STRUCTURAL ADJUSTMENT PROGRAMS AND PEANUT MARKET PERFORMANCE IN SENEGAL

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1.   Introduction

Government intervention in African agriculture has been extensive, often regulating the price farmers receive for their products while subsidizing inputs to pursue cheap food policy goals (Bates, 1989). In fact, in the 1980s external donors demanded that this sort of intervention be ended under the so-called structural adjustment programs (World Bank, 1989). An understanding of the political and economic rationale and impacts of past policies is essential to design politically viable reforms. Often, structural adjustment policies (SAPs) and other reforms are applied with the preconception, but without evidence, that they will be beneficial to agricultural producers or the country as a whole.

The thrust of this article is to examine the impact of structural adjustment programs in the Senegalese peanuts (also called groundnuts) market. It pursues two related objectives. First, it identifies and assesses the key political-economic factors shaping the regulated price of peanuts in the post-independence period. Second, it assesses the impacts of SAPs on social welfare and the welfare of the peanut producers in particular. It is instructive to examine the Senegalese peanut case because it possesses the typical features of government intervention in Africa: past price regulation by marketing boards, subsidization of inputs, and recent reforms under structural adjustment programs. Thus the analysis provides rich lessons and methodology applicable not only to Senegal but also to other cases in the continent.

2.   The Case of Peanuts in Senegal

The Senegalese economy relies heavily on the performance of the peanut sector, which accounts for 40 to 50% of export earnings and 50% of agricultural production (World Bank, 1989; Jammeh, 1987).   Because this sector is both economically and politically vital, it is not surprising that government intervention has been pervasive.

The first decisions taken after independence in 1960 revealed the government's intention to further intervene in agriculture (Waterbury, 1987a). The new authorities initiated a vast government action plan aimed at developing the peanut sector, via intervention in its production and marketing. From 1960 to the early 1980s the production policy program relied on a credit system along with input subsidies. The credit system enabled producers to acquire seed, fertilizer, and equipment. For instance, during the first two decades of post-independence, subsidies on fertilizer averaged 56% of the factory unit cost (Beghin, 1991).

The marketing policy program consisted mainly of regulating prices through a double mechanism. First, the government decided early on to restrict the entry of private traders into the groundnut market. These traders were eventually eliminated,

and the state marketing board became the sole institution allowed to buy groundnuts from farmers. Second, the output price of peanuts was administratively set. A committee essentially dominated by bureaucratic actors and representatives of the peanut crushing firms usually proposed the price to be paid to the farmers. The final decision has always been taken by the President (Jammeh, 1987).

A persistent balance of payments deficit, coupled with shortages of foreign exchange essential for loan repayments, led the Senegalese authorities to launch a structural adjustment program in the early 1980s under pressure from external donors (World Bank, 1989; Durufle, 1995; Vengroff and Creevey, 1997). Farm input subsidies were lifted and the credit system terminated. Eventually, under heavy pressure from the World Bank and the International Monetary Fund, public officials finally decided to dissolve the marketing board and transferred the marketing functions to the state-owned oil plants. In addition, the country was required to lift the import embargo on vegetable oil for domestic consumption.

3.   **Theoretical Model of Pricing Decisions**

Let q_i denote the peanut production of the ith farmer (i=1,…,n) so that $Q = \sum_i q_i(V_i)$ is total peanut production. The aggregate farm supply function is thus given by

$$Q = f(P,V), \tag{1}$$

where Q is the quantity of peanuts supplied, P is the peanut price and V is a vector of supply shifters.

Using the producer surplus (*PS*) concept as a money-metric measure of farmers' welfare (Just et al., 1982), it follows that

$$PS = PQ - \int_{Q^0}^{Q} S(Q)dQ \tag{2}$$

where *P=S(Q)* is the inverse farm supply curve, holding *V* constant, and the term Q^0 is the economically meaningful minimum level of supply when *P=0* or when *Q=0.*

Let the oil processing industry have *m* firms producing a homogeneous output (*Z*) from peanuts *Q.* Processors' welfare is then denoted by

$$PCS = P_z(1+s)aQ - caQ - PQ \tag{3}$$

where P_z is the border price of peanut oil, *s* is a subsidy or tax on oil sold in the world market, and *c* is the per unit cost of processing oil assumed to be equal across firms. For simplicity, the input-output ratio of groundnuts to oil, is assumed to be constant as defined by $Z = aQ$ where *a* is a production coefficient.

Following the model of price regulation presented by Peltzman (1976), it is further assumed that the Senegalese regulatory authorities base peanut pricing decisions on the welfare of both farmers and processors. That is, they politically weigh the welfare of one group against the other in making pricing decisions. Following the revealed preference approach (Gardner, 1987; Lopez, 1994), the government's objective function is assumed to be given by $W = W (PS, PCS)$. More specifically, the government's objective function is defined as

$$\textit{Maximize} \quad W = PS + \textrm{q}\, PCS, \tag{4}$$

where $\textrm{q}$ represents the welfare weight given to processors relative to the welfare of farmers.

Solving the first-order condition for the maximization of (4) with respect to Q yields

$$P^{*} = \frac{MNRP}{1 + \dfrac{1}{\textrm{e}}\left(1 - \dfrac{1}{\textrm{q}}\right)}, \tag{5}$$

where $MNRP = P_{z}(1+s)a - ca$ is the marginal net revenue product from peanuts, $\textrm{e}$ is the price elasticity of supply, and the other notation is as defined above.

4.   Econometric Model Specification

Equations (1) and (5) are the basis for empirically assessing the sources and impacts of peanut pricing decisions in Senegal. With regard to formulating equation (1), it is worth noting that peanut prices are set well before the rainy season. In addition to the peanut price, other variables determining supply levels are the price of millet, the price of fertilizer, rainfall, and a dummy variable to account for severe droughts (Sadoulet and de Janvry, 1995). Millet competes with groundnuts in the same growing season. However, farmers do not know the millet price before the planting season. Its expected price is assumed to be determined via the rational expectation hypothesis (McCallum, 1976). Because the price elasticity of supply appears in the pricing equation, farm supply is modeled using a double-log functional form given by:

$$\ln Q_{t} = \textrm{b}_{0} + \textrm{e}\ln P_{t}/d + \textrm{b}_{2}\ln Pm_{t}^{e}/d + \textrm{b}_{3}\ln RF_{t} + \textrm{b}_{4}DRY_{t} + \textrm{b}_{5}\ln PF_{t}/d + v_{t} \tag{6}$$

where Q_{t} is peanut output in year t, Pm_{t}^{e} is the expected price of millet, PF_{t} is the farm price of fertilizer, RF_{t} stands for rainfall, DRY_{t} is a dummy variable to account for years of severe drought, and d is consumer price index which is used as a price deflator. The $\textrm{b}_{i}$ are fixed parameters, $\textrm{e}$ is the price elasticity of peanut supply, and v_{t} is a disturbance term.

For equation (5), it is assumed that the political weight given to processors in the post-independence period varies according to the following factors:

1. Industrialization Period (Indust) (1960-85): A dummy variable (*Indust=1* for years before 1985, 0 otherwise) is assumed to capture the effects of this industrial policy which tended to strengthen the oil plants' position. *Indust* should be positively related to q, corresponding to a lowering effect on the groundnut price.

2. Structural Adjustment (Adjust) (1980-95): A dummy variable *Adjust* is hypothesized to act as a weakening variable for q. Consequently, *Adjust* is hypothesized to be negatively related to q and thus positively related to the groundnut price.

3. Elections (Elect): A dummy variable is included for election years to assess whether or not the peanut price has been used to attain political support in presidential elections. *Elect* is hypothesized to be negatively related to q and thus positively related to the peanut price.

4. Urban Pressure (Urb): The ratio of urban to total population (*Urb*) is used as a proxy for the pressure that the urban sector may have exerted on the peanut producer price in an attempt to ensure cheap food. Therefore, *Urb* is expected to be positively related to q and negatively related to the peanut price.

5. Vegetable Oil Imports (IMV): As part of SAP conditions, the domestic oil market was opened up to foreign competition from the 1980s onward. In fact, peanut processors were granted exclusive rights to the import of vegetable oils. Given the cheap price of this substitute for peanut oil, oil mills could easily depress the peanut producer price. A ratio of imported vegetable oil over total consumption of oil (*IMV*) is used to capture this impact on the pricing decisions and is expected to have a positive impact on q and a negative impact on price since the policy strengthened the market position of processors.

Making use of the above variables, equation (6) becomes:

$$P_t = \frac{MNRP_t}{1 + e^{-1}\left[1 - (d_1 Adjust_t + \ldots + d_4 IMV_t)^{-1}\right]} + e_t \tag{7}$$

where the term d_i denotes coefficients determining q, the political power parameter, and e_t is an error term.

Thus, the estimating equations of interest are (6) and (7). Data on the variables specified in these equations were collected for the 1960-1995 period. Details on the data sources and management can be found in the appendix. Note that the peanut price is on the right hand side of the first equation and is the dependent variable in the second equation. There is a cross-parameter restriction as e, the elasticity of supply, appears in both equations. In addition, the second equation of the model is nonlinear in

parameters. In essence, the model is recursive, nonlinear in parameters, and has a cross-parameter restriction.

The Breusch-Pagan statistic (L.M. Test) rejected the null hypothesis of zero contemporaneous correlation between the errors of the two equations. Therefore, Nonlinear Three Stage Least-Squares (NL3SLS) was used to deal with the likely simultaneity bias, the nonlinearity of equation (6) and the cross-parameter restriction, making use of the error covariance matrix to increase the efficiency of the estimates. The estimation process was conducted using the SAS software package.

5.   Empirical Results

Table 1 presents a summary of the econometric results. Most coefficients have the expected signs and are statistically significant at the 5% level. Turning next to the main equation of interest, the pricing equation:

The import-substitution dummy variable for the 1961-85 period has a positive and statistically significant coefficient at the 5% level. Thus, from the early years of independence to the mid 1980s, the variable *Indust* seems to reflect a government tendency to set policies detrimental to farmers in favor of industrialists. However, the effect of *(Adjust)* almost offsets the effects of this industrial approach. The dissolution of the marketing board seems to have had a positive impact on peanut price. This corroborates a general belief that farmers have benefited from relatively high product prices during the implementation of the structural adjustment policy. Other SAP effects, such as those on fertilizer subsidies and vegetable oil imports, are explained below. *Adjust* and *Indust* overlap between 1980 and 1985. They seem to annihilate each other and translate into a transition period during which an ending interventionist policy is progressively replaced by an emerging liberalization doctrine.

The election coefficient has the expected sign and is significant at the 10% level. The empirical results do indicate some tendency to increase the peanut price during presidential election years.

The variable *(Urb)* is a powerful determinant of q. Pressure groups from urban areas influence policy makers toward cheap food policies to relieve upward pressure on industrial wages. As a result, *Urb* is negatively related to the peanut price. Finally, as should be expected, there is a negative relationship between the level of imported vegetable oil and the peanut price.

In terms of combined effects on q, the results show the following: The first three years of post-independence display a net favoritism towards agricultural producers. This is no surprise because the socialist view of the President of the Council, Mamadou Dia, was still predominant (Waterbury, 1987b). The triumph of the technocratic option progressively set a competitive equilibrium in which farmers and industrial processors benefited equally. The economic reforms of 1980 abruptly stopped this trend and

provided more incentives to farmers. In the early 1990s, the peanut processors appear to be reviving their market power.

The structural adjustment policy has affected producers of groundnuts in at least three different ways. First, the end of the input support program, meant that both input subsidies and loans were terminated for farmers. Second, the price increase that followed the new policy implementation was be beneficial. Finally, the vegetable oil import policy has had some adverse effects on peanut prices. All simulations are conducted for the 1980-95 period only. The main results are shown in Table 2 and are discussed below.

The removal of the subsidy program has been quite detrimental to peanut producers. Indeed, farmers were unable to acquire adequate amounts of fertilizer due to lack of a credit system and high fertilizer prices. When the assumption of no structural adjustment is made (by setting its dummy variable and oil imports to zero), the effect is a jump in the level of political weight in favor of processors. Consequently, peanut prices would have dropped dramatically throughout the period if the structural adjustment policies had not taken place.

As seen above, structural adjustment policies conferred both costs and benefits on farmers. As shown in Table 2, the cost effect more than offsets the beneficial peanut price impact in the transition period. From 1980 to 1983, farmers recorded welfare gains because fertilizer subsidies were still provided. However, from 1984 onward the net welfare effect is always negative with the exception of 1988. The adverse impact of increased cost from eliminating input subsidies and the credit system exceeds the beneficial impact from incentives through higher prices.

To get a more complete picture of the welfare changes that operate in the peanut sector, one needs to consider the impacts of SAPs on processors, consumers, and the government. As shown in Table 2, processors lost on average about 3 billion CFA francs a year compared to what they would have experienced without SAPs. This does not account, however, for state subsidies and other benefits accruing from the import of vegetable oil, for instance. But there is no doubt that the liberalization process has eroded the lucrative position granted to oil mills through the 1970s.

The import of vegetable oil under SAPs provided consumers with cheaper oil. To account for the welfare benefit to consumers, vegetable oil is treated as a new good introduced in a market in which peanut oil is a close substitute (Hausman, 1997). A demand equation for vegetable oil was specified after using the estimated coefficients, and a reservation price for vegetable oil was calculated. It turns out that consumers gained about 4.4 billion CFA francs a year from this access to cheaper oil.

Overall, the welfare calculations show a deadweight loss. Two explanations are advanced. First, the decline in peanut production has seriously jeopardized the profitability of oil mills, which are running under capacity. Second, and related to this, the drastic response to higher fertilizer prices and the associated welfare losses might be indicative of possible market failures in credit markets or of incomplete markets

(Stiglitz, 1987). For instance, the losses from the removal of fertilizer subsidies far exceed the taxpayer savings from doing so.

6. Concluding Remarks

Past policies were fiscally unsustainable and perhaps politically unfeasible because of the pressure for change from external donors. SAPs have no doubt depoliticized pricing decisions in the movement from governments to markets. However, the question is what to do to address the suffering and welfare losses created by structural adjustment policies in the interim time before the "long run." A viable way to counteract the increases in production costs caused by fertilizer price increases may be to increase farmers' productivity. Since yield-increasing knowledge already exists in research centers in Senegal, one effective way is to transfer this knowledge to farmers via extension and outreach activities. Another way is to target temporary relief programs toward the losers in structural adjustment programs during the "adjustment" period. In the case of peanut pricing in Senegal, our results indicate that the World Bank and the IMF's adjustment programs have likely made peanut producers and the Senegalese society permanent losers.

A particular element of SAPs that appear to have been the most detrimental in the Senegalese peanut case is the abolition of fertilizer subsidies and credit. This particular aspect of SAP policies resulted in dramatic decreases in peanut production, undermining the profitability of the peanut processing plants as well. Not only was the increase in peanut prices insufficient to offset these losses, but the cost to taxpayers was much lower than the benefits from fertilizer subsidies. This suggests that these subsidies and the concurrent credit system were addressing important market failures.

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Table 1. Parameter Estimates for the Supply and Pricing Equations.

Variables	Notation	Coefficient	T-ratio
Supply Response			
Intercept	_1_	0.6923	0.17
Price of Peanuts	_ln P_t_	0.4889***	4.27
Price of millet	_ln Pm_{t-1}_	0.6102*	1.87
Price of Fertilizer	_lnPF_t_	-0.5451***	-3.30
Rainfall	RF_t	0.9451***	2.78
Drought	_DRY_t_	-0.6504***	-2.93
Price Equation			
Structural Adjustment	_$Adjust_t$_	-0.2153***	-2.52
Industrial Policy	_$Indust_t$_	0.3438***	3.89
Elections	_$Elect_t$_	-0.1035*	-1.99
Urban Pressure	_Urb_t_	2.4614***	8.10
Imported Vegetable Oil	_Imv_t_	0.3100*	1.76

Notes: One, two, and three asterisks indicate significance at the 10, 5, and 1 percent levels. The results were obtained via nonlinear 3SLS using 1960-95 data.

Table 2. Impact of SAPs on Peanut Market Performance in Senegal.

	1970-79	1980-95	1980-83	1984-95
	------------------------------SAP Period -----------------------			
Producer Price 1993	97	85	96	81
(1993 CFA Francs per Kg.)				
	---------------------------1000 tons -----------------------------			
Marketed Production				
(Peanuts in shells)	585	354	413	335
Production Peanut Oil	199	118	126	115
Exports Peanut Oil	155	96	125	86
Veg. Oil Imports	0	52	56	51
Foreign Exchange				
(million US$)	125	65	49	44
------------------------1993 million CFAs--------------------				
Changes in Welfare:				
Producer Surplus	--	2,956	6,756	-6,194
Cost Effect	--	-6,692	0	-8,923
Price Effect	--	3,736	6,756	2,729
Processor Surplus	--	-4,734	5,871	-4,354
Fertilizer Sub Savings	--	229	-2,674	1,196
Consumer Surplus	--	4,411	5,901	3,915
Net Welfare Effect	--	-3,050	4,112	-5,437

Notes: All values were deflated by the consumer price index (1993=1.0) before the computation of the means, except for foreign exchange. Foreign exchange was computed as foreign exchange obtained from peanut oil exports minus foreign exchange used in the importation of vegetable oil. Processor surplus estimates do not include any further subsidies used to cover any losses from oil trade. Changes in welfare represent the economic surplus without SAP minus the corresponding surplus with SAP implementation. Note that in 1980-83 fertilizer subsidies were still used, while for the 1984-95 period these subsidies and government-sponsored credit were eliminated.