transaktionen?

- nie
- selten
- mehrmals pro Woche
- täglich (bzw. an jedem Werktag)

29 Wie oft benutzen Sie das Internet um Emails zu versenden oder zu empfangen?

- nie
- selten
- mehrmals pro Woche
- täglich (bzw. an jedem Werktag)

30 Wie oft benutzen Sie das Web um Informationen für ihr Weingut zu beschaffen?

- nie
- selten
- mehrmals pro Woche
- täglich (bzw. an jedem Werktag)

31 Haben Sie Produkte oder Dienstleistungen innerhalb des letzten Jahres für ihr Weingut online eingekauft?

- nein
- 1 mal
- 2 bis 5 mal
- 6 bis 10 mal
- mehr als 10 mal

32 Welche Produkte oder Dienstleistungen haben Sie innerhalb des letzten Jahres für Ihr Weingut online eingekauft?

(Bitte auswählen - Mehrfachantworten sind möglich)

- Bedarf für den Weinberg (Erntekörbe, Pestizide, usw.)
 - Weingutbedarf (Flaschen, Etiketten, Korke, usw.)
 - Bürobedarf (Papier, Stifte, Disketten, usw.)
 - Betriebsmittel/Werkzeug/Maschinen
 - Information
 - Andere
-

Vielen Dank für Ihre Zeit!

Falls Sie einen Ergebnisbericht wünschen tragen Sie bitte hier Ihre email Adresse ein. Wir freuen uns ausserdem über sonstige Anregungen / Kommentare.

Bitte schicken Sie Ihre antworten ab, indem sie auf den "Senden" Knopf drücken.
