5 SPS standards and international competitiveness in Africa: the case of Senegal

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5.1 Introduction

Despite a steady decline in its share of GDP and exports, the agricultural sector continues to play an important role in African economies, and in Senegal in particular, where it employs approximately 60 per cent of the labour force. It accounts for a quarter of national public investment, but contributed only 6 per cent to GDP between 2000 and 2009 (Ministère de l'Economie et des Finances du Sénégal, 2011). Horticulture is one of the promising sectors, as can be observed not only from a rapid growth strategy but also from many national agricultural development strategies, because of the vast range of products included and the high level of income it generates for producers, especially in urban and suburban areas. In addition, Senegal has both a favourable climate and a good geographical position for the export of tropical off-season products. These factors have enabled the country to increase the production and export of fruit and vegetables significantly. Horticultural production has experienced a boom over the last ten years, increasing from about 150,000 to 228,000 metric tons between 1992 and 2000 and to 429,000 metric tons in 2007, an increase of 5.5 per cent per year. In 2008, the production of vegetables (excluding potatoes and fresh tomatoes) recorded a growth rate of 8 per cent and the production of fruit experienced a growth rate of 81 per cent. Accordingly, exports have increased from 6,175 metric tons in 1995 to 9,000 metric tons in 2000 and 31,000 metric tons in 2009, an increase of about 5.5 per cent per year. The main target markets for exports are neighbouring countries and the European Union (Ndoye-Niane, 2004; Senegal, National Agency of Statistics and Demography, 2006–2010).

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However, for horticulture as well as for other agricultural products, the main constraint on exports remains the non-compliance with quality standards, including sanitary and phytosanitary (SPS) standards (Mbaye, 2005). The aflatoxin contamination in peanuts, excess levels of pesticide residues in fruit and vegetables, calibration problems and treatment for gum arabic are obstacles to exports of Senegal's agricultural products. In addition to price competitiveness, quality standards are a challenge for agriculture in Senegal. Unsustainable production practices, which often result from low levels of training and information available to producers, continue to prevail on a large scale in the agricultural sector in Senegal. According to available data in the horticultural sector in the suburban area of Dakar, only 27 per cent of producers are aware of sustainable practices in horticultural production (Gueye, 2009).

The horticultural industry is particularly threatened by a considerable loss of performance due to the high levels of pest contamination. As a result, even when all the agro-climatic conditions are met, a good harvest is not guaranteed. In response to this, the over-use of pesticides often remains the first option to eliminate parasites. A wide range of pesticides is being used to fight against pests and diseases in the Niayes area. Some pesticides (methamidophos, dicofol, dimethoate, malathion, Tamaron, batik, dursban and sulphur) are known for their high efficiency over a large range of different kinds of pests. Other ranges of pesticides are also effective, but their scope is generally more limited, not exceeding one or two pests. Whatever their nature, the over-use of pesticides today is a real threat to the quality of fresh fruit and vegetables, and a real danger to public health. Pesticides are often applied just before harvest and prescribed doses are rarely maintained. This explains why pesticide residues are often found in fresh fruit and vegetables in abnormal doses (Cissé and Fall, 2001).

This chapter seeks to assess the impact of pesticide use on the international competitiveness of the horticultural products of Senegal, using the Ricardian theory of comparative advantage. The model will be adjusted to capture quality as a determinant of export. The chapter is organized as follows: Section 5.2 reviews the SPS standards governing world trade in horticultural products. Section 5.3 presents a review of the literature on the concepts of price competitiveness and quality competitiveness. The conceptual framework of the research is presented in Section 5.4, followed by the results of the model in Section 5.5.

5.2 SPS and trade of Senegalese horticultural products

In recent years, the public health implications of certain diseases of animal or vegetable origin were widely publicized following the spread of some important epidemic and epizootic diseases, such as bovine spongiform encephalopathy (BSE) and certain diseases related to the H1N1 virus.

The application of the SPS measures has resulted in an increasing need and interest by governments to regulate international trade in ways to protect the health and well-being of the consumer. Originally, the application of standards was limited to homogenized products marketed but it has gradually been transformed into rules to protect the health of consumers. In order to maintain or increase their market shares, many private companies have gradually developed strategies to meet consumer demand and have increased the differentiation of their products. Through this set of requirements that directly affect the production process, many companies were able to gain significant sales niches in global trade.

The WTO does not provide for quality standards (SPS) per se, but refers to existing international standards. Its members are encouraged to ensure the application of certain standards of quality, which include those related to the International Plant Protection Convention (IPPC) for plant protection, the World Organisation for Animal Health (OIE) and Codex Alimentarius for food security. The latter organization was founded in 1963 by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO). It sets standards, guidelines and codes of practice to protect the health of consumers and to ensure best practices in food trade. It should be noted, however, that there is no body for the international harmonization of the implementation of these standards and thus they are subject to quite different regulations in different countries. On the European market, which is the main destination for Senegalese products, three organizations are involved in the design and implementation of European legislation: the United Nations Economic Commission for Europe (UNECE); the European Union (EU), which, through its Parliament and Commission defines recommendations, directives and regulations which are Commission rules; and the Organisation for Economic Co-operation and Development (OECD), which ratifies the UNECE texts and publishes explanatory brochures on regulatory texts for the bodies (European Union, 2001).

The issue of pesticide residues has become a hot topic over the past several years in Europe. Many guidelines have been established in connection with the definition of maximum residue limits (MRLs) allowed. European legislation has set limits on pesticide content depending on the type of product: fruit and vegetables, cereals, food of animal origin and others. MRLs are not yet fixed at the same level in different countries, as each country is free to change national legislation guidelines. It was not until 2005 that MRLs were harmonized for all member countries and all food products.

In Senegal, a study supervised by the Senegalese Agricultural Research Institute (ISRA) and another study by Fondation CERES-Locustox (CLX) (2008) on the issue of pesticide residues on horticultural products in the Niayes area revealed significant discrepancies between MRLs and the levels of residues of chemical pesticides found in vegetables grown in the Dakar urban periphery (see Table 1).

Table 1 **Comparison of MRLs and the levels of contamination observed in horticultural production in the area of Les Niayes (standard unit measurement)**

Pesticide	Cabbages		Eggplant		Lettuce		Tomato		Onions	
	Residues	LMR	Residues	LMR	Residues	LMR	Residues	LMR	Residues	LMR
Deltamethrine	0.2	0.1							0.13	0.1
Dicofol	0.04	0.02	0.18	0.02	0.07	0.02			0.03	0.02
Methamidophos	0.06	0.01	0.06	0.01	0.14	0.1	0.06	0.01	0.07	0.01
Manèbé	5.12	1	3.63	2	9.10	5				

Source: ISRA, Codex Alimentarius.

The Fondation CERES-Locustox (2008) study revealed the presence of five organophosphorus pesticides and eight organochlorine pesticides on vegetables in the market. Among these were cited pesticides such as dieldrin, DDT (dichlorodiphenyltrichloroethane), aldrin and heptachlor, which are on the list of "the banned twelve" of the Stockholm Convention on Persistent Organic Pollutants (POPs). Other pesticides commonly used in locust control have also been found in samples analysing vegetables: ethyl chlorpyrifos, malathion and fenitrothion.

In terms of public interventions, there is also a real deficiency in government agencies responsible for the implementation of SPS standards in agricultural and agro-food activities. Despite the existence of an important legal mechanism that regulates the use of pesticides and the implications for some donors in bringing about relevant regulatory procedures, Senegalese horticultural products still face barriers to SPS standards for market access in the EU (Gueye, 2009). Alternative methods of prevention and fighting against parasites were tested through several development projects. These methods apply both to the adoption of sustainable production routes and the use of biological pesticides, but they are mostly ineffective and also very expensive. Moreover, the inputs necessary for their implementation are not always available in the domestic market.

5.3 Price competitiveness versus quality competitiveness: a brief survey of the literature

Despite the preponderance of analyses of international competitiveness based on price and production costs, the issue of quality emerges increasingly as an anchor point in determining the performance of countries in terms of exports and market share (Henson et al., 2002). Due to the consideration of quality as a strategy for product differentiation, the international market for agricultural products is becoming

more and more like a monopolistic form of competition, whereby product differentiation gives way to niche markets for producers. The strategy, for a company, is to provide a product that is distinct from that of its competitors. Differentiation can also be the result of a marketing and advertising campaign targeting consumer preferences (subjective differentiation) (Lancaster, 1979).

The implementation of this differentiation is related to the existence of a real value chain in which different actors are linked by flows of goods and information. Diemer (2001) noted that the main objective of the farmer is primarily to market products likely to generate a positive margin. These margins reflect price competitiveness (productivity, exchange rate) or competitiveness not related to price (innovation, quality and organization).

Since Akerlof (1970), economists tend to predict that, when quality is mastered, the low-quality products tend to crowd out the market areas of high quality. Thus, if we consider the decision of a consumer to buy a product, when they are not sure of its quality, they will not pay more than the expected quality.

Fleckinger (2007) studies "experience goods" which are goods consumed by the consumers themselves or by experts. One speaks of an "experience good" when the consumer buys in a repetitive way: after experiencing the poor quality of the product, the consumer will make a decision and then replace the product with another product or will make a decision not to buy the product any longer. However, this requires, first, that the consumer's relationship with the producer is a long-term one and, secondly, that the producer's firm is identified with every purchase.

The latter condition fails if there is a lack of traceability, if the consumer has a limited memory, or if the frequency of purchases is low. In the case of limited information, the public signal becomes an important remedy. This signal can be provided by experts or by a certification by buyers who come from different types of consumer networks. There are two distinct classes of "experience goods". In the first class, the consumer knows the producer. In the second class, the consumer does not know the producer and it will be very costly for the consumer to identify the producer. Agricultural products correspond to the second class. When goods are imported, identifying the producer of a particular good can be very expensive for the consumer, who tends to impute the collective reputation of such types of goods. Rouvière and Soubeyran (2008) give two aspects of collective reputation:

- the producers are still under the influence of the behaviour of others amongst them
- the collective reputation can be underpinned by a bonus system that would encourage good practices in some industries.

Tirole (1996) considers the collective reputation to be the aggregate of individual reputations. According to Winfree and McCluskey (2005), collective reputation is a collective property of the companies involved. In markets with collective reputation it is difficult to maintain high quality production. Akerlof (1970), in his famous article on "lemons", interprets this as a characterization of the danger of the collective reputation in the market for used cars.

5.4 How to predict the level of exports subject to quality limitation: a conceptual framework

The Ricardian model focuses on labour productivity and labour costs as determinants of comparative advantage. Relative unit labour cost (c) of sector i for country j, with respect to country k, is defined (Golub and Hsieh, 2000; Mbaye and Golub, 2007) as:

$$c_{ijk} = a_{ij}w_{ij}/a_{ik}w_{ik}e_{jk} \quad (1)$$

Where (1/a) is the marginal productivity of labour, w is the wage rate and e is the bilateral exchange rate between the two countries. According to the basic Ricardian model, country j will specialize in the production of good i for which $c_{ijk}<1$, and country k in the production of good i for which $c_{ijk}>1$. Using this analytical framework, Mbaye and Golub (2007) study the competitiveness of Senegalese industry using two indicators: relative unit labour cost (RULC) and the relative producer price (RPP). This article is an extension of their 2002 study on the measurement of competitiveness based on RULCs. The RPP indicator they use is measured as follows:

$$PC_i = \frac{eP_{ij}}{P_{ik}} \quad (2)$$

P_i is the producer price of sectors in country j and k respectively. Mbaye and Golub (2007) conclude that the two measures of competitiveness are strongly correlated. Using their specification of exports, adjusting prices for quality and log-linearizing yields:

$$\log(EXAG_{it}) = \alpha \log(CA) + \beta \log(WDEM_j) + \log(QUALI) + \varepsilon_{it} \quad (3)$$

EXAG is the real agricultural export and CA is the index of price competitiveness, measured alternatively as ULC (unit labour costs) and PP (producer prices). $WDEM_i$ is the global demand for good i. Finally, QUALI is an index of quality.

For each horticultural speculation considered, and for each country, ULC indices and PP indices are computed. The level of world aggregated imports was used for each speculation as a proxy of global aggregate demand for each product.

The model was estimated using ordinary least squares (OLS) and the results are presented in Table 2. A potential problem is that, when quality is low, exports are dramatically discouraged and can even turn out to be nil when exported goods fail to meet international standards. Hence, the export variable is censored and OLS regressions are likely to be biased. To address this issue, the Tobit two-stage estimation technique (Heckman, 1979) with a two-stage regression is used. First, the probability is estimated of having a non-nil level of exports:

$$z_i^* = w_i \gamma + \mu_i \text{ (selection equation)} \quad (4)$$

where z^*_i is the probability of having a positive level of exports in a binary setting.

The second stage regression is done using the following equation:

$$y_i = x_i \beta + \varepsilon_i \text{ (substantive equation)} \quad (5)$$

with y_i observable only when the level of exports is different from zero.

The Heckman two-stage procedure consists of first estimating regression parameters using a maximum likelihood Probit model (selection equation), and then estimating a substantive equation by OLS. Once the selection equation is estimated, the residuals from this equation are used to form a new variable called the Inverse Mills Ratio (IMR - λ). For each observation, λ is the instantaneous probability for this observation to be excluded from the sample. When it is assumed that the error term is distributed according to the standard normal distribution, λ is measured as the ratio of the standard normal probability density function to the cumulative density function. Each individual in the sample receives an individual IMR, based on the residual observed for that individual in the selection equation. The IMR is included as an explanatory variable in the substantive equation to correct for the bias associated with censoring non-positive observations in equation (2) (Heckman, 1979, 1998). When the dependant variable in the substantive equation is continuous, as in our case, the Heckman method provides consistent estimates. But a major limitation of this methodology is its great sensitivity to the quality of selection model specification. If the model is not well specified, and the variables in the selection model do not correctly predict level of exports according to quality limitation or to other factors, then the method may have limited power to detect bias. The results of this procedure are presented in Table 3.

Table 2 Estimation results obtained from Equation 3

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Export	Export	Ln (Export)	Ln (Export)	Market share	Market share	Ln (Market share)	Ln (Market share)	Growth Rate EXP	Growth Rate EXP_EXP	Growth Rate EXP_EXP	Growth Rate EXP_EXP	Ln	LMR
Producer price	-41.8039*				-0.0000***				-0.0025					
	(21.594)				(0.000)				(0.011)					
Demand	0.0459***	0.0470***			-0.0000***	-0.0000***			0.0000	0.0000				
	(0.005)	(0.005)			(0.000)	(0.000)			(0.000)	(0.000)				
Premium	35,341.1438**	35,933.0092**			-0.0023	-0.0003			-6.3597	-6.9479				
	(14,537.662)	(14,769.338)			(0.006)	(0.006)			(7.046)	(6.929)				
Unit cost of labour		-54,966.7049				-0.0668***				16.9004				
		(56,468.092)				(0.024)				(23.854)				
Log (Producer price)			-0.3080*				-0.2447				-3.9051		-0.8785***	
			(0.158)				(0.173)				(5.528)		(0.179)	
log (Demand)			0.3658***	0.4476***			-0.7314***	-0.6231***			3.6690	7.5904**	-0.3622***	0.3145***
			(0.093)	(0.109)			(0.102)	(0.118)			(3.477)	(3.779)	(0.106)	(0.117)
Log (Premium)			0.1986***	0.1868***			0.1949***	0.1863***			-1.5903	-1.1808	0.1778**	0.1516**
			(0.061)	(0.061)			(0.067)	(0.066)			(2.188)	(2.187)	(0.069)	(0.066)
Log (Cost of labour unit)				0.0465				0.1033				5.1128*		0.8104***
				(0.094)				(0.103)				(2.753)		(0.101)
Constant	-3,368.2925	-17,823.1397	5.3785***	2.6574	0.0760**	0.0696*	6.1785***	3.6695**	6.7280	4.4690	-23.2144	-80.4988*	4.9308**	-6.3941***
	(48,078.935)	(71,028.717)	(2.017)	(1.687)	(0.030)	(0.042)	(2.151)	(1.774)	(10.595)	(9.105)	(63.372)	(47.207)	(2.143)	(1.514)
Observations	340	340	340	340	340	340	340	340	323	323	323	323	340	340
Number of countries	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Source: Authors' calculations based on econometric research.
Note: One asterisk indicates significance at 10 per cent; two asterisks, significance at 5 per cent; and three asterisks, significance at 1 per cent.

Table 3 The Heckman two-stage estimation of exports

		Coef.	Std. Error	z-Stat	P-value
Selection equation:	**Dependant variable = log(export/VA)**				
	log(cost of unit labor)	1.103	0.533	2.07	0.038
	log(demand)	0.822	1.370	0.60	0.549
	log(premium)	0.767	1.631	0.47	0.638
	constant	-2.098	3.256	-0.64	0.440
Substantive equation:	**Dependant variable = log(export)**				
	log(cost of unit labor)	0.137	0.099	1.38	0.168
	log(demand)	0.410	0.148	2.78	0.005
	constant	-3.289	1.770	-1.86	0.063
	Mills Inverse Ratio	0.818	1.606	0.51	0.579
	Wald chi2	9.09			
	Prob > chi2	0.03			
	Observations	459			
	Censures observations	19			

Source: Authors' calculations based on econometric research.

5.5 The results of the analysis

The data used in this study are mainly from the FAO database. Data on production, prices, exports and global demand are from the United Nations Commodity Trade Statistics database (UN Comtrade), data on exports are from the United Nations Statistical Division database (UNdata), data on agricultural value added, intermediate consumption, production, producer price index and employment are from the World Bank, and data on wages are from the International Labour Organization (ILO). These databases are very limited because of series that are often incomplete, especially for African countries. Data were cross-checked as much as possible and extrapolation methods were used to complete the series.

The analysis focuses on three main products exported by Senegal: mangos, green beans and tomatoes. Senegal's main competitors for these products are Burkina Faso, Kenya, Mexico, Morocco and South Africa. A premium on quality is observed if a country receives more compared with the price set in the international market (Aiginger, 2001). This premium was estimated as the ratio between the unit price of a given product and its world price. If the ratio is greater than 1, it means that the country has benefited from a quality premium.

Table 2 gives the estimation results obtained from Equation 3 above, with different specifications. Exports are introduced alternatively in log or in share of value added. Competitiveness indices are significant with the expected sign, as well as the variable representing premium quality. This shows that, in addition to cost constraints and price, variables related to quality are just as crucial for exports. Using the Heckman two-stage methodology does not alter these conclusions. The use of such methodology is made relevant by the fact that failure to comply with SPS standards may result in lowering or even impeding exports. That is the case for many products in African countries. Work by Mbaye (2005) shows that exports of confectionery groundnut by Senegal are significantly limited by the high levels of contamination of Senegalese products by aflatoxin. Of 60 thousand metric tons of confectionery groundnut produced, less than a thousand metric tons actually pass the SPS standards barriers to enter the European markets. The study further reveals that most of this share is in fact destined for bird feeding instead of human consumption. Likewise, pineapple juice produced in Benin, Togo and other West African countries is hardly exported at all. Taking into account these zero export levels means that this variable is censored, and using the Tobit method leads to the confirmation of the results obtained with the baseline regressions. That is, while real exchange rate variables have an important explanatory power on exports, quality variables are also critical in determining a country's international competitiveness.

The results of the baseline regression are displayed in Table 3. The Wald statistic is 9.09 for the baseline regression, so the hypothesis that all the regression coefficients are zero is rejected. The selection equation was estimated using the whole set of observations, including those which have a positive level of exports and those which do not. For the second stage regression, only the observations from countries that have a positive level of exports were used. The results indicate that, for the selection equation, the exchange rate variable is significant while the world demand variable is not.

5.6 Conclusions and policy recommendations

This chapter has focused on quality competitiveness as opposed to price competitiveness. Using the Ricardian comparative advantage framework adjusted with a quality index, significant estimates for both sets of variables were observed. These results are also robust to several alternative specifications. The methodology was used on horticultural products, namely mangos, green beans and tomatoes, and the sample countries were Burkina Faso, Kenya, Mexico, Morocco, Senegal and South Africa. Since observance of SPS standards is critical for exports of such goods, exports can be impeded by failure to meet such standards. To take into account this censored variable in some instances which might bias the estimates when OLS are used, the study resorted to the Heckman two-stage estimation

technique which confirmed the same significant relationships. This indicates that quality is at least as critical as price variables in determining competitiveness and exports. Hence, quality management should be given due attention in domestic trade policies as well as in the Aid for Trade mechanism.

Clearly, Senegal has great potential to boost its horticultural production and exports if the quality issue is properly addressed. According to FAO (1966), it is highly possible for developing countries to diminish their levels of pesticide residue contamination dramatically by sticking to some good practices which have been developed through research. For example, by mixing biopesticides and chemical ones, producers may be in a better position to meet most SPS requirements from importing countries. Furthermore, studies on the pesticides industry in Senegal (Cissé and Fall, 2001) reveal that most hazardous pesticides used in the country come from artisanal production or imports of counterfeit pesticides. Hence, the Government should develop its capabilities in investigating and cracking down on such activities.

In Senegal, a special unit within the Ministry of Agriculture, the Directorate of Plant Protection (Direction de la protection des végétaux, DPV) is in charge of quality inspection of horticultural production prior to its exportation. But it is under-funded and under-equipped, and thus has difficulties fulfilling its mission. Support from both the Government and donors could bring to DPV the necessary expertise and instruments to carry out effective inspection for items destined for both domestic consumption and export.

In order to address the SPS challenges facing horticultural exports, beyond mitigating the uncontrolled use of pesticides, an appropriate policy of packaging of goods is also needed. Products are, in general, sent abroad without proper packaging, which further deteriorates their quality. Given the highly perishable character of these products, a system of storage at the airport is needed to ensure that they are not damaged during transportation to external markets. Such a facility was set up at the airport in Dakar in 2012 but, regrettably, its limited capacity poses a real constraint for the booming horticultural exports.

While these adjustments are needed on the supply side of fruit and vegetable exports, efforts are also needed on the demand side. Most importing countries set their SPS standards at very high levels, which are often difficult to meet by exporting developing countries. Hence, rather than protecting consumers against health hazards, the reality seems to point in the direction of SPS standards acting as non-tariff barriers.

To conclude, both importing and exporting countries should work together to ensure that WTO rules are fully observed so as to guarantee consumer health and protection while, at the same time, avoiding restrictions in trade.

Bibliography

Aiginger, K. (2001), *Europe's position in quality competition*, Luxembourg, Office for Official Publications of the European Communities, Entreprise Papers 4–2001.

Akerlof, G. A. (1970), "The market for 'lemons': Quality uncertainty and the market mechanism", *Quarterly Journal of Economics* 84(3): 488-500.

Cissé, I. and S. T. Fall (2001), "Impact du système de production horticole sur l'environnement des Niayes", in Cités horticoles en sursis ? *L'agriculture urbaine dans les grandes Niayes au Sénégal* (S. T Fall and A. S. Fall, Eds.), Ottawa, Centre de recherches pour le développement international (IDRC).

Diemer, A. (2001), "Supply chain management des cultures spécialisées", paper presented at the colloquium "Innovations et économie agricole", L'Institut national de la recherche agronomique (INRA), Paris, 21-22 September.

European Union (2001), "Règlement (CE) No 1148/2001 de la Commission du 12 juin 2001 concernant les contrôles de conformité avec les normes de commercialisation applicables dans le secteur des fruits et légumes frais", *Journal officiel des Communautés européennes* (L156/9) du 13/06/2001.

Food and Agriculture Organization of the United Nations (FAO) (1966), *Proceedings of the FAO symposium on integrated pest control*, Rome, 11-15 October 1965.

Fleckinger, P. (2007), *Collective reputation and market structure: Regulating the quality vs quantity trade-off*, Paris, Ecole Polytechnique, Centre National de la Recherche Scientifique, Cahier n° 2007-26.

Fondation CERES-Locustox (2008), *Détermination du niveau de contamination par les pesticides de légumes du panier de la ménagère*, Dakar.

Golub, S. S. and C.-T. Hsieh (2000), "Classical Ricardian theory of comparative advantage revisited", *Review of International Economics* 8(2), 221-234.

Gueye, A. (2009), *What do we know about the quality of the food we eat? Case study of peri-urban horticulture in the area of Les Niayes.* Master's thesis, Faculty of Economics and Management, University Chiekh Anta Diop, Dakar.

Heckman, J. J. (1979), "Sample selection bias as a specification error", *Econometrica* (47)1: 153-161.

Heckman, J. J. (1998), "Detecting discrimination", *Journal of Economic Perspectives* (12)2: 101-116.

Henson, S. J. et al. (2002), *Impact of sanitary and phytosanitary measures on developing countries*, Reading, UK, University of Reading, Department of Agricultural and Food Economics.

Lancaster, K. (1979), *Variety, equity and efficiency: Product variety in an industrial society*, New York, Columbia University Press.

Mbaye, A. A. (2005), "Sanitary and Phytosanitary Standards (SPS) and Developing Country Agro-food Exports: An Assessment of the Senegalese Groundnut Subsector." Washington, DC, The International Bank for Reconstruction and Development/The World Bank, Agriculture and Rural Development Discussion Paper.

Mbaye, A. A. and S. Golub (2007), "Senegalese manufacturing competitiveness: A sectoral analysis of relative costs and prices", *African Integration Review* (1)1: 96-138.

Ndoye-Niane, A. F., et al. (2004), "Caractérisation socio-économique des exploitations horticoles dans la zone des Niayes, Sénégal", projet collaborative ISRA/BAME-PPMEH : suivi et analyse des exploitations horticoles pour une pérennisation du crédit du PPNEH, ISRA/BAME, Dakar.

Rouvière, E. and R. Soubeyran (2008), *Collective reputation, entry and minimum quality standard*, Milan, Fondazione Eni Enrico Mattei, Note di Lavoro Series 7.2008.

Senegal, Agence Nationale de la Statistique et de la Démographie (2006), *Situation Economique et sociale du Sénégal*, 2005 ed.

Senegal, Agence Nationale de la Statistique et de la Démographie (2007), *Situation Economique et sociale du Sénégal*, 2006 ed.

Senegal, Agence Nationale de la Statistique et de la Démographie (2008), *Situation Economique et sociale du Sénégal*, 2007 ed.

Senegal, Agence Nationale de la Statistique et de la Démographie (2009), *Situation Economique et sociale du Sénégal*, 2008 edition.

Senegal, Agence Nationale de la Statistique et de la Démographie (2010), *Situation Economique et sociale du Sénégal*, 2009 ed.

Senegal, Ministère de l'Economie et des Finances du Sénégal (2011), *Rapport national sur la compétitivité du Sénégal 2011*.

Tirole, J. (1996), "A theory of collective reputations (with applications to the persistence of corruption and to firm quality)", *Review of Economic Studies* (63)1: 1-22.

Winfree, J. A. and J. J. McCluskey (2005), "Collective reputation and quality", *American Journal of Agricultural Economics* 87(1): 206-213.

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