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World Market for French Wines**

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Income and Competition Effects on the World Market for French Wines

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Abstract

The price of wine grew at a fast rate between 2001 and 2010 and has since been stagnating. The period of growth may be explained by the rise in the demand from emerging markets and from richest people (the top 1% and 10%), while the stagnation may come from the entry of new varieties causing a crowding/competition effect on the market. We estimate the generalized model of ideal variety proposed by Hummels and Lugovskyy (2009) that combines these two elements and find support for this explanation. A 1% increases in GDP per-capita (income effect) generated an increase in price of 1.13% between 2001 and 2011. In contrast a 1% increase in market size (competition effect) reduced price by 1.10% over the same period. This paper also analyses these effects by considering exports of wine according to mode of transport and indirectly evaluates economies of scale in transport of wine exported by plane, boat and road.

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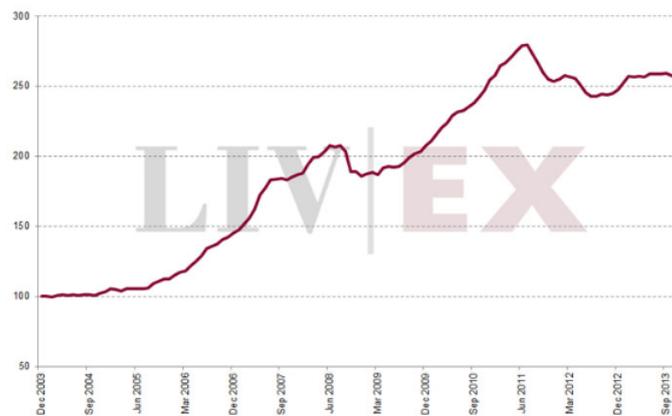
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1 Introduction

The price of wine has soared in recent years but since 2010 competition seems stronger thus dampening price increases. The index of the Fine Wine 1000, which represents 80% of the world market activity by value, multiplied by 2.5 between 2001 and 2010 and then stabilized (see Figure, 1) at around 4 billion dollars (Millar, 2014).

Figure 1: Liv-ex-1000 Wine index for famous wines in the world



The current paper proposes to use insight from the literature of international trade to analyse the wine market. The theoretical trade literature has emphasized demand-side determinants of trade that can be used to explain the period of growth as well as production-side determinants, such as pro-competitive effects which can explain the recent stagnation. In particular, the Generalized Model of Ideal Variety (hereafter GMIV), proposed by Hummels and Lugovskyy (2009) and based on Lancaster (1979, 1984) seems adequate to study these stylized facts.¹ Indeed, by

¹Models with non-homothetic preferences are also discussed. In international trade, non-homothety allows to better explain North-North trade and South-South trade and also reduce the difference between predicted and observable flows (the "missing trade" of Treffler, 1995). Non-homothety has been first presented as an important assumption to explain trade in food products (Hunter and Markusen, 1988) and more general results have been found latter by Hunter (1991) who shows that homothety leads to overestimate trade by 29%. From Cassing and Nishioka (2009) non-homothety allows to explain that developing countries consume relatively more labor- intensive goods than what is predicted with homogeneous preference. Bergstrand (1989) is the first to propose a gravity equation based on these preferences putting GDP per capita at the heart of its empirical investigation. See in particular Markusen (2013) for a survey of the literature calling for using non-homothetic preferences in order to restore the importance of income per-capita as

assuming that the compensation cost of not consuming the ideal variety depends on the level of consumption of this variety, Hummels and Lugovskyy (2009) propose a model in which the optimal choice of consumption is closer to the ideal when expenditures increase. As a result, when individuals become richer, the demand becomes more rigid and price increases. However, when incomes increase, the market size stimulates the entry of firms and fosters competition. Firms reduce markups and prices.²

Here we aim to demonstrate the relevance of Hummels' and Lugovskyy's (2009) model in wine economics. While the literature has not directly tested the GMIV model, many determinants such as the significance of demand has been emphasized. For instance Cevik and Sedik (2011) state that "global macroeconomic variables account for the bulk of the variation in fine wine prices" and Chevet, Lecocq and Visser (2011) point out that "the sky-high price paid for the 2009 vintage can in large part be attributed to increased wine demand from Asia (China in particular)". But such a claim is not investigated in details in Chevet et al. (2011) whose contribution is on the impact of weather conditions on historical price data.

Furthermore, this model introduces a crowding effect in the variety space that can matter in emerging markets where competition starts to be fierce. Here too, the literature has analyzed the rise of competition. In particular, Anderson and Aryal (2014) present data showing the rise of grapevines planted throughout the world between 2000 and 2010 that might fit the Lancasterian intuition.

Lastly, this model finds a natural application in wine economics where the hedonist approach (Griliches, 1961; Rosen, 1974) based on wine characteristics is widely

an explanation of international trade. See also Fieler (2010) which introduces non-homothetic preferences in the Ricardian model of Eaton and Kortum (2002). This article shows how a productivity shock in an emerging country (China) can modify consumption towards luxury goods and then favors partners with high-incomes (Japan, Hong-Kong, Singapore) while being detrimental for countries specialized in necessities goods such as textile (in Malaysia, Philippines and Thailand).

²Bekkers, Francois and Manchin (2013) generalize even more the GIMV by considering that the compensation function does not depend only on the consumption of the variety but on total consumption. Then they demonstrate that the elasticity of trade decreases with an Atkinson index of income inequality.

used. For instance to quote just a few contributions (from a wide-based literature³), Nerlove (1995) discusses the standard hedonic price equation to study preferences of Swedish wine consumers, Combris, Lecocq and Viser (1997) apply this method to Bordeaux wines in order to analyze the impact of sensory characteristics (provided by a jury under blind tasting conditions) on prices, and Roma, Di Martino and Perrone (2013) use this method to explain the price of Sicilian wines.

In comparison to this literature that distinguishes the importance of various characteristics mainly from the supply side,⁴ here we aim to analyze demand side effects. In particular we integrate income per-capita (and income of top 1% and 10%) by applying Hummels and Lugovskyy's (2009) methodology. We find that the own-price elasticity of demand is influenced by GDP per capita and importer GDP contrasting with standard results based on monopolistic competition with Constant Elasticity of Substitution (CES) preferences.⁵ The market size, approximated by importer GDP, has a negative effect on the price differential as well as the share of exportations revealing a competition effect on external markets for French producers.

The paper is divided into two parts. The first part deals with the reasons behind this study and some stylized facts about the rise of income and income per-capita in the recent period. The second part briefly surveys and extends the work of Hummels and Lugovskyy (2009) to analyse the effect of GDP and GDP per capita on exportation as seen through the GMIV and through trade economics more generally. The third part provides empirical results validating the GMIV. The last part

³See Cardebat and Figuet (2013) who provide a review of the hedonic approach applied to wine economics.

⁴Ashenfelter (2008) updates its "Bordeaux wines equation" where prices are explained by weather conditions, wine's age and expert judgments. See Storchmann (2011) for a survey on Ashenfelter's works and on recent developments in wine economics. Furthermore, by using data on endowments (e.g. soil qualities, weather conditions) as well as data on technologies (such as manual operations like picking and selecting grapes, the process of bottled wines etc), Gergaud and Ginsburgh (2008) succeed in discriminating between determinants of quality (by using instrumental variables) in favor of technology.

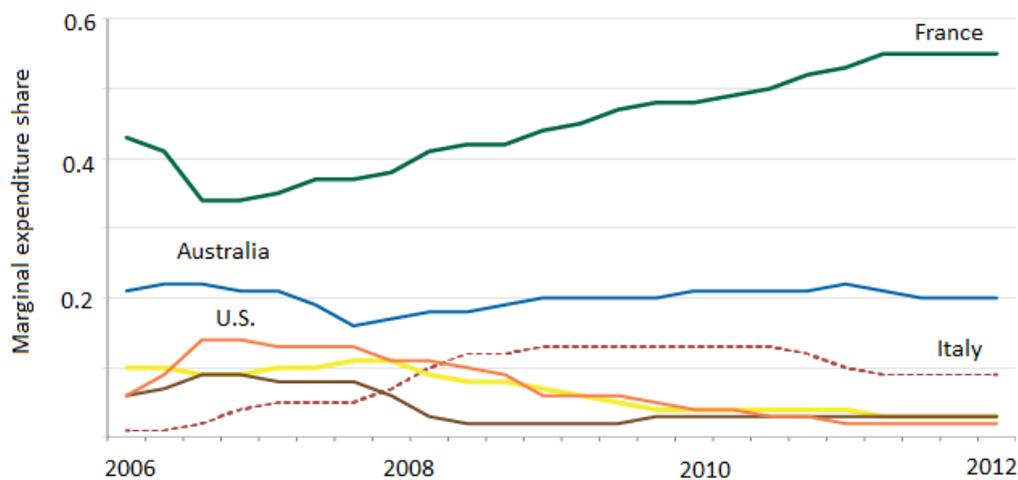
⁵The most recent work in wine economics with CES preferences and monopolistic competition between heterogeneous firms is Crozet, Head and Mayer (2008). By working on Champagne wine, they rightly justify the CES assumption by emphasizing that (in contrast to other wines studied here), producers blend several years of grapes to reproduce a constant quality over time.

analyses alternative models and investigates the role of (dis)economies of scale in the transport of wines.

2 Motivations

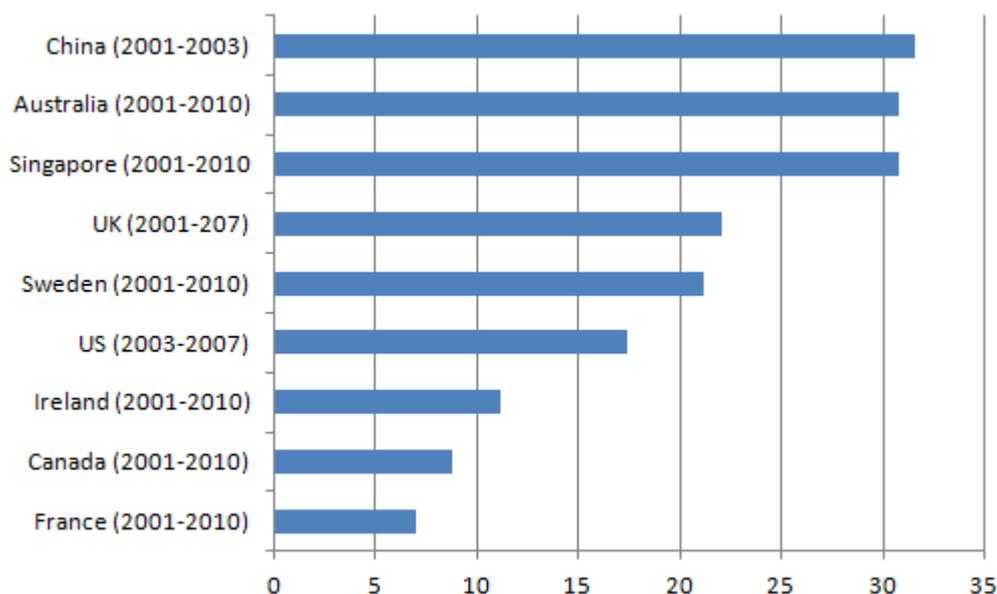
In 1997, Pritchett wrote a paper about 'the great divergence', i.e. the process of economic growth in a small set of countries (e.g. Europe, the U.S, Japan) that enabled them to achieve a huge economic advantage over the rest of the world. Twenty years later, economists speak about the 'great convergence' when observing the fast growth of developing countries such as China and India. According to Maddison's data, between 1980 and 2008 the ratio of Indian output per head to that of the US has increased from 5 to 10 %, while China's rose from 6 to 22 %. Even if this great convergence is fragile and has been weakened by the financial crisis of 2008, it has led to the emergence of a middle class in developing countries which demonstrates consumer behavior that is similar to the developed countries standard. The consumption of meat and wine has thus increased sharply in Asian countries. This is explained by the fact that these are luxury goods and also by the westernization of consumer behavior patterns. Omura, Sakurai and Ebihara (2013) for instance show how wine consumption has been gaining place in the daily life of the Japanese since the seventies. China would appear to be following the same path according to the surge in wine imports. Income effects by increasing the expenditure on wine seems to be an important determinant. As illustrated by Figure (2) borrowed from Muhammad et al. (2013), French wines are those which benefited the most from this rise in demand.

Figure 2: Chinese consumers marginal expenditure share



In addition to this process of convergence between certain nations, a process of divergence inside nations has also occurred (Atkinson, Piketty and Saez, 2011). The share of total income going to top income groups has risen dramatically in recent decades in many countries. The top decile share has surged since the 1970s, and the share of an even wealthier group, the top 1 percent, has increased even more. Figure (3) reports the growth rate of income earned by this group and illustrates its sharp increase in many countries. The top 1% has for instance benefited from a 30% growth of their revenue in a very short period of time in China. Earnings of the top 1% in Australia have also increased strongly and even countries like Sweden had an increase of 21%.

Figure 3: Top 1% Income Growth in the World



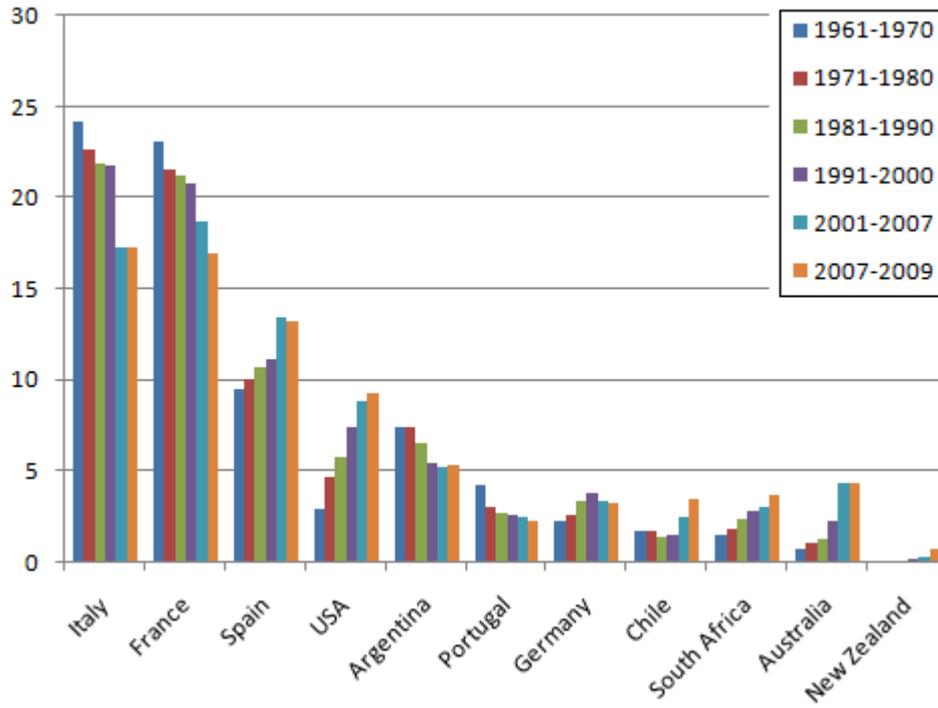
Source: *The World Top Incomes Database*

Such a rise in the concentration of wealth is particularly important for the wine sector as pointed out by Dimson, Rousseau, and Spaenjers (2013) who wrote that "among wealthy individuals, fine wine is a mainstream investment". For instance Barclays (2012) reports that wine represents 2% of the wealth of about one quarter of high-net-worth individuals around the world that owns a wine collection.

French wine has dominated the market, but could encounter a rise in competition to a similar degree as what has been observed in the past in other markets. Indeed, while French (and Italian) wines were leaders at the world level, the 90s was the period when producers in the U.S., in Australia and also in Chile, South Africa, Argentina and New Zealand have increasingly gained market share. To illustrate this, Figure (4), shows the fall in the production of wine in volume in France and the increase in other countries. While production in volume only provides a partial picture of the increase in competition, producers with market power can reduce quantity to increase price (French regulation has indeed implemented strict limitations on volume), in which case the decline in production does not reflect a decline in competition, quite the contrary. However, Figure (5) reporting the fall of

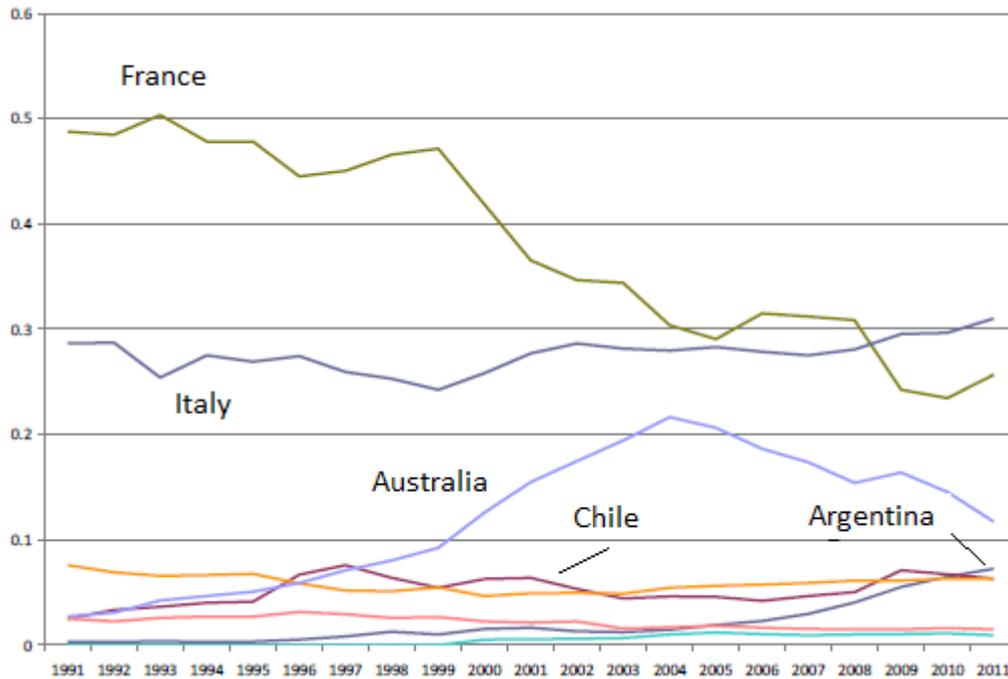
market share in value confirms our suspicion concerning the American market and to a lesser extent concerning other markets; see Morrison and Botticelli (2013) for more details.

Figure 4: Share of world production of wine (volume, %)



Source: Faostat

Figure 5: Market Share in the US (value, %)



Source: Comtrade

Given the three elements impacting the wine industry; the increase of the market size due to more demand in emerging markets, the emergence of a growing class of very rich people, the increase in competition, one proposes to use Hummels and Lugosky's (2009) model of international trade.

3 Theories and applications concerning the link between price elasticity and income per capita

In this section we briefly survey models of international trade where income per capita directly impacts price elasticity. We first present Hummels and Lugovsky's (2009) model of ideal variety and the related empirical investigations. Lastly we discuss models with non-homothetic preferences in which income effects also matter.

3.1 A Generalized Model of ideal Variety (GMIV)

Two goods are consumed, a homogeneous good a produced under constant returns to scale and wine which is a differentiated good denoted by c_i . Varieties of this differentiated good are uniformly distributed on a circle of unit-circumference. Because this product space is finite (circle), more varieties reduce differentiation. Lastly satisfaction is decreasing in distance between current wine consumption and the most preferred type i.e the "ideal variety". The utility function is defined by:

$$U = a^\mu (c_i/h_i)^{1-\mu}$$

where h_i represents the cost of not consuming the ideal variety. More precisely this compensation function is given by:

$$h_i = 1 + q_i^\alpha c_i^\psi d^\gamma$$

$$\text{with } (\alpha, \psi) \in [0, 1] \text{ and } \gamma > 1$$

where d represents the distance between the variety consumed and the ideal variety. In comparison with the initial model we add a parameter q_i which represents a marginal extension to Hummels and Lugovsky (2009). We consider this parameter as a reputation shifter to analyze how reputation by interacting with current consumption and with the distance to the ideal variety impacts optimal choices. This introduction implies that the higher the reputation of a wine, the stronger the dissatisfaction of the consumer regarding the distance between the wine consumed and its ideal variety. This introduction allows to parametrize the compensation function of Hummels and Lugovsky (2009) in which current consumption has the same disutility effect with respect to the expected ideal whatever the wine's reputation.

Regarding the supply side, wine is produced under monopolistic competition. In this sector, each individual supplies l hours of work and earns w per hour. w is taken

as the numéraire. Hummels and Lugovskyy (2009) consider l as a variable that can be approximated by GDP per capita. The total number of agents L represents the market size. Moreover according to the numéraire chosen L can also be interpreted as GDP (indeed $wL = L$). A fixed number of workers, denoted f , is required to supply x quantity of wine. The marginal costs of production in terms of labor is denoted m . Profit maximization under free entry and exit gives:

$$p = \frac{m\varepsilon}{\varepsilon - 1}, \quad (1)$$

$$x = \frac{f}{m}(\varepsilon - 1) \quad (2)$$

The number of varieties under full employment is given by:

$$n = \frac{lL}{f\varepsilon}$$

Lastly distance between varieties depends on the number of varieties and on the circumference of the product space, since we assume unit length we gets:

$$d = \frac{1}{n} \quad (3)$$

Appendix A provides the determination of ε which depends on income, on the population of consumers, on reputation and on competition such as:

$$\varepsilon = 1 + \frac{l^{-\beta} (d/2)^{-\gamma} p^\psi q^{-\alpha} + (1 - \psi)}{2\gamma} \quad (4)$$

Inserting (1) and (3) in (4) yields the implicit solution for the price elasticity.

Differentiating by L and l , Hummels and Lugovskyy (2009) analyzed the elasticity of price with respect to market size and income per worker. We start by considering the effect of L which as having interpreted has a market size effect linked to pro-competition between firms. A rise of income L generates more demand and

the entry of new varieties, leading to more competition between firms which set lower mark-ups to stay in the market. *Ceteris paribus*, there are low prices in large markets.

We now turn to the effect of income per-capita l on price elasticity. From the utility function, it should be remembered that consumers are increasingly finicky regarding the gap between current consumption and the ideal variety when consumption of a typical variety increases. Consequently, when individuals are richer, they value more the consumption of a variety that is close to the ideal. This behavior allows firms to set higher prices. Everything else equal (in particular market size), firms set higher prices when consumers are richer. But in opposition to this effect, rising income per-capita also increases the aggregate income, and thus also generates the market size effect presented previously. In short, while the market size effect generates a pro-competitive effect increasing the price elasticity, the effect of rising income per worker reduces this elasticity. More precisely the conclusion of Hummels and Lugovskyy (2009, Equation 20 and 21 p.11) using our notation can be summed up by:

$$\frac{\partial \varepsilon / \varepsilon}{\partial l / l} = \underbrace{\frac{\partial \varepsilon / \varepsilon}{\partial L / L}}_{\text{Competition Effect}} - \underbrace{\frac{\psi}{\gamma} \frac{\partial \varepsilon / \varepsilon}{\partial L / L}}_{\text{Income Effect}} \quad (5)$$

As explained above, authors prove that the competition effect (GDP growth) involves an increase in the price elasticity of the demand by demonstrating that:

$$\frac{\partial \varepsilon / \varepsilon}{\partial L / L} \in [0, 1] \quad (6)$$

From Equation (1), the *increase* in the price elasticity of demand leads to a *decrease* in the equilibrium price, this means that the competition effect has a negative impact on price. Lastly by using the inequality $\psi/\gamma < 1$ (verified by definition) it is

demonstrated by simple inspection of (5) and (6) that:

$$\frac{\partial \varepsilon / \varepsilon}{\partial l / l} \in [0, 1]$$

Thus the *total effect* of per capita GDP growth on price elasticity is *positive*. However a look at Equation (5) indicates that the same variation *conditioned* to market size (competition effect) has a *negative* impact on the elasticity and thus a *positive* impact on price (see again Equation, 1). This is very important for the empirical analysis, because it implies that once we control for GDP, the remaining effect of per capita GDP growth should lead to an *increase* in price.

Analysing the effect of reputation, we add to this literature this intuitive result:

Proposition 1 *Reputation of wine reduces the price elasticity of demand. This reputation effect is stronger on large markets.*

Proof. By implicit derivation of Equation (4) we get:

$$\frac{\partial \varepsilon / \varepsilon}{\partial q / q} = - \frac{2\gamma l^{-\psi} \alpha (\varepsilon - 1) p^\psi}{t(\varepsilon - 1) + 2\gamma l^{-\psi} (\psi + (\varepsilon - 1)\gamma) p^\psi} \quad (7)$$

where t is a positive term:

$$t = 2q^\alpha \gamma \varepsilon \left(\frac{\varepsilon f}{Ll} \right)^\gamma$$

because by definition $\varepsilon > 1$, we have proved that:

$$\frac{\partial \varepsilon / \varepsilon}{\partial q / q} < 0$$

Lastly market size L reduces t which reduces the denominator of (7). This proves the last part of Proposition 1 asserting the stronger negative impact of reputation on price elasticity in large markets.

■

This Proposition can be related to general findings in international trade such as

the work of Hallak (2006, 2010) showing that richer countries tend to import higher quality goods.

3.2 Empirical analysis of Hummels and Lugovsky

To test their model, Hummels and Lugovsky (2009) propose the following equation:

$$\ln \frac{p_{ij,t}^k}{p_{ij,t-1}^k} = a_0 + a_1 \ln \frac{Y_{i,t}}{Y_{i,t-1}} + a_2 \ln \frac{Y_{i,t}/L_{i,t}}{Y_{i,t-1}/L_{i,t-1}} + \epsilon_{ij,t}^k. \quad (8)$$

As a proxy for prices they use unit values of bilateral export from the Eurostat Database using years 1990 and 2003 (i.e. $t=2003$, $t-1=1990$). They expect three results 1) a negative coefficient \hat{a}_1 to validate that the market size reduces price due to competition effect increasing price elasticity (see 6); 2) a positive coefficient \hat{a}_2 to validate that, conditioning on market size, a rise in GDP per capita increases price due to the income effect that reduces price elasticity (see 5); 3) the sum of coefficients $\hat{a}_1 + \hat{a}_2$ should be negative to verify that the total effect of per capita GDP growth on price elasticity is positive.

Hummels and Lugovsky (2009) verify result 1 ($\hat{a}_1 < 0$) and 2 ($\hat{a}_2 > 0$) but not result 3 ($\hat{a}_1 + \hat{a}_2 > 0$).

3.3 Competing theories and gravity

Hummels and Lugovsky (2009) propose a second equation to discriminate between their model and a second theoretical framework. The main variable of interest is the share of i 's import from j on import of the rest of the world, r , from country j :

$$s_{ij}^k = x_{ij}^k / x_{rj}^k \quad (9)$$

where x_{ij}^k represents bilateral imports in value taking the form of a gravity equation that is specific to the Krugman (1980) model. The Krugman (1980) model is based

on homothetic preferences with Constant Elasticity of Substitution (CES) and thus there are no income effects. Here we aim to show that Hummels and Lugovskyy's (2009) methodology can be extended to specifications where this effect is displayed. To show this we consider the gravity equation proposed by Markusen (2010) (see also Frankel, Stein and Wei, 1998):

$$x_{ij}^k = (Y_j Y_i)^\alpha \left(\frac{Y_j}{L_j} \frac{Y_i}{L_i} \right)^\beta \frac{\tau_{ij}^{1-\sigma}}{P_i P_j}. \quad (10)$$

Where Y_i and Y_j are incomes (GDPs), L_i and L_j are the populations in i and j , P_i and P_j are price indices, τ_{ij} represents bilateral trade costs and σ is the elasticity of substitution between two varieties. With $\alpha = 1$ and $\beta = 0$ the gravity equation is similar to the one obtained in Anderson and van Wincoop (2003), and Krugman (1980): there are no income effects. In these models, income elasticity is equal to 1. However with Deaton (1992, p.9) one can consider that 'the supposition that there are neither luxuries nor necessities contradicts both common sense and more than a hundred years of empirical research.' Thus with $\beta \neq 0$ we can study these kinds of goods.

If this specification plays an important role in the last section of this paper, here it is not the case since Hummels and Lugovskyy (2009) focus on the share of importation s_{ij}^k . Indeed, whatever the specification of x_{ij}^k , the division of this variable by global import of French wines of type k , x_{rj}^k , allows all the variables specific to j (GDP per capita in j , CES price index in j etc) to be eliminated. Moreover, by using fixed effects on i , denoted by f_i^k , Hummels and Lugovskyy (2009) capture specific characteristic of importers i (GDP per capita in i , price index in i , etc). In short, taking the logarithm of (9) using (10) allows the following equation to be estimated:

$$s_{ij}^k = (1 - \sigma) \ln(\tau_{ij}) + f_i^k + \epsilon_{ij}^k$$

Thus, the only variables that explain s_{ij}^k are trade costs τ_{ij} approximated by bilateral

distance d_{ij} . This result contrasts with the GMIV, where the distance to the market depends on the number of competitors which itself varies according to GDP and GDP per-capita. Thus, by introducing distance in interaction with other variables, Hummels and Lugovskyy (2009) obtain "a test of the CES null hypothesis":

$$\ln s_{ij,t}^k = a_0 + a_1 \ln d_{ij} + a_2 \ln d_{ij} \ln(Y_{i,t}) + a_3 \ln d_{ij} \ln(Y_{i,t}/L_{i,t}) + \epsilon_{ij,t}^k. \quad (11)$$

To validate the CES model (and also other models where GDP per-capita enters in a multiplicative form as we have shown), only the coefficient of distance should be significant. They find that $\hat{a}_2 < 0$ and $\hat{a}_3 > 0$ are statistically significant, which validates their model.

This result has been challenged by Simonovska (2009), both by proposing a new model⁶ and also by introducing transport costs. Indeed by working with 245 identical products (from Mango) sold exclusively on the Internet, this author accurately identified the importance of transport costs using DHL Express shipping prices. Simonovska (2009) finds that:

"DHL charges lower prices to ship to both richer (in per-capita terms) and larger markets. Shipping prices are likely falling in market (population) size due to economies of scale as well as due to competition. In addition, shipping prices to richer destinations are likely lower due to better infrastructure and higher efficiency in transportation there, as well as due to higher competition particularly among air carriers as Cristea et al. (2012) argue".

This result is quite important, if transport costs are endogenous to the value of the product then the gravity equation (10) needs to be re-interpreted. This work is

⁶Simonovska (2009) proposes a model with non-homothetic preferences coming from a hierarchic-choice of consumption (Jackson, 1984). In this model where the marginal utility is bounded (consumer can have a null demand for some varieties, see also Sauré, 2011), the *relative* price of a variety is higher in relatively richer markets which contradicts Hummels and Lugovskyy's (2009) results.

presented in detail in our empirical part. While our data does not allow for shipping costs to be controlled as in Simonovska (2009), we do however have export of wine by mode of transport which allows trade flows to be separated and to be analyzed in details in order to reconcile standard models with the data.

4 Data description

The data set on wine exports comes from the Single Administration Declarations (SAD) collected by the French customs and put together by INSEE concerning the period 2001-2011. The database reports exports of wine, by mode of transport, by exporters on every markets, each month, at the 8 digit of the Harmonized System. This database contains the SIREN number that allows each exporter to be identified (address and economic features of each unit). We match this database with the SIREN register and we only retain firms under the label "culture" that includes wine producers. The value and volume of each product are reported monthly, we compute the sum by year, by products, by exporters and by destination markets. This database also contains information regarding the mode of transport. More precisely we know at the individual level and for each destination market if the wine has been exported by plane, boat, road, train, river, postal or by private mode.⁷ Road was the dominant mode of export prior to 2009, but while this mode of transport has been stable, exports by boats have more than doubled during the period, both in value and in volume, now representing the main mode of transport. While this rise is certainly explained in part by the decrease in shipping costs, it can also reflect changes in the destination market. Export by plane has sharply increased, in particular in terms of value. To illustrate this, the ratio of Bordeaux exports in value and volume by each mode of transport to the total exported are respectively plotted in Figures (6) and (7).

⁷Rivers, postal and private modes are marginal, however not uninteresting, for instance in 2009 we observe a volume of 3 liters for a value of 27000 euros exported by private mode.

Figure 6: Export of Bordeaux wine in value (% of all modes of transport)

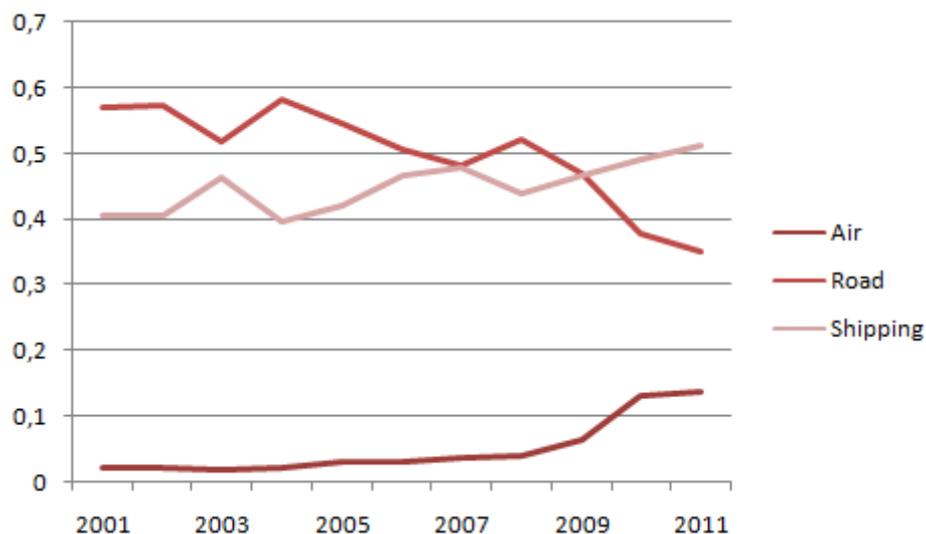
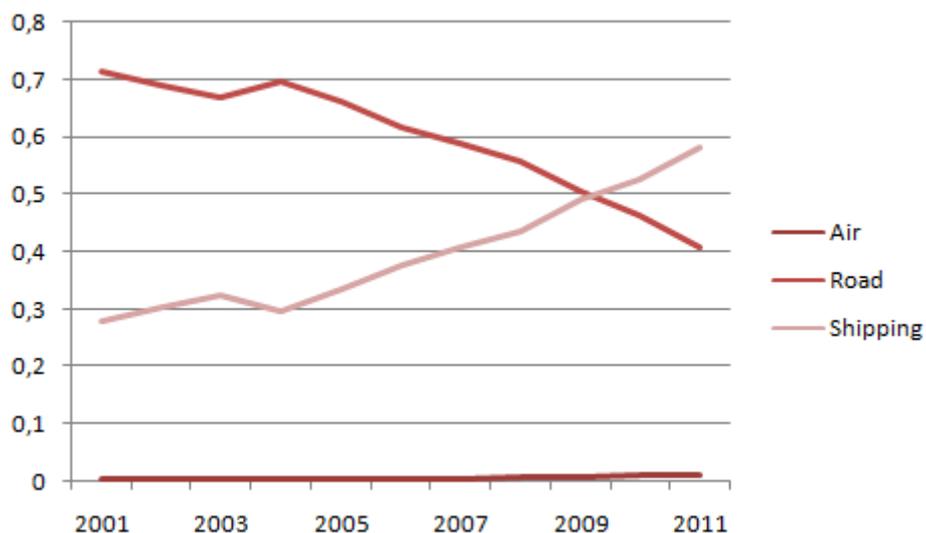


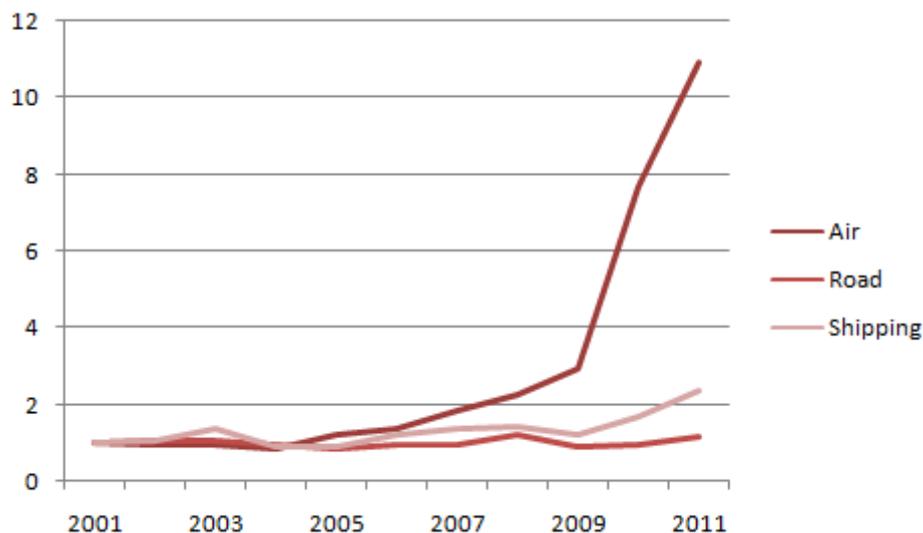
Figure 7: Exportation of Bordeaux wine in volume (% of all modes)



By comparing Figures (6) and (7) an interesting difference is the small and stable share of exports realized by plane in terms of volume, which contrasts with the strong increase in terms of value.

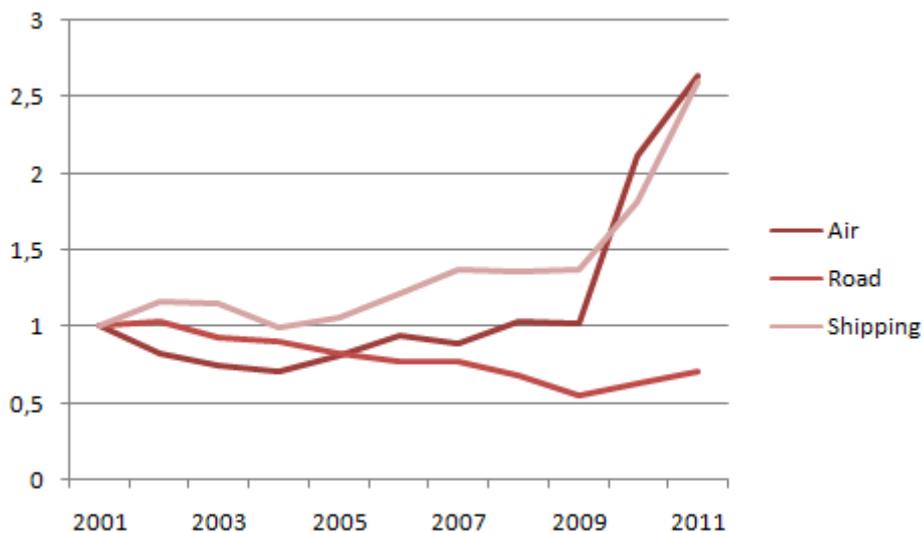
To illustrate the growth of each mode of transport it is useful to set a unit of comparison. In Figures (8) and (9), we chose to represent respectively the value and volume of Bordeaux wine exported each year via each mode relatively to the year 2001.

Figure 8: Export of Bordeaux wines in value and by mode of transport (base=2001)



The most striking result concerns the value of Bordeaux exported by plane, which has soared to represent 10 times more than what was exported in 2001. Regarding volumes in Figure (9), exports by plane have increased at a relatively identical pace to wine exported by boat.

Figure 9: Export of Bordeaux wines in volume (base=2001)



To our knowledge such a large database of French wine has never been used.

To approximate the growth of wine varieties in each market (i.e. competition/entry driven by market size growth) we use the database of *Regional, National*

and Global Winegrape Bearing Areas by Variety, collected by Anderson and Aryal (2013 a) for years 2000 and 2011. Since our time period for international trade starts in 2001, we take the year 2000 of the winegrape database as a proxy for 2001. In this database we use the number of winegrape varieties produced in each nation (44 countries) and the number of regions (in each nation) where production occurs. This database is interesting because when new winegrapes grow in one country/region one can consider this as a response by producers to market opportunities (see Anderson and Aryal (2013, b)). Thus this variable may be interpreted as a proxy of entry/competition in the wine market in each country in the spirit of models with ideal varieties (both because local/specific varieties planted may be closer to the ideal (due to culture or history) and because the most famous varieties (Cabernet Sauvignon, Merlot etc) are also planted increasingly in the 44 countries considered that represent 99 percent of the global wine production). To our knowledge such a database has not yet been used to analyze bilateral trade at the international level in the wine sector.

Data concerning top incomes comes from The World Top Incomes Database⁸. We use here data concerning incomes of top 1% and top 10% as well as the share of GDP owned by these categories. This database has obvious drawbacks, based on tax statistics it understates the wealth of rich people by not taking into account tax avoidance and tax evasion. However there is also advantages in comparison to other databases. First, the coverage of country is high, 25 countries (including China, Australia, the U.S., etc) for almost all the years considered (in comparison to the GINI database of the World Bank which does not give numbers for the U.S., and the CIA database often used as a complement only gives the GINI coefficient for one year). Second, by definition this variable may better capture the income effect in the wine consumption of rich people than alternative measures of income inequality. As far as we are aware, there are no earlier econometric studies analyzing the impact

⁸Alvaredo, Facundo, Anthony B. Atkinson, Thomas Piketty and Emmanuel Saez, The World Top Incomes Database, <http://topincomes.g-mond.parisschoolofeconomics.eu/> , 30/01/2014

of top incomes on the international trade of wine.

GDP and population come from the WDI database. Geographical distance between countries comes from the CEPII database.

5 Results

5.1 Price elasticity, market size and income per-capita

Here we estimate Equation (8) with controls for product (HS8) and firms. These fixed effects partially control for cost variations (due to scale effects) and/or quality variations. We do not introduce destination fixed effects which would control for variations that are specific to importers. These effects can precisely vamp the effect of economic growth of partners that we aim to measure. Table (5.1) reports results. Column 1 follows Hummels and Lugovskyy (2009) explaining price growth over the whole period by only using extrema of the period, i.e. years 2001 and 2011. Column 2 uses price differential yearly (2011-2010, 2010-2009, and so on). Year fixed effects are introduced for estimation reported in this last Column.

	Price differential (using year 2011 and 2001)	Yearly price differential (2001-2011)
GDP per capita	1.13 (0.498) ^b	0.55 (0.160) ^a
GDP	-1.10 (0.481) ^b	-0.49 (0.158) ^a
Year fixed effect	No	Yes
Product fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
R-square	0,587	0,091
Obs	3281	106508

OLS Estimations with RSE in brackets, a: significant at 1%, b: at 5%. All variables are in Log.

Fixed effects on firms and products in Column 1 and on firms, products and years in Column 2.

Table 1: Price regressions of French wines, 2001-2011

Whatever the period considered, Table (5.1) supports the conclusion of the GIMV. Income per capita fosters prices, while market size impacts negatively on

the price differential. Confirming Hummels and Lugovsky's work, the model seems more adequate for a long run analysis than a short period of time, explaining almost 60% of the average price variations between 2001 and 2011, while only 10% per year on average. As in Hummels and Lugovsky (2009), the GMIV is however not totally proven since the total effect (the sum of coefficient) of per capita GDP growth is positive.

5.2 Price elasticity and reputation

To investigate if the previous results hold at a more disaggregated level, we pursue the econometric exercise by focusing on wines at the French regional level. This strategy also aims to analyse the reputation effect presented in Proposition 1. By estimating the previous equation with firms and time fixed effect and by separating wine by region we can compare competition and income effects for wines that benefit from different geographical reputation. Our database does not enable us to identify precisely which bottle is exported (e.g. vintage) and thus prevents the use of ranking of wine by experts to directly test if reputation reduces price elasticity. Thus the following estimation must be viewed as a first and very incomplete attempt to analyse Proposition 1.

We consider three regions: Bordeaux, Alsace and Languedoc Roussillon. Bordeaux is known worldwide for its wine production and thus wines produced there benefit from the best reputation in our sample. To consider a region producing white wines with a clear differentiation we chose Alsace including the reputable dry Riesling and Gewürztraminer wines. Furthermore, this region has the advantage of being located in the "blue banana" and thus its location in the core of Europe, gives to producers an advantage in terms of market access. It is also interesting to notice that this region produces varieties that are mainly exported to neighboring countries. Then, one can think to local reputation inherited from History⁹ for wines that

⁹Alsace has been a German possession over a long period of time during the past two centuries

are well known in Germany but not in other countries for instance. Lastly, we consider the Languedoc Roussillon region which is one of the main producers of wine in France, with production volumes that some years surpass the production of nations like the United States. However the production is heterogeneous in terms of quality and the region suffers from a poorer reputation than wines produced elsewhere (e.g. in Bordeaux).

Table (5.2) presents the results. It is worth noting that while Hummels and Lugovskyy (2009) pool over multiple exporters and provide results at the industry level (HS2), we have enough data variation to lead the estimation at the HS8 level keeping firms fixed effects. This detailed analysis confirms the previous results, a rise in GDP per capita favors wine exportation for many products, while GDP growth, theoretically associated with more competition, is detrimental.

Wine hs8	Bordeaux 22042142	Alsace 22042111	Lang Rous 22042147
GDP per capita	1.26 (0.706) ^c	1.88 (0.971) ^c	1.63 (0.506) ^a
GDP	-0.85 (0.676)	-1.97 (0.970) ^b	-1.52 (0.429) ^a
Year fixed effect	Yes	Yes	Yes
Firms fixed effect	Yes	Yes	Yes
R-square	0.16	0.08	0.13
Obs	13506	3514	4648

OLS with RSE in brackets corrected by clusters on destination market.

a: significant at 1%, b: significant at 5%, c: significant at 10%

All variables are in Log

Table 2: Prices regressions for a panel of French wines

Interestingly, for Bordeaux wines the coefficient of market size is not significant, indicating that competition is less fierce for these wines. This result supports Proposition 1, whereby a reputation effect seems to neutralize the effect of competition. The total effect of per capita GDP growth, thus only depends on a_2 in Equation (8) and is equal to 1.26. This is clearly the strongest impact; indeed, for wines produced in Alsace and in Languedoc Roussillon the total effect is of $\hat{a}_1 + \hat{a}_2 = -0.09$ and of

0.11 respectively. This negative effect for Alsace wines is noteworthy since it reflect a result not yet obtained (previously called 'result 3' in Hummels and Lugovskyy, 2009), reporting that the total effect of per capita GDP growth can increase price elasticity.

5.3 Trade share

We now turn towards Equation (8) that aims to test whether the GMIV is more adequate than a standard model of monopolistic competition using CES preferences. Table (5.3) illustrates results. Column 1 is the benchmark with similar independent variables to those used in the previous section (GDP and GDP per capita) in interaction with distance. Column 2, 3, 4, and 5 use alternative variables of GDP per capita to measure the wealth of individuals. These variations in the explanatory variables have the advantage of being a simple test for multicollinearity problems.

dep var:	Share of trade				
Distance	-1.004 (0.011) ^a	-0.938 (0.019) ^a	-1.115 (0.026) ^a	-1.333 (0.015) ^a	-1.329 (0.015) ^a
GDP	0.032 (0.000) ^a	0.031 (0.001) ^a	0.037 (0.001) ^a	0.045 (0.000) ^a	0.044 (0.000) ^a
GDP per capita	0.010 (0.001) ^a				
Income share of top 1%		0.710 (0.019) ^a			
Income share of top 10%			0.797 (0.069) ^a		
Income top 1%				0.025 (0.003) ^a	
Income top 10%					0.029 (0.004) ^a
R-square	0.368	0.388	0.386	0.380	0.386
Obs	203375	113097	111383	113132	106129

OLS Estimations (RSE in parentheses) with year, firms and product fixed effects

a: significant at 1%, b: significant at 5%, c: significant at 10%

Table 3: Share of trade and wealth

All results disqualify the CES assumption used with a simple model of monop-

olistic competition.¹⁰ Interactions between distance, market size and wealth matter to explain the share of wine exported. The impact of economic wealth has the expected sign according the GMIV whatever the variable considered. Ten percent increases in GDP per-capita lead to 0.1% of the share of goods exported. This is a small number, however the coefficients of top income (1% and 10%) are strong, confirming that income inequality matters. Introducing other variables than GDP per capita is reassuring concerning the validation of the model since sign never change.

However, results do not fully support the model, in particular the impact of GDP has the opposite sign than the one expected.

Looking for an alternative proxy to market size, we follow Simonovska (2009) by using population. In Table (5.3), the first column gives the associated results, with market size favoring market share. We then use Anderson and Aryal's (2013 a,b) database, which contains the number of winegrape varieties as well as the number of regions where varieties have grown in 2010 and 2000. These two variables are taken as proxies for market size/competition fitting well with what we aim to capture: when the market grows, more varieties are produced. According to the model this should reduce the share of the pie for first competitor. This is not verified since the increasing numbers of new grapes grown does not have an impact on the share of wine exported by French exporters over the period 2001-2011 (see Table (5.3), column 2). The same can be observed regarding the number of regions inside nations where grapes are grown (see Table (5.3), column 3). The sole indicator that supports the GMIV is the ratio of the number of varieties per the number of regions. It is possible that the concentration of competition helps to acquire the technique of producing high quality in order to compete with French wine. However, we recognize that this ratio is hard to interpret clearly. The most plausible explanation is that competition has not been so fierce over the period considered but further analysis beyond 2011 may give results supporting the theoretical model.

¹⁰Obviously this does not disqualify CES preferences used with more sophisticated models of monopolistic competition, in particular those using heterogeneous firms.

dep var:	Share of trade			
Distance	-1.428 (0.039) ^a	-0.354 (0.025) ^a	-0.263 (0.026) ^a	-0.238 (0.026) ^a
GDP per capita	0.068 (0.002) ^a	0.047 (0.002) ^a	0.034 (0.002) ^a	0.039 (0.002) ^a
Population	0.03 (0.001) ^a			
Number of Varieties		0.016 (0.001) ^a		
Number of Regions			0.017 (0.001) ^a	
Varieties/Regions				-0.021 (0.001) ^a
R-square	0.517	0.500	0.499	0.493
Obs	22054	20291	21029	21029

OLS Estimations, SE in brackets, with year, firm and product fixed effects

a: significant at 1%, b: significant at 5%, c: significant at 10%

Table 4: Share of trade and market size

6 Non-homothetic preferences and trade costs

It may appear surprising to observe that the GMIV has a better predictive power than alternative models based on the very standard/powerful gravity equation (10). Thus we come back to this equation (instead of the share used previously). After rearrangement and by taking the log of (10) we obtain the following expression:

$$\ln(x_{ij}^k) = (\alpha + \beta) \ln(Y_j Y_i) - \beta \ln(L_j L_i) + (1 - \sigma) \ln(\tau_{ij}) + \ln(P_i P_j). \quad (12)$$

From this we estimate the following equation by separating wines exported by air, boat and road:

$$\ln(x_{ij,t}^k) = a_1 \ln(Y_{j,t} Y_{i,t}) + a_2 \ln(L_{j,t} L_{i,t}) + a_3 \ln(\tau_{ijt}) + a_4 \ln(P_{it} P_{jt}) + \epsilon_{ijt}^k$$

We expect to obtain support for non-homothetic preference with a positive impact of GDP per capita for wine exported by plane. Indeed these wines may be of better

quality than wine exported via other modes of transport and thus export via this mode may be more sensitive to GDP per capita. The crucial coefficient is that of population; indeed with a negative sign, $\hat{a}_2 < 0$ we verify that $\beta > 0$ and thus the gravity equation (10) with GDP per capita influencing positively export.

To control for price index, we follow a wide literature by using consumer price indices (e.g. Bergstrand 1985, Baldwin and Taglioni 2011). Although not reported here, we undertook many robustness checks concerning this last variable.¹¹

Furthermore, estimating the gravity equation by type of transport allows us to partially treat heterogeneity in term of products and in terms of destination markets. Indeed a selection effect linked to distance and to product quality certainly leads to choose one mode of transportation over another.

For now, we consider a standard form for trade costs:

$$\tau_{ijt} = dist_{ij} e^{b_{ij}}$$

where b_{ij} includes dummies representing common language, $lang_{ij}$, and past colonial links, col_{ij} , such as $b_{ij} = dist_{ij} col_{ij}$. Common language and colonial history appear crucial to explain bilateral trade but direct measures are ridden with measurement errors. The use of a constructed 0-1 index allows the extent of this error to be minimized. In wine economics the importance of past colonial links has been studied for instance by Melonni and Swinnen (2012) who detail the rise and fall of Algeria

¹¹Anderson and van Wincoop (2003) as well as Baldwin and Taglioni (2007) have recommended to set partner fixed effects to control for price index and to obtain unbiased coefficient of *distance* (and border effects). These fixed effects have thus been used here and provide similar results to consumer price index. However, because our main interest lies in GDP and population (and not on dyadic variables such as distance) it appears natural to avoid these fixed effects. This is also the empirical strategy adopted by Baldwin and Taglioni (2011) who write: 'If the econometrician is only interested in estimating the impact of a pair-specific variable – such as distance or tariffs – the standard solution is to put in time-varying country-specific fixed effects. [...] Plainly we cannot use this approach to investigate the impact of using GDPs as the economic mass proxies'. We have also conducted estimations with different functional forms such as: 1) all variables concerning France (including price index) have been reported on the left right hand of the equation (a trade adjusted measure) 2) fixed effects and only population have been used on the right hand side to analyse whether the sign of population change when multicollinearities between variables are reduced to the minimum 3) introduction of unit value of wines instead of price index. Whatever the specification, results reported in the text table are still verified.

as the largest exporter of wine in the world during the French colonization.

We use the OLS estimator, as well as the PPML and Gamma estimators.¹² Indeed Santos Silva and Tenreyro (2006) prevent that taking the log of the gravity equation and leading a estimation with OLS involves strong assumption regarding the error terms (log-normality) and thus results are biased in presence of heteroskedasticity. Using Monte Carlo simulations, they recommend the Poisson pseudo-MLE that performs better than the traditional linear-in-logs OLS. Head and Mayer (2013) complement this approach by recommending the use of OLS, Poisson and Gamma PML. Indeed as they notice if the sample is large enough then Poisson and Gamma PML should give approximately the same result and estimates will only converge on the OLS estimates under log-normality of the error term.

Dep var:	French Wine Exportation (adjusted by french GDP per-capita)				
Mode:	Air		Shipping		Train & Road
Estimator:	OLS	PPML	Gamma	OLS	OLS
GDPs	-0.007 (0.036) ^b	-0.012 (0.028)	-0.034 (0.029)	0.290 (0.007) ^a	0.385 (0.018) ^a
POPs	0.083 (0.039) ^b	0.116 (0.027) ^a	0.075 (0.030) ^b	-0.063 (0.009) ^a	-0.115 (0.017) ^a
Distance	-0.105 (0.075)	-0.001 (0.064)	-0.143 (0.063) ^b	0.108 (0.009) ^a	-0.180 (0.013) ^a
CPIs	-1.792 (1.779)	-3.764 (1.207) ^a	-2.573 (1.474) ^a	-1.941 (0.385) ^a	1.570 (0.724) ^b
Colony	-0.411 (0.102) ^a	-0.799 (0.083) ^a	-0.620 (0.081) ^a	0.348 (0.015) ^a	-0.047 (0.044)
Common Language	-0.661 (0.134) ^a	-0.192 (0.118)	-0.448 (0.110) ^a	0.155 (0.019) ^a	0.332 (0.025) ^a
R ² /Pseudo R ²	0.762	0.672	0.086	0.401	0.389
Obs	3971	3971	3971	69079	39619

Estimations realized with year, firm and product fixed effects

a: significant at 1%, b: significant at 5%, c: significant at 10%

Table 5: Gravity equation

Columns 1, 2 and 3 give results for wine exported by plane using the three different estimators. Distance and price index have the expected sign, but GDP and

¹²As recommended for instance by Head and Mayer (2013) who write "if all three estimates are similar, then we can relax because the model appears to be well specified [...] Therefore the OLS results are the maximum likelihood estimates".

population contradict the theory. Indeed a positive sign is obtained for population rejecting the idea that wines exported with this mode of transport are luxury goods. On the contrary, the theory is validated for wines exported by ship and road reported in Table 6 in column 4 and 5 using OLS (we have also done estimations with Poisson and Gamma PML with similar results). This validation of non-homothetic preferences is also surprising. Indeed we consider as a 'placebo sample'¹³ the sample of wines exported by road, i.e a sample where wine are inferior or normal goods and thus where income effects are absent (or at least less present than for wines exported by planes). After various unsuccessful attempts to obtain other results, we conclude that they are robust and that the theoretical model needs to be revisited. To reconcile our data with theory we decide to introduce economies of scale in transport. Indeed it is quite obvious that depending on the value of the export, firms do not pay the same transport costs. There is a wide range of literature on this topic of industrial goods. For instance Skiba (2007) considering economies of scale in transport finds that a 10% increase in the volume of trade brings about a 2.5% reduction in trade costs. Clark et al. (2004) find that transport costs are smaller when trade volumes are high. In Kleinert and Spies (2011) the level of export determines the transport technology and transport costs vary with investment in more efficient technology. By using price data from UPS, they find that a 10% increase in exports decreases transport prices by 0.8%. Hummels, Lugovsky and Skiba (2009) show that shipping costs decrease with the number of competitors, with low tariffs and product prices and with high demand elasticities.¹⁴ Lastly Rudolph (2009) demonstrates how a standard gravity equation can be biased if economies of scale in transport are not introduced.

¹³The term is borrowed to Brühlhart, Carrère and Robert-Nicoud (2013)

¹⁴There also are interesting theoretical papers, for instance Duranton and Storper (2008) propose a model whereby the decrease in transport costs can generate an increase in trade costs. In their model with vertical firms where the quality of input is not contractible, they show that a decrease in transport costs leads to exchange higher quality of goods for which trade costs increase. Lastly to make transport costs endogenous with respect to trade is not innocuous in terms of specialization and location choice (see Matsuyama, 2007 and Behrens Gaigné and Thisse, 2009, Behrens and Picard, 2011)

We follow this literature and assume that transport costs take the following form:

$$\tau_{ij} = (x_{ij,t}^k)^\eta d_{ij} e^{b_{ij}}$$

where $x_{ij,t}^k$ represents the export of wines in value and η density (dis)economies. There are economies of scale with η negative, and diseconomies in the opposite case. Inserting this function in the gravity equation and resolving for $x_{ij,t}^k$ to eliminate the endogeneity bias gives:

$$\begin{aligned} \ln(x_{ij,t}^k) &= \frac{\alpha + \beta}{1 - (1 - \sigma)\eta} \ln(Y_{j,t}Y_{i,t}) + \frac{\beta}{1 - (1 - \sigma)\eta} \ln(L_{j,t}L_{i,t}) + \frac{(1 - \sigma)\eta}{1 - (1 - \sigma)\eta} \ln(d_{ij}e^{b_{ij}}) \\ &\quad + \frac{1}{1 - (1 - \sigma)\eta} \ln(P_{it}P_{jt}). \end{aligned}$$

This last gravity equation is helpful in revisiting the previous results. We start by the coefficient of distance, which under some assumptions regarding elasticity of trade, provides a measure of economies of scale in transport. Indeed the previous equation allows us to establish that the coefficient of distance is composed of the following parameters:

$$\hat{a}_3 = \frac{(1 - \sigma)\eta}{1 - (1 - \sigma)\eta} \quad (13)$$

For air transport according to the estimation using the Gamma PML estimator we have $\hat{a}_3 = -0.143$, thus assuming an elasticity of substitution equal to 5 (which is a realistic value of σ according to estimations of Broda and Weinstein, 2010), we obtain $\eta = -1.988$. From such a result we can now deduce β , indeed we have:

$$\hat{a}_2 = \frac{\beta}{1 - (1 - \sigma)\eta} \quad (14)$$

and from Table (6, Gamma PML) the coefficient of population gives $\hat{a}_2 = 0.075$ thus using η and σ we get $\beta = -0.524$. This result confirms the income effect that was

previously rejected. Lastly by using the coefficient of GDPs from:

$$\widehat{a}_1 = \frac{\alpha + \beta}{1 - (1 - \sigma)\eta} \quad (15)$$

with $\widehat{a}_1 = -0.034$ one gets $\alpha = 0.762$ which is not so far from the unit elasticity of GDP obtained in many trade gravity equations. It can be remarked that our calculation of α and β does not depend on our assumption regarding σ , in other words these parameters only depend on our estimation done in table (6). Indeed resolving the system (13,14,15) gives expressions of (η, β, α) where η depends on σ but where α and β only depend on estimates:

$$\eta = \frac{\widehat{a}_3}{(1 + \widehat{a}_3)(1 - \sigma)}, \quad \beta = \frac{\widehat{a}_2}{1 + \widehat{a}_3}, \quad \alpha = \frac{\widehat{a}_1 - \widehat{a}_2}{1 + \widehat{a}_3}$$

Table (6) summarizes the numerical expressions derived from estimations and also reports results for wine exported by road and ship since we expect a null value for β that was not obvious until now.

Mode:	Air	Shipping	Road
Transp econ scale (η)	-1.988	-0.024	0.054
Income per cap (β)	-0.524	-0.056	-0.140
GDPs (α)	0.762	0.318	0.609

Calculation for η done with $\sigma = 5$

Table 6: Economies of scale in Transport

Expected results are obtained. Wine exported by ship and road benefits from a smaller income effect than wine exported by air. The coefficient of β is not strictly equal to zero but however closer to this value, in particular for wine exported by ship. Interestingly economies of scale are observed for transportation by plane and boat ($\eta < 0$) but not for road. A 10% increase in the value of wine exported by road leads to a rise in transportation costs of 0.5%. Obviously, such a result needs to be considered as a simple exercise. The previous analysis, both theoretical and empirical (mis-specification regarding transport costs is observable concerning

coefficient of distance that varies from one estimator to another) indicates that direct introduction of transport costs can allow the analysis of the international trade of wine to be improved.

7 Conclusion

Hummels and Lugovsky (2009) proposed a model generalizing the ideal variety approach of Lancaster (1979, 1984). By applying this model to the wine sector, we have shown that some of its conclusions cannot be unvalidated. A one percent increase in GDP per capita generates on average an increase in price differential of between 0.55% and 1.13%. The share of trade is strongly influenced by all variables approximating wealth concentration such as income earned at the top of the distribution. Lastly a gravity trade equation supports the view that income effects matter in explaining wine exports but also raises questions about transport costs. Depending on economies of scale and market structure in this sector, changes in price and volume exported may be explained by transport costs that interact with the rise in global demand.

References

- [1] Anderson, K. and N. Aryal, "Database of Regional, National and Global Wine-grape Bearing Areas by Variety, 2000 and 2010," *Wine Economics Research Centre, University of Adelaide* (2013a).
- [2] Anderson, K. and N. Aryal, "Where in the world are various winegrape varieties grown? Evidence from a new database," *Wine Economics Research Centre, University of Adelaide* (2013b).
- [3] Ashenfelter, O. "Predicting the prices and quality of Bordeaux wines," *The Economic Journal* 118 (2008): 40-53.

- [4] Atkinson, A. B. and T. Piketty, *Top Incomes over the Twentieth Century: A Global Perspective* (Volume 2). Oxford: Oxford University Press (2010).
- [5] Baldwin R., D. Taglioni, “Gravity for Dummies and Dummies for Gravity Equations,” *NBER Working Papers 12516*, National Bureau of Economic Research (2007).
- [6] Baldwin R, D. Taglioni, “Gravity Chains: Estimating Bilateral Trade Flows When Parts And Components Trade Is Important,” *NBER Working Papers 16672*, National Bureau of Economic Research (2011).
- [7] Barclays, *Profit or pleasure? Exploring the motivations behind treasure trends*. Wealth Insights, Volume 15 (2012).
- [8] Behrens, K., Gaigné, C., Thisse, J-F. “Industry location and welfare when transport costs are endogenous,” *Journal of Urban Economics*, 65 (2009):195-208.
- [9] Behrens, K., Picard, P. M, “Transportation, Freight Rates, and Economic Geography,” *Journal of International Economics* (2012).
- [10] Bekkers T, Francois J and M Manchin, “Import prices, income, and inequality,” *European Economic Review*, 56 (2012): 848–869
- [11] Bergstrand, J. H, “The Generalized Gravity Equation, Monopolistic Competition, and the Factor- Proportions Theory in International Trade,” *Review of Economics and Statistics* 71 (1989): 143-53.
- [12] Cardebat J-M. and Figuet J-M., “Experts Opinions and Bordeaux Wine Prices: An Attempt to Correct the bias of subjective judgments,” *AAWE WP No. 129* (2013)
- [13] Cassing J. and S. Nishioka, “Nonhomothetic Tastes and Missing Trade of Factor Services,” *Working Papers 09-03*, West Virginia University (2009).

- [14] Cevik and Sedik, “A Barrel of Oil or a Bottle of Wine: How Do Global Growth Dynamics Affect Commodity Prices?” *IMF WP 11/1* (2011).
- [15] Chevet, J.-M., S. Lecocq and M. Visser, “Climate, grapevine phenology, wine production and prices: Pauillac (1800-2009),” *American Economic Review: Papers and Proceedings* 101 (2011):142-146.
- [16] Combris P., Lecocq S. and Visser M, “Estimation of a Hedonic Price Equation for Bordeaux Wine : Does Quality Matter ?”, *The Economic Journal* 107 (1997):390-402.
- [17] Crozet M., K. Head and T. Mayer, “Quality Sorting and Trade: Firm-level Evidence for French Wine,” *Review of Economic Studies*, Oxford University Press, 79 (2012):609-644.
- [18] Deaton, A, *Understanding Consumption*, New York: Oxford University Press (1992).
- [19] Dimson, Rousseau, and Spaenjers, “The Price of Wine” *AAWE Working Paper* 142 (2013).
- [20] Duranton G. and M. Storper, “Rising trade costs? Agglomeration and trade with endogenous transaction costs,” *Canadian Journal of Economics* 41 (2008):292-319.
- [21] Eaton J. and S. Kortum, “Technology, Geography, and Trade, *Econometrica*,” 70 (2002):1741-1779.
- [22] Fieler, A, “Nonhomotheticity and Bilateral Trade: Evidence and a Quantitative Explanation”, *Econometrica* 79 (2011):1069-1102.
- [23] Frankel, Jeffrey, Ernesto Stein, and Shang-Jin Wei, “Continental Trading Blocs: Are They Natural or Super-Natural?” in Jeffrey Frankel, editor, *The Regional-*

- ization of the World Economy* (Chicago: University of Chicago Press), 91-113 (1998).
- [24] Gergaud O., V. Ginsburgh, “Natural Endowments, Production Technologies and the Quality of Wines in Bordeaux. Does Terroir Matter?” *The Economic Journal* 118 (2008):142-157.
- [25] Griliches Z, “Hedonic Price Indexes for Automobiles : An Econometric Analysis of Quality Change”, in *The Price Statistics of the Federal Government*, General Series n° 73, Columbia University Press, New York, pp. 137-196 (1961).
- [26] Hallak J. C, Product quality and the direction of trade. *Journal of International Economics* 68 (2006):238–265.
- [27] Hallak J. C, A product-quality view of the linder hypothesis. *The Review of Economics and Statistics* 92 (2010):453-466.
- [28] Head, K., and T. Mayer, “What separates us? Sources of resistance to globalization,” *Canadian Journal of Economics* 46 (2013):1196-1231.
- [29] Hummels D. and V. Lugovskyy, “International Pricing in a Generalized Model of Ideal Variety,” *Journal of Money, Credit and Banking* 41(2009):3-33.
- [30] Hummels D, Lugovskyy V and Skiba A., “The trade reducing effects of market power in international shipping,” *Journal of Development Economics* 89 (2009):84-97.
- [31] Hunter L, “The Contribution of Non-homothetic Preferences to Trade,” *Journal of International Economics* 30 (1991):345-358.
- [32] Hunter L., Markusen J., “Per-Capita Income as a Determinant of Trade,” in: Feenstra, R. (Ed.), *Empirical Methods for International Trade*, The MIT Press, Cambridge, MA, 89-109 (1988).

- [33] Jackson, L. F. “Hierarchic Demand and The Engel Curve for Variety,” *The Review of Economics and Statistics* 66 (1982): 8-15.
- [34] Lancaster K, *Variety, Equity, and Efficiency*, New York: Columbia University Press (1979).
- [35] Lancaster K, “Protection and Product Differentiation”, In H. Kierzkowski (ed.), *Monopolistic Competition and International Trade*. Oxford: Clarendon Press (1984).
- [36] Lecocq S. and Visser M, “Spatial Variations in Climate and Bordeaux Wine Prices,” Working Paper n°06-01 INRA (2006).
- [37] Markusen J.R, “Putting Per-Capita Income Back into Trade Theory,” *Journal of International Economics* 90 (2013):255-265.
- [38] Matsuyama K, “Beyond Icebergs: Towards a Theory of Biased Globalization,” *Review of Economic Studies* 74 (2007):237-253.
- [39] Millar R, “Liv-ex launches Fine Wine 1000 index,” *The Drinks Business* (2014).
- [40] Muhammad A, A M. Leister, L L. McPhail, and W Chen, “The Evolution of Foreign Wine Demand in China,” *Australian Journal of Agricultural and Resource Economics*. doi: 10.1111/1467-8489.12029, (2013).
- [41] Nerlove M, “Hedonic Price Functions and the Measurement of Preferences: The Case of Swedish Wine Consumers,” *European Economic Review* 39 (1995):1697-1716.
- [42] Omura M, Y Sakurai and K Ebihara, “An Analysis of Wine Consumption Trends and Food-Related Expenditures in Japan,” *AWWE Working Paper* 144 (2013).
- [43] Pritchett L, “Divergence, Big Time,” *The Journal of Economic Perspectives* 11 (1997):3-17.

- [44] Roma, P., Di Martino, G. and Perrone G. “What to show on the wine labels: a hedonic analysis of price drivers of sicilian wines,” *Applied Economics* 45 (2013):2765-2778.
- [45] Rosen S.M, “Hedonic Prices and Implicit Markets : Product Differentiation in Pure Competition,” *Journal of Political Economy* 82 (1974):34-55.
- [46] Rudolph S, “The Gravity Equation with Micro-founded Trade Costs,” *Dresden Discussion Paper* 28 (2010).
- [47] Santos Silva S. and S Tenreyro, “The Log of Gravity,” *Review of Economics and Statistics* 88 (2006):641-658.
- [48] Saure P, “Bounded Love of Variety and Patterns of Trade,” *Open Economies Review* (2011).
- [49] Simonovska I, “Income Differences and Prices of Tradables,” *NBER Working Paper* 16233 (2009).
- [50] Skiba A, “Regional Economies of Scale in Transportation and Regional Welfare,” *Working Paper Series in Theoretical and Applied Economics* 200705, University of Kansas (2007)
- [51] Storchmann K, “Wine Economics: Emergence, Developments, Topics,” *AAWE WP* 85.
- [52] Trefler D, “The Case of the Missing Trade and Other Mysteries,” *The American Economic Review* 85 (1995): 1029-46.

8 Appendix A

In reason of Nash competition and of uniform distribution of varieties around a circle, the demand in wine 1 depends only on the closest substitute on its right and

left hand. These competitive varieties are symmetrically distant from variety 1 (see Figure 10.a).

Figure 10: Lancaster's space of varieties

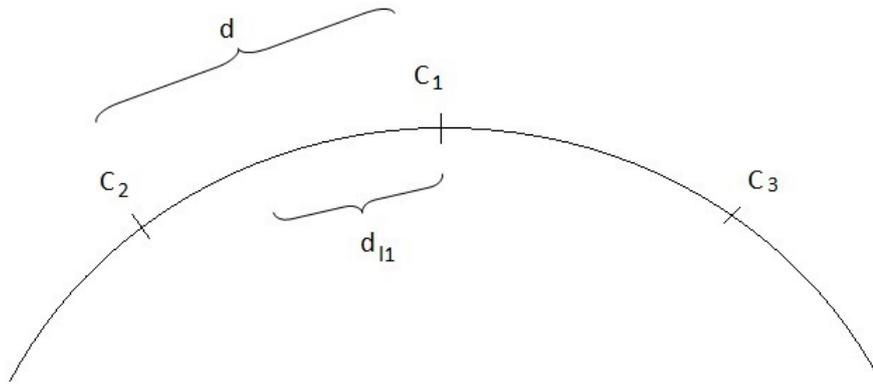


Figure (a)

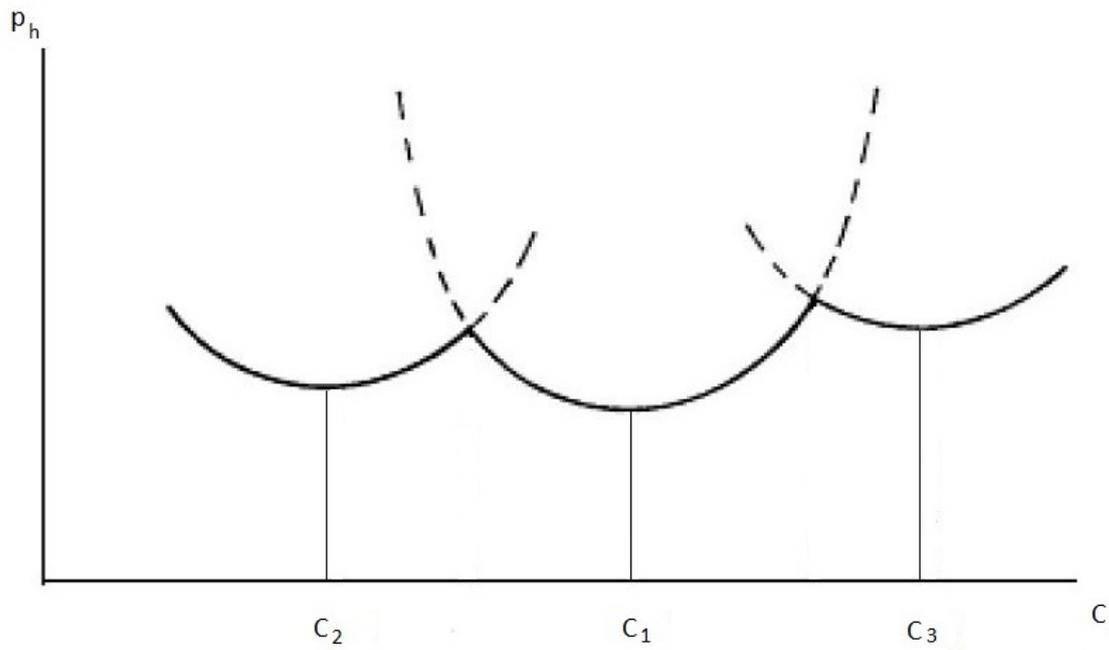


Figure (b)

The ideal variety between wine 1 and 2 (or indifferent consumer between wine 1 and 2) is located at d_{11} . As illustrated by Figure 10.b, which represents the effective

price with respect to varieties, such a situation of wine equivalence is defined by:

$$p_2 \left[1 + q_2^\alpha c_2^\psi (d - d_{l1})^\gamma \right] = p_1 (1 + q_1^\alpha c_1^\psi d_{l1}^\gamma)$$

Similarly the ideal variety between 1 and 3 is given by:

$$p_3 \left[1 + q_3^\alpha c_3^\psi (d - d_{r1})^\gamma \right] = p_1 (1 + q_1^\alpha c_1^\psi d_{r1}^\gamma)$$

Because utility maximization of one individual gives $c = wl/p$ one obtains from the previous equation the following equation:

$$\begin{aligned} p_2 \left[1 + q_2^\alpha (wl)^\psi p_2^{-\psi} (d - d_{l1})^\gamma \right] &= p_1 + q_1^\alpha (wl)^\psi p_1^{1-\psi} d_{l1}^\gamma \\ p_3 \left[1 + q_3^\alpha (wl)^\psi p_3^{-\psi} (d - d_{r1})^\gamma \right] &= p_1 + q_1^\alpha (wl)^\psi p_1^{1-\psi} d_{r1}^\gamma \end{aligned}$$

we derive with respect to p_1 , which gives:

$$\begin{aligned} \frac{\partial d_{l1}}{\partial p_1} &= - \frac{(wl)^{-\psi} + (1 - \psi) q_1^\alpha p_1^{-\psi} d_{l1}^\gamma}{q_2^\alpha p_2^{1-\psi} \gamma (d - d_{l1})^{\gamma-1} + q_1^\alpha p_1^{1-\psi} \gamma d_{l1}^{\gamma-1}} < 0 \\ \frac{\partial d_{r1}}{\partial p_1} &= - \frac{(wl)^{-\psi} + (1 - \psi) q_1^\alpha p_1^{-\psi} d_{r1}^\gamma}{q_3^\alpha p_3^{1-\psi} \gamma (d - d_{r1})^{\gamma-1} + q_1^\alpha p_1^{1-\psi} \gamma d_{r1}^{\gamma-1}} < 0 \end{aligned}$$

By imposing symmetry i.e

$$d_{l1} = d_{r1} \equiv \frac{d}{2}, \quad (16)$$

$$q_2 = q_3 \equiv q, \quad (17)$$

$$p_2 = p_3 \equiv p. \quad (18)$$

one gets:

$$\frac{\partial d_{l1}}{\partial p_1} = \frac{\partial d_{r1}}{\partial p_1} = - \frac{(wl)^{-\psi} (d/2)^{1-\gamma} + (1 - \psi) q_1^\alpha p_1^{-\psi} d/2}{2q^\alpha p^{1-\psi} \gamma} \quad (19)$$

These expressions are next used to analyze the aggregate demand. Indeed because

utility maximization of one individual gives $c = wl/p$, the aggregate demand in 1 is:

$$C_1 = \frac{(d_{l1} + d_{r1})wl}{p_1} \quad (20)$$

deriving with respect to p_1 and using using (16) yields:

$$-\frac{p_1 \partial C_1}{C_1 \partial p_1} = 1 - 2 \frac{\partial d_{l1}}{\partial p_1} \frac{p_1}{2d}$$

and with (19) and $p_1 = p$ one gets:

$$\varepsilon = 1 + \frac{(wl)^{-\psi} (d/2)^{-\gamma} p^\psi q^{-\alpha} + (1 - \psi)}{2\gamma},$$

which is the expression presented in the text.