Asymmetric Information and Markets in Transition: Vineyard Auctions in the Mosel Valley after the French Revolution

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In 1794, the now-German part of the Mosel valley was occupied by French troops. During the secularisation period that followed, all property of the Church and the nobility was expropriated by the Napoleonic administration and put up for auction. The secularisation process was accompanied by a substantial deregulation of the wine market. At the same time, the introduction of a new technology (cork-sealed bottles) enabled vintners to produce 'vintage wines' from select vineyards. Together with the liberalised wine market, vineyard values were re-assessed and substantially revised. This analysis examines the profitability of investments made at auctions. Drawing on a small sample of 72 observations, it is shown that wine-related professions, i.e., insiders, appear to have a significant information advantage. Other vocational groups had no specific knowledge about the vineyard quality, which is an indication for an efficient market. However, professional brokers had a strong tendency to overestimate the value of vineyards and incurred considerable losses during the public auction phase. This might be due to the option to return 'lemons'.

1. Introduction

In the wake of the French revolution of 1789-1791, the now-German part of the Mosel valley was conquered by French troops in 1794 and the "Sarre-Département" (Saar-Department) was incorporated into France in 1801. This turned out to be a very fortuitous event for viticulture in the Mosel valley. After centuries of strict regulation by the Church and the nobility, a free wine market was stimulated. Vintners were encouraged to bring their wines to market rather than sell them at fixed prices as rent to the clergy and the Elector of Trier. At the same time, winemakers began to keep wine in bottles that were sealed with shaped corks. As a result,

wines lasted much longer than a single year and, therefore, winemakers were enabled to produce 'vintage wines' (Unwin, 1991).

At the same time, between 1803 and 1811, the property of the Church and the nobility was expropriated and put up for public auction. Depending on the vineyard's price (investment) and the wine price (income stream) during that period, purchasers could realize a considerable profit on their auction transactions. The buyer's task was to anticipate the future profitability of a vineyard and acquire it at a good price.

This was the era of a small group of professional brokers and realtors. Given their knowledge, experience and assumed superior information, they could realise enormous profits. Hence, auctions designed to oust the *ancien régime* created a kind of new upper class, the so-called "Rhenish Bourgeoisie" (Clemens, 1995). It is the purpose of this paper to examine whether the emergence of real-estate brokers as new "Rhenish Bourgeoisie" was due to their assumed expert knowledge.

Auction purchases, like other capital investments, are normally associated with uncertainty. However, by gathering information on the investment object, in this case the vineyard, the investor can minimise this lack of knowledge and decrease the uncertainty significantly. In general, there are two ways of attaining additional investment information: become an expert yourself or rely on other experts, e.g. experienced middlemen. For two reasons middlemen are often considered experts. Firstly, a middleman buys many more goods than an ordinary buyer. Thus he has an incentive to invest in knowledge about the object and become an expert. Secondly, since middlemen want to stay in business, they may place a high value on their reputation and sell only high-quality goods (Biglaiser, 1993). Middlemen offer their expertise in all kinds of markets, e.g. the stock market, the real-estate market or the used car market. There are two groups of people in the stock market who are distinguished from the heap of regular investors according to their information level: insiders and middlemen, i.e. brokers. While insiders are not allowed to apply their knowledge, professional brokers sell their information to the ignorant public. Accordingly, there is a lively market for investment funds and hedge funds, and there are plenty of so-called 'secret tips.' However, the

information advantage of professional experts should not be taken for granted. In fact, as far as the stock market is concerned, many authors assume efficient markets and suggest that a portfolio chosen randomly may significantly outperform an expert's portfolio (e.g. Malkiel, 2000, 2003). This suggests that expert knowledge could be dubious in other markets as well. This paper aims to detect information asymmetries and to evaluate the knowledge of experts, i.e. professional brokers.

The auctions studied were designed as "open English auctions", i.e. the price is successively raised until only one bidder remains. Then that bidder wins the item. For this study, it is assumed that the value of a vineyard to be auctioned had approximately the same value for all bidders, i.e. common-value auctions (e.g. McAfee and McMillan, 1987). However, bidders do not know precisely what the value is – they can only estimate it, and bidders' estimates vary. Inherent to common value auctions is an adverse selection problem, which is referred to as the 'winner's curse' (Capen, Clapp, and Campbell, 1971). The bidder who wins the bid is the one who makes the highest bid. Since everyone else has estimated the item's value to be less, winning can be bad news for the winner. Thus winning bids often produce below normal or even negative profits. There is some evidence that the 'winners' curse' exists in a wide range of markets such as auctions of offshore oil rights (Capen, Clapp, and Campbell, 1971), the market for baseball players (Cassing and Douglas, 1980), or corporate takeovers (Roll, 1986). It is disputed if only novices fall prey to the 'winner's curse', or if experts make the same mistakes. Laboratory experiments by Dyer, Kagel, and Levin (1989) indicate increasing evidence that an experienced bidder does no better than a naïve one. However, since English auctions constantly reveal information about the value of the object to other bidders, the winner's curse is assumed to be less pronounced than at other forms of auction (e.g., Milgrom and Weber, 1982).

This paper assesses the profitability of vineyards bought in auctions in the Mosel valley after the French Revolution from a retrospective point of view. For that purpose a meticulously detailed acquisition database for 1803–1808 that includes the purchase price and vocation of the buyer was used to calculate the net present value of each vineyard auction purchase.

The next section provides a brief history of viticulture in the Mosel valley before 1794 and the changes during the period of French government. Section III describes the database and the variables used. Section IV discusses the determinants of the net present value (NPV) results for vineyard auction transactions. Section V summarises the main findings.

2. Historical background

Before 1794, the Church and the nobility were the largest vineyard owners in the Mosel valley. According to a first measurement of the Trier area in 1719-1721, approximately 26 percent of all vineyards belonged to the Church and approximately 11 percent were owned by the nobility. Vintners who leased those vineyards normally had to pay a third of the harvest as in-kind rent. This practice is referred to as 'third-grapes.'[1] Since this in-kind rent was an invitation to cheat, the harvest was strictly regulated by the proprietor. Harvest time and the order of the vineyards to be harvested were fixed in advance by the landlord and the grapes were picked under surveillance of the Church or of the nobility.[2] During the last weeks before the official harvest time, vineyards were closed and trespassing was prohibited. In addition, a Church tax that comprised 10 percent of the harvest, referred to as the so-called 'tenth-tax', was required by every vintner in addition to the 'third-grapes tax.'[3]

The fixing of the harvest date turned out to be particularly inhibitory for viticulture focusing on quality wines. With the harvest centrally planned, vintners could not meet the respective local requirements with respect to the necessary ripeness of the grapes. Sometimes harvested grapes were unripe. Sometimes they were overripe, or even mouldy. In addition, the regulations did not take into consideration the prevailing

[1] Depending on the contract levies, rents of up to half of the crop yield was not uncommon (Meyer, 1926).

[2] "During the harvest, the 'third-vintner' (i.e. the vintner who owes a third of his harvest as rent) had to divide the entire yield into three equal parts in his own bins. In order to avoid any fraud by unequally filled bins, the landlord then had the right to choose one among them for his own" (Meyer, 1926).

[3] For additional taxes see Meyer (1926) and Bassermann-Jordan (1923).

mixed-variety-plantation of late-ripening *Riesling* and early *Kleinberger* (now called *Elbling*). Both varieties were picked at the same time, resulting in a loss in quality (Meyer, 1926).

Although the Mosel, Saar, and Rur valleys have experienced a lively wine trade since Roman times with the first wine auction in 1757 (Laufner, 1980), the free formation of prices was impaired several times by interventions. In 1680, the prices of all wines from certain vineyards were fixed by decree: 15 fl. (gulden or florins) per 1000 litres for wines from the lower Mosel and 30 fl. for wines from the upper Mosel (Hegner, 1905). In 1753, an attempt to divide all Mosel vineyards into three quality classes and fix their prices annually failed because of the resistance of the town of Bernkastel, which has one of the best vineyard sites in the valley (Laufner, 1980)[4]. However, often wine prices were more or less fixed by the administration so that the market process was, at least, impaired (Bassermann-Jordan, 1923; Meyer, 1926). In addition, the setting of price ceilings or price floors was not uncommon (Bassermann-Jordan, 1923).

The lack of flexibility as well as limited incentives for self-accountability resemble the production in centrally-planned economies. Vintners did not develop a quality approach to producing wine, but they developed a quantity mentality: it paid to produce more wine rather than better wine.

In addition, before the French occupation, wine was predominantly blended from the fruit from several vineyards and sold in large 1000 litre barrels. At the same time, winemakers began storing wine in glass bottles that were sealed with shaped corks.[5] As a result, wines lasted much longer than a single year and, therefore, winemakers were able to produce 'vintage wines' from distinct vineyard sites (Unwin, 1991).

In 1794, the French revolutionary army occupied the left bank of the Rhine river and annexed the Departments of Saar, Rhein-Mosel, Donnersberg, and Rur. In spite of German resistance, the occupation was accepted legally in the treaty of Lunéville (1801) between Napoleon and the German states. Subsequently, the Saar Department, with its capital Trier, became part of France. Between 1803 and 1813, during the

[4] In 1720-24 a more differentiated vineyard ranking based on specific crop yields was introduced without being price-binding (Christoffel, 1929).
[5] Cork screws were mentioned first in 1792 (Bassermann-Jordan, 1923).

secularisation (expropriation of the Church) and mediatization (expropriation of the nobility) period all four Departments experienced a shift of assets to an extent which was inconceivable at the time. As in revolutionary France, the Church and the nobility were expropriated and the assets were put up for public auction[6]. In total, about 10,000 national properties, including land and buildings of all kinds, were put up for auction (Schieder, 1991). In order to provide a comprehensive register for the national property administration and for the issue of the *affiches* (sales announcements), a detailed protocol of each item was made. The annual rent of the property as of 1790 became the basis for estimating the item's value. As for vineyards, the land value was normally determined to be ten times the annual rent (Müller, 1980).

With the abolition of the feudal upper class, all levies, including the third-grape rule, were abandoned. All price fixations imposed by Church or nobility were cancelled as well. The expansion of French law into the new departments boosted the self- accountability of the vintners. For example, the first chapter of the *law on rural properties and customs* stated that "the territory of France is as free in its full extent as all the persons who live in it." Chapter two further stated that "[the] proprietors are free to cultivate and use their land, to harvest and to decide on all products of their property within the kingdom and beyond according to their will, but without impairing the rights of others and according to the laws." (cited according to Laufner, 1987). The requirement of harvest dates was, however, not completely abandoned but was now determined by decentralised municipal authorities.

In order to redeem remaining rents in kind (in wine) the French authorities published a quality-ranking by village for the Saar Department in 1804 (Hegner, 1905). On the basis of market observations[7], ten classes

[6] The Prussian government official, Johann Nepomuk von Schwerz, described the situation as: "Since the existence of the world, purchase and sale has never occurred so often" (Clemens, 1995). Some historians even claimed that the extent of this market in properties was not exceeded until 1945 (Morsey, 1966).

[7] Vineyard classifications were originally launched for the sake of fiscal justice. Accordingly, they always referred to the net return and, therefore, to wine market prices : "*La classification doit être déterminée par la combinaison de la quantité, de la qualité et du prix des denrées.*" (Le Ministre des Finances de la France, 1811)

and their respective rent prices were determined. These rent prices, therefore, reflect market prices.

The early stage of the liberalisation was characterized by considerable price fluctuations. The liberalised market's corrections are reflected in the evolution of the rents of unsold vineyards. *Table 1* shows examples of vineyards with pre-French rents that were substantially above the actual market value. Apparently, the liberalised wine market assessed the value of those properties significantly lower than the Church or the nobility had done a few years earlier. Hence, the national property administration was forced to lower the appraised values for these lots. For instance, rents and appraisals of vineyards in Lieser and Pommern, which could not be sold for several years, had to be reduced by more than 90 percent. On the other hand, in Brauneberg and Oberemmel oder Wehlen vineyards were auctioned off at their first offering for more than tenfold their estimated value. Thus, vineyard valuations in the pre-French system and the liberalised system differed enormously.

Accordingly, the 1804 vineyard rating for the Saar Department had to be revised to account for changing market prices and an updated classification was published in 1808 (Prefekt des Saar-Departements, 1808). Compared to the first appraisal, some radical adjustments were made (see *Table 2).* Firstly, the overall level of the rent wine prices was lowered by about 15 per cent. Secondly, significant corrections were made regarding the quality assessment of certain vineyards. For instance, vineyards in Filzen and Fastenau were upgraded by three classes, while vineyards in Erden and Trittenheim were downgraded. All these corrections are considered to be the result of a market system in transition due to *(i)* market liberalisations and *(ii)* new technologies (bottles). With perfect information and foresight a buyer could certainly have made a fortune at those public auctions.

3. Database and variables

This study draws on the almost completely conserved *affiches* (sales announcements), together with the auction protocols of the French national property administration for the entire auction period from 1803

to 1808. Schieder (1991) summarized, edited and published these data for all four Rhine departments.

In this dataset, an auction lot may consist of a single object (e.g. a vineyard) or a mixed bundle of different objects (e.g. a house, a vineyard, a field and a garden). Since mixed lots were not broken up, but purchased as a whole, one cannot assign an exact price to each single object. Thus lots containing a mixed bundle of different objects were eliminated from the data. In addition, lots that either could not be sold, were not in the Saar Department (a vineyard classification is available only for this department) or that were incompletely specified were also disregarded. The remaining 72 lots comprise the data used in this report.

Besides the date of the auction, there is plenty of information on each lot. First, the village in which the vineyard is located is given, in some cases along with an exact site description. Since marginal variations in the slope or the orientation of a vineyard determine its quality (Ashenfelter and Storchmann, 2006), one might argue that a definition on the village level is inappropriate to describe a vineyard's quality correctly. Compared to current vineyard site definitions, a definition "just" by village appears to be far too general. However, in this study the village level can be justified for two reasons. Firstly, at the beginning of the nineteenth century the glass bottle had just been introduced. Wine was still predominantly sold in large 1000 litre barrels and marketed exclusively by village name. Secondly, the present definition of vineyard sites and the then prevailing village definition are virtually the same in terms of their disaggregation level, that is the size of the vineyards. *Table 3* shows that the average vineyard size in 1981 (24.2 hectares) and 1802 (24.8 hectares) is almost identical. If one takes into account that the data for 1802 includes fallow land – whereas the data for 1981 does not – the village definition might even seem more precise than the present one.[8]

Besides the location of the vineyard, the data provide information about the size of the vineyard measured in hectares (ha) and the number of parcels belonging to one lot. The range of both variables is

[8] The most meticulous vineyard definition, however, is the one from 1925 that goes back to the old Prussian definition from the 1830s (Goldschmidt, 1925).

considerable: The smallest vineyard up for auction measured only 0.01 hectares, whereas the largest covered 8.66 hectares. One auction lot could consist of just one single parcel, or of up to 36 often dispersed parts. Moreover, the rent as well as the estimated value was given for the entire lot. All prices have been divided by the size of the property and prices have been calculated per square metre (m^2).

Besides the description of the property, the data source provides the name of the former proprietor, i.e. the name of the expropriated clerical owner or nobleman, as well as the name of the former renter. A dummy variable is used for clerical property in order to consider the common hypothesis that the predominantly Catholic population was reluctant to buy expropriated Church land. If the hypothesis holds, Church vineyards must have been rather inexpensive. Another dummy variable shows whether or not the buyer was also the former renter of the same vineyard. If the buyer was a former renter, his or her information level could be higher, resulting in a more realistic assessment of the vineyard's value. However, there might be some emotional attachment to the property that would distort such clear economic reasoning. Thus, the relationship of this variable to the purchase price is unclear *a priori*.

The buyers of the vineyards are given by their name, place of residence and occupation. In total, 76 occupational groups were distinguished. However, only 24 of them bought vineyards.

In our dataset, the category of merchants is made up of wholesalers (*négociants*) and retailers (*marchands*). This classification does not allow a distinction according to their size, and both expressions were often used synonymously. In addition, all members of both groups were realtors i.e., professional property brokers. They also represent the vast majority of realtors within the sample.[9] The "broker" variable thus includes wholesalers and retailers.

Similar definition problems are to be found with the occupational groups *vigneron* (vintner), *cultivateur* (rich farmer) and *laboureur* (poor peasant). Since most vintners were farmers, too, and *vice versa* (Müller,

[9].The group of 35 realtors in the Saar Department is made up of wholesalers, retailers, one physician and one architect (Clemens, 1995).

1980), a clear-cut distinction between the three professions cannot be drawn. Moreover, the distinction between *cultivateur* and *laboureur* was problematic as well, since it did not allow the researcher to draw any conclusions regarding social status. Whether and to what extent *cultivateur* and *laboureur* were perfect synonyms remains unclear. Given the uncertainties in these definitions, the variables *vigneron*, *cultivateur*, and *laboureur* were analysed separately in one regression, as well as bundled together in a second regression by combining the vintner-farmer-peasant-complex into one "vintner" variable.

The occupations variable "retiree" is comprised of *rentier* and *propriétaire*. Both terms were used synonymously and denote wealthy citizens who live on their capital without any defined profession. Another compound group is "officials" which encompasses mayors (*maires*), auction excutives (*receveurs*), and secretaries (*secretaires*). The variable "notary" consists of notaries and attorneys (*notaires, avoués*). Further occupations are "baker" (*boulanger*), "brewer" (*brasseur*), "barkeeper" (*aubergist*), "physician" (*médecin*), "architect"(*architect*), and "others". "Others" includes butchers (*bouchers*), tanners (*tanneurs*), shoemakers (*cordonniers*), goldsmiths (*orfèvres*), blacksmiths (*maîtres de forges*), land surveyors (*arpenteurs*), joiners (*menusiers*), and fishermen (*pecheurs*). Each of those groups is denoted by a dummy variable.

An additional dummy variable, "brokered", was introduced to indicate whether the purchase of the vineyard was on behalf of somebody else or brokered by a third person.[10]

Often, lots were bought not by a single person but by a group of people (joint bid), e.g. lot 5267 was purchased by a group of five vintners. Within the entire data sample, the purchasing group size ranged from 1 to 11. This may indicate that bidders colluded in "rings". A ring is a group

[10] There were basically four possibilities of buying a vineyard at the auctions: (1) the property was bought by auction directly; (2) the property was bought by a realtor on behalf of the actual buyer; (3) a realtor bought the property without being registered as the new owner (and without paying the respective taxes): instead, he had to present a real buyer within a certain period of time; (4) a realtor bought the property and was registered as the buyer. He was the owner and could resell the property on the secondary market or could return it to the national property administration by paying a penalty (Clemens, 1995, pp. 94).

of bidders who agree to re-auction the item they purchase among themselves, dividing the profit among the ring members (Graham and Marshall, 1987). When the coalition contains the two bidders with the highest valuation of the object, the ring can realize a gain. However, this assumes a private-value auction. For common-value auctions one can assume that the combined knowledge of several people allows bidders to sharpen their estimate of the value of the object. That could lead to cautious bidding behaviour and lower prices. On the other hand, the shared risk could also lead to an underestimation of the financial risks and burden, and may lead to incautious bidding. Krishna and Morgan (1997) demonstrated that, by pooling information, the bidders may bid more aggressively, resulting in higher prices. To capture this effect, the size of the purchasing group was included.

Since the auctions took place between the spring of 1803 and the summer of 1808, the bidding behaviour was not assumed to remain the same over the entire time period. With the unleashed wine market conveying increasingly numerous price signals, potential bidders got more information over time. Consequently, as their estimate got closer to the true value of the lot, bids could have adjusted and the net present value could have increased the later a vineyard was bought.[11] However, there might be other forces working, such as risk aversion and quantity constraints that could lead to increasing bids over time. Therefore a time variable which denotes the number of the months beginning with June 1803 has been included.

4. Net present value results for vineyard auction purchases

First, a simple grouping of the data by occupation reveals some interesting results. *Table 4* reports the characteristics of items bought,

[11] This is not to be confused with price anomalies described by Ashenfelter (1989, 1992), which also lead to decreasing prices over time. At wine and art auctions, where identical lots are for sale, the winner of the first bid had the right to buy all other lots at his price too. That made risk-averse bidders bid more for the first lots rather than risk not getting any item. Thus bids declined over time. At condominium auctions, the first buyers had the right to choose among almost identical apartments which gives earlier bids an additional value. In auctions considered here, these rights did not exist.

analysed according to the occupation of the buyer. Brokers, vintners and retirees are the dominant buyers: they account for more than half of all successful bids.[12] When the size of the lots is taken into account, brokers alone account for about half the total vineyard area sold. In contrast, vintners rank sixth when the area is considered. That is due to the average vineyard size bought at auctions. The size of lots bought by barkeepers (2.90), brewers (1.90), bakers (1.61), retirees (1.43) and brokers (1.42) was significantly above the average of 0.92 ha/lot. Vintners (0.42), officials (0.50) and others (0.29) apparently bought lots that were considerably smaller. Moreover, vintners not only tended to buy very small lots, but also lots consisting of many parts. The vintners' average of 8.57 parts per lot, or a weighted average of 13.11 parts per lot, is about 100% above the average for the entire sample. Vintners focused on buying extremely small and dispersed vineyards. As a result, an average size per parcel of land of 0.05 ha for vintners is the smallest in the sample. In contrast, parts bought by brokers averaged 0.28 ha, retirees averaged 0.72 ha, and barkeepers bought large parcels of land that averaged 1.45 ha.

The weighted average size of a winning group[13] is given in the last column of *Table 4*. The range lies between 1 and 2.5. Inferring wealth from occupation, it may be stated that affluent physicians, architects and attorneys did not bid in large groups, whereas barkeepers and others did. Since coalition building can alleviate budget constraints, this is not surprising (Cho, Jewel, and Vohra, 1998). However, the below-average group size of presumably poor vintners and the large group size of rich retirees does not fit that pattern.

Table 5 shows that brokers and attorneys also paid the highest price per square metre, whereas architects and barkeepers purchased inexpensive vineyards. The combination of large areas and high prices made brokers the "big spenders" at vineyard auctions. They accounted for approximately two third of all expenditures: 130,000 francs. High prices are not, however, necessarily associated with high quality as shown in column 5 of *Table 5*. The average value of a vineyard bought by

[12] Note that since lots were often bought by a group of people, the sum of lots bought by occupation is higher than the total number.
[13] According to the size of the lots bought.

brokers is only slightly above the average of 92.5 francs/1000 litres. Barkeepers and retirees owned primarily inferior vineyard land, while vineyards bought by vintners were appreciated most according to the 1808 price table.

The net present value (NPV), that is the profitability of the vineyards, was calculated retroactively by referring to the price paid and the value of the property, as defined in the classification of 1808. The NPV assumes an infinite physical life of the vineyard, refers to the base year 1803 and is computed as:

$$NPV_j = \left[\frac{Y_j}{i} - \sum_{t=1}^{\tau} \frac{Y_{jt}}{(1+i)^t} \right] - \frac{I_{jt}}{(1+i)^t} \qquad [1]$$

where Y_j is the annual yield, i.e. the rent wine price, of vineyard j. I is the investment cost, i.e. the purchasing price, t is a monthly time variable starting with 1 in with January 1803, and τ is the date of the purchase (also measured in months).

For instance, suppose an item bought for 50 centimes per square metre in January 1804, i.e. one year after the base year, yields annual revenues of 10 centimes according to the 1808 classification. Assuming an annual discount rate of 10 percent, the discounted lifetime revenue of this item will be 100 centimes (10/0.1) minus the 9.09 centimes foregone in 1803 (10/1.1). Given the discounted investment of 45.45 centimes, the 1803 net discounted value of the item was 45.46 centimes per square metre.

For this study the rent wine prices, i.e. the annual yields, were converted from francs per litre into francs per hectare. According to Hoppmann and Hüster (1993), it is assumed that the specific yield at the beginning of the nineteenth century was about a fourth of the average present amount of 100 hectolitres/ha (hl/ha), that is 25 hl/ha. This value was viewed as an average and was held constant. Wine prices were also assumed to be constant even though this may appear unrealistic, given the considerable vintage fluctuations. However, since the fixed rent wine prices are perennial averages, this assumption seems to be justified. For the sake of simplicity, it was further assumed that there were no variable costs. The depreciation time of the land was assumed to be infinite.

The purchase cost per month was discounted since the date of the investment also determines its profitability. Because harvest is a distinct event (once a year) with no monthly yield, the entire yield for the first year after the purchase was considered only if the vineyard was bought before 1 October[14].

Computed net present values show a considerable range and are often negative. The last column of *Table 5* shows the NPV per occupational group, assuming a discount rate of 10%. Firstly, it is surprising that the purchase of vineyards at auctions seems to be a bad investment: considering all purchases, the overall NPV is -3.7 centimes per square metre. Accounting for labour and other variable costs, this number may drop even lower. The high prices that auction bidders paid suggest the presence of the 'winner's curse.' It is even more astounding that brokers, the most experienced bidders, achieved an NPV of only -14.1 centimes per square metre – by far the worst NPV of all occupational groups. On the other hand, architects, physicians and barkeepers seemed to have made good bargains. The performance of vintners – with an NPV of 6.1 centimes per square metre – was slightly above the average.

5. Regression analysis: NPV determinants

Given that brokers bought about one third of all lots, spent about two thirds of the total expenses and yielded by far the worst NPV results, two questions arise. Is this outcome due to some systematic pattern? What explains the NPV range?

Apparently, there must have been some information asymmetries among buyers. In order to evaluate the influence of different determinants on the NPV value a simple hedonic approach was adopted in which the three groups of variables were distinguished: technical variables, intrinsic value variables and a time variable.

Firstly, a group of technical variables that characterise the lots' traits, such as size and number of parcels ("parts"), was defined. In addition,

[14] Because of the prevailing mixed plantation of late-ripening Riesling and early Kleinberger the harvest was finished by late September.

the size of the purchasing group, if there was a joint bid, and dummy variables for brokered land and prior church land were included. Since only a few bidders had the financial capacity to purchase large lots, discounts for large parcels and, therefore, a positive relationship between the size variable and NPV could be expected. The opposite is assumed with respect to the variable "parts". In the absence of machines and economies of scale, fragmented lots alleviated the division and appeared to be an economic advantage. Thus, the relationship between "parts" and the NPV is assumed to be negative. As for the other expected relationships between the NPV and the other variables, see Section III.

The variables that determine the intrinsic value of the land were reflected by proxy variables such as latitude, orientation, slope, proximity to a major water body, frost hazard and humidity (e.g. Gladstones, 1992; Ashenfelter and Storchmann, 2006). The relationship between these variables and the intrinsic land value is not directly observable. One would need expert knowledge regarding these characteristics to assess the future profitability of a vineyard. Thus, dummy variables for each vocational group were included in order to quantify their respective expertise.

In order to account for improving information and learning over time, from the first auction in 1803 until the last one in 1811, a time variable was included. Equation [2] summarises this approach:

$$NPV_i = \alpha_0 + \sum_j \beta_j VINEYARD_i + \sum_k \gamma_k BUYER_i + \delta t_i + \varepsilon_i \qquad \textbf{[2]}$$

where NPV_i denotes the net present value of vineyard i, $VINEYARD_i$ stands for the technical characteristics of vineyard i, $BUYER$ denotes a vector representing the information level of the buyer regarding the intrinsic value of the vineyard land, variable t depicts the time variable, and ε is the stochastic error term.

Equation **[2]** was estimated for different discount rates ranging from 5 percent to 20 percent. The results are given in *Table 6* (separately for *vignerons*, *cultivateurs*, and *laboureurs)* and in *Table 7* (for all *vintners),* respectively. Firstly, the tables show that the results are relatively stable over all discount rates. Secondly, given that the results are cross-section

estimates, all equations have a sufficient goodness to fit ranging from 50 percent to 62 percent. Thirdly, the NPV variability is predominantly due to the technical characteristics of the property rather than to those of the buyers. Fragmentation of a lot into many small parts appears to lessen the value of the investment significantly. The significance is above the 2 percent level at all discount rates. The same is true for smaller properties. However, the results of the specification reported in *Table 7* show a lower significance. Apparently, a sizable property that is not easily dividable was less expensive. The estimates do not lend any support to the hypothesis that former Church vineyards were less expensive than comparable vineyards formerly owned by the nobility. The estimated coefficients for the "Church" variable are insignificant in all specifications.

Similarly to the "Church" variable, there is no indication that the "brokered" and "groupsize" variables matter in explaining NPV variations: both are insignificant. This suggests that brokered lots were not more expensive (compared to their 'true' quality) than non-brokered ones. In addition, the bidding behaviour did not change when people entered into joint bids.

Given that the market process between 1803 and 1811 discloses progressively more information about the vineyards 'true value', it may be assumed that a lot bought in 1810 is more likely to yield a high NPV than a lot bought in 1803. However, the insignificance of the "time" variable suggests that the decrease in risk was offset by an increase in prices over time. In other words, the gain in information was directly reflected in land values, which supports the efficient market hypothesis.

Assuming the characteristics of the lot as given, *Table 6* and *7* also report about the relevance of buyers' traits.[15] As expected, the estimates for most buyers' occupations are fairly insignificant, indicating a common state of ignorance about the intrinsic land value. There are, however, some major exceptions. The dummy variables for *vignerons* and *laboureurs* have a significantly positive influence on the property's NPV. The same is true for *cultivateurs* – although with lower significance. This suggests that,

[15] The regression results refer to the variable "others", which was omitted from the equation.

holding technical traits of the lot constant, these groups clearly knew much more about the intrinsic land value than others did. Nevertheless, this result has to be treated with caution for two reasons. As mentioned above, *vignerons*, *cultivateurs* and *laboureurs* are not easily distinguishable. In addition, there are 12 *laboureurs* in the sample, but only one *vigneron* and one *cultivateur*. In order to have an alternative measure, these three wine-related professions have been merged into one variable called "vintners". The estimates as given in *Table 7* suggest that the overall results are basically the same, although at a slightly lower significance level.

The opposite is true for notaries and brokers: in *Table 6*, as well as in *Table 7*, we see a negative relationship between these occupational groups and the NPV. However, their significance level is very low, and at best reaches the 7 percent level. This may suggest that notaries and brokers had overly optimistic expectations regarding the potential land values and paid prices that were in excess of the vineyard market value. Since it is not to be expected that brokers and notaries had below average information, there are two possible explanations for this result: firstly, brokers and notaries tended to fall prey to the "winner's curse" more often than other groups or, secondly, the auction was not a pure common-value auction, but contained some private elements.

Besides vintners (positive), brokers and notaries (both negative with lower significance), no other profession significantly influences the NPV of the lots bought.[16] The information level among other bidders appears to be indistinguishable. It turns out that not even the former renters of the property could take advantage of additional information with respect to their vineyard. Apparently, the emotional ties to the property, as well as the lack of interregional comparability, keep the former renter from a rational economic decision.

These results raise the following questions:

- Why could vintners not take advantage of their apparently superior information level?

- Given their bad performance, as shown in *Tables 5, 6* and *7*, why were brokers able to stay in business?

[16] Architects show some significant results in Table 7. However, given that only two lots were bought by architects, this can be neglected.

It seems as though vintners were suffering from significant budget constraints. By looking at the average expenditure per lot in *Table 5*, we see that vintners spent less than 1000 francs per winning bid, or approximately a third of the overall average. In contrast, brokers spent 5600 francs per lot. Apparently, vintners did not take advantage of the possibility of joint bidding to alleviate their constraints. As shown by the correlation matrix in *Table 8*, the correlation between the vintner occupation and the size of the bidding (winning) group is positive but very small (0.04). *Table 8* reveals some other characteristics of vintners' buying behaviour: as explained above, vintners purchased small and fragmented vineyards. Thus, "vintner" was correlated negatively with the variable "size" and positively with "parts". Moreover, the negative correlation between "vintner" and "church" indicates that vintners apparently tried to avoid expropriated Church land in favour of more expensive nobility land. Although there was no relationship between the NPV and the date of the purchase, vintners were among the first who bought land at auctions as indicated by the negative correlation between "vintner" and "time".

Table 8 also shows that brokers and retirees, i.e. the wealthier part of the bidders, tended to buy later as indicated by the positive correlation with the time variable. More important, brokers were focused on less-fragmented large properties which were owned by the Church. These points help to reduce the lack of information, but cannot explain how brokers could maintain a sustainable business.

Brokers bought vineyards and other properties mainly to resell them. In order to attract buyers with budget constraints, large entities were broken up into smaller pieces and then put to secondary auctions. In doing so, brokers realized a considerable profit margin. According to Clemens (1995), brokers in the Saar Department attained an average profit of 38.4 percent by reselling the lots (including non-vineyard land and buildings) they had acquired at auctions.

The value of a vineyard may have been somewhat different to a broker than it was to someone else. Thus, that might shed some doubt on the assumption of a pure common-value auction, and assuming an 'almost common value auction', which includes some private value

elements (Klemperer, 1997), may be a more appropriate assertion. Accordingly, since the value of the lot is higher to brokers, they will bid more aggressively and that will increase the risk of the winner's curse for other bidders. This will make other bidders bid more cautiously and, therefore, reduce the (pseudo-) winner's curse for brokers. Therefore, even a negative NPV could have meant good news for the brokers, since they won the auction and could resell the item profitably. However, the option to resell a vineyard was not open only to brokers; anybody could do so. Whether there were some private value elements for brokers, therefore, depends on their access to secondary markets. Although this analysis cannot provide an exhaustive answer to the question, it is to be assumed that brokers could benefit from their experience and their contacts.

Brokers, however, were able to auction off only a fraction of the property they bought. According to Clemens (1995), the twenty most important brokers of the Saar Department resold 25 percent of their lots (including non-vineyard land and buildings); in terms of value, 35 percent were resold. Since partial sales are not included in these numbers, this is certainly the lower limit; hence, the actual number of resold vineyards may be somewhat higher. For the Trier Arrondissement , which was part of the Saar Department, Müller (1980) calculated that approximately 40 percent of all vineyards were resold.

The French authorities granted every buyer the right to return a lot bought at the auctions at a penalty of 10 percent of the purchase price, which effectively limited the maximum loss that a buyer could incur. As a result, a large fraction of all properties bought at auctions were returned – the vast majority by brokers (Schieder and Kube, 1987).[17] According to Clemens (1995), brokers in the Saar Department returned approximately 20 percent of the lots they bought. Within our sample, we can confirm 11 vineyards (15 percent) that were returned. Thus the maximum loss was limited. Given that only profitable vineyards were resold and that vineyards which turned out to be a bad buy were returned, the economic success of brokers was guaranteed.

[17] Note that the possibility of returning an auction lot was open to everybody.

6. Conclusion

This paper analyses the investment behaviour in a changing wine market at the beginning of the nineteenth century. Firstly, technological advances, such as the increasing use of cork-sealed bottles, enabled vintners to produce 'vintage wines' from distinct vineyards. Secondly, the French occupation of the Mosel valley in 1794 and the subsequent secularisation resulted in major changes in the wine market. More than a third of all Mosel vineyards were expropriated by the Napoleonic administration and were put to auction, beginning in 1803. During that time, the wine market experienced a significant liberalisation. In 1804, the French administration published the first 10-step classification of all vineyards within the then Saar Department according to market prices. Due to a rapidly changing market, this classification was updated and revised significantly in 1808. This classification, which provides wine prices by vineyard, was referred to as the "true market price" benchmark. Taking these income streams and subtracting the initial investment cost yields the NPV of a vineyard bought at the auctions.

This analysis examines whether the NPV value is affected by characteristics of the property or of the buyer. In particular, it considers whether the occupation of the buyer allowed him to anticipate future market prices correctly or not. The determinants of the net present values of 72 vineyards were studied for this purpose.

It is shown that technical attributes of the lot strongly influenced the profitability of a purchase. Large and less-subdivided properties were not as expensive as small and largely-fragmented parcels. There was no evidence that prices of vineyards formerly owned by the Church were lower than prices of vineyards owned by the nobility.

With respect to possible information asymmetries among the occupational groups, the analysis suggests that wine-related professions, i.e. insiders, had a significant information advantage. Other occupational groups seem to have no specific knowledge about the vineyard quality, which is an indication of a perfect market: there is no expert except the insider. Vintners could not, however, take advantage of their expert knowledge – presumably due to financial constraints. On the other hand,

professional brokers tended to overestimate the potential value of vineyards. On average, the NPV of all broker-bought vineyards was approximately -14 percent. However, brokers still realized substantial gains. They acquired larger properties, broke them up into many small parts and re-sold them at secondary auctions. The auction rules alleviated the risk for brokers: if a purchased lot turned out to be not marketable, it could simply be returned for a penalty fee.

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Appendix

Asymmetric Information and Markets in Transition:
Vineyard Auctions in the Mosel Valley
after the French Revolution

TABLE 1. Changes in rent and appraisal of select vineyards (1803-1808)

	Size (in ha)	First rent	Last rent when sold	First appraisal (in centimes per square metre)	Last appraisal	Adjustment of appraisal (in %)
Pommern	0.07	3.14	0.29	62.86	5.71	-90.9%
Karden	0.31	1.29	0.32	25.81	7.10	-72.5%
Lieser	0.23	5.22	0.17	57.39	3.48	-93.9%
Rachtig	0.51	3.63	0.78	54.12	15.69	-71.0%
Mertesdorf	0.74	0.97	0.34	10.70	6.76	-36.8%

Source: Schieder (1991).

TABLE 2. French ranking of vineyards in the Saar Department in 1808
(by village and repurchase price)

Rank	Name of village	Repurchase price in francs/1000 litres
1	Brauneberg	146 (172)
2	Ferres, Graach, Piesport, Wehlen, Zeltingen	128 (150)
3	Bernkastel, Erden (2), Grünhaus, Müstert, Oberemmel, Reinsport	119 (140)
4	Casel, Cröf, Cues, Filzen/Mosel (7), Kesten (3), Kinheim, Kindel, Lösenich (2), Lieser, Machern (2), Mehring (5), Minheim (3), Monzel (5), Mülheim, Neumagen, Niederemmel (3), Ockfen, Dhron, Uerzig, Wintrich	110 (129)
5	Awelsbach (6), Conz, Eitelsbach, Neudorf (7), Staadt (4), Waldrach, Wolff (4), Olewig (6), Reil (6), Mertesdorf (6), Osann (7), Fell (8), Fasterau (8)	101 (118)
6	Ayl, Biebelhausen, Burgen, Castel, Clüsserath (7), Crutweiler, Detzem, Köwerich (7) Kewenich, Irsch/Saar, Leiwen (8), Longuich (7), Mahring, Pölich (7), Rachtig, Schweich (7), St. Matthias (4), Thörnich, Trittenheim (5), Veldenz	92 (107)
7	Comlingen, Ensch, Hamm, Helfand, Hupperath (10), Lörsch, Longen, Merzlich, Nennig, Niederleuken, Olkenbach (10), Pfalzel, Pichter, Wawern, Wies, Trier	82 (96)
8	Beurig, Feyen, Kürenz, Löwenbrück, Niedermennig, Palzem, Perl, Platten (7), Rölingen, Sendorf, Schleich, Hl. Kreuz	74 (86)
9	Andel, Bekond, Ehrang, Euren, Feilz, Hetzerath, Issel, Irsch/Olewig, Kenn, Kernscheid, Luxem, Monaise, Metzdorf, Oberkirch, Niederkirch, Pallien, Pellingen, Plein, Rivenich, Riol, Ruwer, Wittlich, Zewen	64 (75)
10	Bausendorf, Bengel, Bergweiler, Korlingen, Drees, Flußbach, Springirsbach	55 (64)

Source: Prefekt des Saar-Departments (1808) and Hegner (1905). Ranking and prices of 1804 in parenthesis

TABLE 3. Vineyard definition 1802, 1925 and 1981

Year	Definition	Total vineyard area (in ha)	Average vineyard size (in ha)
1802	123 villages	3,053	24.8
1925	4550 vineyard sites	6,800	1.5
1981	523 vineyard sites	12,671	24.2

Source: Own calculation according to Zegowitz, 1802, Goldschmidt, 1925, and Stöhr et al., 1981

TABLE 4. Characteristics of vineyards bought by occupation

	Lots bought	Total area (ha)	Average size (ha)	Parts per lot	Parts per lot weighted(c)	Size per part (ha)	Group size weighted(c)
Broker(a)	23	32.55	1.42	5.04	5.79	0.28	1.52
Vintner(b)	14	6.58	0.47	8.57	13.11	0.05	1.36
Retiree(c)	11	15.73	1.43	2.00	2.70	0.72	2.37
Attorney(d)	6	6.48	1.08	2.00	1.85	0.54	1.08
Official(e)	5	2.52	0.50	2.00	2.95	0.25	1.60
Baker	5	8.04	1.61	3.20	3.56	0.50	1.90
Brewer	5	9.48	1.90	2.20	3.08	0.86	1.63
Barkeeper/Hotelier	4	11.60	2.90	2.00	1.49	1.45	2.58
Physician	3	3.58	1.19	3.00	3.07	0.40	1.00
Architect	2	1.61	0.81	2.00	2.74	0.40	1.00
Other(f)	7	2.05	0.29	4.00	8.17	0.06	1.85
ALL	72	66.26	0.92	4.35	5.35	0.21	1.82

(a) incl. négociant (wholesaler), marchand (retailer); (b) incl. vigneron (vintner), cultivateur (farmer), laboureur (peasant), (c) incl. propriétaire, rentier (wealthy retirees); (d) incl. notaire (notary), avoué (attorney); (e) incl. receveur (auction executive), maire (mayor), secretaire (secretary); (f) incl. arpenteur (land surveyor), boucher (butcher), cordonnier (shoemaker), maître de forges (blacksmith), menuisier (joiner), orfèvre (goldsmith), pêcheur (fisherman), tanneur (tanner). (c) weighted by vineyard size.

TABLE 5. Prices, expenses and returns by occupation

	Expenses per lot in 1000 francs	Total expenses in 1000 francs	Price paid in centimes/ sq. m (weighted avg)(a)	Value in 1808 Rentwine price francs/ 1000 litres	NPV at r=10% centimes/ sq. m (weighted avg)(a)
Broker	5.60	128.9	39.6	94.9	-14.1
Vintner	0.91	12.7	19.3	98.8	6.1
Retiree	1.13	12.4	7.9	75.8	11.8
Attorney	4.18	25.1	38.7	82.7	-11.1
Official	0.63	3.1	12.4	86.4	8.7
Baker	2.24	11.2	13.9	82.9	8.4
Brewer	2.02	10.1	10.7	92.4	11.9
Barkeeper/Hotelier	2.15	8.6	7.4	78.2	12.4
Physician	0.93	2.8	7.9	89.4	12.2
Architect	0.45	0.9	5.7	98.5	17.8
Other	0.92	6.5	31.6	81.7	-9.3
ALL	2.58	185.5	28.0	92.5	-3.7

(a) weighted by vineyard size

TABLE 6. Net present values of vineyards and their determinants distinguishing *vignerons*, *cultivateurs*, and *laboureurs*

Independent variables	5%	10%	15%	20%
Broker	-0.12	-0.13	-0.13	-0.11
	(-1.39)	(-1.56)	(-1.58)	(-1.57)
Vigneron	1.56**	1.48**	1.44**	1.43*
	(2.66)	(2.52)	(2.46)	(2.37)
Cultivateur	0.50*	0.50*	0.50*	0.51*
	(1.85)	(1.86)	(1.86)	(1.82)
Laboureur	0.28**	0.28**	0.28**	0.28*
	(2.35)	(2.42)	(2.45)	(2.36)
Retiree	0.11	0.10	0.09	0.09
	(1.42)	(1.41)	(1.34)	(1.29)
Brewer	0.08	0.06	0.06	0.09
	(0.83)	(0.58)	(0.52)	(0.77)
Baker	0.14	0.14	0.15	0.14
	(1.12)	(1.27)	(1.34)	(1.26)
Official	0.03	0.05	0.07	0.06
	(0.29)	(0.61)	(0.72)	(0.80)
Barkeeper	-0.16	-0.13	-0.11	-0.11
	(-1.00)	(-1.12)	(-0.98)	(-1.04)
Notary	-0.29*	-0.24*	-0.19	-0.17
	(-2.00)	(-1.73)	(-1.56)	(-1.45)
Physician	0.02	0.04	0.05	0.05
	(0.25)	(0.51)	(0.67)	(0.67)
Architect	0.08	0.08	0.08*	0.07
	(1.14)	(1.58)	(1.70)	(1.50)
Prior renter	-0.02	-0.02	-0.02	-0.03
	(-0.19)	(-0.25)	(-0.23)	(-0.29)
Brokered	0.14	0.13	0.13	0.13
	(1.18)	(1.11)	(1.08)	(1.07)
Church	0.29	0.32	0.33	0.33
	(1.35)	(1.48)	(1.54)	(1.52)
Log(Size)	0.09**	0.08**	0.08**	0.07**
	(2.89)	(2.83)	(2.73)	(2.55)
Parts	-0.05**	-0.05**	-0.05**	-0.05**
	(-2.80)	(-2.81)	(-2.78)	(-2.67)
Group size	-0.01	-0.00	0.00	0.00
	(-0.16)	(-0.04)	(0.10)	(0.06)
Time	-0.00	-0.00	0.00	-0.00
	(-0.94)	(-0.07)	(0.42)	(-0.04)
Constant	0.18	-0.11	-0.21	-0.23
	(0.86)	(-0.51)	(-1.00)	(-1.09)
R-squared	0.581	0.601	0.611	0.606
Adj. R-squared	0.428	0.456	0.469	0.462
S.E. of regression	0.290	0.282	0.273	0.271
White's Test (a)	54.71	56.84	59.86	64.12

Own calculations. Significance: **=2%, *=5%.*=10% (a) White's test without cross terms; the critical value of χ^2 (23) at 1% level is 41.6. Heteroscedasticity consistent t-values in parentheses

TABLE 7. Net present values of vineyards and their determinants aggregating all wine-related occupations

Independent variables	5%	10%	15%	20%
Broker	-0.14	-0.15*	-0.15*	-0.14*
	(-1.65)	(-1.80)	(-1.81)	(-1.79)
Vintner	0.32*	0.32*	0.32*	0.32*
	(2.05)	(2.10)	(2.13)	(2.06)
Retiree	0.12*	0.11*	0.10	0.10
	(1.75)	(1.73)	(1.66)	(1.62)
Brewer	0.11	0.09	0.08	0.11
	(0.97)	(0.73)	(0.67)	(0.88)
Baker	0.17	0.17	0.17	0.16
	(1.13)	(1.29)	(1.35)	(1.27)
Official	0.07	0.09	0.10	0.10
	(0.78)	(1.16)	(1.30)	(1.40)
Barkeeper	-0.12	-0.09	-0.07	-0.07
	(-1.10)	(-0.87)	(-0.73)	(-0.76)
Notary	-0.28*	-0.23	-0.18	-0.15
	(-1.91)	(-1.66)	(-1.48)	(-1.36)
Physician	0.04	0.06	0.07	0.07
	(0.52)	(0.79)	(0.95)	(0.94)
Architect	0.10	0.11+	0.11*	0.09+
	(1.57)	(2.00)	(2.10)	(1.88)
Prior renter	-0.00	-0.00	-0.00	-0.01
	(-0.02)	(-0.03)	(-0.02)	(-0.08)
Brokered	0.06	0.05	0.05	0.05
	(0.66)	(0.60)	(0.57)	(0.57)
Church	0.32	0.35	0.35	0.36
	(1.24)	(1.36)	(1.41)	(1.40)
Log(Size)	0.08**	0.08**	0.07**	0.06*
	(2.55)	(2.53)	(2.44)	(2.25)
Parts	-0.04+	-0.04*	-0.04*	-0.04*
	(-1.94)	(-2.05)	(-2.07)	(-2.02)
Group size	0.02	0.03	0.03	0.03
	(0.58)	(0.73)	(0.78)	(0.74)
Time	-0.00	0.00	0.00	0.00
	(-0.80)	(0.11)	(0.64)	(0.15)
Constant	0.05	-0.22	-0.31	-0.34
	(0.19)	(-0.80)	(-1.17)	(-1.23)
R-squared	0.492	0.522	0.535	0.527
Adj. R-squared	0.332	0.372	0.388	0.379
S.E. of regression	0.312	0.303	0.293	0.291
White's Test (°)	50.39	50.27	50.83	50.89

Own calculations. Significance: **=2%, *=5%, +=10% (°) White's test without cross terms; the critical value of χ^2 (23) at 1% level is 41.6. Heteroscedasticity consistent t-values in parentheses

TABLE 8. Correlation coefficients for net present value equation variables

	Broker	Vintner	Retiree	Brewer	Baker	Official	Barkeeper	Attorney	Physician	Architect	Other	Prior Renter	Brokered	Church	Size	Parts	Group Size	Time
Broker	1.00																	
Vintner	-0.34	1.00																
Retiree	0.07	-0.20	1.00															
Brewer	-0.07	-0.13	-0.11	1.00														
Baker	0.22	-0.15	0.17	0.12	1.00													
Official	-0.07	0.00	-0.11	-0.07	-0.08	1.00												
Barkeeper	0.09	-0.12	0.25	-0.07	0.15	-0.07	1.00											
Attorney	-0.10	-0.15	0.02	-0.08	-0.09	-0.08	-0.07	1.00										
Physician	-0.14	-0.10	-0.08	-0.06	-0.06	-0.06	-0.05	-0.06	1.00									
Architect	-0.12	-0.08	-0.07	-0.05	-0.05	-0.05	-0.04	-0.05	-0.04	1.00								
Other	-0.21	-0.02	-0.12	-0.08	-0.09	-0.08	-0.07	-0.09	-0.06	-0.05	1.00							
Prior Renter	-0.02	-0.04	0.00	-0.09	-0.10	0.09	-0.08	-0.10	-0.07	-0.06	0.07	1.00						
Brokered	0.14	0.08	0.17	-0.15	0.08	0.12	0.16	-0.16	-0.11	-0.09	-0.16	0.05	1.00					
Church	0.15	-0.16	0.01	-0.08	-0.21	-0.08	0.09	-0.05	0.07	0.06	0.11	-0.03	0.08	1.00				
Size	0.25	-0.17	0.19	0.20	-0.11	-0.09	0.36	0.04	0.04	-0.01	-0.14	-0.02	0.15	0.03	1.00			
Parts	0.08	0.33	-0.10	-0.09	-0.07	-0.10	-0.09	-0.11	-0.04	-0.06	0.04	-0.10	0.09	-0.06	0.11	1.00		
Group size	-0.00	0.04	0.08	-0.07	0.03	-0.03	0.04	-0.01	-0.08	-0.06	0.03	0.01	0.35	0.03	0.15	0.18	1.00	
Time	0.16	-0.12	0.32	-0.19	0.00	-0.06	0.10	0.04	-0.21	-0.07	0.21	-0.05	0.17	0.21	0.07	-0.17	0.07	1.00

Source: Own calculations