Vertical segmentation in the wine sector:
Estimating a production function for different wine segments in Brazil

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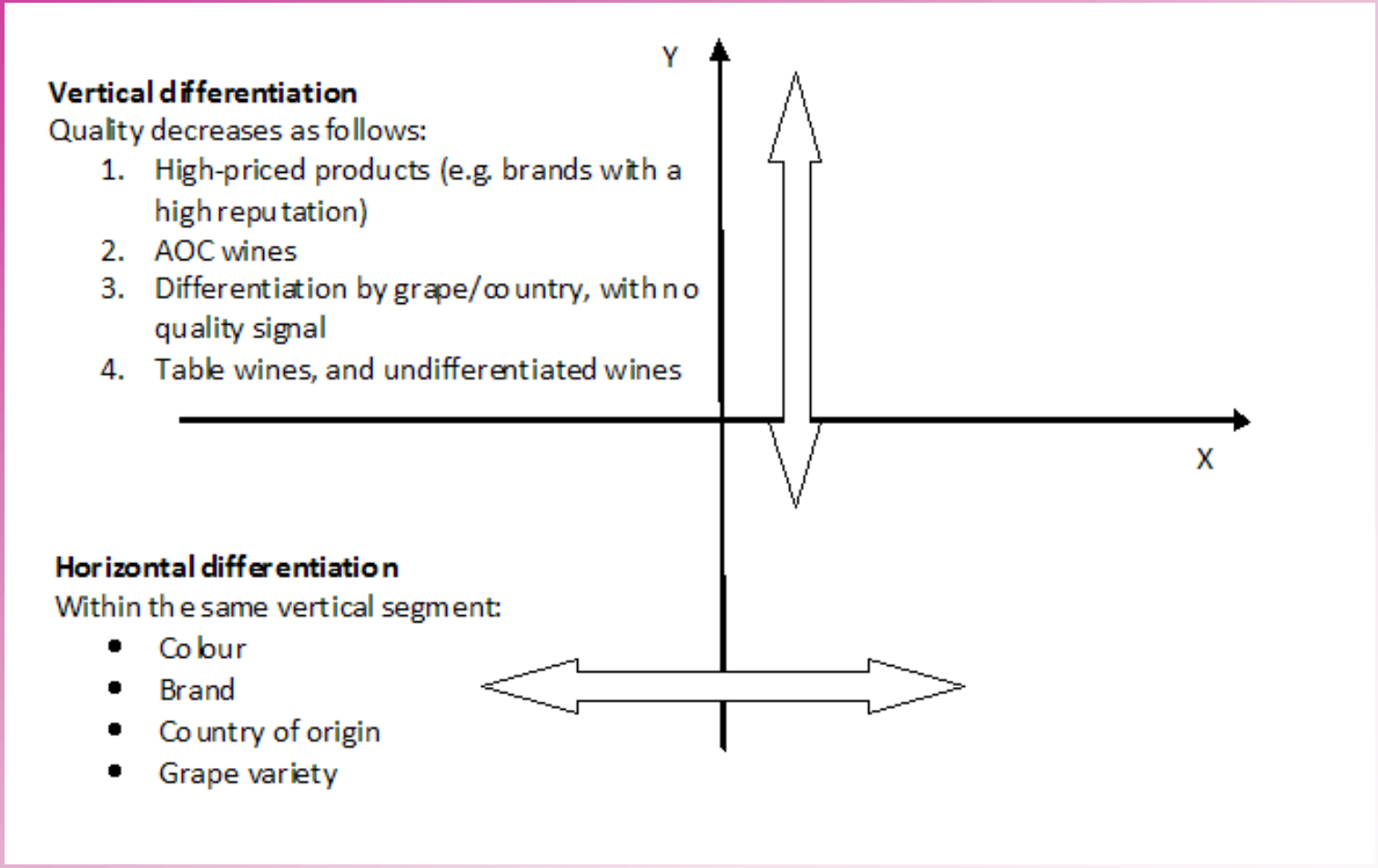
Differentiation in the wine market

- **The wine sector is generally characterised by a large amount of products supplied.**
- **Consequently, producers have shown a very strong tendency to differentiate their offer:**
  - **Horizontally, i.e. supplying products that differ not in the overall level of quality (by grape, by country of origin, etc).**
  - **Vertically, i.e. differentiating by quality level (e.g. AOC label, different price bands...).**
  - **Often, the strategy is mixed, supplying one or more good to each different quality segment.**
- **Differentiation occurs as a consequence of producers' marketing and economic strategies .**
- **In the particular case of wine, vertical differentiation can also be a consequence of governmental regulation, that endorses the need to protect national or regional products from imitation strategies, and guarantee the establishment of a collective reputation in the area of production.**
- **The case of the Brazilian wine sector, differentiation arises from both an institutional and a supply side policy. "Vale dos Vinhedos", the main area considered in this work, received a quality signal that can be assimilated to an AOC label.**

Differentiation in the wine market



The Y axis represent different quality levels, while the X axis represents differentiation within similar quality categories.

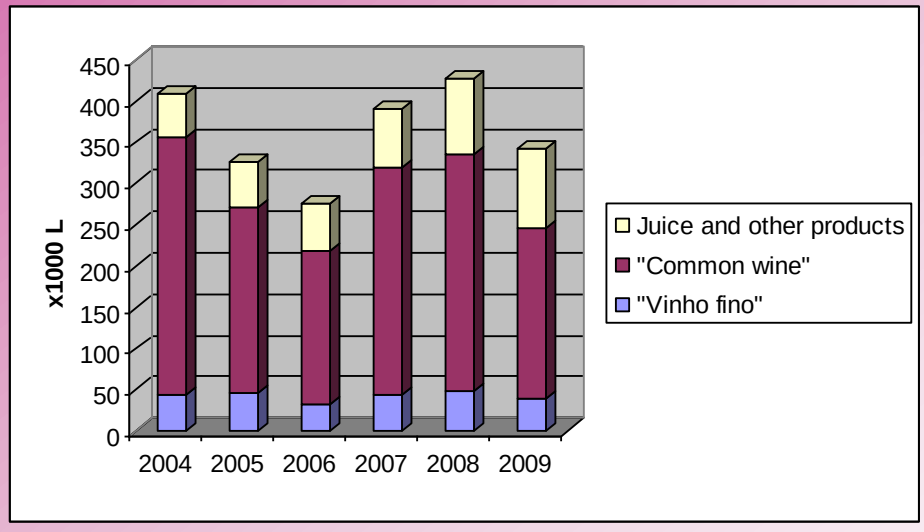
The area in the graph represents a continuum of consumer's preferences.

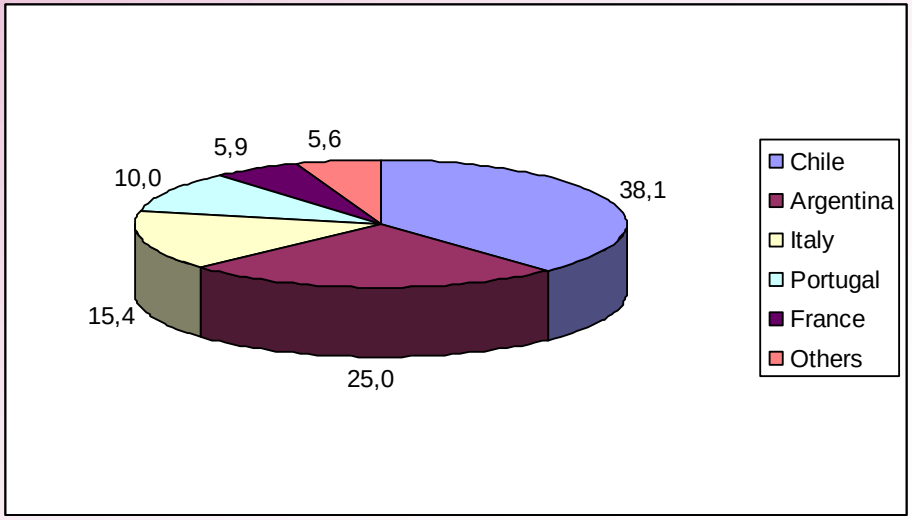
The Brazilian wine market

- **The second half of the nineteenth century, marks the development of the Brazilian wine industry in the Serra Gaúcha, Rio Grande do Sul (RGS).**
- **Winemaking was initially based on European varieties. This was replaced by American autochthonous vines (*Vitis labrusca)* because they better performed given the local climate.**
- **The mid-twentieth century (1930-1960) viticulture started a diversification process, where European varieties were reintroduced (*Vitis vinifera*), and new hybrid varieties were developed (*Vitis vinifera x Vitis labrusca)*.**
- **After the 70s, the market saw an increase in the production of varietal wines, based on *vitis vinifera* grapes, such as Cabernet Sauvignon, Merlot, and Chardonnay, driven by multinational companies.**
- **Winemaking was institutionalised and supported by the State through institutions such as:**
  1. **IBRAVIN (the Brazilian Wine Institute)**
  2. **Embrapa Grape and Wine (for research and extension)**
  3. **SEBRAE (support for micro and small firms)**
  4. **FUNDOVITIS (for financial support)**
  5. **Projects for promotion, such as “Wines from Brazil”.**

The Brazilian wine market

- **Today, the area planted with vines in Brazil is 90 000 ha (2007 data), 54% of which are concentrated in Rio Grande do Sul (RGS).**
- **Contrary to other States, 90% of grapes in RGS is produced for the production of wine, juice and other products. This State produces about 90% of all Brazilian wine.**
- **Although the production of "vinho fino" using *Vitis vinifera* varieties has increased in recent years, its relative weight is still low in Brazil (11.3%).**
- **The bulk of production is "table wine" (66% of the market), produced with hybrids and American varieties.**
- **Wine consumption in Brazil is still very low (1.9 liters / person / year), but wine imports have grown steadily in the last years, reading about 60 million litres annually, mostly from neighbouring countries, such as Chile and Argentina.**





Vertical differentiation in the Brazilian wine market

- **Differentiation in the Brazilian wine market is crucially associated with the grape variety.**
- **The lowest segment is made of local varieties, and quality wine can be achieved only with Vitis Vinifera varieties, which are not frequently grown in the country.**

Main category	Subcategory	Type of vine
Premium wines	Ícone	Vitis vinífera
	Ultra Premium	Vitis vinífera
	Super Premium	Vitis vinífera
	Premium	Vitis vinífera
Sparkling wines	Espumante Asti	Vitis vinífera
	Espumante Charmat	Vitis vinífera
	Espumante Champenoise	Vitis vinífera
	Filtrado Doce	Vitis vinífera
Luxury Basic wines	Básico Luxo	Vitis vinífera
	Básico Semi-Luxo	Vitis vinífera
Popular Basic wines[1]	Básico Popular	Híbrid and American vines

Data

- **Random sample of 55 wine producing firms in a total population of 660 firms recorded in the State of Rio Grande do Sul, all specialized in the production of table wine and "vinho fino".**
- **All fixed and variable costs of the selected companies were collected. Information was gathered from all written records of the firms, or inquired from the owner or his representative.**
- **The cost variables were recorded for 31 items, which were later grouped into eight categories:**
  - **Grape: Its value was based on the market price of grapes, or by the opportunity cost when it is produced by the firm.**
  - **The packaging (of wine): includes standard glass bottles, PET bottles (various volumes), carboy and bag-in-box.**
  - **The stopper: includes natural cork, pressed cork, rubber or plastic.**
  - **Labels, capsules and boxes: this is the remaining material needed for packaging;**
  - **Electricity;**
  - **Transport;**
  - **Labour related to the production process (no administrative labour);**
  - **Others: include all categories not previously considered, e.g. water, cleaning supplies, sewage treatment, paper, etc.**

Theoretical model

- **Imagine a market where producer *j* supplies the market with product *i*. Every product consists of a combination of inputs, which characterises the final product. The final value of the output crucially depends on the value of the inputs used by the producers, and by the level of inefficiency that characterises its production.**
- **Assume that each products is characterised by an individual production process.**
- **The starting point is a linearised Cobb-Douglas production function of the form:**

- ***y* is the total value of output, and *x* is a matrix of values of inputs. ξ_{ij} is the residual, while ζ_{ij} is the unobservable inefficiency term.**
- **Using a Cobb-Douglas production function, the coefficients (the betas) correspond to the value of the revenue elasticity of each input.**
- **Assume an half-normal model, where the inefficiency term is assumed to be strictly positive and normally distributed.**

$$\xi_{ij} = iidN(0, \sigma_\xi^2)$$
$$\zeta_{ij} = iidN^{+}(0, \sigma_\zeta^2)$$

- **The efficiency term is forced to be between 0 (perfect inefficiency) and 1 (perfect efficiency). Estimation is made via Maximum Likelihood using Stata.**

Results

Results refer to red wines only

(whites were 14 out of 323 wines)

	All wines		Popular Basic		Luxury Basic[1]		Premium		Sparkling	
y	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Intercept	2.6558***	0.1015	2.3703***	0.1548	3.0145***	0.2355	3.0213***	0.2793	2.4879***	0.5991
Grape	0.5586***	0.0321	0.6725***	0.0467	0.2592	0.1597	0.4444***	0.1732	0.1547	0.0950
Bottling	0.1229***	0.0286	0.1328***	0.0299	0.4371**	0.1796	0.0996	0.2359	0.4096	0.3245
Cork	0.0460*	0.0236	0.0081	0.0278	0.0350	0.0687	0.0820	0.0988	-0.0366	0.3266
Label/capsule/box	0.0626**	0.0262	0.0074	0.0311	0.0802	0.0775	0.1836	0.1213	0.2357	0.1514
Energy	0.0556***	0.0190	0.1040***	0.0260	0.0055	0.0523	0.0181	0.0716	-0.0020	0.0564
Transport	0.0529***	0.0170	0.0350	0.0221	0.1328***	0.0508	0.0157	0.0584	0.0819	0.0536
Labour	0.0147***	0.0242	-0.0394	0.0304	-0.0106	0.0792	0.1380*	0.0811	0.0809	0.1122
Other	0.1077	0.0158	0.1020***	0.0262	0.0818**	0.0359	-0.0186	0.0700	0.0592*	0.0331
Icone	1.2573***	0.1435					0.6682**	0.2772		
Ultra premium	0.8399***	0.1291					0.4709*	0.2570		
Super premium	0.7314***	0.1012					0.3566**	0.1635		
Premium	0.4745***	0.0847					Reference			
Basico Popular	Reference									
Basico Luxo	0.3431***	0.0775			Reference					
Basico Semi-Luxo	0.2346***	0.0712			0.0392	0.1605				
Sparkling Asti	0.3404***	0.1019							0.3518	0.4512
Sparkling Charmat	0.3207***	0.0998							0.4207	0.4467
Sparkling Champenois	0.5723***	0.1137							0.6714	0.4557
Filtrado doce	-0.2611	0.2124							Reference	

- **Vertical differentiation optimises the use of resources for wine producers. In particular**
  1. **Grape decreases as quality increases: grapes used in the top segments already possess a high and homogeneous quality level.**
  2. **The average value of products (the intercept) increases with quality: high quality segments have the highest average value.**
  3. **Packaging is highest for the Luxury Basic segment. Other packaging is not significantly different from zero in all segments.**
  4. **High quality segments like Premium and Sparkling wines are characterised by a relatively high elasticity for process variables: labour for Premium wines, and "Other expenditures" for Sparkling wines.**

Results

- **The value of lambda, which is significantly different from zero only in the Popular and Luxury Basic segments, testify that these are the only segments in the market affected by systematic inefficiencies, while the remaining segments seem to be working efficiently.**

	All wines		Popular Basic		Luxury Basic[1]		Premium		Sparkling	
y	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
$\mathrm{Ln}(\sigma_\xi^2)$	-2.4646***	0.2038	-2.5392***	0.2783	-3.8818	18.0942	-2.0192	10.4815	-2.9296	2.8192
$\mathrm{Ln}(\sigma_\varsigma^2)$	-2.2214***	0.4477	-2.8570***	1.0067	-2.7996***	1.2106	-10.4318***	3.6506	-12.3176***	2.5731
σ_ξ^2	0.2916	0.0297	0.2809	0.0391	0.1436	1.2989	0.3644	1.9095	0.2311	0.3258
σ_ς^2	0.3293	0.0737	0.2397	0.1206	0.2466	0.1493	0.0054	0.0099	0.0021	0.0027
$\sigma^2 = \sigma_\xi^2 + \sigma_\varsigma^2$	0.1935	0.0353	0.1364	0.0408	0.0814	0.3456	0.1328	1.3914	0.0534	0.1506
$\lambda = \frac{\sigma_\varsigma^2}{\sigma_\xi^2}$	1.1293	0.1000	0.8531	0.1553	1.7179	1.3735	0.0149	1.9171	0.0092	0.3267
Likelihood-ratio test of $\sigma_\varsigma^2 = 0$										
chibar2(01)	3.15**		0.44		19.72***		0.00		0.00	
Number of obs	328		147		74		55		52	
Replications					/1000		909/1000		828/1000	
Wald chi2	8462.06***		4875.91***		1482.44***		859.94***		3705.65***	
df Wald chi2	21		11		11		11		11	
Log likelihood	-122.55		-39.08		-4.71		-22.51		2.38	

Results

- **Production of wines using the Vitis Vinifera tends to provide a more homogenous level of efficiency in the sample used in this work.**
- **This could be a consequence of the agronomic and technological predisposition of this plant to wine making, but it can also indicate a greater marketing efficiency, as producers are more able to transform value of inputs in value of output.**
- **Currently, Vitis vinifera varieties are not widely used, and this finding suggests that the use of this vine in Brazil has a good potential for wine making, that should be explored further.**

Inefficiency	Mean	Std. Dev.	Min	Max
Popular basic	0.8347	0.0528	0.5609	0.9388
Luxury basic	0.8047	0.1405	0.1690	0.9561
Premium	0.9957	0.0000	0.9956	0.9958
Sparkling	0.9983	0.0000	0.9983	0.9983

Conclusions

- **From the analysis presented in this paper, it is possible to observe that through differentiation producers can optimise their use of inputs.**
- **As the quality segment increases, the elasticity of grape, the essential and basic input for wine, tends to decrease. This is because top segments have a decreasing benefit of using quality grapes: the average level of this input is generally high and homogeneous, and further increases generate a diminishing value of output.**
- **Packaging increases its relative importance in the Luxury Basic segment, the lowest quality level using a *Vitis Vinifera* grape. This is particularly the case of expenditures in bottle, which give sensibly higher revenues to producers in the Luxury segment compared to the Basic Popular segment.**
- **The two highest segments of the market have a higher average market value compared to the basic segments (the intercept).**
- **The Premium and Sparkling wine segments tend to value process-based inputs, such as labour and other expenditures.**

Conclusions

- **A drawback: the low number of observations – it makes estimation unclear in some of the two top segments, Premium and Sparkling wines. Consequently, better estimation would require a larger number of observations for each segment.**
- **This work only identifies the economic return of inputs in the wine sector per segment, and it does not explore other economic incentives that producers may have for segmenting the market.**
- **Further research in the area would be useful to explain better producers' behaviour in vertical and horizontal differentiation, both inside and outside the wine sector.**

Thank you very much for your attention