Padua 2017 Abstract Submission

I want to submit an abstract for:
Conference Presentation

Corresponding Author
Britta Niklas

E-Mail
britta.niklas@rub.de

Affiliation
Ruhr-University Bochum

Co-Author/s

Name	E-Mail	Affiliation
Wolfram Rinke	Wolfram.Rinke@fh-burgenland.at	Fachhochschule Burgenland

Keywords
hedonic pricing model, Wine pricing, Climate, Articial Neural Network (ANN) Models

Research Question
What is the impact of weather changes on wine prices of German wines?

Methods
Hedonic pricing model, cluster analysis, artificial neural network models, dependency matrix

Results
The preliminary results support previous concepts found in literature, but also shows that a simple equation does not exist to describe the observed price finding strategy.

Abstract
As the relationship between weather and wine is very close, annual weather changes have a particular impact on wine production, the quality of fine wines and on their prices (Ashenfelter 2008). A growing number of studies on the impact of weather changes on wine quality and wine prices prove that this is an appealing and important topic for economic analysis (Ashenfelter, Storchmann 2016). Most of the studies use either time series data or cross section data in order to identify this impact. Ashenfelter (1986, 1987a, 1987b, 1990), Ashenfelter; Ashmore; Lalond (1995) and Ashenfelter (2008) focus on Bordeaux Grand Cru and explain the variation in auction prices by applying age and weather indicators as explanatory variables. The cross sectional model ("Bordeaux equation") shows a positive effect of temperature increases on Bordeaux wine prices, and weather (temperature, rainfall) accounts in the 2008 model for over 60% of the price variation (Storchmann 2012). Jones and Storchmann (2001) estimate cross sectional equations of 21 selected premier cru chateaus by first determining the impact of weather on acid and sugar level and then running the price equations. They confirm the positive effect of raising temperatures on prices of Bordeaux Wines. Ginsburgh et al (2013) found in a cross section study of Médoc Wines that wine making practices are more important than weather variables, which constitute the second-most important factors. Haeger and Storchmann (2006) focus on Pinot Noir in California and Oregon and find significant impacts of growing temperature (quadratic) and of harvest and winter rain on price variations. In 2010 Ashenfelter and Storchmann (2010) show that results differ depending on the price sample (auction, retail and wholesale prices) with the strongest positive impacts of temperature on auction prices. Byron and Ashenfelter (1995) focus on Australien Grange and show that rising temperatures have a positive impact on prices while rain at harvest time and temperature differences have a negative impact. Wood and Anderson (2006) examine vintage variations for 3 Australian wines using auction prices and find a positive linear relation of growing temperatures and wine prices for 2 varieties and a quadratic positive relation for one variety. In a time series analysis (35 years) Ramirez (2008) analyses Napa Valley prices and sees that rain and temperature accounts for 45% of the price variation. In another long time series analysis (1800 to 2009) Chevet, Lecocq and Visser (2011) study prices and yields from a single

Grand Cru Chateau and confirm the positive impact of temperature. Storchmann (2005) proves in an analysis of the impact of weather on wine quality of Schloss Johannisberg for the years 1700 to 2003 that warming improves the quality of wine. Alston et al (2011) find that rising temperatures contribute to higher sugar levels, but that a change in production technologies has a much larger impact. Oczkowski 2016 uses a panel data set (66 regions, at least 3 vintages) and in a first stage determines the impact of weather on quality and then in a second stage the impact of quality on price and identifies winners and looser of temperature changes depending on the grape variety.

Most of the studies suggest that growing season temperature and harvest rainfall may have an important impact on wine prices. As the predicted temperature increase for european wine growing regions is essential (1.5 to 5 degrees (European Commission 2009, see Asthenfelter, Storchmann 2016)), Germany is not only an interesting study area but as well an important one, as Germany is the 10th biggest wine producer of the world, the 4th biggest consumer of wine, the largest wine importer and the seventh largest wine exporter of the world (Das deutsche Weinmagazin, 2015). Moreover there is only a restricted number of studies focusing on Germany.

We use a panel data set, as panel data is hardly employed in other studies, and also examine the impact of additional weather variables. The data set covers the vintages 1998 to 2013 for all 13 german wine regions and prices for 62 different grape varieties and 3 cuvées from 177 producers who were randomly sampled. Allover 17380 observations were included in the analysis. Price data (gate prices reported by wine producers) and data on additional control variables was obtained from Gault Millau Wine Guide. Daily weather data was provided by the German Weather Service from 13 local weather stations. Instead of taking data from one single weather station as recommended in the literature (Lecoque and Visser, 2006), data from different local weather stations was gathered as air temperature (min, max, average) and ground temperature, precipitation, hours of sunshine, humidity and days of frost vary tremendously in the different areas which are hence different in their suitability for grape growing (Ashenfelter, Storchmann 2010).

We developed a hedonic pricing model, based on the extended version of the Ricardian approach (Mendelsohn, Nordhaus, Shaw, 1994; Schlenker, Hanemann, Fisher, 2006, 2005; Deschenes and Greenstone, 2006; Ashenfelter and Storchmann, 2010) using a set of variables for weather changes and a set of control variables being visible for wine consumers such as the regional origin, the grape variety, the quality category of wine, the color (red, white), the level of alcohol and the age. We as well included Gault Millau scores in the analysis as some consumers may have gathered information on wine scores and a trend variable capturing inflationary trends.

As the quality wine categories of german wines (Quality Wine, Kabinett, Spätlese, Auslese, Beerenauslese, Eiswein, Trockenbeerenausles) are partly related to the sugar content at harvest, we developed different models to analyse the relationship between environmental parameters and final gate prices.

One model assumes a direct impact of weather variables (and the other control variables) on the price. We assume that weather characteristics of a year are reflected by the vintage on the label, and that vintages are known to be a “good vintage” or a “bad vintage”.

Another model assumes an indirect impact of weather variables on the price. Here we model in the first stage the impact of weather variables on wine quality and then use wine quality (and the other control variables) in the second stage in order to analyze the impact on the wine price.

The method used to analyze and model this huge dataset is based on different data mining algorithms. First we use a cluster analyses to identify potential clusters in this dataset. Secondly we assume the red and white wines follow different pricing principles. We assume that even each cluster follows a different pricing model, as an overall single pricing model is not successful from our observation.

We use artificial neural network (ANN) models to generate the functional model between environmental parameters and other marketing parameters in relation to gate prices. In a second step we calculate the dependency matrix (Rinke, 2015) for each model previously generated ANN model. The dependency matrix is a normalized accumulated Jacobi matrix over the observed data space. It represents the relative impact of independent variables on its dependent variables of a certain system, derived from a non-linear functional model of the observed system. The preliminary results support previous concepts found in literature, but also shows that a simple equation does not exist to describe the observed price finding strategy.