

Final report



Agriculture Global Practice - West Africa (GFA01)
Africa Region



SENEGAL

Groundnut Value Chain Competitiveness and Prospects for Development

Final report

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The report builds on and complements a previous analysis (World Bank 2015), which provides a comprehensive review of the groundnut value chain in Senegal and the role of the country in the groundnut oil global markets. The new report provides updated results using the Policy Analysis Matrix approach to assess competitiveness and comparative advantage of the country's groundnut value chain, and analyzes policy options for sustainable agro-industrial development that keeps the country on track with global markets.

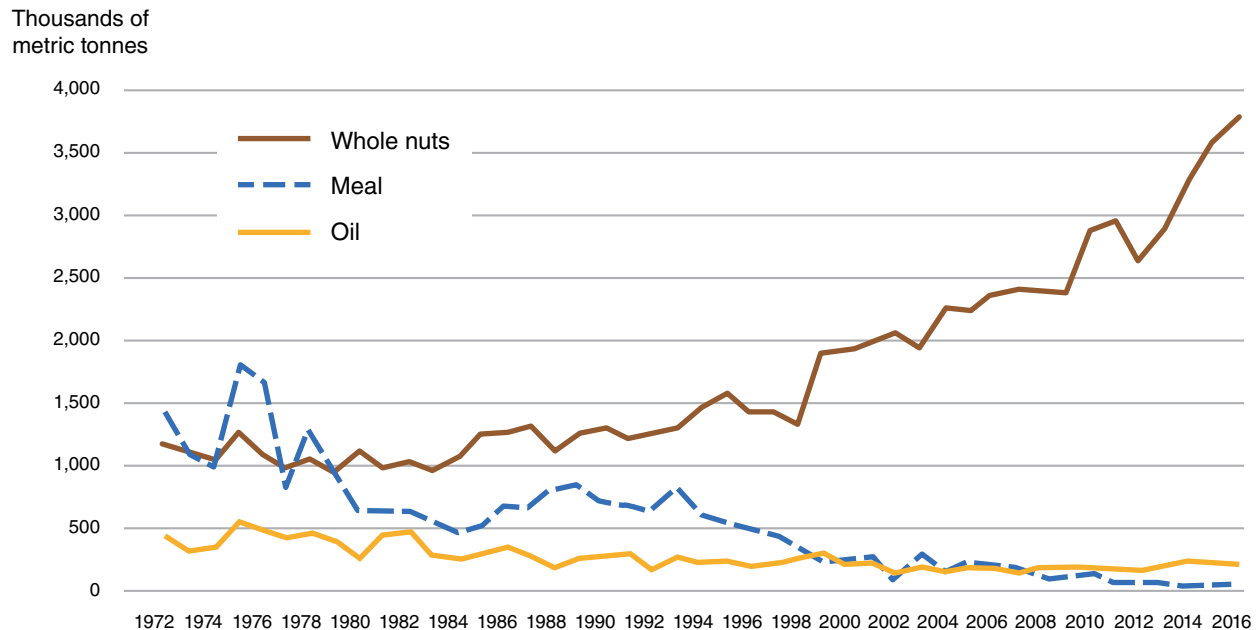
Policy Brief

CONTEXT

Groundnut trade, traditionally important for Senegal, has experienced major structural changes in the global and domestic markets

Historically a backbone of the rural economy in Senegal, groundnut production remains critical for the country's poverty reduction efforts. Since the mid-19th century, groundnuts have played a central role in Senegalese agricultural development and trade. Today, growing the crop continues to be a primary source of income for a vast majority of family farms, accounting for about half of the total cropped area in the country and employing two-thirds of the rural population, mostly below the official poverty line. In fact, groundnuts are grown by 27 percent of all households in Senegal, and by 52 percent of households in extreme poverty (ANSD, 2011). Moreover, supporting labor-intensive activities down the value chain, such as transportation, storage, and processing, remains an important source of non-farm employment in both formal and informal sectors.

The global groundnut trade has gradually shifted from oil and meal to whole nuts, and Asia has become the major producer. In the 1970s, global trade in oil and meal (by-product of processing used as animal feed) exceeded trade in whole nuts. However, since the 1980s shifts in relative transport costs in favor of shipping whole nuts as well as shifts in consumer preferences to use groundnuts for food and not oilseeds (with soya and palm oil replacing peanut oil) has led to a decline in global trade in groundnut products and significant increases in the export of whole nuts (Figure 1). Indeed, while exports of groundnut increased 2.2 percent a year since the early 1980s, exports of groundnut oil and meal fell 1 percent and 2.5 percent respectively and meal exports fell, despite growing global consumption of both products (Diop, Beghin and Sewadeh 2005). As a result, even highly industrialized exporters tend to produce cake and oil only for domestic consumption, while exporting the rest as whole nuts that now dominate global trade flows.

FIGURE S1. Trends in Global Exports of Groundnut Products, 1972-2016

Source: USDA Production, Supply and Distribution database (<https://apps.fas.usda.gov/psdonline>). Years shown correspond to harvest, at the start of the marketing year, with USDA estimates for 2016. Authors calculations based on USDA Production, Supply and Distribution Database.

Lagging behind global trends, Senegal has only recently liberalized exports of whole nuts, allowing domestic producers to benefit from increasing international demand. Senegal, similar to the rest of Sub-Saharan Africa (SSA), did not manage to keep abreast with these global trends, as its share of international whole nuts trade shrunk from 17.4 percent in 1962-1964 to a mere 1 percent in 1992-2005 (SSA experienced a drop from 88.6 percent to 5.2 percent over the same period). This was largely due to inconsistent quality (stemming from seed quality and poor management of aflatoxin), unreliable supply, and the lack of adequate incentive framework to allow farmers to engage profitably in whole nuts trade, as well as large increases in production in Asia. In fact, for much of the 20th century, the Government of Senegal (GoS) restricted direct exporting of whole nuts, forcing their lower-price sales to industrial processors for export as oil and cake. With the shift in global demand away from groundnut oil, those exports became increasingly unprofitable. This incited the Government to lift its ban on whole nut exports in 2010, leading to a sharp rise in prices paid to producers and new opportunities for some of Senegal's poorest farmers and rural entrepreneurs, who have started to expand production, storage and transport activities. The decline of processing led to eventual bankruptcy of the largest processing firm, SUNEOR, which was re-nationalized in 2016 under its former name SONACOS (throughout the document systematically referred to as SONACOS) to avoid liquidation and loss of several hundred jobs.

In this context, the study examines the evolution and future prospects of the sector, aiming to provide the Government with empirical evidence for its ongoing policy deliberations. In particular, it strives to answer the following questions:

- i. Will the production of groundnuts and their processing into oil remain competitive in the foreseeable future?
- ii. Will the export of whole nuts be more beneficial for farmers and the whole economy than the export of groundnut oil?
- iii. What policy, institutional, and technological changes should be considered to make the entire value chain more competitive?

KEY FINDINGS

Senegal has a clear strong comparative advantage in groundnut production, but an unproven and uncertain comparative advantage in oil processing

The data collected for this study show that Senegal has a distinct comparative advantage in growing groundnuts under current open market conditions, with profitability being consistently high regardless of the production system. All four types of farming systems¹ examined generate revenues well in excess of costs (inputs and factors), with profitability ranging from 27 percent for the least competitive cooperatives engaged in seed production to 72 percent for the most profitable irrigated off-season selling systems (Table 1). These sizeable profit margins arise due to the farmers' strong underlying comparative advantage, as reflected in Domestic Resource Cost (DRC) ratios well below 1, which implies an efficient use of domestic factors, wherein each unit of value added requires only 0.27 to 0.50 units of land, labor and other resources (depending on the farming system).

Nevertheless, the full value of whole nuts exports is not yet passed through to farmers. This is largely due to a heavy burden of implicit taxation to protect the oilseed industry, which reduces groundnut production and erodes incentives for further investment in the sector. Transfers and losses along the current value chain amount to 24-32 percent of farmers' current revenues (as measured by the Producer Subsidy Equivalent -PSE). These transfers and losses are mostly due to the historical protection of SONACOS (receiving 13-29 percent equivalent subsidy over the past three years), and also to a yet limited entry of competing small and medium enterprises capable of offering farmers access to low cost transport, storage and marketing options. These results are consistent with the findings of a similar study carried out in 2003 for the groundnut value chain², with the main difference being a noticeable increase in the implicit taxation of farmers' revenues in recent years (PSE and SPR for farm production were only around minus 3 percent in the years preceding the privatization of SONACOS).

¹ The four major categories of farms in Senegal's groundnut sector include the following: (1) standard groundnut producers, defined as smallholders with below-average input use and yield; (2) irrigated farms with very high levels of inputs and yields for sale in the off-season when groundnut prices are high; and agricultural cooperative members with access to above-average levels of inputs and yield who sell groundnuts either for seed (3) or for export (4).

² Senegal, Ministère de l'Agriculture et de l'Elevage (MAEL) - Etude sur la compétitivité et la rentabilité des filières agricoles avec la matrice d'analyse des politiques (MAP). Février 2003.

BOX 1. The PAM Methodology**Overview**

The principal methodology used in this study is the Policy Analysis Matrix (PAM) developed by Monke and Pearson (1989), which helps policy makers assess the attractiveness of agricultural systems under existing technologies and prices by using enterprise budgets at market prices to measure the commercial profitability / competitiveness of various activities in the value chain, and by using social opportunity costs (comparable world market prices) of the same activities to measure their contribution to the economy as a whole (comparative advantage), taking account of resource transfers and losses due to government policies.

Enterprise budget:	Revenues from outputs	- Cost of inputs	- Cost of resources	= Profits from the enterprise
at market prices	a	b	c	d = a-b-c
- at social costs	e	f	g	h = e-f-g
= transfers and losses	i = a-e	j = b-f	k = c-g	l = d-h
	<i>Tradable goods (foreign exchange)</i>		<i>Domestic resources (value added in GDP)</i>	

Indicators

The PAM generates three sets of indicators:

Competitiveness (Profitability) Indicators:

- Private Benefit-Cost Ratio, $PBC = a/(b+c)$
- Resource Cost Ratio, $RCR = c/(a-b)$
- Gross Margin, $GM = d/a$
-

Comparative Advantage Indicators:

- Social Benefit-Cost Ratio, $SBC = e/f+g$
- Domestic Resource Cost Ratio, $DRC = g/(e-f)$
- Social Gross Margin, $SGM = h/e$
-

Policy Effects (Distortions) Indicators:

- Nominal Protection Coefficient, $NPC = a/e$
- Effective Protection Coefficient, $EPC = (a-b)/(e-f)$
- Producer Subsidy Equivalent, $PSE = l/a$,
- Subsidy Ratio to Producers, $SRP = l/e$.³

Data Sources

The PAM analysis is based on the 2010-2015 budgets of groundnut enterprises along the four stages of the value chain: 1) production on farms, 2) post-harvest handling and transportation, 3) processing into exportable oil and cake, and 4) exporting whole nuts. This analysis is further complemented by longer-term data on world prices and market shares since 1972.

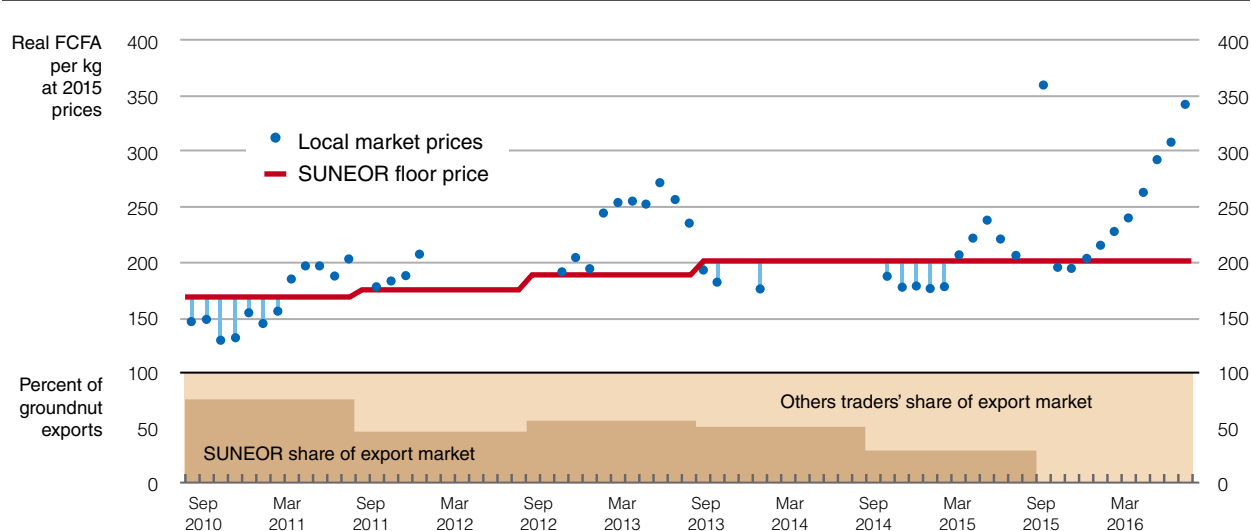
³ Further details on the PAM methodology and indicators are discussed in the report and in Annex1. Reader can also refer to Monke and Pearson (1989), Masters (1993) and Masters and Winter-Nelson (1995).

TABLE S1. Summary PAM Results for Senegal Groundnut Farming Systems

Groundnut Farming System	Profitability	Comparative advantage	Policy-induced distortions	
	Benefit-Cost Ratio (BCR)	Domestic Resource-Cost Ratio (DRC)	Nominal Protection Coefficient (NPC)	Producer Subsidy Equivalent (PSE)
Standard farms for export	1.32	0.45	-23%	-26%
Irrigated farm for off-season sales	1.72	0.27	-26%	-29%
Coop farm for seed production	1.27	0.50	-27%	-32%
Coop farm for export	1.66	0.36	-23%	-23%

Source: Authors calculations

Following recent important reforms, the sector has benefited from expanded competition and increased prices. In the last decade, the Government has introduced important reforms, ceasing SONACOS monopoly by allowing new formal oilseed producers to enter the domestic market, and, more recently, by authorizing exports of raw groundnuts. Consequently, groundnut producers in Senegal now face many more options for marketing compared to a decade ago. The prices and market shares shown in the Figure 2 reveal the magnitude of changes that have already occurred, as almost all farmers now have better options than selling to SONACOS under a pre-determined farm gate price negotiated and set by the Groundnut Inter-professional Committee (*Comité National Interprofessionnel de l'Arachide, CNIA*)⁴. These trends indicate that since 2010 SONACOS has been increasingly unable to outbid other buyers in rural groundnut markets for domestic use and even for export, with its share of exports declining steadily from nearly 75 percent in 2010 to less than 5 percent in 2016.

FIGURE S2. Local groundnuts prices and export market shares, 2010-2016

Note: Local market prices are national averages from Commissariat à la Sécurité Alimentaire (CSA), with gaps where data are not available. Lightly shaded bars show months in which the average CSA market price fell below the floor price for procurement by SUNEOR and other oil processors.

Source: CSA and SUNEOR field data; exports totals are from USDA, Senegal Oilseeds and Products Annual Report, 19 July 2016, from Government of Senegal. CSA and SONACOS file data; USDA Senegal Oilseeds and Products Annual Report, 19 July 2016.

⁴ As demonstrated by the Figure 2, in each year prices systematically rose well above the SONACOS floor to the levels determined by the balance between local supply and demand from consumers and exporters.

Senegal's competitive position in processing groundnuts into crude oil is much more uncertain, as the dominant government-owned operator fails to generate value under current market conditions, while other private processors seem to experience similar challenges. Transformation of whole groundnuts into oil and meal for export by SONACOS has highly variable returns that are now particularly low. Despite large transfers from taxpayers (fiscal subsidies) and border protection, without which the company would not have started operations in the first place, SONACOS has been increasingly unable to maintain its market share⁵ and last earned significant profits back in 2011. Its operations are traditionally characterized by high unit costs and low oil extraction rates. Negative Gross Margins indicate private losses, while negative DRCs reveal negative value added at social prices, indicating that the company is actually destroying wealth through its continued operation. In fact, under the new more competitive market conditions, the company is no longer profitable. Its continued functioning required a nearly 30 percent of subsidy equivalent (projected) in 2016 to operate, compared to around 20 percent in 2014 (which is similar to the level needed in 2011, when SONACOS operated at 68 percent of its processing capacity - the highest over the period covered by the study). As for other private processing companies, while no sufficient data was collected to conduct a separate PAM, the fact that they have been producing below capacity the past two years (operating at 4 and 12 percent of their capacity in 2015 and 2016, respectively) suggests that they are also likely facing challenges in procuring sufficient grain at current market prices (further analysis is warranted to confirm this hypothesis).

TABLE S2. Summary PAM Results for SONACOS

SONACOS, Fiscal Year	Profitability	Comparative advantage	Policy-induced distortions	
	Benefit-Cost Ratio (BCR)	Domestic Resource-Cost Ratio (DRC)	Nominal Protection Coefficient (NPC)	Producer Subsidy Equivalent (PSE)
2016 (projections)	0.76	(7.63)	1.71	28.6%
2015	0.88	(5.10)	1.18	13.4%
2014	0.87	(0.73)	1.41	19.0%
2013	1.08	0.61	1.06	-2.8%
2012	1.05	1.86	1.20	19.8%
2011	1.34	0.54	1.19	24.2%

Source: Authors calculations.

SONACOS faces daunting financial, technical and economic challenges. The sensitivity analysis based on the available data from SONACOS demonstrates that it is not able to break even, generating negative value added at current market prices.⁶ The main way for the company (or any other processor in Senegal) to become a competitive exporter of oil would be to raise its low revenue per unit (kg) of groundnuts purchased. A breakeven would require a 58-percent increase in oil revenues per kg of nuts purchased. With current oil export prices and no other budget changes, this implies a costly need for SONACOS to reach an extraction rate of 44 percent, which appears highly unlikely given the company's current remarkably low rate of 28 percent.⁷ The sensitivity analysis also tests a Government-led pathway to increased profitability - a restriction of whole nuts exports and consequent price decreases, which effectively penalizes farmers. This scenario would require a 34 percent tax on exports, similar to an export ban in place before 2010, which would lower domestic whole nut prices by an equal amount (34 percent), potentially deepening poverty incidence among groundnut producers.

⁵ Without commercial viability, it cannot buy enough groundnuts after harvest to prevent local market prices from falling below officially negotiated rates at that time, which is followed by seasonal price rises that reflect high real interest rates, storage losses, uncertainty and other contributors to the cost of holding groundnut stocks in rural areas.

⁶ Presently, the company is generating negative value added - buying whole groundnuts whose export value is 292 FCFA/kg, with revenues (the sum of all the oil, cake and residue from nuts) providing not more than 224 CFA/kg.

⁷ This rate is much lower than what the company could actually achieve (35 percent before privatization), or what is typically achieved by other groundnut processors - Chinese oil press manufacturer, for example, reports oil extraction rate between 35 and 45 percent (<http://www.bestoilpresses.com/related-posts/how-to-improve-peanut-oil-yield.html>).

POLICY IMPLICATIONS

With adequate policies Senegal is well positioned to transform the whole groundnut value chain into a powerful engine of economic growth, poverty reduction and social stability.

The Government of Senegal has already undertaken major policy actions and measures as part of the implementation of the Agricultural Growth Acceleration Program in Senegal (PRACAS), which resulted in redressing the overall agricultural sector performance. In the groundnut sector in particular, the Government's efforts, performance targets under PRACAS were met or exceeded for the year 2016, both nuts in terms of seed capital renewal with 55,000 certified seeds produced against a target of 40,000 metric tons (mt), and in terms of total output with 1,050,000 metric tons of groundnut produced against a target of 1,000,000 mt for 2017⁸. Furthermore, the government has taken significant steps to eliminate monopsony around the supply chain of oil mills, SONACOS in particular, and to improve competition for the collection and marketing of groundnuts in the region. Countries, with greater openness to export markets for diversified products of groundnut especially high-quality nuts. The government has encouraged the entry of new operators in the collection, processing and export of groundnut oils and seeds, and took over SONACOS from the main shareholder for its next privatization. In addition, the government has also initiated initiatives to encourage the diversification of cropping systems in the groundnut basin, with expansion of rain-fed and low-land rice cropping systems, sesame and horticulture in addition to livestock.

These efforts should be pursued and deepened to allow the country and its groundnut producers to take better advantage of opportunities in the global markets. In this context and moving forward, the Government should consider the followings:

To achieve this objective, the Government may consider the following three policy objectives:

- Groundnut sector policy cannot be done on the back of the groundnut producers, who represent a very large number of poor people in the country and enjoy clear comparative advantage in their economic activity.
- Policies that support the groundnut producers' access to the best market opportunities need to be accompanied by policies that mitigate fluctuation risks and provide social safety nets.
- A competitive and market-driven downstream sector is more likely to identify the real economic opportunities in groundnut value chain (such as confectionary nuts) rather than a small protected and subsidized oil transformation sector.

The groundnut value chain should be anchored in a stable and credible policy framework for whole nut exports. The new system centered on producing high quality groundnuts for exports as whole nuts can provide significant profitability if well managed. The diversification of actors and increased employment all along the groundnut export value chain has already been beneficial to producers who now face a more competitive market to sell their output (domestic prices jumped from 16 to 37 percent of the international price for traded whole groundnut between 2011 and 2016).

⁸ According to Official statistics from the Ministry of Agriculture

Consolidate the competitive incentive framework for groundnut producers and processors that also supports investments in key public goods and services

Producers should be offered the possibility to grab domestic and global markets opportunities through full liberalization of the domestic price. CNIA farm gate price setting is tagged to ground oil price, and not to international of whole nuts, generating substantial forgone revenues for producers. Free contractual arrangements between informed individual and organized producers and off-takers will certainly move farm gate price closer to the international price of whole nuts. This does preclude a mutually accepted inter-professional regulation mechanism to ensure transparency and minimize contract breach by participants (e.g. side selling). The mission, organizational structure and functions of current inter-professional body (CNIA) should be revisited in light of increasing diversity of actors and to ensure a much closer adherence to global prices. A strong inter-professional coordination body could be tasked to accompany the development of the new value chain, as the Government steps back from production (through SONACOS) and focuses on providing key public goods such as continued Research & Development, training and advisory services to farmers on groundnut-based production systems to close the productivity gaps and improve management of production related risks, improving domestic marketing through better access roads and marketing logistic along the key groundnut corridors and consolidation points, and setting the regulatory framework for effective implementation of contractual arrangements, better access to market information, and improved quality control.

The new value chains driven by exports of whole nuts could also generate revenue for the Government through an export tax kept at a lowest level with the proceeds re-invested into the groundnut sector. Such a low export tax would prevent regressive effects, in particular on farmers' revenue and welfare. A small export tax (ideally around 5 percent) would have limited impacts on farmers and could be re-invested to support public good investments in the sector. Switching from the pre-2016 situation of policies that cost farmers about 20 percent of revenue to an export tax in the order of 5 percent would bring a significant increase in farm earnings, and would convert fiscal subsidies into a source of tax revenues. Estimates suggest that a 5-percent tax would bring the Government an average of over 10 billion FCFA per year, with high variance and great sensitivity to the size of each year's harvest. If the export tax is used for the general budget it will only reduce prices to producers and eventually dampen production and agricultural growth, however if the revenue is invested back into the sector it could also raise total factor productivity for groundnut producers and liberate resources to be invested in other agricultural and non-agricultural activities (Box 2).

BOX S2

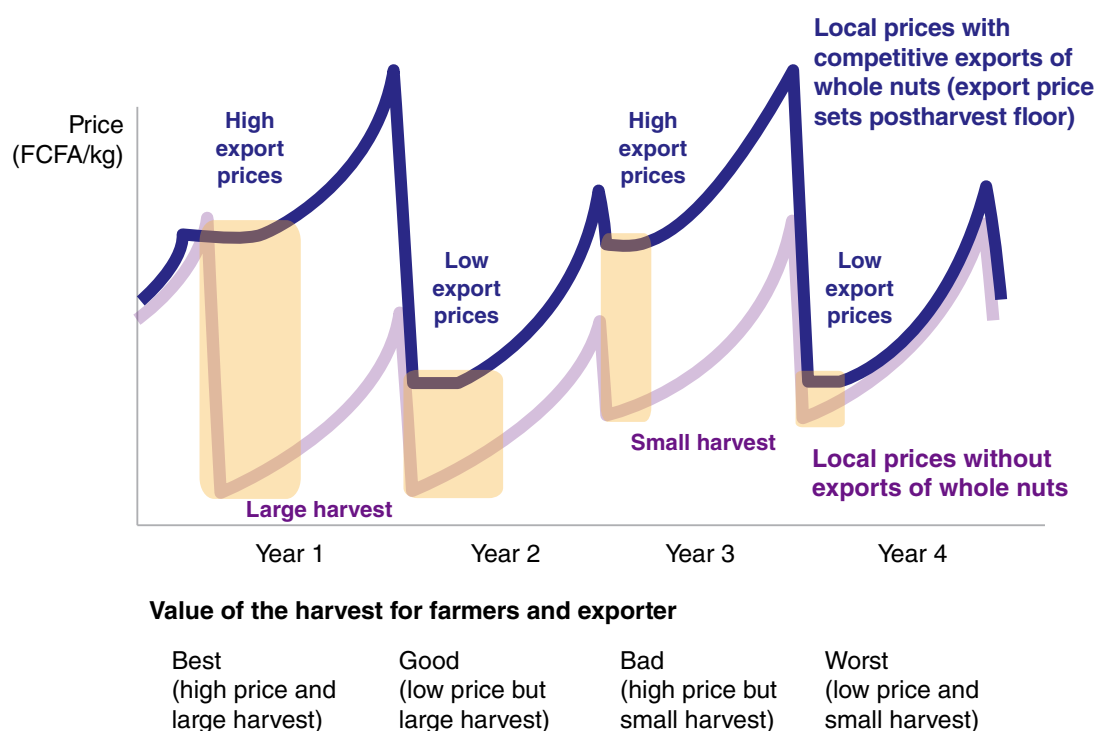
As a contribution to this report, a simulation by the International Food Policy Research Institute (IFPRI) of the impact of the export tax (4 and 10 percent on shelled and unshelled nuts, respectively) suggests the following in case of non-targeted use of revenues in consumption and / or investments: i) negative impact on groundnut growers and the groundnut oil industry; ii) market adjustment through prices in the short term and through outputs in the medium term; iii) low sectoral and macroeconomic effects, with negative growth in the agriculture sector and quasi neutral effect on non-agricultural and overall economic growth. However, if the collected revenue is invested back into the value chain, targeting farm productivity as a priority, positive impact on both agricultural and non-agricultural sectors is expected through increased total factor productivity (TFP) for groundnut production (farming), which frees labor and capital factors, stimulating their reallocation into agricultural and other economic sectors, and through lower prices for goods and services, as a result of increased production, favorable to consumption.

Opening the market (along with climate change) will expose the sector to greater fluctuations and mechanisms are needed to support the sector in coping with price and production variability

Establishing mechanisms to protect against higher vulnerability to price and output fluctuations can be done with several instruments. Higher seasonal and annual price fluctuations previously covered by the variation in fiscal transfers to SONACOS, are now felt directly by farmers. The examples of varying price and output patterns as well as the mechanism of export prices setting the floor at each harvest are demonstrated in Figure 3.⁹ Moreover, there is much greater spatial variation, with lower prices in more remote surplus areas. These fluctuations call for measures saving the profits from good years for the use in downturns and for investing in farmers' resilience through targeted social protection measures. Several policy instruments are potentially available to pursue these goals, differing widely in their feasibility, effectiveness, and unintended consequences. As elaborated in the full report, the most promising combination of policy options involves:

- Periodic adjustments to keep the export tax under 10 percent of the global CIF price since it lowers prices paid to farmers even as it reduces prices for domestic buyers (including oil processors);
- Reinvesting part of the tax revenues in public services needed to strengthen the competitiveness of the sector, including varietal improvement, seed multiplication and market infrastructure; and
- Investing the other part of export proceeds in resilience-building and risk-mitigating social protection measures, including disbursements to farm households at times and places when low prices coincide with small harvests.

FIGURE S3 Example trajectories for prices and exports of groundnuts in Senegal



Source: Authors' calculations.

⁹ Month-to-month storage costs and expectations about local demand determine the seasonal price rise thereafter, as sellers aim to meet demand gradually and draw stocks to reach zero just as the next harvest comes in. The size of each harvest does not determine price, but sets only the quantity exported, which is traders' expectations about the available surplus after local demand is met. Export revenue depends on both quantity and price, with relatively high prices or large harvests yielding good years whose income must be saved for use in bad years when low prices coincide with small harvests.

Maintaining fair competition by limiting the use of public resources to protect and subsidize the industrial processing segment, in particular SONACOS. A policy aimed only at preserving industrial processing of oil for export would be hard to sustain, probably even in the short run. Relative prices in world markets ensure that such a policy is possible only with drastic measures at a high cost to groundnut farmers and taxpayers, as the Government would need to pay nearly the entire operating cost of the processing plants. Moreover, there is a considerable opportunity cost of forgoing investments in expanding profitable exports of increasingly valuable whole nuts. The future of the oilseed sector should be determined by market forces, and all companies operating in the sector (oil producing and whole nuts exporting companies alike) should face a level playing field. Complete withdrawal of the Government from the management of SONACOS and accelerating its privatization (or divestiture of its assets) would clarify the business environment and increase investor confidence in the processing and export segment.

Focusing Government support on providing public goods that improve the country's global competitiveness through closing the productivity and quality gaps. Removing distortions and developing private sector led inputs markets, taking advantage of the wide range of available climate smart germplasms that cover almost all country's agro ecological zones to uplift yields per hectare; facilitating and reducing transaction costs associated with domestic marketing of groundnuts by supporting to cooperatives for better consolidate and store harvests, ensuring adequate maintenance of farm access and feeder roads and their connection to main road networks; improving compliance and quality management, particularly in the area aflatoxin control, through access to improved and efficient technology, such as the IITA-released Aflsafe; promoting better farming practices through contractual arrangement with off-takers; and supporting a market-based and sustainable seeds production and inputs distribution system, with targeted support to accelerate farmers' access to climate resilient technologies. Increasingly, the option of contract farming is growing in popularity as a way to minimize risk, access needed input subsidies, and for the oilseed producers to ensure their purchases of grain.

In summary, Senegal is well positioned to transform its groundnut sector into a powerful engine of economic growth, poverty reduction and social stability. Senegal's strong comparative advantage in its large groundnut sector creates the opportunity to use export revenues for productive investments, improved input supply and groundnut marketing, and targeted social protection against downturns. Export taxes would be much less burdensome than previous export bans, but if the resulting revenue is not reinvested wisely the tax will return the sector to its previously downward trajectory. Similarly, if social insurance funds are not well managed, vulnerability will lead to less efficient and equitable forms of risk avoidance, such as not growing groundnuts at all. Success is not guaranteed, but with well-designed policies Senegal's unique position in world groundnut markets offers remarkable opportunities ahead.

TABLE OF CONTENTS

Executive summary	ii
List of Tables	xiii
List of Figures	xiv
List of acronyms	xv
1. Introduction and background	1
2. The market for groundnuts in Senegal	3
3. Competitiveness, comparative advantage and distortions by activity	5
3.1 Production	5
3.2 Transport and handling	10
3.3 Processing into oil and cake	13
3.3.1 Processing by SUNEOR/SONACOS	13
3.3.2 Processing by artisanal operators	17
3.3. Exporting whole nuts	18
4. Global trends and market dynamics	20
4.1 World prices and trade by product type	20
4.2 Senegal market shares and comparative advantage	22
4.3 The role of China	24
5. Scenarios and policy options for Senegal	27
5.1 Strategic goals and available instruments	27
5.2 Modeling the impacts of export taxes on the groundnut sector in Senegal	29
6. Conclusions and ways forward	37
7. References cited	38
Annex 1. Detailed Policy Analysis Matrix results	42
A1.1 Definitions and notation used for calculation of Policy Analysis Matrix results	42
A1.2 Summary indicators of competitiveness, comparative advantage and distortions	43
A1.2 Enterprise budgets in Policy Analysis Matrix form	44
A1.2 Enterprise budgets in itemized form, at private and social costs	45
A1.3 Complete list of all price distortions used in Policy Analysis Matrix results	49
Annex 2. Persons consulted	50
Annex 3. Terms of Reference	53

LIST OF TABLES

Table 1.	Farm production budgets at market prices, per kg of groundnuts in shell	7
Table 2.	Farm production budgets at social costs, per kg of groundnuts in shell	8
Table 3.	Policy Analysis Matrices for farm production (2015 FCFA/kg).....	9
Table 4.	Financial and economic ratios for farming, at social costs with new policies.....	9
Table 5.	Policy distortion ratios for farm production	10
Table 6.	Transportation budgets at market prices, per kg of groundnuts in shell	10
Table 7.	Transportation budgets at social costs, per kg of groundnuts in shell	11
Table 8.	Policy Analysis Matrices for transport services (2015 FCFA/kg)	11
Table 9.	Financial and economic ratios for transport services.....	12
Table 10.	Policy distortion ratios for transport services	12
Table 11.	SUNEOR processing budgets at market prices, per kg of groundnuts in shell	14
Table 12.	SUNEOR processing budgets at social costs, per kg of groundnuts in shell	15
Table 13.	Policy Analysis Matrices for SUNEOR groundnut processing (2015 FCFA/kg).....	16
Table 14.	Financial and economic ratios for SUNEOR groundnut processing	16
Table 15.	Policy distortion ratios for SUNEOR groundnut processing.....	17
Table 16.	Summary of results for artisanal processing.....	17
Table 17.	Whole nut exporting budgets at market prices, per kg of groundnuts in shell	18
Table 18.	Whole nut exporting budgets at social costs, per kg of groundnuts in shell	18
Table 19.	Policy Analysis Matrices for exporting whole nuts (2015 FCFA/kg)	19
Table 20.	Financial and economic ratios for exporting whole nuts.....	19
Table 21.	Policy distortion ratios for exporting whole nuts.....	19

LIST OF FIGURES

Figure 1.	Local prices, SUNEOR prices and export shares, Sept. 2010-June 2016	3
Figure 2.	Local market prices for groundnuts in Senegal by month, Oct. 2005-July 2016	4
Figure 3.	Structure and definitions of the Policy Analysis Matrix.....	5
Figure 4.	World price ratio of groundnut oil to whole nuts, Jan. 2000 - June 2016	20
Figure 5.	World trade in whole groundnuts, meal and oil, 1972-2016.....	21
Figure 6.	World trade in whole groundnuts, meal and oil, 2000-2016.....	22
Figure 7.	Senegal's share of world trade in groundnut oil, meal and nuts, 1972-2016	23
Figure 8.	Senegal's share of world groundnut production and processing, 1972-2016.....	24
Figure 9.	China's share of world trade in groundnut oil, meal and nuts, 1972-2016	25
Figure 10.	China's share of world groundnut production and processing, 1972-2016.....	26
Figure 11.	Impacts of export policies on groundnut markets in Senegal.....	30
Figure 12.	Impacts of an export tax on poverty and economic welfare	30
Figure 13.	Seasonal price formation in isolated rural markets over time.....	31
Figure 14.	Seasonal price formation in rural markets with exports	32
Figure 15.	Year-to-year variation in farm income and export earnings.....	32
Figure 16.	Year-to-year variation in export taxes and price stability.....	33
Figure 17.	Expected returns from a 5% ad-valorem export tax on whole groundnuts	34
Figure 18.	Reduction in living standards of groundnut farmers due to a 10% export tax	35
Figure 19.	Evolution and growth of the groundnut value chain	36

LIST OF ACRONYMS

ANSD	Agence National de Statistique et Démographie
ASPRODEB	Association Sénégalaise pour la Promotion du Développement par la Base
CAIT	Complexe Agro-Industriel de Touba
CNIA	Comité National Interprofessionnel de l'Arachide
COPEOL	Joint venture between SOFIPROTEOL and Castel
CSA	Commissariat à la Sécurité Alimentaire
DAPSA	Direction de l'Analyse de la Prévision et des Statistiques Agricoles
FAO	Food and Agriculture Organization of the United Nations
GoS	Government of Senegal
MAER	Ministere d'Agriculture et de l'Equipeement Rural
MAFAP	Monitoring and Analysing Food and Agricultural Policies (program of FAO)
SAED	Société Nationale d'Aménagement et d'Exploitation des Terres du Delta
SEDAB	Sahélienne d'Entreprise de Distribution en Agrobusiness
SONACOS	Société nationale de commercialisation des oléagineux du Sénégal (formerly SUNEOR)
SUNEOR	The privatized entity SONACOS (Not an acronym – often written Suneor)
USAID	United States Agency for International Development

1. INTRODUCTION AND BACKGROUND

The groundnut value chain is of major economic, social and political importance in Senegal. Most rural households grow the crop, and its transport, storage or processing is a key source of nonfarm employment in both formal and informal enterprises.

Senegal's groundnut sector was originally developed by colonial authorities, using a monopoly over exports to control the domestic market. Prices were negotiated annually before each harvest, and applied uniformly throughout the year in all parts of the country. This panterritorial, panseasonal pricing system was characteristic of colonial marketing regimes, and ensured that private traders would not store or transport the crop, so farmers would have no choice but to sell their entire surplus to a single buyer.

After independence in the 1960s, Senegal and other former colonies gradually reformed their monopoly marketing organizations, often choosing to retain and modify them under government or private ownership (Badiane, 1997). For groundnuts in Senegal, the French-owned oil processor was nationalized to form SONACOS in 1975, which proved increasingly costly to operate and was eventually privatized in 2005 to form SUNEOR in 2007. That too has suffered increasing losses and in January 2010 the government finally ended the monopoly system, allowing farmers to sell to competing firms for either direct export or processing. Despite large fiscal subsidies SUNEOR has been able to buy a declining fraction of each year's groundnut harvest at the officially negotiated prices, was unable to pay its debts and was renationalized in 2016 restoring the name SONACOS. SUNEOR/SONACOS itself increasingly relies on other vegetable oils for its business operations, and prices actually received by farmers after harvest result from competition among traders. The official price negotiated with government for purchases by SUNEOR/SONACOS has had relatively little influence on farmers because other buyers are more competitive.

Despite turmoil in the groundnut processing sector, groundnut production itself remains a mainstay of the rural economy. Growing the crop is the main source of income for family farms, involving about half of total cropped area and about two-thirds of the rural population, most of whom are below the poverty line (ANSD, 2011). Although SUNEOR/SONACOS is unable to compete successfully, other firms are able to buy and trade groundnuts profitably in a variety of forms. A major destination is China, with whom Senegal signed an agreement for tariff-free access in October 2015 (USDA, 2016).

This report builds on a number of previous studies to inform ongoing changes in the sector. Most notably, we build on the diagnostic analysis of the groundnut value chain that was conducted in 2014 (World Bank 2015) and addressed a set of key reform proposals including:

- resolving SUNEOR/SONACOS debt and rebuilding a competitive groundnut sector;
- renovating and strengthening the groundnut inter-professional committee;
- building a transparent, efficient and targeted subsidy policy;
- reviewing the farm gate pricing mechanism for better connection to the groundnut oil international price trend;
- reviewing policy related to the export of groundnut seeds and grains.

The focus of this report is detailed in its Terms of Reference (Annex 4). Our primary aim is to inform the Government of Senegal with empirical evidence on the following questions:

- i. Will groundnuts production and groundnut-based oil production and processing be competitive in the foreseeable future?
- ii. Would export of whole groundnuts work better than exports of oil for farmers and the economy?
- iii. What policy, institutional, and technology options might be needed to make the value chain more competitive?

To answer these questions, the study:

- Identifies the main stages of the value chain (production, marketing, and processing) within the groundnut subsector in Senegal at which measurements are undertaken;
- Estimates the cost structure and financial profitability of the main groundnut value chains to assess whether limited resources are utilized efficiently;
- Assesses how competitive Senegal is in relation to other major groundnut exporters in the region/in the world, both in financial and economic terms;
- Examines the government's producer price policy compared to equivalent world market prices; Analyzes the capacity of Senegal to respond to key structural changes in groundnut systems (identify potential inefficiencies and suggest which areas productivity should be improved);
- Derives policy implications about how to improve the comparative advantage of groundnut for Senegal.

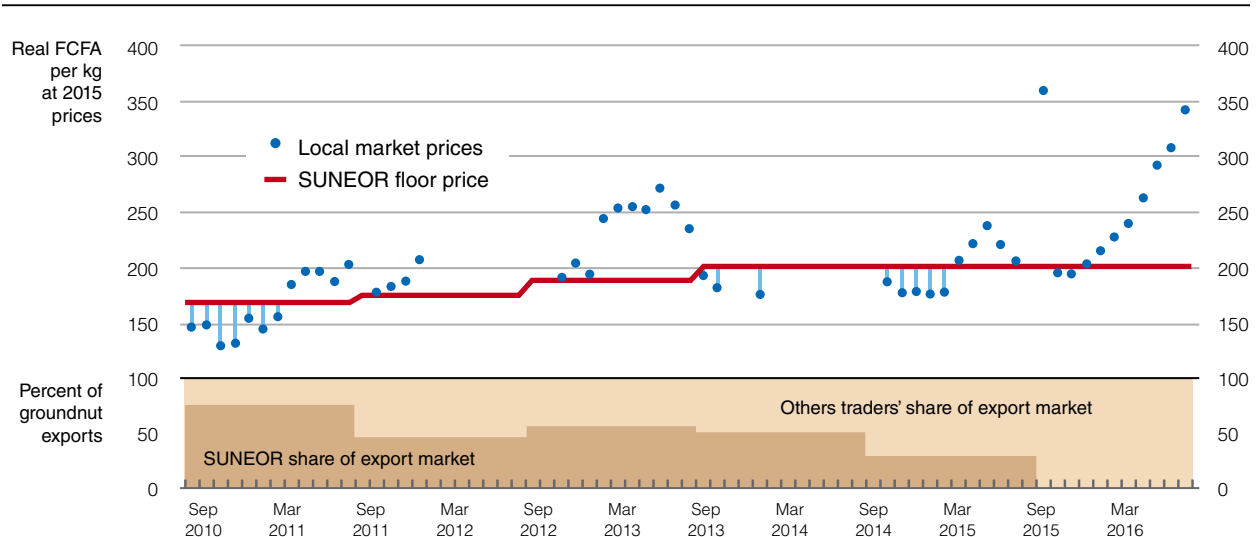
As detailed in our Terms of Reference, the methodology used here to answer these questions is the Policy Analysis Matrix (PAM) approach to measuring competitiveness for 2010 and 2015, complemented by historical data on prices and quantities to address longer-term changes and dynamic comparative advantage. The PAM approach, developed by Monke and Pearson (1989), uses enterprise budgets at market prices to measure the commercial profitability of various activities in the value chain, and those same activities valued at social opportunity costs to measure their contribution to the economy as a whole, taking account of resource transfers and losses due to government policies that could be altered in the future. The differences between private profits or competitiveness, and social values or comparative advantage, are known as divergences or distortions.

A principal feature of the PAM method is that it takes account of each enterprise's underlying productivity and policy effects at all stages of the value chain, from farm inputs to transport and marketing. Using that approach allows us to expand upon previous studies which focus almost exclusively on output prices, such as the Anderson and Masters (2009) study of agricultural distortions in Africa which included extensive analysis of the groundnut pricing in its chapter on Senegal (Masters 2009). To summarize the PAM budgets we make use of several kinds of cost-benefit ratios, whose interpretation is based on Monke and Pearson (1989), Masters (1993) and Masters and Winter-Nelson (1995).

2. THE MARKET FOR GROUNDNUTS IN SENEGAL

The ability of SUNEOR/SONACOS to compete with farmers' other options has been declining steadily since 2010. The figure below shows actual local market prices for groundnuts in shell, relative to the Government mandated minimum prices for groundnut purchases by SUNEOR and other major traders. Actual prices are observed by the Commissariat à la Sécurité Alimentaire (CSA), and represent a national average that is not available for all months so each is shown by a dot. Vertical shading between the actual price and the SUNEOR procurement price show periods in which actual prices after harvest fell below the official floor, indicating that SUNEOR and other traders were unable to buy enough groundnuts to keep prices above the level negotiated by the Comité National Interprofessionnel de l'Arachide (CNIA). In each marketing year, prices then rose well above the SUNEOR floor at levels determined by the balance between local supply and demand from consumers and exporters. These trends indicate that, since 2010, SUNEOR has been increasingly unable to outbid other buyers in rural groundnut markets for domestic use and even for export. The bottom of Figure 4 shows SUNEOR's share of Senegalese groundnut exports, which has declined steadily from nearly 75% in 2010 to less than 5% in 2016.

FIGURE 1. Local prices, SUNEOR prices and export shares, Sept. 2010-June 2016



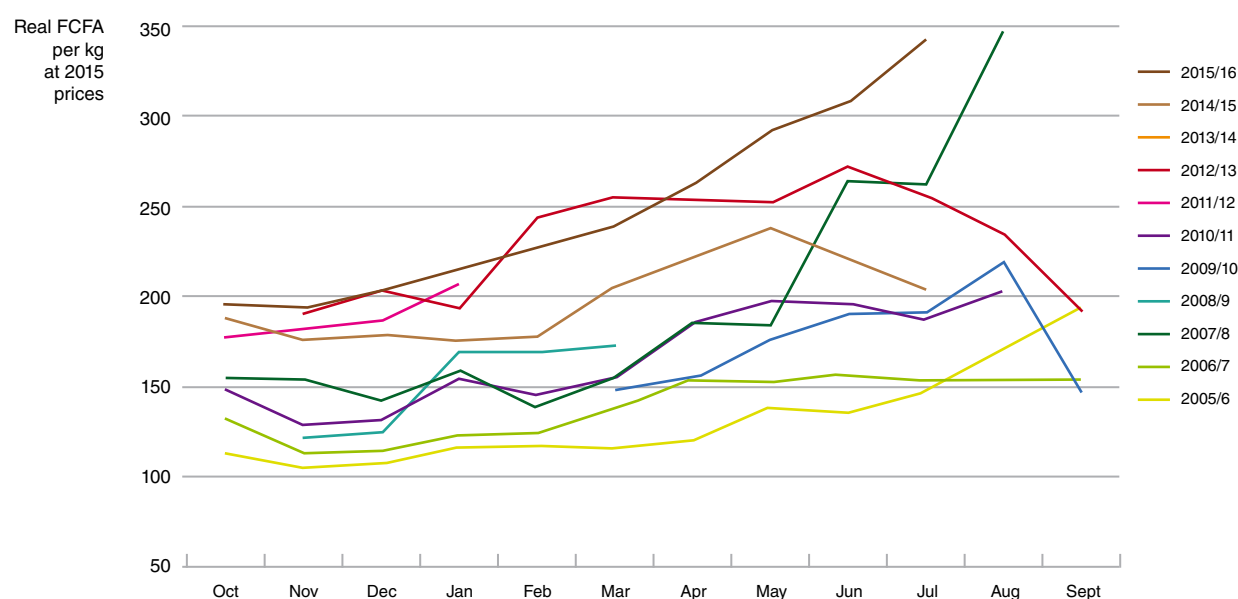
Note: Local market prices are national averages from Commissariat à la Sécurité Alimentaire (CSA), with gaps where data are not available. Lightly shaded bars show months in which the average CSA market price fell below the floor price for procurement by SUNEOR and other oil expressors.

Source: CSA and SUNEOR field data; exports totals are from USDA, Senegal Oilseeds and Products Annual Report, 19 July 2016, from Government of Senegal.

As indicated above, a characteristic feature of groundnut markets is the seasonal pattern of local prices within Senegal. Prices fall at harvest as local buyers accumulate stocks for storage and processing for export or local sale later in the season at higher prices. The rate of seasonal price increase reflects costs of storage, especially the implicit cost of capital involved in holding a valuable crop from one month to the next, as well as traders' expectations about supply-demand balances in future months. These prices have trended up over time in real terms, relative to overall inflation in Senegal, as the groundnut harvest has become an increasingly valuable export product.

The figure below provides CSA shows the seasonal price variation in local markets for groundnuts in shell. Darker colors show more recent year. From the data it is apparent that prices are not only trending upward at the start of each marketing year in October, but also rising faster from month to month as the market transitions from the fixed-price system negotiated through CNIA before 2010, to the market-price system negotiated between individual farmers and individual traders since then.

FIGURE 2. Local market prices for groundnuts in Senegal by month, Oct. 2005-July 2016



Note: Local market prices are national averages from Commissariat a la Securite Alimentaire (CSA), with gaps where data are not available. Darker colors are more recent years.

The historical price patterns presented in Figures 1 and 2 above play a crucial role in our analysis of future scenarios and policy options to be discussed in section 4 of this report.

3. COMPETITIVENESS, COMPARATIVE ADVANTAGE AND DISTORTIONS BY ACTIVITY

The PAM approach to policy analysis begins by identifying specific activities at each stage of the value chain, and then constructing enterprise budgets for those activities at market prices to measure their competitiveness and at social opportunity costs to measure their comparative advantage relative to other activities, as shown in the figure below.

FIGURE 3. Structure and definitions of the Policy Analysis Matrix

Enterprise budget:	Revenues from outputs	- Cost of inputs	- Cost of resources	= Profits from the enterprise
at market prices	a	b	c	d = a-b-c
- at social costs	e	f	g	h = e-f-g
= transfers and losses	i = a-e	j = b-f	k = c-g	l = d-h
	<i>Tradable goods (foreign exchange)</i>		<i>Domestic resources (value added in GDP)</i>	

The construction and interpretation of PAM budgets was originally detailed in Monke and Pearson (1989), with subsequent extensions in Masters (1993) and Masters and Winter-Nelson (1995). Using the notation above, indicators of competitiveness are the Benefit-Cost Ratio, $BCR = a/(b+c)$, the Resource Cost Ratio, $RCR = c/(a-b)$, and Gross Margin, $GM = d/a$. Indicators of comparative advantage are the Social Benefit-Cost ratio, $SBC = e/f+g$, the Domestic Resource Cost ratio, $DRC = g/(e-f)$, and the Social Gross Margin, $SGM = h/e$. Indicators of policy effects are the Nominal Protection Coefficient, $NPC = a/e$, the Effective Protection Coefficient, $EPC = (a-b)/(e-f)$, the Producer Subsidy Equivalent, $PSE = l/a$, and the Subsidy Ratio to Producers, $SRP = l/e$.

In this study budgets for groundnut enterprises are constructed at each distinct stage of the value chain: (1) groundnut production on farms, (2) transport and handling after harvest, (3) processing into exportable oil and cake, and (4) exporting whole nuts. Groundnut production is further divided into six distinct kinds of farm enterprise, and processing is split into two kinds of oil expressing activities. This allows us to analyze competitiveness, comparative advantage and policy effects for ten distinct kinds of activity, each of which is presented here as the national average for that activity. Future work could consider diversity within each of these categories, including differences by region and other enterprise characteristics.

3.1 PRODUCTION

For the first stage of groundnut production we provide six distinct enterprise budgets, based on three major categories of farms in Senegal's groundnut sector:

1. Smallholders in low-input systems with limited access to inputs, which we call the standard farm;
2. Members of agricultural cooperatives who use moderate input levels to attain above-average yields; and
3. Farmers with access to irrigation who can use high input levels and sell at high prices in the off-season.

Most groundnuts come from the first two categories of farms, but taking account of irrigated production is also important (Lynn et. al. 2015). For standard farms we compute budgets in two distinct enterprises: production for sale to local markets at prices measured by the CSA during the post-harvest selling season (Oct-Jan), and production for sale to SUNEOR at official seasonal prices set through the CNIA. For cooperative members we do budgets for sales to both of those markets, plus a third budget for sales as groundnut seeds. For irrigated farms, we use local market prices measured by the CSA in high-priced season before rainfed crops are harvested (June-Sept).

All farm budgets represent the 2015 harvest with corresponding prices and subsidies which are presented in 2015 FCFA/kg. Across all budgets, costs and revenues are annualized and adjusted per kg of groundnuts in shell, taking account of all inputs and outputs of the system. Most notably revenue from groundnut hay is included in revenues for all farming systems, as this has become an increasingly important source of farm income and livelihoods (Noba et al. 2015).

Standard Farm Budgets: The standard farm budget was constructed from a variety of sources to create a composite image of the average low-input farm in the basin arachidier. Using a World Bank funded investigation of cooperative farm systems performed by M. Luzietoso in Feb. 2016 as a base we adjusted the figures to represent a lower yielding system. For example, labor costs, which were very high in the Luzietoso budgets were adjusted according to available government production budgets (DAPSA, 2013 and 2016) and expert opinion. Seeds, which for cooperative budgets were purchased in full each year were adjusted to include 50% seed retention. Yields for the standard farm budgets are 740 kg/ha, representing the average of the lower 50% of regional groundnut yields (GOS, 2016).

Irrigated Farm Budget: The irrigated farm budget is an adjusted version of the 2009 irrigated system budget produced by SAED, the Société Nationale d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Sénégal et des Vallées du Fleuve Sénégal et de la Falémé. Yields on these farms are much higher (3500 kg/ha) than in rainfed operations, making the added cost of irrigation fees and unsubsidized seed reasonable. This is the only budget which includes large amounts of fertilizer application, again relying on high yields to remain profitable, which it does in both private and social budgets.

Cooperative Budgets: The bulk of the cooperative budgets for both seed producers and non-seed producers was taken from the Luzietoso budgets. However, some important adjustments were made. For example, as in the standard budget, labor valuation and quantity was reduced using government budget estimates. In addition, it is important to note that these producers were assumed to buy ecrémé seed at a government subsidized rate.

Table 1 presents the itemized farm budgets at private prices, and Table 2 presents them at social opportunity costs. Divergences between the two account for observed subsidies on seeds, other farm inputs and financing (MAER, 2016), as well as market inefficiencies that would be remedied by policies designed to improve competitiveness by facilitating entry of new traders exporting whole nuts after harvest. The social opportunity costs shown here are based on measured 2015 export revenues, minus the actual costs incurred by exporters and transporters in that year including a ten percent profit margin for traders in a competitive market. In the appendix, we also present social costs that would follow from a failure to alter current policies, in which revenues in the social budget reflect those currently found on the open market as measured by the CSA for the 2015 harvest.

TABLE 1. Farm production budgets at market prices, per kg of groundnuts in shell

	Private budgets (2015 FCFA/kg)					
	Standard farm (for local mkt)	Standard farm (for SUNEOR)	Irrigated farm (off season)	Coop farm (for seed)	Coop farm (for local mkt)	Coop farm (for SUNEOR)
Fixed inputs						
Equipment	1	1	0	1	1	1
Land	10	10	10	32	7	7
Communication	-	-	-	4	4	4
Fixed inputs (total)	11	11	10	37	12	12
Farm labor						
Hired labor	95	95	13	118	76	76
Family labor	26	26	26	32	20	20
Farm labor (total)	120	120	39	149	96	96
Intermediate inputs						
Seed (Ecrémé)	23	23	-	-	29	29
Seed (Certified & subsidised)	-	-	-	16	-	-
Seed (Retained)	20	20	-	-	-	-
Seed (Certified, full price)	-	-	34	-	-	-
Seed (Certified, R1)	-	-	-	7	-	-
Seed (Certified, R2)	-	-	-	4	-	-
Sacks (25kg)	12	12	3	7	4	4
Sacks (50kg)	4	4	1	7	4	4
Fertilizer (DAP, 18-46-00)	-	-	6	-	-	-
Fertilizer (NPK, 6-20-10)	-	-	-	7	-	-
Fertilizer (KCL)	-	-	6	-	-	-
Fertilizer (Urea)	-	-	3	-	-	-
Herbicide (e.g. Treflan)	-	-	6	-	-	-
Fungicide (e.g. Granox)	3	3	1	3	-	-
Irrigation charges	-	-	19	-	-	-
Machinery cost	33	33	30	21	29	29
Intermediate inputs (total)	95	95	108	71	66	66
Financing costs						
Cooperative fee	-	-	-	4	4	4
Insurance R1	-	-	-	1	-	-
Insurance R2	-	-	-	1	-	-
Financing charges	6	6	5	7	5	5
Financing costs	6	6	5	13	10	10
Total costs	233	233	161	270	183	183
Revenues						
Revenue (gnut in shell)	202	200	217	90	202	200
Revenue (gnut hay)	105	105	60	60	105	105
Revenue (gnut R1 seed)	-	-	-	125	-	-
Revenue (gnut R2 seed)	-	-	-	68	-	-
Total revenue	307	305	277	343	307	305
a. Profit	74	72	116	74	123	122
b. Total returns (profits + return to land and family labor)	110	108	152	137	150	149

Note: All data shown are for the 2015 harvest (the 2015-16 marketing year).

TABLE 2. Farm production budgets at social costs, per kg of groundnuts in shell

	Social budgets (2015 FCFA/kg)					
	Standard farm (for local mkt)	Standard farm (for SUNEOR)	Irrigated farm (off season)	Coop farm (for seed)	Coop farm (for local mkt)	Coop farm (for SUNEOR)
Fixed inputs						
Equipment	2	2	0	1	1	1
Land	10	10	10	32	7	7
Communication	-	-	-	4	4	4
Fixed inputs (total)	12	12	10	37	12	12
Farm labor						
Hired labor	79	79	11	98	63	63
Family labor	26	26	26	32	20	20
Farm labor (total)	105	105	36	130	84	84
Intermediate inputs						
Seed (Ecrémé)	44	44	-	-	57	57
Seed (Certified & subsidised)	-	-	-	30	-	-
Seed (Retained)	20	20	-	-	-	-
Seed (Certified, full price)	-	-	34	-	-	-
Seed (Certified, R1)	-	-	-	12	-	-
Seed (Certified, R2)	-	-	-	7	-	-
Sacks (25kg)	12	12	3	7	4	4
Sacks (50kg)	4	4	1	7	4	4
Fertilizer (DAP, 18-46-00)	-	-	11	-	-	-
Fertilizer (NPK, 6-20-10)	-	-	-	15	-	-
Fertilizer (KCL)	-	-	12	-	-	-
Fertilizer (Urea)	-	-	6	-	-	-
Herbicide (e.g. Treflan)	-	-	6	-	-	-
Fungicide (e.g. Granox)	3	3	1	3	-	-
Irrigation charges	-	-	19	-	-	-
Machinery cost	33	33	30	21	29	29
Intermediate inputs (total)	116	116	122	101	93	93
Financing costs						
Cooperative fee	-	-	-	4	4	4
Insurance R1	-	-	-	1	-	-
Insurance R2	-	-	-	1	-	-
Financing charges	10	10	8	12	9	9
Financing costs	10	10	8	18	13	13
Total costs	243	243	177	285	202	202
Revenues						
Revenue (gnut in shell)	292	292	314	130	292	292
Revenue (gnut hay)	105	105	60	60	105	105
Revenue (gnut R1 seed)	-	-	-	181	-	-
Revenue (gnut R2 seed)	-	-	-	98	-	-
Total revenue	397	397	374	470	397	397
a. Profit	153	153	197	184	194	194
b. Total returns (profits + return to land and family labor)	189	189	233	247	221	221

Note: Data are for 2015 harvest. Social value of nuts is export earnings minus competitive farm-to-export handling costs.

The policy analysis matrix reveals any divergences between private incentives and social costs along the value chain. Table 3 presents the 2015 farm budgets in PAM format, and Table 4 presents these same data in ratio form. From them we can see that all systems are profitable in private terms, but much more so in social terms.

TABLE 3. Policy Analysis Matrices for farm production (2015 FCFA/kg)

	Standard farm-export market					Coop farm-export market			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	307	96	137	74		307	66	117	123
Social Prices	397	118	125	153		397	94	108	194
Divergences	(90)	(22)	12	(79)		(90)	(28)	9	(71)

	Irrigated farm (off season)					Coop Farm (for seed)			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	277	89	72	116		343	72	198	74
Social Prices	374	104	73	197		470	102	183	184
Divergences	(97)	(15)	(1)	(81)		(126)	(31)	15	(110)

Note: Data are for 2015 harvest. The social value of nuts in shell sold after harvest is export earnings from shelled nuts, minus competitive farm-to-export costs of transport, handling, shelling and quality control.

TABLE 4. Financial and economic ratios for farming, at social costs with new policies

	Private competitiveness				Social comparative advantage		
	Benefit/cost ratio (BCR)	Resource cost ratio (RCR)	Private gross margin (GM)		Benefit/cost ratio (SBC)	Resource cost/ ratio (DRC)	Social gross margin (SGM)
Farming enterprises after adjustment (social prices with competition for export as shelled nuts)							
Standard farms for export	1.32	0.65	24.2%		1.63	0.45	38.7%
Irrigated farm for off season sales	1.72	0.38	41.8%		2.11	0.27	52.7%
Coop farm for seed production	1.27	0.73	21.5%		1.64	0.50	39.2%
Coop farm for export	1.66	0.49	39.9%		1.96	0.36	49.0%

Tables 5 summarizes the policy distortions between private and social budgets. The net tariff-equivalent Subsidy Rate to Producers is -20 percent, implying that 20 percent of what farmers would have earned in a competitive market is now being transferred to the rest of Senegalese society. As shown in the budgets for processing, these funds are now absorbed by SUNEOR, but after reforms this amount could be retained by farmers as their own revenue, or be used by government to provide public services from export tax revenues.

TABLE 5. Policy distortion ratios for farm production

	Policy distortions			
	Nominal protection coefficient (NPC)	Effective protection coefficient (EPC)	Producer subsidy equivalent (PSE)	Subsidy Rate to Producers (SRP)
Farming enterprises after adjustment (social prices with competition for export as shelled nuts)				
Standard farms for export	0.77	0.76	-25.8%	-20.0%
Irrigated farm for off season sales	0.74	0.70	-29.2%	-21.7%
Coop farm for seed production	0.73	0.74	-32.1%	-23.5%
Coop farm for export	0.77	0.79	-23.9%	-18.3%

Results of the production budgets indicate that groundnut production remains profitable relative to farmers' other opportunities, despite the many challenges they face in the groundnut sector. This very strong competitiveness and comparative advantage has sustained the groundnut value chain for decades.

3.2 TRANSPORT AND HANDLING

Transport and handling of groundnuts from the farm to end-users plays a crucial role in the value chain. It is a relatively labor-intensive activity, offering high value added in the sense of employment opportunities per unit of tradable output. Under what is known as the *carreau-usine* system, transporters were brought into government-sponsored price negotiations with SUNEOR/SONACOS and other big oil producers, to set farmgate prices and transporter payments at the beginning of each season. Transporters may also provide other services related to groundnuts and other crops, including storage. Indeed many informants mentioned that more diversified agrifood enterprises, known as *opérateur privé stockeur* (OPS), are now transporting large quantities of groundnuts and also competing with end-users to hold stocks so as to arbitrage over both space and time. For the purposes of these budgets (Tables 6-10) we were unable to obtain independent information on these OPS agents, so we present only the negotiated terms as provided by SUNEOR. They are adjusted to incorporate taxes and disaggregate diesel costs based on FAO (MAFAP) provided estimates.

Results of Tables 6-10 reveal that transport activities are generally competitive, with moderate profit rates at both private prices and social costs, and face no special taxes on their groundnut activities.

TABLE 6 Transportation budgets at market prices, per kg of groundnuts in shell

	Private budgets (2015 FCFA/kg)					
	2010	2011	2012	2013	2014	2015
<i>Product in process + other budget items</i>						
Groundnut in shell	166.9	174.5	188.2	200.2	200.0	200.0
Diesel	3.1	3.1	3.1	3.1	3.1	3.1
1. Tradable costs	170	178	191	203	203	203
Non-tradable costs						
Illicit Tax	0.23	0.23	0.23	0.23	0.23	0.23
Legal Tax	0.69	0.69	0.69	0.69	0.69	0.69
Other costs	10	11	23	11	11	13
2. Non-tradable costs	11	12	24	12	12	14
3. Total revenue	195	203	241	229	229	231
4. Profit (operating margin)	14	14	25	14	14	14

TABLE 7 Transportation budgets at social costs, per kg of groundnuts in shell

	Social budgets (2015 FCFA/kg)					
	2010	2011	2012	2013	2014	2015
<i>Product in process + other budget items</i>						
Groundnut in shell	166.9	174.5	188.2	200.2	200.0	200.0
Diesel	3.1	3.1	3.1	3.1	3.1	3.1
1. Tradable costs	170	178	191	203	203	203
Non-tradable costs						
Illicit Tax	-	-	-	-	-	-
Legal Tax	-	-	-	-	-	-
Other costs	10	11	23	11	11	13
2. Non-tradable costs	10	11	23	11	11	13
3. Total revenue	195	203	241	229	229	231
4. Profit (operating margin)	15	14	26	15	15	15

TABLE 8. Policy Analysis Matrices for transport services (2015 FCFA/kg)

	2015			
	Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	231	203	14	14
Social Prices	231	203	13	15
Divergences	-	-	1	(1)

	2014			
	Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	229	203	12	14
Social Prices	229	203	11	15
Divergences	-	-	1	(1)

	2013			
	Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	229	203	12	14
Social Prices	229	203	11	15
Divergences	-	-	1	(1)

	2012			
	Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	241	191	24	25
Social Prices	241	191	23	26
Divergences	-	-	1	(1)

	2011			
	Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	203	178	12	14
Social Prices	203	178	11	14
Divergences	-	-	1	(1)

	2010			
	Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	195	170	11	14
Social Prices	195	170	10	15
Divergences	-	-	1	(1)

TABLE 9. Financial and economic ratios for transport services

	Private competitiveness			Social comparative advantage		
	Benefit/cost ratio (BCR)	Resource cost ratio (RCR)	Private gross margin (GM)	Benefit/cost ratio (SBC)	Resource cost/ratio (DRC)	Social gross margin (SGM)
Transport from farm to SUNEOR (harvest years)						
2015	1.06	0.51	5.9%	1.07	0.48	6.3%
2014	1.06	0.47	5.9%	1.07	0.44	6.3%
2013	1.06	0.47	5.9%	1.07	0.44	6.3%
2012	1.12	0.49	10.5%	1.12	0.47	10.9%
2011	1.07	0.47	6.7%	1.08	0.43	7.1%
2010	1.08	0.44	7.1%	1.08	0.40	7.5%

TABLE 10. Policy distortion ratios for transport services

	Policy distortions			
	Nominal protection coefficient (NPC)	Effective protection coefficient (EPC)	Producer subsidy equivalent (PSE)	Subsidy Rate to Producers (SRP)
Transport from farm to SUNEOR (harvest years)				
2015	1	1.00	-0.4%	-0.4%
2014	1	1.00	-0.4%	-0.4%
2013	1	1.00	-0.4%	-0.4%
2012	1	1.00	-0.4%	-0.4%
2011	1	1.00	-0.5%	-0.5%
2010	1	1.00	-0.5%	-0.5%

3.3 PROCESSING INTO OIL AND CAKE

Groundnut processing in Senegal takes place through a few primary channels which we present below. Industrial processing of groundnuts into oil has historically taken over half of the groundnut harvest, the vast majority of which is then exported in crude form (USDA). Industrial oil expressers such as SUNEOR/SONACOS move large quantities of groundnuts around the country to their centralized factories for processing and shipping. On the other end of the spectrum are dispersed artisanal oil processors who purchase from local markets and sell crude and refined oil for that same market.

3.3.1 PROCESSING BY SUNEOR/SONACOS

In the tables below we present the private and social budget for SUNEOR. These are budgets of continuing operation, meaning they do not take into capital recovery costs for fixed assets and land; however, they do take into account repair costs. Unlike the other budgets presented in this report which are based on harvest years, the SUNEOR budgets are based on audited financial statements which use calendar years.

Costs and revenues are presented in terms of 2015 FCFA per kg of groundnut in-shell processed as throughput each year, adjusted by the value of groundnut products in audited sales data. Yearly variation in operating costs per unit of throughput depends on largely on volume handled, so costs per unit are presented in the form of a four-year average covering 2011 through 2014. Revenues were estimated using financial statement valuation of end product and corroborated with SUNEOR provided FOB prices. Financial statements are not yet available for 2015 and 2016, so revenues for those years are based on FOB prices instead of SUNEOR's own financial statements.

As can be seen below, the three most important factors in determining SUNEOR competitiveness are the cost of groundnuts purchased, the value of oil and cake sold, and the cost of operations. Recent years involve large losses regardless of prices paid to farmers, due to very low revenue per unit of groundnuts purchased. Revenues as declared in financial statements imply extraction rates below 30%, which is far less than the levels typically achieved by other groundnut processors. This kind of inefficiency is compounded by high costs of operation, in part because of low throughput. Even with very large subsidies from government the company lacks the revenue needed to buy enough groundnuts to operate its machinery at full capacity. Given low extraction rates, however, raising subsidies to increase throughput would just increase the total losses, and in any case these are symptoms rather than causes of SUNEOR's dependence on subsidies, as the underlying lack of commercial viability limits payoffs to efficient operations.

Tables 11 and 12 below provide enterprise budgets for SUNEOR operations at private and social costs. The social cost reflects distortions observed on the ground and through government documents. The SUNEOR price paid to suppliers in has benefited from occasional subsidies paid by the government to SUNEOR in order to maintain price floor set by CNIA and the government. A portion of the subsidy on price has been attributed to SUNEOR in years that the market price was above the SUNEOR price, while it has not been in year when the price was indeed below the SUNEOR price. The budget also reflects the removal of operating subsidies, and the overpayment of labor apparent in their financial documents (votresalaire.org).

TABLE 11. SUNEOR processing budgets at market prices, per kg of groundnuts in shell

SUNEOR continuing operations to extract and export oil (per kg of gnut in shell)						
	Private budgets (2015 FCFA/kg)					
	2011	2012	2013	2014	2015	Projected 2016
<i>Product in process + other budget items</i>						
Groundnut in shell	195	203	241	229	229	231
Electricite	1	5	3	2	4	32
Autres energies	0	1	1	1	1	8
Petit materiel et outillage	0	0	0	0	0	2
1. Tradable costs	196	210	245	232	234	273
Management	2	11	7	5	8	44
Supervisors	0	2	1	1	1	5
Techniciens	4	18	12	8	14	60
Unskilled	3	13	8	5	9	33
Labor costs	9	44	28	18	33	142
Eau	0	1	0	0	1	5
Fournitures d'entretien non stockables	0	0	0	0	0	1
Fournitures de bureau non stockables	0	0	0	0	0	1
Transports pour le compte de tiers	0	0	0	0	0	0
Transports du personnel	0	1	0	0	0	4
Entretien, reparations des biens immobiliers	0	2	1	1	1	11
Entretien, reparations des biens mobiliers	0	1	0	0	0	4
Publicité, publications, relations publiques	0	1	0	0	0	4
Frais de telecommunication	0	1	1	1	1	8
Remmunerations d'intermediaires et conseils	0	2	1	1	1	12
Financement	8	38	25	16	28	86
Taxes	0.088	0.406	0.263	0.169	0.303	0.149
2. Non-tradable costs	19	90	58	37	67	276
Groundnut oil (Brute)	167	153	213	129	171	190
Groundnut cake (Tourteaux)	55	65	74	22	31	31
Gnut oil refined and blended with others oils	7	30	9	2	8	8
Groundnut residue (shells)	13	13	13	13	13	13
Subsidy received (per kg)	40	25	-	57	19	-
Subsidy received (general operating)	6	28	18	12	21	173
3. Total revenue	289	314	327	235	264	416
4. Profit (operating margin)	74	14	24	(35)	(37)	(133)
Total quantity processed (throughput, mt/yr)	203,341	44,099	67,947	106,084	58,998	7,146

Note: Data shown are for calendar years, which are also SUNEOR fiscal years, from audited accounts for 2011-14 and projections for 2015; product in process cost are SUNEOR global payment. All data in 2015 FCFA, adjusted for inflation.

TABLE 12. SUNEOR processing budgets at social costs, per kg of groundnuts in shell

SUNEOR continuing operations to extract and export oil (per kg of gnut in shell)						
	Social budgets (2015 FCFA/kg)					
	2011	2012	2013	2014	2015	Projected 2016
<i>Product in process + other budget items</i>						
Groundnut in shell	209	211	219	209	231	231
Electricite	1	5	3	2	4	32
Autres energies	0	1	1	1	1	8
Petit materiel et outillage	0	0	0	0	0	2
1. Tradable costs	210	218	224	212	236	273
Management	1	3	2	1	2	11
Supervisors	0	1	0	0	0	1
Techniciens	1	4	2	2	3	12
Unskilled	1	3	2	1	2	7
Labor costs	2	10	6	4	7	33
Eau	0	1	0	0	1	5
Fournitures d'entretien non stockables	0	0	0	0	0	1
Fournitures de bureau non stockables	0	0	0	0	0	1
Transports pour le compte de tiers	0	0	0	0	0	0
Transports du personnel	0	1	0	0	0	4
Entretien, reparations des biens immobiliers	0	2	1	1	1	11
Entretien, reparations des biens mobiliers	0	1	0	0	0	4
Publicité, publications, relations publiques	0	1	0	0	0	4
Frais de telecommunication	0	1	1	1	1	8
Remunerations d'intermediaires et conseils	0	2	1	1	1	12
Financement	14	63	41	26	47	143
Taxes	-	-	-	-	-	-
2. Non-tradable costs	18	81	52	34	60	223
Groundnut oil (Brute)	167	153	213	129	171	190
Groundnut cake (Tourteaux)	55	65	74	22	31	31
Gnut oil refined and blended with others oils	7	30	9	2	8	8
Groundnut residue (shells)	13	13	13	13	13	13
Subsidy received (per kg)						
Subsidy received (general operating)	-	-	-	-	-	1
3. Total revenue	243	261	309	166	224	244
4. Profit (operating margin)	15	(37)	33	(80)	(72)	(252)
Total quantity processed (throughput, mt/yr)	203,341	44,099	67,947	106,084	58,998	7,146

Note: Data shown are for calendar years, which are also SUNEOR fiscal years, from audited accounts for 2011-14 and projections for 2015; product in process cost are SUNEOR global payment. All data in 2015 FCFA, adjusted for inflation.

Summary PAMs in Table 13 show that transfers have taken place on the revenue side through fiscal subsidies while there has been an implicit social tax on costs through higher labor costs. The net result is very large social losses in all years except 2011 and 2013, and despite large subsidies there were private losses as well in all years except 2011, 2012 and 2013.

TABLE 13. Policy Analysis Matrices for SUNEOR groundnut processing (2015 FCFA/kg)

	Projected 2016					2015			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	416	273	276	(133)	Private Prices	264	234	67	(37)
Social Prices	244	273	223	(252)	Social Prices	224	236	60	(72)
Divergences	172	-	53	119	Divergences	40	(2)	7	35

	2014					2013			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	235	232	37	(35)	Private Prices	327	245	58	24
Social Prices	166	212	34	(80)	Social Prices	309	224	52	33
Divergences	69	20	4	45	Divergences	18	22	6	(9)

	2012					2011			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	314	210	90	14	Private Prices	289	196	19	74
Social Prices	261	218	81	(37)	Social Prices	243	210	18	15
Divergences	53	(8)	9	52	Divergences	47	(14)	2	59

Note: All data shown are in 2015 FCFA/kg. SUNEOR budgets are for calendar years 2011-2015 (projected 2016); all others are for 2015 harvest (the 2015-16 marketing year).

A distinctive feature of SUNEOR operations is that value added at social prices is so low as to have fallen below zero, and stayed negative since 2014. As shown in Table 14 below, this makes the traditional DRC measure of comparative advantage useless for comparisons. A more general social benefit-cost (SCB) ratio is therefore preferable, showing very low values reaching below 0.50 FCFA in social gain benefits for every FCFA of social costs.

TABLE 14. Financial and economic ratios for SUNEOR groundnut processing

	Private competitiveness			Social comparative advantage		
	Benefit/cost ratio (BCR)	Resource cost ratio (RCR)	Private gross margin (GM)	Benefit/cost ratio (SBC)	Resource cost/ratio (DRC)	Social gross margin (SGM)
SUNEOR oil extraction and exports (calendar years)						
2016 (projections)	0.76	1.93	-32.0%	0.49	(7.63)	-103.5%
2015	0.88	2.22	-13.9%	0.76	(5.10)	-32.2%
2014	0.87	14.66	-14.8%	0.68	(0.73)	-48.1%
2013	1.08	0.71	7.4%	1.12	0.61	10.8%
2012	1.05	0.86	4.6%	0.88	1.86	-14.3%
2011	1.34	0.21	25.5%	1.07	0.54	6.2%

As shown in Table 15 the policy distortions provided to SUNEOR are very large, in all years except 2013, although as shown above even these heavy subsidy rates are not sufficient to maintain private profitability.

TABLE 15. Policy distortion ratios for SUNEOR groundnut processing

	Policy distortions			
	Nominal protection coefficient (NPC)	Effective protection coefficient (EPC)	Producer subsidy equivalent (PSE)	Subsidy Rate to Producers (SRP)
SUNEOR oil extraction and exports (calendar years)				
2016 (projections)	1.71	172.25	28.6%	48.9%
2015	1.18	41.99	13.4%	15.8%
2014	1.41	48.73	19.2%	27.1%
2013	1.06	-3.33	-2.8%	-3.0%
2012	1.20	60.70	16.5%	19.8%
2011	1.19	60.54	20.3%	24.2%

3.2.2 PROCESSING BY ARTISANAL OPERATORS

Small-scale artisanal oil expressors have been gaining attention from policy makers and development groups as an opportunity for labor-intensive entrepreneurship in small towns and cities (World Bank, 2015, p.41). Previously a cause for some concern because of high rates of aflatoxin, interviews with local experts suggest that improved processing methods have helped reduce risks in artisanally processed oils (Lynn et.al., p.39). Enterprise budgets for this activity are sufficiently simple as to summarize quickly in Table 16. Costs refer to continuing operation of existing facilities, rather than new establishments, so as to permit direct comparison with our budgets for SUNEOR/SONACOS. Costs are based on FAO estimates and Luzietoso (World Bank 2016) budgets, and refer only to the 2015 harvest due to lack of data for previous years. The budget shown here refers to an enterprise with a throughput of roughly 5400 mt per year, with high levels of labor employment as detailed in the itemized budget (Annex A1.2).

TABLE 16. Summary of results for artisanal processing

	Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	282	224	47	11
Social Prices	282	224	47	11
Divergences	-	-	-	-
Benefit/costs ratio (BCR)				1.04
Resource cost ratio (RCR)				0.81
Private gross margin (GM)				4.0%
Benefit/cost ratio (SBC)				1.04
Resource cost ratio (DRC)				0.81
Social gross margin (SGM)				4.0%
Nominal protection coefficient (NPC)				1
Effective protection coefficient (EPC)				1.00
Producer subsidy equivalent (PSE)				0.0%
Subsidy Rate to Producers (SRP)				0.0%

3.3. EXPORTING WHOLE NUTS

The growth in whole groundnut export, which has received much recent attention, has grown substantially since export restrictions were lifted in 2010. These processors do not benefit from the price setting of the CNIA and government, but buy nuts on the local markets, shell them in warehouses near the markets and ship them directly to the port (Lynn & Hathi, 2016). Budgets presented below are from a single exporter, SEDAB, which shared cost data from their 2015 marketing year with us.

TABLE 17. Whole nut exporting budgets at market prices, per kg of groundnuts in shell

	Private budgets (2015 FCFA/kg)					
	2010	2011	2012	2013	2014	2015
<i>Product in process + other budget items</i>						
Groundnut in shell	166.3	188.5	231.7	178.6	213.5	248.0
Processing costs	32.4	32.4	32.4	32.4	32.4	32.4
Transport de Dirourbel to Dakar	4.0	4.0	4.0	4.0	4.0	4.0
Export charges (Shelled)	0.27	0.27	0.27	0.27	0.27	0.27
Frais fixe par shipment de 25 ctnrs	0.3	0.3	0.3	0.3	0.3	0.3
Frais fix par conteneur de 20'	2.2	2.2	2.2	2.2	2.2	2.2
Frais d'approche DPW par conteneur	8.4	8.4	8.4	8.4	8.4	8.4
Financing charges	10.4	11.8	14.5	11.2	13.3	15.5
1. Tradable costs	170.2	192.4	235.6	182.5	217.4	251.9
2. Non-tradable costs	54.0	55.4	58.1	54.8	57.0	59.1
3. Total revenue	512.0	738.0	400.7	372.2	425.1	403.2
4. Profit (operating margin)	287.7	490.3	107.0	134.8	150.7	92.2

Note: Data shown are for each harvest, at the start of each marketing year, from SEDAB (2015) for operating costs, CSA (various years) for groundnut procurement and authors' calculations from world prices for revenues. SEDAB's stated 2015 budget uses much lower revenues.

TABLE 18. Whole nut exporting budgets at social costs, per kg of groundnuts in shell

	Social budgets (2015 FCFA/kg)					
	2010	2011	2012	2013	2014	2015
<i>Product in process + other budget items</i>						
Groundnut in shell	166.3	188.5	231.7	178.6	213.5	248.0
Processing costs	32.4	32.4	32.4	32.4	32.4	32.4
Transport de Dirourbel to Dakar	4.0	4.0	4.0	4.0	4.0	4.0
Export charges (Shelled)	0.27	0.27	0.27	0.27	0.27	0.27
Frais fixe par shipment de 25 ctnrs	0.3	0.3	0.3	0.3	0.3	0.3
Frais fix par conteneur de 20'	2.2	2.2	2.2	2.2	2.2	2.2
Frais d'approche DPW par conteneur	8.4	8.4	8.4	8.4	8.4	8.4
Financing charges	10.4	11.8	14.5	11.2	13.3	15.5
1. Tradable costs	170.8	192.9	236.2	183.1	218.0	252.5
2. Non-tradable costs	53.5	54.8	57.5	54.2	56.4	58.6
3. Total revenue	512.0	738.0	400.7	372.2	425.1	403.2
4. Profit (operating margin)	287.7	490.3	107.0	134.8	150.7	92.2

Note: Data shown are for each harvest, at the start of each marketing year, from SEDAB (2015) for operating costs, CSA (various years) for groundnut procurement and authors' calculations from world prices for revenues. SEDAB's stated 2015 budget uses much lower revenues.

TABLE 19. Policy Analysis Matrices for exporting whole nuts (2015 FCFA/kg)

	2015					2014			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	403	252	59	92	Private Prices	425	217	57	151
Social Prices	403	252	59	92	Social Prices	425	218	56	151
Divergences	-	(1)	1	-	Divergences	-	(1)	1	-
	2013					2012			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	372	183	55	135	Private Prices	401	236	58	107
Social Prices	372	183	54	135	Social Prices	401	236	58	107
Divergences	-	(1)	1	-	Divergences	-	(1)	1	-
	2011					2010			
	Revenue	Tradable inputs	Domestic resources	Profits		Revenue	Tradable inputs	Domestic resources	Profits
Private Prices	738	192	55	490	Private Prices	512	170	54	288
Social Prices	738	193	55	490	Social Prices	512	171	53	288
Divergences	-	(1)	1	-	Divergences	-	(1)	1	-

Note: All data shown are in 2015 FCFA/kg. SUNEOR budgets are for calendar years 2011-2015 (projected 2016); all others are for 2015 harvest (the 2015-16 marketing year).

TABLE 20. Financial and economic ratios for exporting whole nuts

	Private competitiveness			Social comparative advantage		
	Benefit/cost ratio (BCR)	Resource cost ratio (RCR)	Private gross margin (GM)	Benefit/cost ratio (SBC)	Resource cost/ratio (DRC)	Social gross margin (SGM)
Exporting shelled nuts (harvest years)						
2015	1.30	0.39	22.9%	1.30	0.39	22.9%
2014	1.55	0.27	35.5%	1.55	0.27	35.5%
2013	1.57	0.29	36.2%	1.57	0.29	36.2%
2012	1.36	0.35	26.7%	1.36	0.35	26.7%
2011	2.98	0.10	66.4%	2.98	0.10	66.4%
2010	2.28	0.16	56.2%	2.28	0.16	56.2%

TABLE 21. Policy distortion ratios for exporting whole nuts

	Policy distortions			
	Nominal protection coefficient (NPC)	Effective protection coefficient (EPC)	Producer subsidy equivalent (PSE)	Subsidy Rate to Producers (SRP)
Exporting shelled nuts (harvest years)				
2015	1.00	0.55	0.0%	0.0%
2014	1.00	0.55	0.0%	0.0%
2013	1.00	0.55	0.0%	0.0%
2012	1.00	0.55	0.0%	0.0%
2011	1.00	0.55	0.0%	0.0%
2010	1.00	0.55	0.0%	0.0%

4. GLOBAL TRENDS AND MARKET DYNAMICS

The PAM results presented in this report are based on enterprise budgets for cultivation, marketing and processing of groundnuts harvested in Senegal between 2010 and 2015. To project forward into future scenarios and policy options, a longer perspective on prices and quantities is needed. The data presented here focus on changes since 2000, in the context of evolving market conditions since comparable data became available beginning in 1972. These data allow us to assess longer-term competitiveness and comparative advantage at each stage of the groundnut value chain, so as to answer the fundamental questions motivating this report:

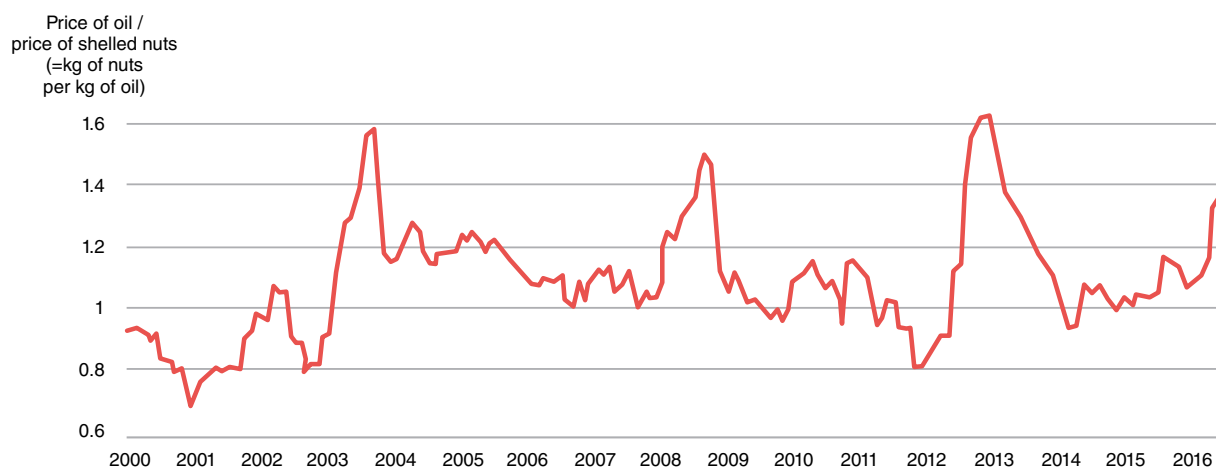
- i. Will groundnuts production and groundnut-based oil production and processing remain competitive in the foreseeable future?
- ii. Will exports of raw groundnut work better for farmers and the economy?
- iii. What policy, institutional, and technology options might be needed to make the value chain more competitive?

4.1 WORLD PRICES AND TRADE BY PRODUCT TYPE

The question of whether Senegal should export groundnuts in whole form or processed into oil and meal depends fundamentally on the price premium offered for these processed products, relative to the value of whole nuts and the costs of processing.

The world price premium for oil over whole nuts since 2000 is shown in the figure below, using monthly data for standard varieties and locations. Senegal may be able earn more or less than these baseline values for its whole nuts or its oil, but the figure shows clearly that, in general since 2003, the world-market premium paid for oil over whole nuts has fluctuated with brief spikes above 40% in 2004, 2008 and 2013, followed by long valleys below 20% and many months in which the premium varies around zero.

FIGURE 4. World price ratio of groundnut oil to whole nuts, Jan. 2000 - June 2016



Note: Prices are cif Rotterdam, for groundnut oil (all origins) and shelled nuts (US origin, runners 40/50).

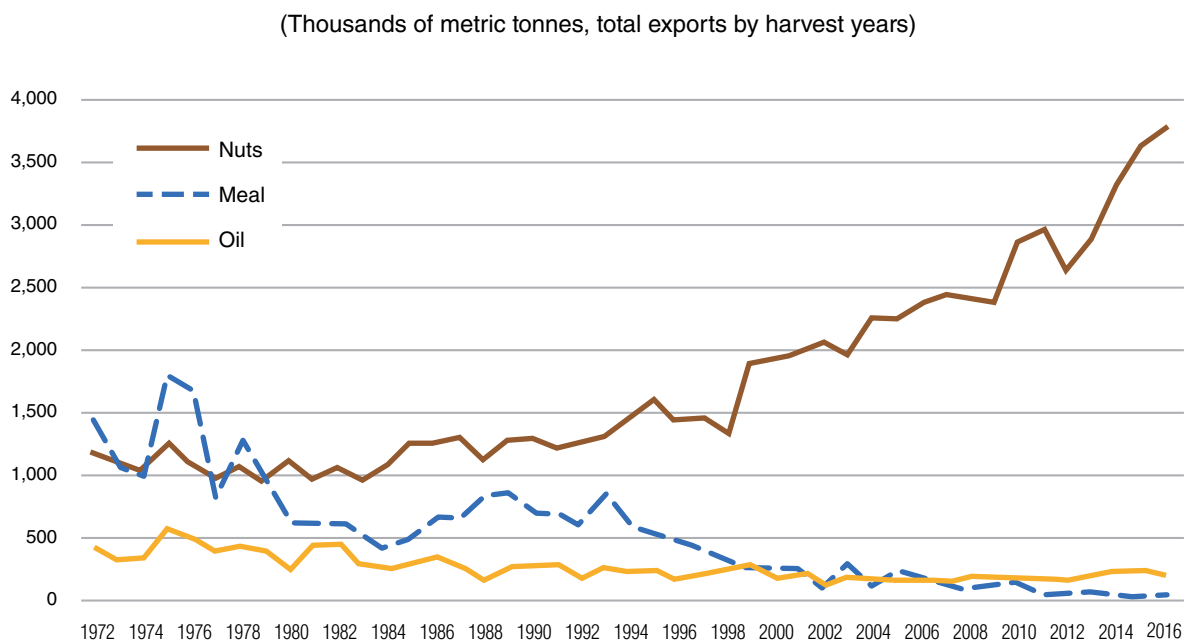
Source: World Bank Commodity Price data, 2016.

One reason for the low premium on oil relative to whole nuts is that processing nuts into oil also generates cake, which is sold as animal feed. Senegal exports both oil and cake, but there is now relatively little international trade in cake and no world price series for it is available. The fact that groundnut oil enters international trade in much larger volumes than groundnut cake indicates that expressing is done in countries that consume the cake locally to feed as livestock. This was not always the case. Groundnut cake, also known as meal, was previously traded even more widely than groundnut oil. The shift in processing from places like Senegal that export the meal to places where meal is consumed locally is among the most important changes in world groundnut markets.

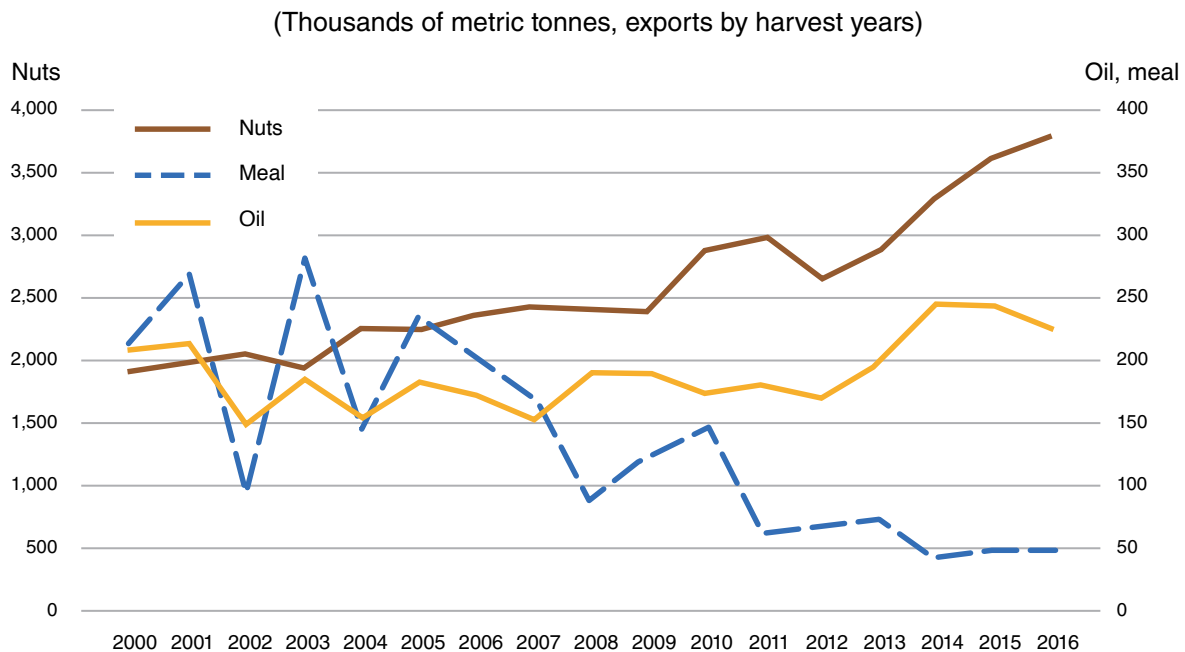
Long-term trends in world trade volumes for all three major groundnut products since 1972 are shown in the figures below. These start in the first year for which comparable data are available, and a subsequent chart provides a close-up view of changes since 2000 for comparison with the chart above showing the premium paid for oil over whole nuts. These charts reveal that, in the 1970s, world trade in groundnut meal equaled or exceeded trade in whole nuts, and both were much larger than trade in oil. Oil expressing occurred either in countries where groundnuts were grown, like Senegal, or in countries where the oil was consumed.

The location of oil expressing shifted gradually during the 1980s and 1990s, as world trade in whole nuts increased steadily and world trade in groundnut meal declined. During a brief period from 2000 to 2005 trade in meal fluctuated around the same volume as trade in oil, but since 2005 world trade in meal has continued its decline as trade in nuts continued to rise. The trend that began in the 1970s has come to its logical conclusion, with world groundnut trade being conducted primarily in the form of whole nuts. Oil expressing occurs primarily where both oil and meal are consumed.

FIGURE 5. World trade in whole groundnuts, meal and oil, 1972-2016



Source: USDA Production, Supply and Distribution database (<https://apps.fas.usda.gov/psdonline>). Years shown correspond to harvest, at the start of the marketing year, with USDA estimates for 2016.

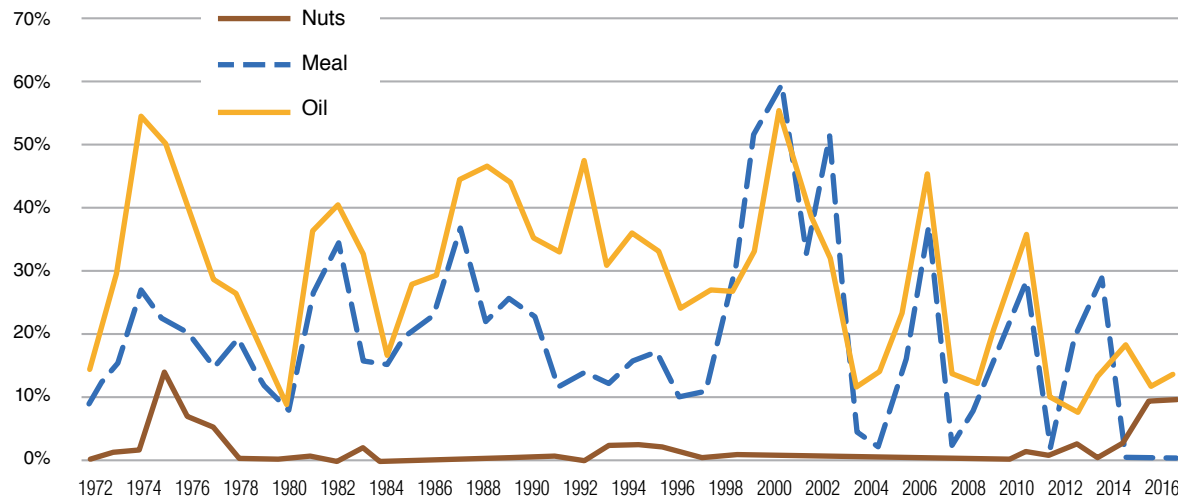
FIGURE 6. World trade in whole groundnuts, meal and oil, 2000-2016

Source: USDA Production, Supply and Distribution database (<https://apps.fas.usda.gov/psdonline>).
Years shown correspond to harvest, at the start of the marketing year, with USDA estimates for 2016.

4.2 SENEGAL MARKET SHARES AND COMPARATIVE ADVANTAGE

As shown above, since 1972 the location of groundnut oil processing has shifted away from groundnut-exporting countries like Senegal to the places where oil and meal are consumed, leaving international trade in groundnuts to be dominated by shipments of whole nuts.

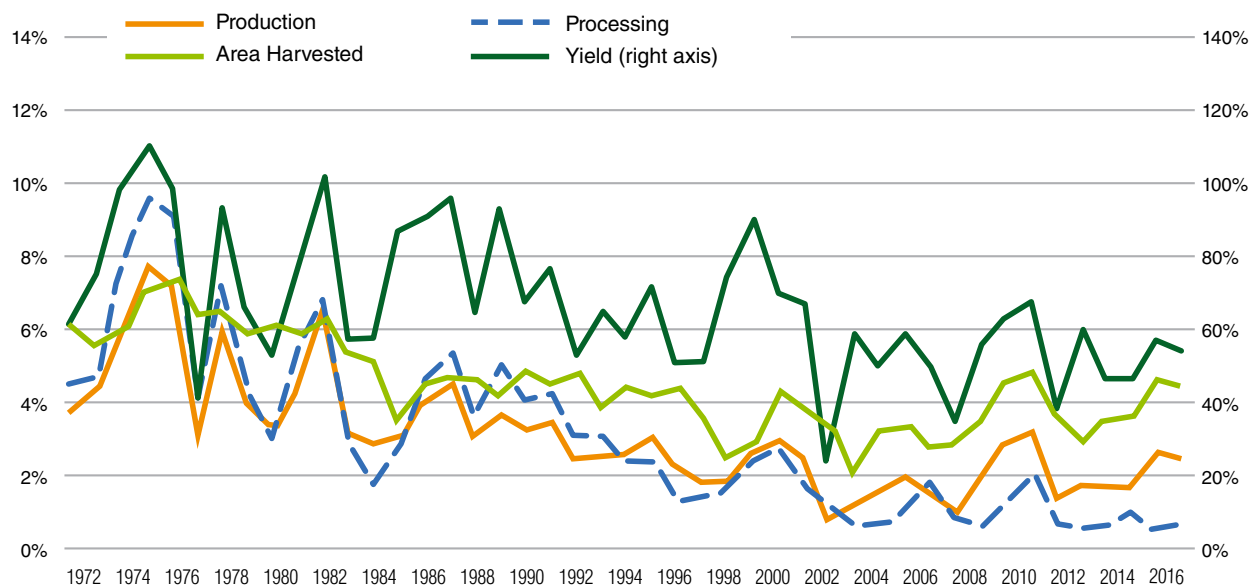
Figure 7 below reveals how Senegal's share of the dwindling market for internationally-traded oil and meal has fluctuated over time from the 1970s through the 1990s, and then declined steadily after 2000. Direct exports of whole nuts from Senegal were permitted only occasionally, such as during the boom years around 1975, until Senegal joined the world market tendency to trade groundnuts in that form in 2014 and 2015. Before 2014, Senegal was transforming almost all of its surplus nuts into oil and meal and exporting both. In the late 1980s and 1990s the country's market share of oil was significantly above its market share of meal, indicating that other countries were crushing nuts for their home oil markets and exporting the meal, but after 2000 the two market shares returned to fluctuating in tandem as the rest of the world processed its groundnuts close to demand for both oil and meal.

FIGURE 7. Senegal's share of world trade in groundnut oil, meal and nuts, 1972-2016

Source: USDA Production, Supply and Distribution database (<https://apps.fas.usda.gov/psdonline>).

The next set of long-term data presented here reveal key trends underlying Senegal's market shares. In Figure 8 below, the top line shows Senegal's groundnut yields per area of harvested land relative to the world average. This peaked above 100% of the global mean in 1975 and then fluctuated around a downward trend until reaching its lowest level just above 20% in 2002, and then recovering to vary around 50% since then. The lightest shaded line, second from top in most years, shows Senegal's share of global groundnut area harvested which peaked in 1975 at around 7% of global groundnut area and then declined steadily to just above 2% in 2003, after which it recovered to above 4% since 2014.

Taken together, area and yield determine Senegal's share of world groundnut production which is shown in the figure below by the orange colored line. The country's share of global groundnuts peaked in 1974-75 at above 7%, declined to below 1% in 2002, and then recovered to above 2% since 2014. This contrasts clearly with Senegal's share of world groundnut processing, which peaked in 1974-75 above 9% and then declined to below 2% in 1995 and has remained below 1% since 2011.

FIGURE 8. Senegal's share of world groundnut production and processing, 1972-2016

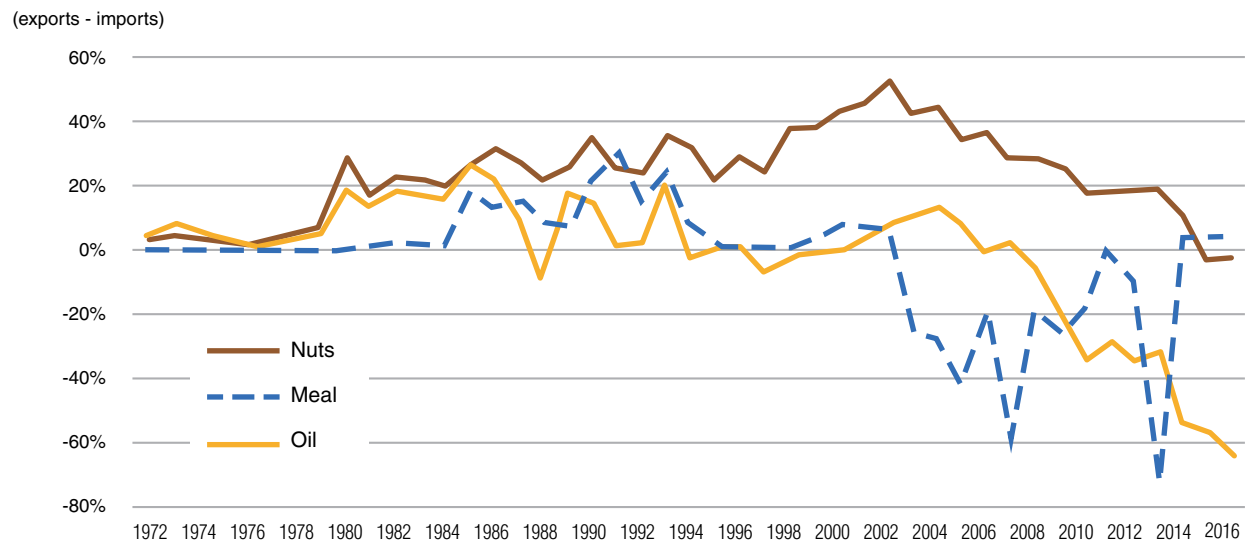
Source: USDA Production, Supply and Distribution database (<https://apps.fas.usda.gov/psdonline>).
Years shown correspond to harvest, at the start of the marketing year, with USDA estimates for 2016.

The picture presented by the figure above clearly reveals how Senegal now plays a very small role in the global groundnut processing industry, even as it remains a major player in the production of groundnuts as such. The country has successfully ended the 1980s and 1990s declines in relative groundnut area and yield compared to other producers, and since 2002 has achieved significant increases in its global share of area planted. The country has not yet recovered its position in terms of relative yield per hectare, which calls for renewed efforts to improve supply of high-quality seeds and other inputs.

4.3 THE ROLE OF CHINA

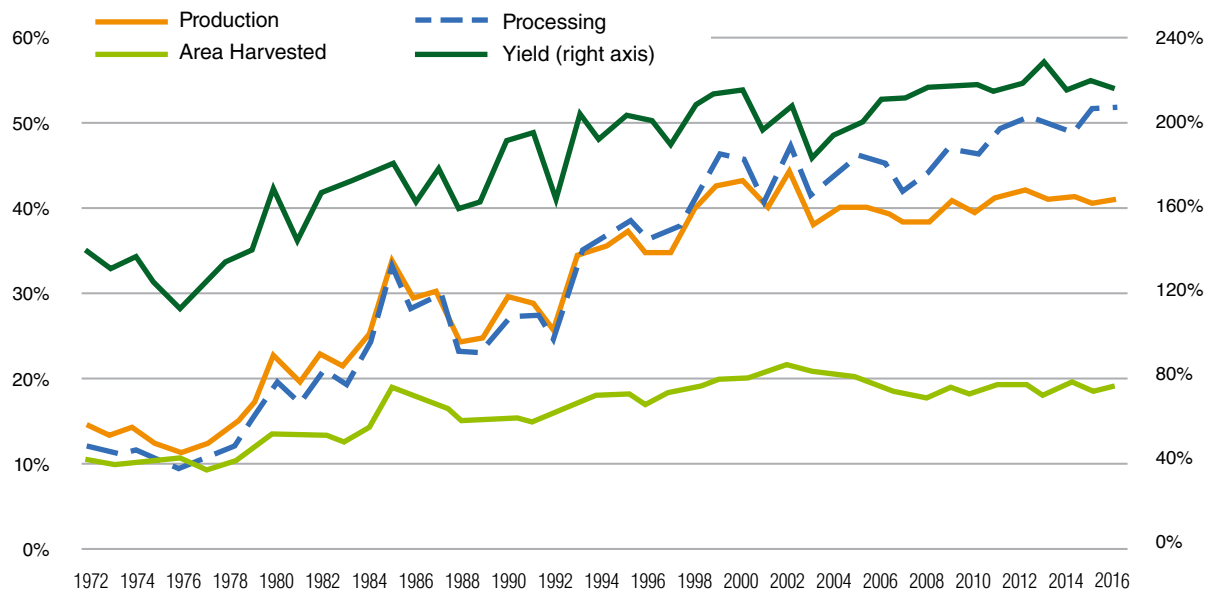
Many actors in the groundnut sector are interested in Senegal's trade with China, which has recently become a large importer of groundnut oil and a significant importer of whole nuts. The figure below traces China's evolving role in global groundnut markets, in terms of its net trade (exports minus imports) of whole nuts, oil and meal. The top line shows how China emerged as a major exporter after its agricultural reforms of 1980, peaking at around 50% of global exports in 2001. Over the past 15 years China has steadily shifted its supply-demand balance towards its own domestic consumers, becoming a net importer of whole nuts in 2015 and 2016.

China's oil expressing industry led its net exports of oil to rise after 1980 to a peak above 20% of global markets in 1985, after which it cut back on oil exports to around zero in most of the 1990s, and became an increasingly large net importer after 2006. The country's trade in groundnut meal largely tracked its groundnut oil trade until the 2000s when it absorbed large volumes of meal to feed its livestock, but that has ended as the country turns to importing whole nuts instead.

FIGURE 9. China's share of world trade in groundnut oil, meal and nuts, 1972-2016

Source: USDA Production, Supply and Distribution database (<https://apps.fas.usda.gov/psdonline>).
Years shown correspond to harvest, at the start of the marketing year, with USDA estimates for 2016.

China's changing share of world trade is underpinned by changes in the underlying competitiveness of its groundnut production and processing sector. In Figure 10 below, the top line shows China's groundnut yields per area of harvested land relative to the world average. China's yields were about 120% of world averages in 1975, but after the country's 1980 agricultural reforms those yields rose much faster than yields elsewhere, reaching more than 200% of the world average after 1996 and remaining well above that level since 2005. Meanwhile, China's share of global area planted to groundnuts stopped growing in 2000 and has stayed below 20% of the world total since 2002, leading the country's share of global production to peak at about 42% in 2000 and stay around 40% since then. In 2000, China's share of global processing began to rise above its share of groundnut production, reflecting the global tendency of processing to be located closer to consumers of groundnut products than to the farmers who grow the crop. China's share of processing reached above 50% in 2015 and is estimated to remain there in 2016.

FIGURE 10. China's share of world groundnut production and processing, 1972-2016

Source: USDA Production, Supply and Distribution database (<https://apps.fas.usda.gov/psdonline>).
 Years shown correspond to harvest, at the start of the marketing year, with USDA estimates for 2016.

Taken together, the long-term trends presented in this section, plus the enterprise budgets and PAM results presented earlier, clearly indicate that Senegal has ongoing competitiveness and comparative advantage in growing groundnuts for export as whole nuts but not processing for export of oil and cake. The location of processing has been gradually shifting over several decades, from where groundnuts are produced to where they are consumed. Senegal persisted in not exporting its whole nuts through the 2000s, even as exporting oil and cake became increasingly unprofitable and its market share declined. Now that the country has allowed export of whole nuts Senegal is regaining market share, and with investments adapted to the new demand for whole nuts rather than oil or cake the country's groundnut sector could grow quickly. In the following section we address the principal scenarios and policy options by which Senegal could take advantage of this evolving situation.

5. SCENARIOS AND POLICY OPTIONS FOR SENEGAL

The decline of Senegal's oil-expressing industry since its peak of global market share in 1975 has had profound effects on the country. The thousand or so individuals who are employed directly and the many others who are invested in processing groundnuts into oil and cake find their livelihoods at stake, and a decades-old system of politically negotiated prices can no longer be enforced. A clear majority of Senegalese people are benefiting from the change, including hundreds of workers in the labor-intensive business of transporting, handling and shelling groundnuts, plus more than 400,000 low-income farmers who grow them. These and other Senegalese workers no longer need to support an unprofitable oil processing industry, but their gains involve unprecedented direct exposure to groundnut price fluctuations. Some of these price changes will offset changes in yields, when high prices are earned in low-yield years or vice-versa, but occasionally farmers will experience periods in which both yields and prices are low, just as there will be occasional boom years when both yields and prices are high.

5.1 STRATEGIC GOALS AND AVAILABLE INSTRUMENTS

Policy options to address the decline of oil expressing in Senegal can be considered in terms of the following strategic goals:

- (1) limit the decline and permit future recovery of the groundnut expressing industry;
- (2) accelerate expansion of the value chain for export of whole nuts; and
- (3) protect consumers and farmers against fluctuations in prices and real income, especially for farmers when low prices coincide with low yields.

The policy instruments available to achieve each of these goals are listed below; those which are feasible to implement are then retained for further discussion in a set of viable options and future scenarios for groundnut sector development.

For the first aim, to limit the decline and permit future recovery of the groundnut expressing industry, the available instruments are:

- (1.1) continued fiscal subsidies, which is clearly unaffordable as the government would need to keep paying the industry's entire cost of operations; or
- (1.2) a return to restricting exports of whole nuts, which would force farmers to sell nuts to processors at lower prices than they could receive from exporters.

Of these, only option 1.2 is politically acceptable, but would be very costly in terms of economic growth and poverty reduction. Restricting whole nut exports always costs farmers and other workers in the value chain more than the benefits received by processors, thus reducing growth. Furthermore, in the Senegalese context farmers who sell groundnuts are generally poorer than those who buy groundnuts and therefore benefit from lower prices. Each year's potential gains from trade are lost forever, compounding the impoverishing effect of export restrictions.

For the second aim, to accelerate expansion of this new value chain, the main policy action needed is a clear commitment to preserve and improve opportunities to export whole nuts, thereby encouraging entry and investment by new enterprises of all kinds. That commitment can then be backed up by specific actions including:

- (2.1) increased investment in developing the input supply sector, to deliver larger volumes of improved seeds for both higher yields and improved quality, including increased sales of confectionary-grade nuts;
- (2.2) continued investments to support farmers in expanding acreage, increasing yields, and protecting groundnuts from aflatoxin and other post-harvest losses;
- (2.3) a new focus on rural marketing systems tailored to entry and competition among agrifood entrepreneurs engaged in the purchase, storage, transport and handling of higher value, aflatoxin-free improved varieties of whole nuts.

All of these policy options involve much lower fiscal costs but significant investments in training and institutional change. The largest change would be for option 2.3. By encouraging entry and competition among agrifood entrepreneurs, the country would create new rural and urban jobs in a relatively dynamic, labor-intensive sector. Free entry of groundnut traders keeps the margin between farmgate and export prices as small as possible, thus ensuring maximum pass-through of gains from export opportunities. Traders who face limited competition can earn monopoly profits, so this option requires a clear focus on facilitating entry of new firms and gradual improvements of the infrastructure that they share such as rural roads and marketing facilities, rural electrification and transport hubs.

For the third aim, to protect farmers and agrifood workers against income fluctuations such as when low prices coincide with low yields, the available instruments include:

- (3.1) crop insurance, perhaps involving a combination of weather or yield indexes to protect against low harvests and price indexes to protect against low prices;
- (3.2) price stabilization, undertaken through government stockholding or variable export restrictions; or
- (3.3) social insurance, in the form of conditional cash transfers triggered by eligibility for support determined in a transparent and equitable manner.

Of these three, options 3.1 and 3.2 are traditional market-based tools attempted by numerous governments around the world. The first instrument (3.1) is the now the principal farm support instrument used by the United States, for example, and there are many instances of its introduction in other countries (Iturrioz, 2009, p.6). These are all heavily subsidized by taxpayers, however, and they are well known to give farmers much less benefit than their fiscal cost due to the distortions in behavior that they introduce, and the difficulty of designing insurance that actually pays off in times of need. Insurance for crop yield and prices should therefore be seen as a mechanism for spending money to deliver subsidies in response to interest-group lobbying, rather than a way to accelerate growth and sustain poverty reduction by profitably expand a value chain. The only forms of crop coverage known to be economically efficient are those for commercially insurable risks such as fire and hail.

The option of price stabilization (3.2) is infeasible to accomplish via stockholding, because any change in government stocks would be offset by changes in quantity traded or private stocks held by farmers and groundnut traders. Some price stabilization could be achieved by a variable export levy, or by an ad-valorem export levy that rises when world prices are high and declines when world prices are low. The main limitation of price stabilization is that it fails to protect producers against the most important form of risk, which is when low prices coincide with low yields.

The social insurance approach (option 3.3) is increasingly popular around the developing world, primarily because new technologies for monitoring and transfer of funds permit protection of overall livelihoods, rather than narrowly defined price or weather risks, with relatively low transaction costs (Grugel and Riggiozzi, 2012). Senegal itself is among the pioneers in this domain, having recently introduced a Bourse Familiale for which eligibility has already been drawn up using a national register of 450,000 low-income households. The government does not yet have funds to provide transfers to all of those eligible, but the Bourse Familiale infrastructure offers a promising and viable mechanism by which to channel funds to rural areas affected by eventual downturns in the groundnut sector.

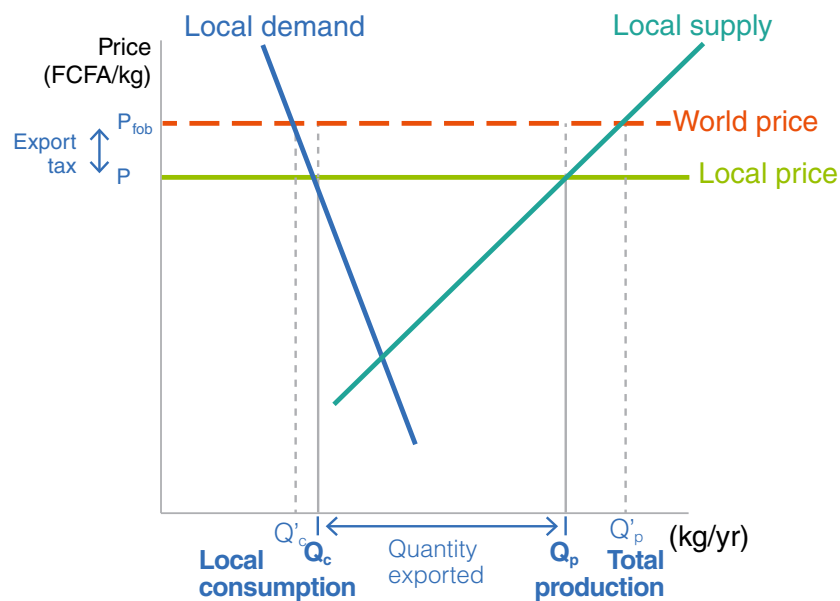
A viable combination of policy options would involve an export tax whose revenues would be dedicated to investment in both groundnut productivity and social protection. This reform package could begin with a variable levy or ad-valorem tax on whole nut exports that generates revenue, and in so doing lowers and somewhat stabilizes prices paid by groundnut buyers inside Senegal. Roughly one third of WTO members used export taxes as of June 2014, primarily developing countries in situations somewhat similar to groundnuts in Senegal (Zambersky and Cajka 2015). Many countries use export taxes that worsen inequality and also efficiency (Laborde et al. 2013), but a well-managed tax can be an attractive alternative to other instruments (Piermartini 2004) that remains a widely-used part of the policy toolkit (Solleder 2013). Recent case studies of their use in Africa include Mkumba (2015) on timber exports from Malawi, and Fitawek and Kalaba (2016) on leather exports from Ethiopia. A detailed simulation study of oilseed export taxes in Argentina and Indonesia is provided by Bouet et al. (2014).

In Senegalese situation, a tax on exports of whole groundnuts would reduce prices received by groundnut farmers, but the cost of that could be more than offset by farmers' gains from increased public investment in input supply and marketing services. Revenues from the tax could also be disbursed via the Bourse Familiale at the times and places of greatest need. Switching from the recent export ban to a future export tax would turn the groundnut sector from a fiscal cost that slows economic growth and worsens income distribution to a source of fiscal revenues that can accelerate inclusive growth as long as the export tax rate and resulting revenue are managed appropriately to invest in higher productivity and insurance against times when low yields coincide with low prices.

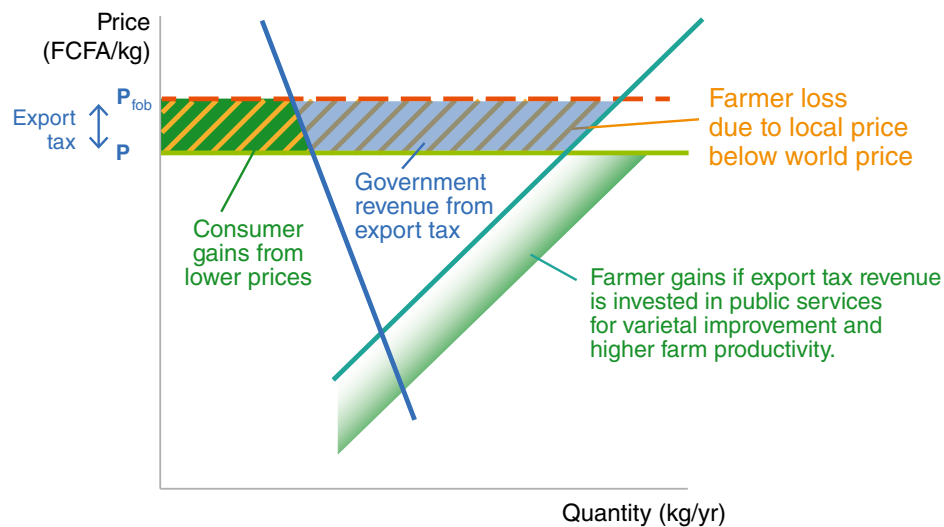
5.2 MODELING THE IMPACTS OF EXPORT TAXES ON THE GROUNDNUT SECTOR IN SENEGAL

Constructing scenarios to predict how the Senegalese groundnut market will change over time and respond various policy options involves construction of an analytical model. The approach illustrated in the figures below summarizes standard economic theories of how actors in the groundnut value chain would respond to an export tax or other policy changes, including their effects on poverty and economic development.

Figures 11 and 12 represent total Senegalese production and consumption of whole nuts available in Dakar and other port cities for local consumption or shipment to the rest of the world in any given year. With free international trade the price paid for exports (P_{fob}) would determine quantities produced (Q_p') and consumed (Q_c'), but with an export tax the net price received by producers and paid by consumers is the observed local price (P), with the associated lower quantity produced (Q_p) and consumed (Q_c).

FIGURE 11. Impacts of export policies on groundnut markets in Senegal

Consumers (including oil processors) benefit from lower prices paid, at the expense of farmers who receive and produce less. The economic gains and losses are shown in Figure 12, with consumers losing the shaded trapezoid determined by quantities consumed, farmers losing the entire area up to quantities produced shaded with forward slashes (///), and government tax revenue shown as a rectangle over quantity exported, between production and consumption.

FIGURE 12. Impacts of an export tax on poverty and economic welfare

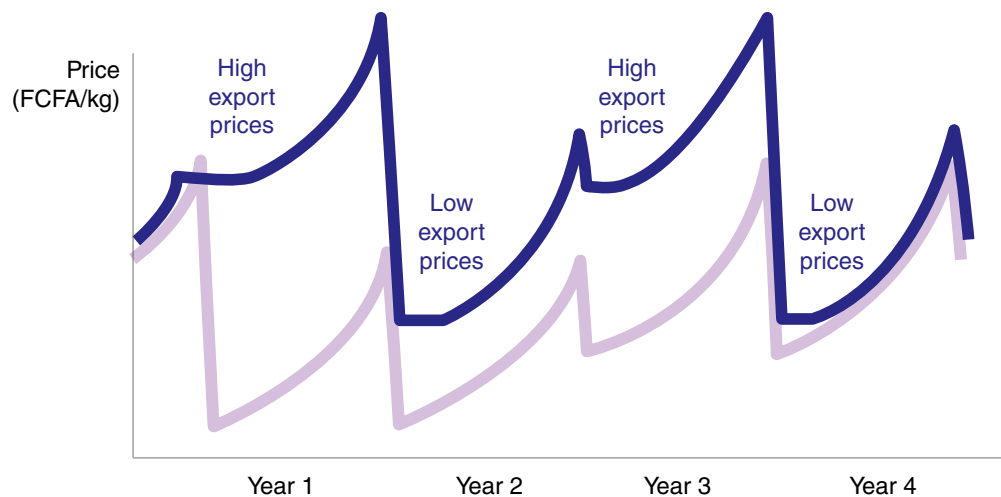
As shown in Figure 12, in each year the farmers' losses from an export tax are larger than the sum of consumer gains and groundnut fund revenues, due to deadweight loss from foregone trade. This observation is the basis for standard economic arguments against export taxation. The economic cost of taxation depends heavily on the tax rate, as deadweight losses rise exponentially and tax revenues obtained increase less than linearly with any increase. For example, doubling an export tax will less than double tax revenue, but much more than double the deadweight losses to Senegalese society. For this reason, a lower level of export tax is more likely to be cost-effective, and its net value to Senegalese society depends entirely on how the revenue is invested. Figure 12 illustrates how farmers would benefit from investments in productivity enhancements such as improved seeds, which raise yields and lower cost per unit sold, thus allowing farmers to gain the area shaded with dots. The magnitude of these gains could potentially be much larger than farmers' losses from lower prices, if the policy led to new investment in high-value services such as seed systems that are now underfunded because the government's available resources are being absorbed by SUNEOR.

To trace the effects of alternative policies to the farm level, it is helpful to move beyond the single year model shown above to consider price dynamics over time in rural markets. The standard economic model of storage and price formation is shown in Figure 13 below, for a hypothetical region isolated from the rest of Senegal. For visual clarity the picture is simplified by imagining that each successive crop is harvested simultaneously, at which point prices fall and then gradually rise to their next peak the following year. Each year's average price is determined by expected demand relative to local supply, so prices start and end lower after a large harvest, and higher after a small harvest. Within each year, the percentage rate of price increase from month to month depends on the cost of storage, which is the opportunity cost of capital invested in stocks plus any storage losses. Improvements in the marketing system that reduce storage costs will flatten the curve, reducing seasonal fluctuations around each year's average price.

FIGURE 13. Seasonal price formation in isolated rural markets over time

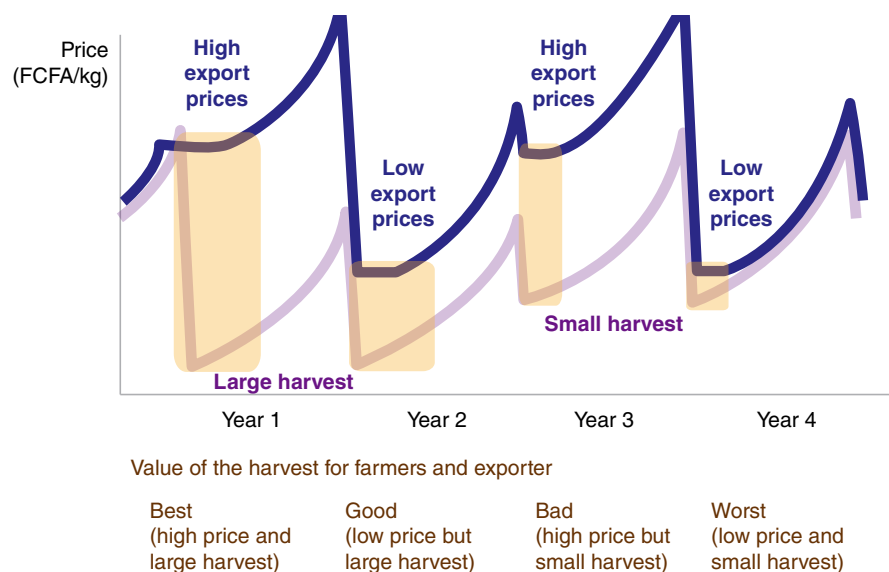


The simplified picture in Figure 13 above is clearly unrealistic for groundnuts in Senegal, where almost all production areas have potentially profitable opportunities to sell at least some of each harvest to other places including overseas markets. Figure 14 below adds the effect of export opportunities, with a horizontal line at the time of harvest showing the price level offered by buyers for transport and sale elsewhere. That price reflects the supply, demand and trade diagram shown in Figures 11 and 12, with fluctuations over time such as the changes actually observed in Figure 1 at the start of this report.

FIGURE 14. Seasonal price formation in rural markets with exports

The figure above helps explain actual price patterns observed in rural areas. In each year that exports take place, average prices are above what they would be in the absence of trade. Local prices are set by export opportunities after each harvest, and remain at export price levels for as long as transporters are actively buying for shipment to other regions. Once each year's surplus is sold, the local market becomes self-sufficient and prices rise at the cost of storage from month to month until the next harvest.

In the hypothetical scenarios shown here as well as the actual prices shown in Figure 1, each year's average local price is determined by the value of groundnuts sold for export at the end of each harvest. Based on the supply-demand analysis shown in Figure 11, urban prices after each harvest would be foreign prices minus any export taxes. Sellers in rural markets must also pay for transport and handling to the urban market, so any improvements in infrastructure and marketing systems that lower transaction costs will bring a correspondingly higher rural price level each year. Our supply-demand diagrams emphasize that local prices for goods that can profitably be traded with other regions do not depend on local supply and demand. Local prices are set by foreign prices net of taxes and transaction costs. Fluctuations in local supply and demand do not affect prices, but they do determine the quantities produced, consumed and traded. This effect is illustrated in Figures 15 and 16 below.

FIGURE 15. Year-to-year variation in farm income and export earnings

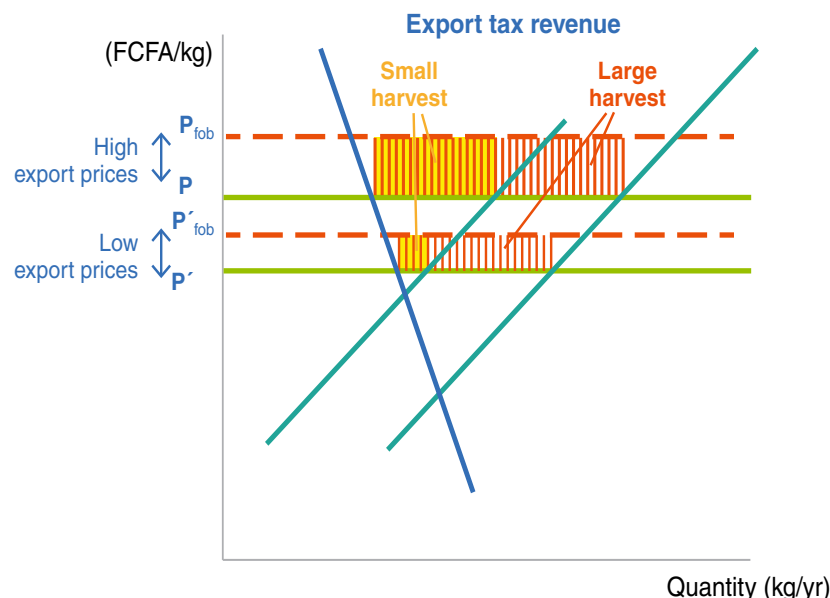
The figure above shows how farm income and export earnings from each marketing year depends on both the level of export prices and the size of the harvest. In the stylized example shown here, harvests are large in years 1 and 2 and then small in years 2 and 3, while export prices alternate between high and low. This allows us to simulate the full range of possible interactions between price and quantity. In reality the frequency and sequence of such shocks will vary, and there may be many more bad years than good ones. The best years are when high prices coincide with large harvests, and the worst are when both are low.

Figure 16 below translates the example shown in Figure 14 back to a supply-demand framework, so as to show yearly variation in export tax revenue and its effects on economic stability. A smaller local harvest is illustrated by shifting the supply curve to the left, and lower global supply-demand balance shifts the horizontal world price downward. For realism, some exports remain profitable in all years, but export quantities and hence tax revenues vary widely. As drawn here, when prices are high the smaller harvest cuts export tax revenue in half. When prices are low there is an even greater reduction in tax revenue, and in the worst year total exports are almost down to zero.

The analysis presented here is particularly helpful to assess options for price stabilization. Most importantly, accumulating or releasing stocks has little effect on prices in this setting, for the same reason that large and small harvests do not affect price: those changes cause fluctuations in quantities exported. Adjusting government stocks can influence market prices only when trade volumes are fixed, perhaps at zero, and even then a change in the government's stocks is likely to cause an offsetting change in the private stocks held by farmers and wholesalers. For this reason stockholding is primarily used as a farm subsidy measure to deliver targeted benefits for political reasons at a particular time and place, and it generally does so much less efficiently than other instruments.

The price stabilization instrument revealed by this analysis to be very effective is variation in the export tax. The vertical gap between world and local prices, $P_{fob} - P$, is the magnitude of the tax when expressed in FCFA/kg. This can be fixed at a specific rate, or it can be adjusted as a variable levy: in the case of whole groundnuts, for example, the rate might be calculated on a sliding scale from 80 FCFA/kg when export prices ex-Dakar are above 1000 FCFA/kg, down to 10 FCFA/kg when export prices are below 500 FCFA/kg. Fixing the percentage rate at an intermediate *ad valorem* level also provides some price stabilization. In the variable levy example just given, percent rates range from 8% to 2%. With a fixed 5% rate, the specific tax would vary from 50 to 25 FCFA/kg over that range.

FIGURE 16. Year-to-year variation in export taxes and price stability



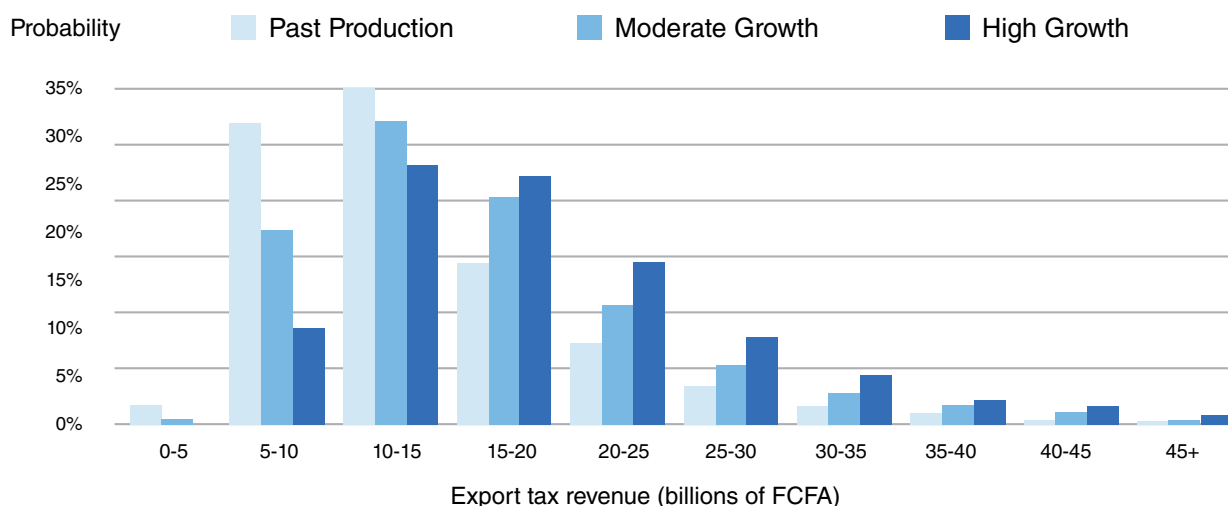
Allowing the specific tax rate to vary with export prices provides some price stabilization from year to year, which is particularly helpful for groundnut consumers in urban areas. Among farmers, price risks are usually less important than variation in harvest quantities, especially given climate and health risks that can harm all the crops and livestock on a given farm. For this reason, actions that raise and stabilize farm production or provide social insurance for overall incomes are almost always more powerful than price stability as a source of economic resilience for farmers. The main kind of price stabilization that helps farmers comes from investments to lower seasonal storage costs, thereby reducing seasonal price rises, and from investments to lower the costs of farm-to-market transport, thereby raising the farm-level prices associated with any given export opportunity.

The analytical models presented above allow comparison of alternative policies under various scenarios, providing qualitative results about the direction and relative magnitude of effects. This helps rule out infeasible policy choices, and narrow the search for those that are most likely to achieve the government's goals. Quantitative simulations of various scenarios can then be used to guide actual implementation of any particular set of interventions.

As an illustration of how simulations could be used to guide policymaking, we modeled the expected fiscal revenues from switching to a 5% export tax on whole nuts, with corresponding policies aimed at increasing productivity and lowering marketing costs along that value chain. For this initial simulation, each year's quantity exported was defined as total production minus local consumption for food, seed and post-harvest losses, from the USDA's PSD database, and each year's export prices FOB Dakar were estimated from World Bank commodity prices net of transport costs. To compute expected future values, we drew all possible combinations of the quantities and prices actually observed in the past, then simulated the sector's response to using export tax revenues for public investment in production growth and social insurance.

The resulting distribution of tax revenues is shown below, as the probability of export revenues falling in the given ranges each year. Based on past production, there is a 30% probability that a given year's tax revenues will be in the 5-10 billion FCFA range, a nearly 35% probability that it will fall in the 10-15 billion range, and in a third of cases revenues would be above that. But even a moderately higher level of groundnut production leads to much higher probabilities of even larger tax revenues, thus highlighting the importance of reinvesting tax revenue in productivity enhancement. High variability also emphasizes the need for dedicated fiscal accounts to save earnings in good years for use during downturns.

FIGURE 17. Expected returns from a 5% ad-valorem export tax on whole groundnuts

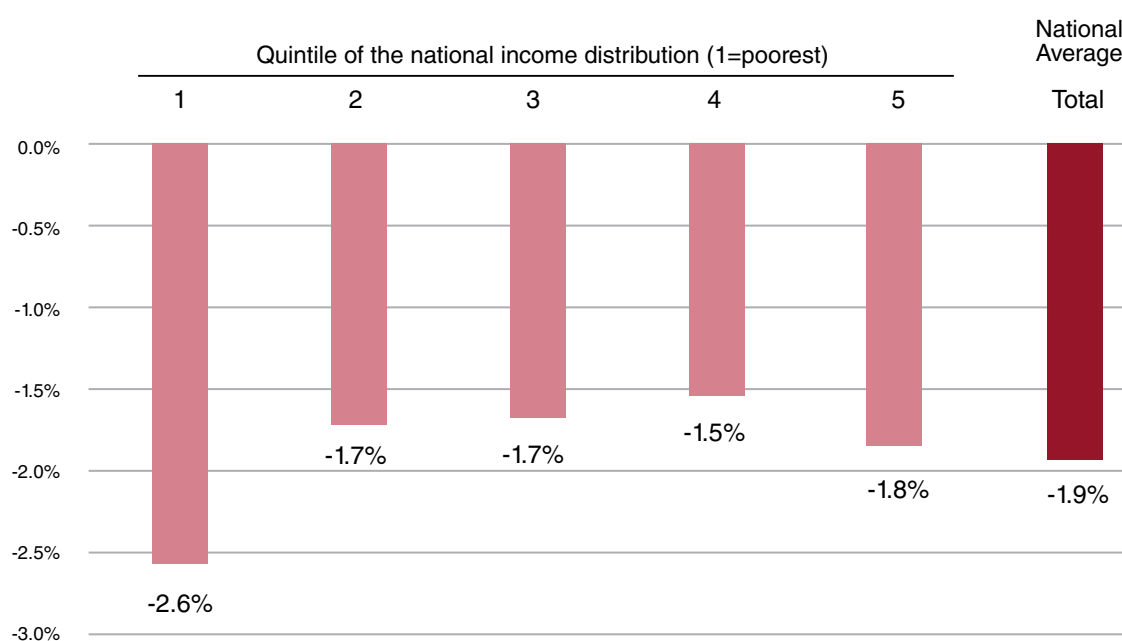


Note: Simulations are based on 1584 random draws from historical production net of local food use for 1994-2015 and FOB prices for whole nuts from 1980-2015. Scenarios use actual data and then moderate (15%) or high (30%) increases in groundnut production, with an increase in domestic consumption (5%) corresponding to increased incomes and poverty reduction from higher production.

The figure above shows the probability of reaching each level of export tax revenue to the government. These revenues would come primarily at the expense of groundnut farmers, due to the reduction in price received. The distributional impact on farmers can be seen through an analysis conducted by Marzo and Martinez (2016), using data from the national poverty survey of 2011. For numerical convenience, they compute the effects of a 10% export tax, and then show its effects on groundnut farmers in each quintile of the income distribution, in terms of total household expenditure. Based on the 2011 household survey, it turns out that the poorest groundnut farmers have the most dependence on that crop, followed by the highest income quintile, while those in between tend to be more reliant on other crops.

As shown in Figure 18 below, the net effect of the 10% export tax is to reduce annual consumption expenditure by 2.6% for the poorest and 1.8% for the richest groundnut farming households, with lower levels in between and decline for the national average groundnut farming household of -1.9%.

FIGURE 18. Reduction in living standards of groundnut farmers due to a 10% export tax



Source: World Bank estimates (Marzo and Martinez 2017)

Looking beyond groundnut farmers, the impacts on the Senegalese population as a whole of a 10% export tax have been estimated using a general equilibrium model by Fofana et al. (2017), based on the Social Accounting Matrix of Fofana et al. (2015). This model focuses on how Senegalese activity would adjust to the tax after the revenue is spent, using quantities observed in 2015. As shown in the previous figure, the tax would reduce incentives and earnings from groundnut farming, leading to reduced total production and exports. With reallocation of farm labor and capital to other crops, they estimate that the total quantity of groundnuts grown in Senegal would decline by 0.9%. The most important insight from this model is that a realistic increase in groundnut productivity, rising by just 1% in the short run and 2% in the medium run, would be sufficient to offset that decline in the short run, and raise national-average disposable income in the medium run. This 1-2% increase in farm productivity of groundnuts would not happen automatically, but would be feasible if export tax revenues are reinvested in genetic improvement and multiplication of improved seeds.

In actual practice, the Senegalese government did introduce an export tax on groundnuts in December 2016, at the specific rate of 15 FCFA per kg for export of in-shell groundnuts, and 40 FCFA per kg for shelled groundnuts (Republique du Senegal, 2017). The relevant passage of this law reads in full:

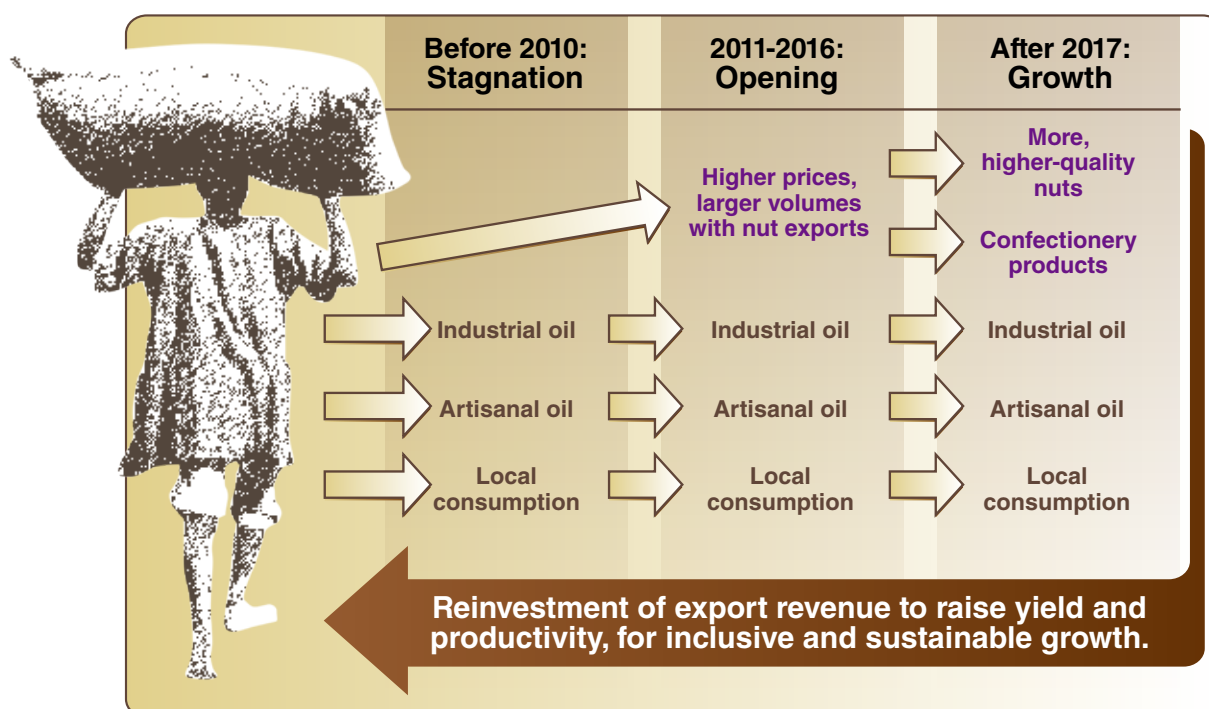
Article 20 : Institution d'un droit de sortie sur les exportations d'arachides

- I. Il est institué au profit du budget de l'Etat, un droit de sortie applicable sur les exportations d'arachides.
- II. Le taux du droit de sortie est fixé comme suit:
 - 15 FCFA par kilogramme net pour les arachides en coques;
 - 40 FCFA par kilogramme net pour les arachides décortiquées.
- III. La liquidation, le recouvrement et le contentieux du droit de sortie se font comme en matière de douane.

The percentage level of this specific tax depends on foreign prices actually paid for exports. To ensure that the rate does not rise above levels of cost to farmers and others that can be offset by productivity gains from improved seeds, it would be very important to monitor world prices and adjust the specific rate over time so that it does not exceed modest levels on the order of 10%. Transparent communications about the use of tax revenues, especially with groundnut growers through a reformed CNIA, is also essential to ensure that revenues are reinvested in productive public services such as crop improvement, seed multiplication and seed certification for larger quantities of more valuable new varieties.

A graphical summary of the reform sequence is illustrated in the figure below. Before 2010, the ban on exports of whole nuts forced all groundnuts to be consumed or processed into oil, keeping prices and quantities low and stagnant. Starting in 2011, new and more valuable export opportunities led to higher prices and larger volumes for generic nuts, with opportunities to improve and expand through exports of confectionery nuts and groundnut products other than oil. And looking forward, further growth after 2017 could be accelerated by reinvesting some of the export revenues in public services to sustain productivity growth and improve quality over time.

FIGURE 19. Evolution and growth of the groundnut value chain



6. CONCLUSIONS AND WAYS FORWARD

In summary, Senegal's deep comparative advantage and large size of its groundnut sector create the opportunity to use export of whole nuts to fund much-needed investments. The country's major goals could be achieved by reorienting the sector towards the most competitive activities, using proceeds from an export tax to improve input supply and groundnut marketing systems, and to provide social protection against downturns. The use of export taxes dedicated to a sector's development has a long tradition in similar situations elsewhere, where a large and concentrated export-oriented sector can help fund productivity enhancement and insurance to cover future risks.

The negative unintended consequences of export taxes rise sharply as tax rates increase, however, and their positive benefits depend entirely on how tax revenues are spent, so keeping a low tax whose revenues are well governed is essential to success. If funds are not reinvested in productivity growth, export taxes might simply replace the old export bans and return the sector to its previously downward trajectory. Similarly, if social insurance accounts are not maintained and disbursed at the times and places of greatest need, then vulnerability will lead to less efficient and equitable forms of risk avoidance such as not growing groundnuts at all.

Success is not guaranteed, but Senegal is well positioned to transform its groundnut sector into a powerful engine of economic growth, poverty reduction and social stability. Further analysis and annual monitoring of the sector, ideally conducted within Senegal for the CNIA or farmers' associations and other groups as well as the government, will be crucial to ensuring that policies adjust over time to changing conditions.

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ANNEX 1. DETAILED POLICY ANALYSIS MATRIX RESULTS

A1.1 DEFINITIONS AND NOTATION USED FOR CALCULATION OF POLICY ANALYSIS MATRIX RESULTS

The definitions of each indicator, using the Policy Analysis Matrix notation below, is: Benefit-Cost Ratio, $BCR=a/(b+c)$; Resource Cost Ratio, $RCR=c/(a-b)$; Gross Margin, $GM=d/a$; Social Benefit-Cost ratio, $SBC=e/f+g$; Domestic Resource Cost ratio, $DRC=g/(e-f)$; Social Gross Margin, $SGM=h/e$; Nominal Protection Coefficient, $NPC=a/e$; Effective Protection Coefficient, $EPC=(a-b)/(e-f)$; Producer Subsidy Equivalent, $PSE=l/a$; Subsidy Ratio to Producers, $SRP=l/e$, where each lowercase letter (a-l) is a cell in this matrix:

TABLE A1. Notation used for calculation of Policy Analysis Matrix results

	Revenue -	Tradable costs -	Domestic resources	=	Profits
Private budget	a	b	c		d=a-b-c
- Social budget	e	f	g		h=e-f-g
= Distortions	i=a-e	j=b-f	k=c-g		l=d-h

The most useful summary measures of competitiveness and comparative advantage in this context are the private and social benefit-cost ratios, since DRC rankings are not helpful in settings like SUNEOR when value added at social prices is sometimes negative. Among policy measures, the SRP is particularly helpful as it measures the tariff-equivalent (or in this case the export-tax-equivalent) cost of policies.

Detailed results presented below are images from a workbook which contains all data and calculations, itemized in 7 color-coded spreadsheets:

- A sheet marked <AllRatios> contains all the pertinent economic and cost ratios for each segment of the groundnut value chain such as the social benefit cost ratio, the domestic resource cost ratio and the nominal protection coefficient
- A sheet labeled <AllPAMs> contains matrices summarizing all 25 enterprise budgets estimated in the exercise.
- Five sheets labeled <EnterpriseCalc> for each kind of enterprise, with detailed summaries of each budget split into the three distinct stages of marketing: production, transportation, and processing/export. These include 6 budgets each for transport, industrial processing, and export spanning 2011 to 2015 as well as 6 production budgets with 4 different cost structures and yields and one budget for artisanal oil production.
- A sheet of <SelectedData> containing parameters that enter multiple sheets.

A1.2 SUMMARY INDICATORS OF COMPETITIVENESS, COMPARATIVE ADVANTAGE AND DISTORTIONS

	Private competitiveness			Social comparative advantage			Policy distortions			
	Benefit/cost ratio (BCR)	Resource cost ratio (RCR)	Private gross margin (GM)	Benefit/cost ratio (SBC)	Resource cost/ ratio (DRC)	Social gross margin (SGM)	Nominal protection coefficient (NPC)	Effective protection coefficient (EPC)	Producer subsidy equivalent (PSE)	Subsidy Rate to Producers (SRP)
Farming enterprises after adjustment (social prices with competition for export as shelled nuts)										
Standard farms for export	1.32	0.65	24.2%	1.63	0.45	38.7%	0.77	0.76	-25.8%	-20.0%
Irrigated farm for off season sales	1.72	0.38	41.8%	2.11	0.27	52.7%	0.74	0.70	-29.2%	-21.7%
Coop farm for seed production	1.27	0.73	21.5%	1.64	0.50	39.2%	0.73	0.74	-32.1%	-23.5%
Coop farm for export	1.66	0.49	39.9%	1.96	0.36	49.0%	0.77	0.79	-23.9%	-18.3%
Farming enterprises without adjustment (social prices without increased entry of competitors for shelled nut exports)										
Standard farms for sales to local mkt.	1.32	0.65	24.2%	1.26	0.66	20.7%	1.00	1.12	3.5%	3.5%
Standard farms for sales to SUNEOR	1.31	0.65	23.8%	1.26	0.66	20.7%	0.99	1.11	2.9%	2.9%
Irrigated farm for off season sales	1.72	0.38	41.8%	1.57	0.42	36.2%	1.00	1.09	5.7%	5.7%
Coop farm for seed production	1.27	0.73	21.5%	1.20	0.76	16.9%	1.00	1.13	4.6%	4.6%
Coop farm for sales to local mkt.	1.67	0.49	40.2%	1.52	0.51	34.1%	1.00	1.13	6.1%	6.1%
Coop farm for sales to SUNEOR	1.66	0.49	39.9%	1.52	0.51	34.1%	0.99	1.12	5.6%	5.6%
SUNEOR oil extraction and exports (calendar years)										
2016 (projections)	0.76	1.93	-32.0%	0.49	(7.63)	-103.5%	1.71	172.25	28.6%	48.9%
2015	0.88	2.22	-13.9%	0.76	(5.10)	-32.2%	1.18	41.99	13.4%	15.8%
2014	0.87	14.66	-14.8%	0.68	(0.73)	-48.1%	1.41	48.73	19.2%	27.1%
2013	1.08	0.71	7.4%	1.12	0.61	10.8%	1.06	-3.33	-2.8%	-3.0%
2012	1.05	0.86	4.6%	0.88	1.86	-14.3%	1.20	60.70	16.5%	19.8%
2011	1.34	0.21	25.5%	1.07	0.54	6.2%	1.19	60.54	20.3%	24.2%
Exporting shelled nuts (harvest years)										
2015	1.30	0.39	22.9%	1.30	0.39	22.9%	1.00	0.55	0.0%	0.0%
2014	1.55	0.27	35.5%	1.55	0.27	35.5%	1.00	0.55	0.0%	0.0%
2013	1.57	0.29	36.2%	1.57	0.29	36.2%	1.00	0.55	0.0%	0.0%
2012	1.36	0.35	26.7%	1.36	0.35	26.7%	1.00	0.55	0.0%	0.0%
2011	2.98	0.10	66.4%	2.98	0.10	66.4%	1.00	0.55	0.0%	0.0%
2010	2.28	0.16	56.2%	2.28	0.16	56.2%	1.00	0.55	0.0%	0.0%
Artisanal oil extraction for local sales										
2015	1.04	0.81	4.0%	1.04	0.81	4.0%	1	1.00	0.0%	0.0%
Transport from farm to SUNEOR (harvest years)										
2015	1.06	0.51	5.9%	1.07	0.48	6.3%	1	1.00	-0.4%	-0.4%
2014	1.06	0.47	5.9%	1.07	0.44	6.3%	1	1.00	-0.4%	-0.4%
2013	1.06	0.47	5.9%	1.07	0.44	6.3%	1	1.00	-0.4%	-0.4%
2012	1.12	0.49	10.5%	1.12	0.47	10.9%	1	1.00	-0.4%	-0.4%
2011	1.07	0.47	6.7%	1.08	0.43	7.1%	1	1.00	-0.5%	-0.5%
2010	1.08	0.44	7.1%	1.08	0.40	7.5%	1	1.00	-0.5%	-0.5%

A1.2 ENTERPRISE BUDGETS IN POLICY ANALYSIS MATRIX FORM

	Farming with new policies in place			Farming without new policies			Transport and handling			SUNEOR oil processing			Shelled nut exports		
	Budget	Private Prices	Social Prices	Divergences	Standard farm (for local market)	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources
	From budgets below are for 2015 harvest, with social value of nuts in shell sold at harvest defined as export earnings from shelled nuts, minus competitive farm-to-export costs of transport, handling, shelling and quality control.				307	96	137	74	307	118	125	64	-	(22)	12
					307	118	125	64	307	118	125	64	307	96	137
					-	(22)	12	11	-	(22)	12	11	-	(1)	(1)

	Standard farm-export market			Standard farm (for SUNEOR)			2014			2015			2014		
	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources
Private Prices	307	96	137	74	305	96	137	72	229	203	12	14	264	234	67
Social Prices	397	118	125	153	307	118	125	64	229	203	11	15	224	236	60
Divergences	(90)	(22)	12	(79)	(2)	(22)	12	9	-	-	1	(1)	40	(2)	7

	Irrigated farm (off season)			Irrigated farm (off season)			2013			2014			2013		
	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources
Private Prices	277	89	72	116	277	89	72	116	229	203	12	14	235	232	37
Social Prices	374	104	73	197	277	104	73	100	229	203	11	15	166	212	34
Divergences	(97)	(15)	(1)	(81)	-	(15)	(1)	16	-	-	1	(1)	69	20	4

	Coop Farm (for seed)			Coop Farm (for seed)			2012			2013			2012		
	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources
Private Prices	343	72	198	74	343	72	198	74	241	191	24	25	327	245	58
Social Prices	470	102	183	184	343	102	183	58	241	191	23	26	309	224	52
Divergences	(126)	(31)	15	(110)	-	(31)	15	16	-	-	1	(1)	18	22	6

	Coop farm-export market			Coop farm (for local market)			2011			2012			2011		
	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources
Private Prices	307	66	117	123	307	66	117	123	203	178	12	14	314	210	90
Social Prices	397	94	108	194	307	94	108	105	203	178	11	14	261	218	81
Divergences	(90)	(28)	9	(71)	-	(28)	9	19	-	-	1	(1)	53	(8)	9

	Artisanal oil processing			Coop farm (for SUNEOR)			2010			2011			2010		
	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources	Profits	Revenue	Tradable inputs	Domestic resources
Private Prices	282	224	47	11	305	66	117	122	195	170	11	14	289	196	19
Social Prices	282	224	47	11	307	94	108	105	195	170	10	15	243	210	18
Divergences	-	-	-	-	(2)	(28)	9	17	-	-	1	(1)	47	(14)	2

A1.2 ENTERPRISE BUDGETS IN ITEMIZED FORM, AT PRIVATE AND SOCIAL COSTS

Farm production enterprise budgets with new policies (per kg of groundnut harvested, in shell)

	Private budgets (2015 FCFA/kg)						Social budgets (2015 FCFA/kg)					
	Standard farm (for local mkt)	Standard farm (for SUNEOR)	Irrigated farm (off season)	Coop farm (for seed)	Coop farm (for local mkt)	Coop farm (for SUNEOR)	Standard farm (for local mkt)	Standard farm (for SUNEOR)	Irrigated farm (off season)	Coop farm (for seed)	Coop farm (for local mkt)	Coop farm (for SUNEOR)
Fixed inputs												
Fixed inputs (total)	11	11	10	37	12	12	12	12	10	37	12	12
Farm labor												
Hired labor	95	95	13	118	76	76	79	79	11	98	63	63
Family labor	26	26	26	32	20	20	26	26	26	32	20	20
Farm labor (total)	120	120	39	149	96	96	105	105	36	130	84	84
Intermediate inputs												
Intermediate inputs (total)	95	95	108	71	66	66	116	116	122	101	93	93
Financing costs												
Financing costs	6	6	5	13	10	10	10	10	8	18	13	13
Total costs	233	233	161	270	183	183	243	243	177	285	202	202
Revenues												
Revenue (gnut in shell)	202	200	217	90	202	200	292	292	314	130	292	292
Revenue (gnut hay)	105	105	60	60	105	105	105	105	60	60	105	105
Revenue (gnut R1 seed)	-	-	-	125	-	-	-	-	-	181	-	-
Revenue (gnut R2 seed)	-	-	-	68	-	-	-	-	-	98	-	-
Total revenue	307	305	277	343	307	305	397	397	374	470	397	397
a. Profit	74	72	116	74	123	122	153	153	197	184	194	194
b. Total returns (profits + return to land and family labor)	110	108	152	137	150	149	189	189	233	247	221	221

Note: Data are for 2015 harvest. Social value of nuts is exporting minus competitive farm-to-export handling costs.

Radio indicators					
Benefit-cost ratio (a/[b+c])	1.32	1.31	1.72	1.27	1.67
Resource cost ratio (c/[a-b])	0.65	0.65	0.38	0.73	0.49
Gross margin (d/a)	24%	24%	42%	21%	40%
Total returns to hhld	36%	35%	55%	40%	49%

Farm production enterprise budgets without change in policies (per kg of groundnut harvested, in shell)

	Private budgets (2015 FCFA/kg)							Social budgets (2015 FCFA/kg)						
	Standard farm (for local mkt)	Standard farm (for SUNEOR)	Irrigated farm (off season)	Coop farm (for seed)	Coop farm (for local mkt)	Coop farm (for SUNEOR)		Standard farm (for local mkt)	Standard farm (for SUNEOR)	Irrigated farm (off season)	Coop farm (for seed)	Coop farm (for local mkt)	Coop farm (for SUNEOR)	
Fixed inputs														
Fixed inputs (total)	11	11	10	37	12	12		12	12	10	37	12	12	
Farm labor														
Hired labor	95	95	13	118	76	76		79	79	11	98	63	63	
Family labor	26	26	26	32	20	20		26	26	26	32	20	20	
Farm labor (total)	120	120	39	149	96	96		105	105	36	130	84	84	
Intermediate inputs														
Intermediate inputs (total)	95	95	108	71	66	66		116	116	122	101	93	93	
Financing costs														
Financing costs	6	6	5	13	10	10		10	10	8	18	13	13	
Total costs	233	233	161	270	183	183		243	243	177	285	202	202	
Revenues														
Revenue (gnut in shell)	202	200	217	90	202	200		202	202	217	90	202	202	
Revenue (gnut hay)	105	105	60	60	105	105		105	105	60	60	105	105	
Revenue (gnut R1 seed)	-	-	-	125	-	-		-	-	-	125	-	-	
Revenue (gnut R2 seed)	-	-	-	68	-	-		-	-	-	68	-	-	
Total revenue	307	305	277	343	307	305		307	307	277	343	307	307	
a. Profit	74	72	116	74	123	122		64	64	100	58	105	105	
b. Total returns (profits + return to land and family labor)	110	108	152	137	150	149		99	99	136	121	132	132	
Note: All data shown are for the 2015 harvest (the 2015-16 marketing year).														
Radio indicators														
Benefit-cost ratio (a/[b+c])	1.32	1.31	1.72	1.27	1.67	1.66		1.26	1.26	1.57	1.20	1.52	1.52	
Resource cost ratio (c/[a-b])	0.65	0.65	0.38	0.73	0.49	0.49		0.66	0.66	0.42	0.76	0.51	0.51	
Gross margin (d/a)	24%	24%	42%	21%	40%	40%		21%	21%	36%	17%	34%	34%	
Total returns to hhhd	36%	35%	55%	40%	49%	49%		32%	32%	49%	35%	43%	43%	

Transportation services to SUNEOR (per kg of groundnut transported, in shell)

Note: All data shown are for each harvest, at the start of each marketing year, and from SUNEOR file data and audited accounts.

	Private budgets (2015 FCFA/kg)						Social budgets (2015 FCFA/kg)					
	2010	2011	2012	2013	2014	2015	2010	2011	2012	2013	2014	2015
<i>Product in process + other budget items</i>												
Groundnut in shell	166.9	174.5	188.2	200.2	200.0	200.0	166.9	174.5	188.2	200.2	200.0	200.0
Diesel	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
1. Tradable costs	170	178	191	203	203	203	170	178	191	203	203	203
Non-tradable costs												
Illicit Tax	0.23	0.23	0.23	0.23	0.23	0.23	-	-	-	-	-	-
Legal Tax	0.69	0.69	0.69	0.69	0.69	0.69	-	-	-	-	-	-
Other costs	10	11	23	11	11	13	10	11	23	11	11	13
2. Non-tradable costs	11	12	24	12	12	14	10	11	23	11	11	13
3. Total revenue	195	203	241	229	229	231	195	203	241	229	229	231
4. Profit (operating margin)	14	14	25	14	14	14	15	14	26	15	15	15
Ratio indicators												
Benefit/costs ratio (3/[1+2])	1.08	1.07	1.12	1.06	1.06	1.06	1.08	1.08	1.12	1.07	1.07	1.07
Resource cost ratio (2/[3-1])	0.44	0.47	0.49	0.47	0.47	0.51	0.40	0.43	0.47	0.44	0.44	0.48
Gross margin (4/3)	7%	7%	11%	6%	6%	6%	8%	7%	11%	6%	6%	6%

SUNEOR continuing operations to extract and export oil (per kg of gnuts in shell)

	Private budgets (2015 FCFA/kg)						Social budgets (2015 FCFA/kg)					
	2011	2012	2013	2014	2015	Projected 2016	2011	2012	2013	2014	2015	Projected 2016
<i>Product in process + other budget items</i>												
1. Tradable costs	196	210	245	232	234	273	210	218	224	212	236	273
2. Non-tradable costs	19	90	58	37	67	276	18	81	52	34	60	223
3. Total revenue	289	314	327	235	264	416	243	261	309	166	224	244
4. Profit (operating margin)	74	14	24	(35)	(37)	(133)	15	(37)	33	(80)	(72)	(252)
Total quantity processed (throughput, mt/yr)	203,341	44,099	67,947	106,084	58,998	7,146	203,341	44,099	67,947	106,084	58,998	7,146

Note: Data shown are for calendar years, which are also SUNEOR fiscal years, from audited accounts for 2011-14 and projections for 2015; revenues are SUNEOR global payment. All data in 2015 FCFA, adjusted for inflation.

Shelling and handling raw groundnuts for export (per kg in shell)

	Private budgets (2015 FCFA/kg)							Social budgets (2015 FCFA/kg)						
	2010	2011	2012	2013	2014	2015	Stated 2015	2010	2011	2012	2013	2014	2015	Stated 2015
<i>Product in process + other budget items</i>														
1. Tradable costs	170.2	192.4	235.6	182.5	217.4	251.9	253.9	170.8	192.9	236.2	183.1	218.0	252.5	254.4
2. Non-tradable costs	54.0	55.4	58.1	54.8	57.0	59.1	59.2	53.5	54.8	57.5	54.2	56.4	58.6	58.7
3. Total revenue	512.0	738.0	400.7	372.2	425.1	403.2	324.5	512.0	738.0	400.7	372.2	425.1	403.2	324.5
4. Profit (operating margin)	287.7	490.3	107.0	134.8	150.7	92.2	11.3	287.7	490.3	107.0	134.8	150.7	92.2	11.3
Ratio indicators														
Benefit/costs ratio (3/[1+2])	2.28	2.98	1.36	1.57	1.55	1.30	1.04	2.28	2.98	1.36	1.57	1.55	1.30	1.04
Resource cost ratio (2/[3-1])	0.16	0.10	0.35	0.29	0.27	0.39	0.84	0.16	0.10	0.35	0.29	0.27	0.39	0.84
Gross margin (4/3)	56%	66%	27%	36%	35%	23%	3%	56%	66%	27%	36%	35%	23%	3%

Note: Data shown are for each harvest, at the start of each marketing year, from SEDAB (2015) for operating costs, CSA (various years) for groundnut procurement and authors' calculation from world prices for revenues. SEDAB's stated 2015 budget uses much lower revenues.

Continuing operation of artisanal processing to extract oil for local sale (per kg of gnuts in shell)

	Private budgets (2015 FCFA/kg)	Social budgets (2015 FCFA/kg)
<i>Product in process + other budget items</i>		
1. Tradable costs	223.8	223.8
2. Non-tradable costs	47.3	47.3
3. Total revenue	282.2	282.2
4. Profit (operating margin)	11.2	11.2
<i>Nota:</i> Total quantity processed (throughput, mt/yr)	5,400	5,400

Note: All data shown are for the 2015 harvest (the 2015-16 marketing year), from composite sources (World Bank, FAO and CSA).

A1.3 COMPLETE LIST OF ALL PRICE DISTORTIONS USED IN POLICY ANALYSIS MATRIX RESULTS (SHOWN AS NOMINAL PROTECTION RATES)

Budget and item	NRP	Notes
Farm production		
Revenue		
Groundnut in shell (standard)	-32%	Price received is 200 (if sold to SUNEOR), 202 (if sold to others); opp. cost is 292
Groundnut in shell (off-season)	-31%	Price received is 217, opportunity cost is 314
Groundnut seed (R1)	-31%	Price received is 125, opportunity cost is 181
Groundnut seed (R2)	-31%	Price received is 68, opportunity cost is 98
Fixed inputs		
Equipment	50%	Expert opinion (same as fertilizer)
Farm labor		
Hired labor	-20%	Expert opinion (efficiency wage for hired labor is 20% above opportunity cost)
Intermediate inputs		
Fertilizer (DAP, 18-46-00)	50%	USDA/GOS
Fertilizer (NPK, 6-20-10)	55%	USDA/GOS
Fertilizer (KCL)	50%	USDA/GOS
Fertilizer (Urea)	50%	USDA/GOS
Financing costs		
Financing charges	40%	Expert Opinion
Transporters		
Illicit tax	0.23	FCFA per kg of groundnut transported, in shell
Legal tax	0.69	FCFA per kg of groundnut transported, in shell
SUNEOR processing		
Inputs		
Groundnut in shell (standard)	1%	Price paid is 229, opportunity cost is 231 (relative to CNA price)
Note: Gnut in shell (standard)	43%	Price paid is 229, opportunity cost is 403 (relative to private exporters)
Labor cost		
Management	-283%	Estimated private-sector salaries of comparable workers
Supervisors	-255%	Estimated private-sector salaries of comparable workers
Techniciens	-387%	Estimated private-sector salaries of comparable workers
Unskilled	-357%	Estimated private-sector salaries of comparable workers
Financement		
	40%	
Subsidy received (per kg)	19	FCFA per kg of groundnut processed, in shell
Subsidy received (fixed)	21	FCFA per kg of groundnut processed, in shell

Note: All subsidies are shown as positive if they increase enterprise profits (raise revenue or lower cost), and negative otherwise. All budget items not shown in this table have no subsidy or tax. Budgets for **private-sector exporters** and artisanal processors have no distortions. Where present, distortions are also shown in the rightmost column (P, R or F) of the corresponding enterprise budget.

ANNEX 2. PERSONS CONSULTED

Nathaniel Rosenblum – Data collection, July 2016

Fabrice Bidault	Director General	COPEOL
Boulaye Dado Camara	Director of Operations	SUNEOR
Louise Cord	Country Director	World Bank
Abdoulaye Dia	Agriculture Specialist	USAID
Fodé Diémé	Analyst	ANSD
Abdou Karim Diop	Financial Director	SUNEOR
Matar Gaye	Senior Manager	Feed the Future, Senegal
Mandaw Guisse	Grain Purchaser	SUNEOR
Lucile Hummel	Policy Analyst	FAO
Phillipe Nguala Luzietoso	Consultant	
Federica Marzo	Senior Economist	World Bank
Alban Mas Aparisi	Policy Analyst	FAO
Ousman Ndiaye	Director	ASPRODEB
Mouhamadou Ndiaye	Coordinator	CSA
Afia Ndoeye	Sr. Agricultural Economist	World Bank
Dogo Seck	Secretary General	Ministry of Agriculture
Moustapha Sene	Executive Manager	CAIT
Hamat Sy		Ministry of Finance
Modou Thiam		SEDAB
Adama Touré	Lead Agricultural Economist	World Bank
Anne Williams	Country Director	USAID

William A. Masters – Report presentation and validation, 27 October 2016

Prénoms/Noms	Institution
Oumar Ba	Direction Agriculture
Youssoupha Diallo	CT1/MAER; PCA SONACOS SN
Amadou Niang	DGID/ MEFP
Mamadou Fall	Ing/CT de la CNRF
Anne Williams	USAID
Simeon Ehui	Banque Mondiale
Dogo Seck	MAER
Mariane Drame	ANCAR
Ibrahima Mendy	DAPSA/MAER
Marietou Diawara	PPAAO/WAAPP/MAER
Mbene Dieye Faye	PAPA/MAER
Waly Diouf	MAER
Mamina Ndiaye	PPAAO
Alioune Fall	MAER/ISRA
Ndeye Coura M. Diop	PDIDAS
Cheikh M Bamba Siby	Cabinet MEFP
Mademba Ndiaye	Senior Communication Officer, Banque Mondiale

William A. Masters – Technical working group, 28 October 2016

Prénoms/Noms	Institution
Waly Diouf	MAER
Simeon Ehui	Banque Mondiale
Aifa F Niane	Banque Mondiale
Mbene Dieye Faye	PAPA/MAER
Alioune Fall	MAER/ISRA
Mouhamadou Moustapha Sy	ADIE
Mamina Ndiaye	PPAAO
Ibrahima Mendy	DAPSA/MAER
Youssoupha Diallo	PCA/SONACOS SA, CT1/MAER
Dogo Seck	SG/ MAER

ANNEX 3. TERMS OF REFERENCE

Analysis of the Competitiveness of Groundnut Value Chain in Senegal

Terms of Reference of World Bank Technical Assistance

Background and rationale

Groundnut is a crop of major economic importance in Senegal. The majority of rural households depend on groundnuts for their livelihoods, both for subsistence crop and for income generation. The groundnut subsector was for many decades the driver of agro-industrial development in Senegal, serving not only as the key input for processing of edible oil, but also as the main source of animal feed, and soil fertility for rainfed cropping systems.. Groundnut played a vital role in the national economy especially in the 1960s. However, the groundnut value chain in Senegal has been confronted with increasing difficulties in recent years including: (i) declining yields relative to other producers (900 kg/ha in 2009-2014 compared to 1,500 kg/ha in Nigeria, 3,000 kg/ha in China, and 6,900 kg/ha in Israel) due to traditional farming and increased cultivation on marginal lands, inefficiencies in distribution of seeds and fertilizers coupled with the use of low-yielding seed varieties and uncontrolled outbreaks of pests and diseases; (ii) unstructured producers' organizations and value chain coordination bodies like the inter-professional committee, with weak or absence of linkages with the processing industry and end-markets; (iii) inconsistent and distorting sectoral policies; and (iv) the growing importance of alternative oilseed and oil products in the global market (palm oil, soya, cottonseed, rapeseed, sesame), which have caused groundnut market share erosion and falling of revenues from exports. This protracted crisis has significantly reduced the economic performance of the groundnut value chain over the last fifteen years.

These structural problems notwithstanding, groundnut remains in terms of volume and value, the most widely produced crop in Senegal. It is the main source of income of rural households or family farms especially in the primary production region. Indeed, it involves 63% of the rural population, 60% of whom are below the poverty line; 482,000 family farms (ANSD, 2011); and 45-60% of the total cropped areas.

Since the privatization of SONACOS in 2005 (which became SUNEOR in 2007) performance in the collection and industrial processing of groundnut oil underwent dramatic decline from year to year. SUNEOR is bankrupt today with accrued debts over FCFA 51 billion in September 2015. A diagnostic analysis of the groundnut values chain was conducted in June 2014 along with a set of key reform proposals consisting of:

- resolving SUNEOR debt crisis and rebuilding a competitive groundnut oil industry;
- renovating and strengthening the groundnut inter-professional committee;
- building a transparent, efficient and targeted subsidy policy;
- reviewing the farm gate pricing mechanism for better connection to the groundnut oil international price trend;
- reviewing policy related to the export of groundnut seeds and grains.

The World Bank Technical and Financial Support

Owing to the insolvency of SUNEOR, the depth of its financial crisis and consistent inability to operate at capacity, the Government of Senegal (GoS) has called for a second round of reforms. GoS held a minority stake in the company, and has decided to replace the majority stockholder, Groupe Advens, and take de facto ownership of the company. The Government has called upon the World Bank Group for financial and technical support to address both the short term issue of reactivating the groundnut oil processing industry as well as the long term viability of the sector. The World Bank Group has responded favorably to Government request through an additional financing (AF) of USD 20 million to the ongoing West Africa Agricultural Productivity Program (WAAPP-2A). The AF would help finance the introduction of new activities proposed in response to restructuring the groundnut value chain in Senegal and reinforcing achievements made under WAAPP-2A in developing the national seed multiplication system. More specifically, the AF would support the GoS in:

- i. Strengthening of the national certified seeds production and marketing systems for groundnuts (US\$15.60 million): As part of this process, the AF will finance costs related to: (1) the acquisition and distribution of about 40 000 tons of certified groundnut seeds (US\$12.50 million) by matching the Government funding to keep certified seeds prices at affordable level while expanding the use of an ITC based platform developed under WAAPP-2A (US\$0.10 million) for targeting farmers and ensuring transparency in the system; and (2) the provision of storage facilities (US\$2.00 million) and agricultural equipment to cooperatives and seed producers' organizations (US\$1.00 million);
- ii. Supporting comprehensive technical assistance as a building block for longer-term sustainability of the groundnut value-chain and economic diversification in the groundnut producing areas (US\$2.10 million). As part of this process, the AF will finance costs related to:
 - a. Support to the SUNEOR cession (US\$0.85 million) including: (1) establishing a performance contract between the Government and SUNEOR for the transitional period and conducting a readiness scoping study with IFC support to provide an updated financial, technical and legal due diligence status of SUNEOR (US\$0.05 million). A preliminary study will help to determine how soon and under what conditions a competitive bidding process could be launched to attract new strategic partners for SUNEOR. IFC will also assist in the drafting of terms of reference for a transaction adviser; (2) procuring transaction advisory services to elaborate the baseline business plan and assist the GoS in attracting new investors for SUNEOR through a competitive and transparent process (US\$0.80 million);
 - b. Support to the GoS for the elaboration of a new development policy strategy for the groundnut value chain, conduct necessary analysis for the preparation of a longer term strategy along with an investment program for the economic restructuring and diversification of the groundnut producing regions (US\$1.25 million);
- iii. Supporting the GoS in conducting the agricultural enterprises census (US\$2 million) as part of the general census of Senegalese enterprises aiming at updating the national directory of enterprises and associations.

Objectives and Scope of the Technical Assistance Assignment

The World Bank is engaged in an intensive policy dialogue with the Government at a very high level including with the Minister of Agriculture, the Minister of Finance, the Prime Minister and the President of the Republic. To better support this dialogue, the World Bank would like to conduct further studies on the competitiveness of the Groundnut value chain.

This competitiveness study will help to inform the Government with evidence-based analysis on the impacts of different current and potential policies. Given the high level competition with other countries and the growing importance of alternative oil products (e.g. palm oil, soya, cottonseed, rapeseed, sesame) , questions are:

- i. Will groundnuts production and groundnut-based oil production and processing remain competitive in the foreseeable future?

- ii. How does groundnut production in Senegal compare with other high value crops?
- iii. Would an export option of raw groundnut work better for farmers and the economy?
- iv. What policy, institutional and technology options might be needed to make the value chain competitive?

The proposed study will take into consideration and update the World bank study carried-out in 2014 (diagnostic of the groundnut value chain) as well as the 2007 analysis by William Masters (Distortions to Agricultural Incentives in Senegal) and will further deepen the analysis using the Policy Analysis Matrix by Monke and Pearson¹ or a variant of this approach as may be appropriate.

Specifically the study will:

- Identify the main stages of the value chains (production, marketing, and processing) within the groundnut subsector in Senegal as well as the various locations at which measurements will be undertaken;
- Estimate the cost structure and financial profitability of the main groundnut value chains (production, marketing, and processing) to assess whether limited resources are utilized efficiently;
- Assess how competitive Senegal is in relation to the global supply-demand balance for edible oil and other groundnut products that Senegal could export, both in financial and economic terms;
- Examine the government's producer price policy compared to world market prices and transaction costs associated with transport, storage and processing; Analyze the capacity of Senegal to respond to key structural changes in groundnut systems (identify potential inefficiencies and suggest which areas productivity should be improved);
- Derive policy implications about how to improve the comparative advantage of groundnut for Senegal in the medium (5 years) and long term (10 years).

Methodology

The study will assess the competitiveness of groundnut value chains in Senegal from both a financial and economic perspective with the aim to provide additional empirical analysis to assess whether further investments in commercial groundnut value chains in Senegal are warranted, and if so, of which kinds.

The financial analysis will use standard budgeting techniques to compute the cost of production, net value added, and the private-cost ratio (PCR) using prevailing market prices, including any taxes and subsidies received by value chains actors. The economic analysis will use a domestic resource cost (DRC) and social cost-benefit (SCB) ratio approach to assess the comparative advantage of the groundnut production and marketing systems, netting out the value of any transfers and accounting for the effects of distorted exchange rates. While the financial analysis examines the profitability of groundnut production and marketing to private actors under existing market conditions, the economic analysis measures profitability to the economy as a whole. Understanding the distribution of the total financial revenues and costs among actors within the value chain as well as the economic performance of the groundnut value chain from the societal point of view will allow to provide proper incentives to various stakeholders while allocating scarce resources in a more efficient manner. In so doing, the study will identify and quantify the main distortions causing differences between the actual current use of resources in the sector drawn by competitive advantage (PCR) and the opportunity cost of those resources dictated by comparative advantage (DRC). Using a Divergence-Separation-Module (DSM) approach, these distortions will be separated into policy and structural components, to distinguish between policy-induced transfers among Senegalese actors (such as tariff revenues paid to government), from structural inefficiencies and deadweight losses (such as the cost of fuel and machinery used in value-subtracting activities).

Then, the study will also conduct various sensitivity and scenario analyses to assess the implications of the changing dynamics of the domestic, regional and international markets for the comparative advantage of groundnut value chains in Senegal under alternative assumptions about the evolution of production costs, yields, exchange rates, world prices, wage rates and transport costs or other relevant identified parameter. The set of PCR, DRC, SCB

¹ Monke, E., Pearson, S.R. 1989. The Policy Analysis Matrix for Agricultural Development. Cornell University Press, Ithaca, NY.

and DSM ratios derived from the various scenarios will indicate whether there is a good case for further exploring efficiency aspects of expanding groundnut production in Senegal.

The above will be structured in a Policy analysis matrix (PAM) to evaluate the competitiveness of groundnut value chain. The approach is employed due to its simple and understandable nature, particularly to policy makers (Monke and Pearson, 1989; Gotsch, 1989; Fox et al., 1990; Staal, 1995). It evaluates the competitiveness of commodities concerned by comparing data from the private and social budgets. While private profits are estimated based on market prices, social profits are estimated on the basis of social prices. The standard PAM structure is given in Annex 3.

Data Collection

In order to present the most representative and economically important set of PAMs the researchers will be guided by previous studies and through on-the-ground experts. Data gathering will take place primarily through the initial mission starting around July 10. The researcher will start by interviewing local staff to determine the value chain characteristics to be profiled including but not limited to: regions of interest, marketing channels, processing types, and end-user markets.

Following determination of the value chains to profile the researchers will collect cost, quantity and revenue data for each stage of the process from farm to final point of sale broken up by tradable and non-tradable factors. Administrative data, especially that of SUNEOR will be provided by a recent study performed by the World Bank and otherwise obtained through interviews with key personnel. Travel to market locations in Senegal may be necessary, along with telephone and email contact with local and overseas trading offices to determine shadow prices and transport or processing costs for each product may be necessary. Researchers will also need to obtain reliable estimates of the shadow exchange rate, and any overt distortionary government policies.

During the site visit, the World Bank staff will facilitate travel and setting up meetings for the purpose of obtaining any necessary data. After data collection, staff will remain available to support the project through completion.

Expected Results

The expected results from this technical assistance is a concise report on the competitiveness analysis of groundnut value chain along with a policy brief to be discussed and validated with the Government to guide the reform process.

Profile and skills of the WB and Tufts University team

The work will be implemented under the overall joint coordination of Simeon Ehui, Practice Manager, Agriculture and Louise Cord, Country Director for Senegal. The team will consist of:

- William Masters, Professor, Tufts University (Team Leader)
- Holger Kray, Lead Agriculture Economist, WB (co-Team Leader)
- Nathaniel Rosenblum, Consultant Researcher, Tufts University
- Aifa Fatimata Ndoeye Niane, Senior Agriculture Economist, WB
- Ramziath Adjao, Young Professional, WB
- El Hadji Adama Toure, Lead Agriculture Economist, WB
- Chakib Jenane, Senior Agri-Business Specialist, WB

Duration

The study will be conducted in July and August 2016 including missions of up to 14 days in Senegal, and remote support thereafter.

Annex 1: The Domestic Resource Cost (DRC) and Social Cost-Benefit (SCB) Approach

There are various measures of comparative advantage. Among those measures, the domestic resource cost (DRC) ratio has been widely used. The domestic resource cost (DRC) approach was developed by Michael Bruno in the 1960s and it compares the opportunity costs of domestic production to the value added that it generates. The numerator is the sum of the costs of using domestic primary resources - land, labour and capital (non-internationally traded inputs) - valued in terms of shadow prices. The denominator is the value-added (value of output minus tradable input costs per unit of output) in border prices. The DRC for commodity i is calculated as:

$$\text{DRC} = \frac{\sum_{n=1}^N P_{en} * Q_n}{(P_{ei} * Q_i - \sum_{t=1}^T P_{et} * Q_t) * \text{SER}}$$

where P_{ei} and Q_i are the economic price and quantity of output i ; P_{et} and Q_t are the economic price and quantity of tradable input t used to produce output i ; P_{en} and Q_n are the economic price and quantity of nontradable input n used to produce output i ; and SER is the shadow exchange rate.

The DRC value may be positive or negative. A positive value below unity indicates efficiency and comparative advantage – the economy saves foreign exchange from local production; a value equal to unity indicates that the economy neither gains nor saves foreign exchange through domestic production; and a value greater than unity indicates inefficiency and lack of international comparative advantage – the economy is incurring costs in excess of what it gains or saves from the production in terms of foreign exchange.

The main limitations of the DRC method include: 1) the tendency for some “domestic” costs to involve imported components, which are not always easy to disaggregate; 2) the partial equilibrium framework on which it is based and which focuses only on a single market without addressing the linkages among markets (i.e., the indicator ignores substitution and cross-price effects); and 3) possible undervaluation or overvaluation of imported resources due to undervalued or overvalued exchange rates; thus, assumptions about real exchange rate are critical, as competitiveness may be artificially created by devaluing the domestic currency, which results in the decrease of the economic valuation of exports and increase in those of imports (Latruffe 2010).

As shown by Masters and Winter-Nelson (1995), when a PAM is constructed using an estimate of the opportunity cost of foreign exchange (the shadow exchange rate, SER), alternative activities should be ranked using a ratio of total costs to total benefits at social prices. This social cost-benefit (SCB) ratio uses the same data as the DRC in slightly different form:

$$\text{SCB} = \frac{(\sum_{n=1}^N P_{en} * Q_n) + ([\sum_{t=1}^T P_{et} * Q_t] * \text{SER})}{(P_{ei} * Q_i)}$$

Using the SCB instead of DRC ratios to rank activities is preferred because it takes full advantage of the information provided by the shadow exchange rate, avoiding the tendency of DRC comparisons to understate the economic value of relatively labor- or land-intensive activities (Masters and Winter-Nelson 1995). In this study both DRC and SCBs will be estimated using farm budget data and relevant macro- and microeconomic data by: (1) classifying and decomposing input items into their tradable, non-tradable and transfer payments (tax or subsidy) components;

(2) estimating social (or shadow prices) of the output and all the inputs; (3) constructing commodity and system budget tables; (4) and computing the corresponding DRC and SCB ratios.

There is a substantial literature on shadow pricing, and two kinds of numeraire have been widely used: the first one, the “world price” numeraire, adjusts the prices of nontraded goods to be equivalent to border prices, while the second one, the “domestic price” numeraire, adjusts the prices of traded goods to be equivalent to domestic prices (Belli et al 1997; Gittinger 1982). This study will compute shadow prices using the “domestic price” numeraire. More specifically:

- traded goods, which include production output (i.e., milled rice) and inputs (i.e., seeds, fertilizers, pesticides, herbicides, transport, and farm equipment) are valued at their economic parity prices. The import parity price is the economic price of the imported good at the point of delivery obtained by adding to its FOB² price all freight and insurance charges between the world market and the point of reference, accounting for the adjustment of the currency. Conversely, the export parity price, which is the economic price of exports at a specific point, is obtained by deducting freight and issuance charges from the CIF³ price, accounting for the adjustment of the currency;
- tradable but nontraded goods, which are goods that are not traded because of government regulation (e.g., rice under an export ban), are valued at their domestic market price; and
- non traded goods are goods that by their very nature tend to be cheaper to produce domestically than to import but for which the export price is lower than the domestic cost of production. Such goods include labor, capital and land, farm tools, construction, services, utilities, credit and irrigation water and are valued at their opportunity costs or the benefit forgone by using a scarce resource for one purpose instead of its best alternative use (Gittinger 1982).

Annex 2: Divergence-Separation Module (DSM) Approach

The total divergences between domestic prices and their border price equivalents result from the effects of policy distortions and effects of market failure (or market imperfections). Since the majority of existing *direct* policy interventions and subsidy programs influencing the input and output markets of the analyzed activities is known (from Government policy documents), a separation of quantitative effects of these instruments can to be carried out to quite an extent. Assuming that the sum of divergences (b_i) for each activity is the result of observable policy distortions (b_p) and structural distortions (b_{st}), $\{b_i = b_p + b_{st}\}$, and b_i is known from the results of the protection analysis, the methodology of separation can be characterized as an identification of b_p and subsequent computation of the residual b_{st} . By this token, b_p is defined as the set of all directly observable policy influences, as there are for example direct subsidies to factors and products, taxes (import taxes, tax^i ; excise taxes, tax^v), tariffs (tar), import surcharges (sur), export subsidies (sub), and quotas of importation. Consequently, b_{st} is defined as the sum of all influences that are not directly observable and thus for the most part consist of market failure influences of spill-over effects of policies not intended to influence the analyzed price directly.

Following the definitions of price theory the private domestic price of a good at a border location B (p_B^p) equals the border price equivalent (social price) of identical goods at the same location (p_B^s) if markets for tradables are assumed to be perfect and undistorted. The existence of a different b_i , $\{p_B^p - p_B^s \neq 0\}$, implies the existence of distorting influences causing private prices to differ from their border price equivalents. If b_i is totally explicable by the set of observable policies, all distortion can be characterized as direct policy distortion b_p , leading to the identity $b_i = b_p$ and implying that there is no existing structural distortion b_{st} . Using the p_i that can be derived from the “standard” protection analysis and in order to identify the levels of b_p and b_m for the analyzed activities, the following steps are carried out:

² Free on Board or FOB is a term of sale to indicate that the price quoted by a seller includes all charges up to placing the goods on board a ship at the port of departure specified by the buyer.

³ Cost, Insurance, Freight or CIF is a term of sale to indicate that the price quoted by a seller includes insurance and all other charges up to the named port of destination.

The observed private prices of tradables at the farm-gate location (p_F^P) are converted into private border prices (p_B^P) by adding (in an net export situation) or subtracting (in an net import situation) the costs of interregional transportation and processing ($t_{F \rightarrow B}^P$ or $t_{B \rightarrow F}^P$, with B indicating the border location and F indicating the farm-gate location). Doing so leads on one hand to comparability at an identical location, and on the other hand domestic interregional transportation and processing costs are not taken into account for the following calculation of tariff influences. In the so-called 'Divergence-Separation-Module' (DSM), a withdrawal of influences of border instruments such as import tariffs, import quotas at reduced tariffs, import surcharges, export taxes and subsidies on domestic prices is carried out on the basis of p_B^P . The results are displayed as so-called *corrected private border prices* (p_B^C). A subtraction of social border prices of the tradable good p_B^S from its corrected border price p_B^C thus will display the level of distortions left after trade policy withdrawal. These *rest distortions* (~structural distortions) after trade policy adjustments are indicated by the abbreviation b_{st}^* . If no other influences on domestic tradable prices exist, then p_B^C will equal p_B^S ; all distortions can be explained to be direct trade policy distortions b_p and no other distortions b_{st}^* will be observable. If, in addition, direct subsidies are paid on tradables (w/ direct taxes being introduced as direct negative subsidies), a further adjustment for these payments has to be carried out, resulting in b_{st}^* . By multiplying the results by the physical unit of factor use (x_i) the total level of policy and rest distortions of the analyzed activity are computed.

Thus for a tradable, (net) imported commodity the DSM becomes

$$b_{st}^* = \sum_{i=1}^n \left(\frac{p_{Fi}^P - t_{t \rightarrow F}^B}{(1+T_i + T_i \text{tax}_i^I + \text{sur}_i)(1+\text{tax}_i^V)} - p_{Bi}^S \right) x_i \quad \text{with} \quad T_i = \frac{\sum_{r=1}^m \text{tar}_i^r q_i^r}{\sum_{r=1}^m q_i^r}$$

where q is the value of imports of commodity i under tariff regime r

For a tradable, (net) exported commodity the equation becomes

$$b_{st}^* = \sum_{i=1}^n \left(\frac{(p_{Fi}^P + t_{t \rightarrow B}^F)(1 + \text{tax}_i^E)}{1 + \text{tax}_i^V} - \text{SUB}_i^E p_{Bi}^S \right) x_i \quad \text{with} \quad \text{SUB}_i^E = \frac{\sum_{r=1}^m \text{sub}_i^r q_i^r}{\sum_{r=1}^m q_i^r}$$

with: q : value of imports of commodity i under export subsidization regime r

The Policy Analysis Matrix:

The PAM, developed by Monke and Pearson (1989), is a partial equilibrium framework that allows analysis of policies in terms of their impact on commodity systems, representing the results in a matrix of private and social values (table 1 below).

The PAM approach requires the formation of accounting matrices for revenues, costs, and profits (revenues minus costs). Costs are defined in two columns as tradable inputs and domestic factors (essentially land, labour, and capital). Tradable inputs are those available at the international market level; those available domestically are potential exports. Intermediate inputs (e.g. fuel, feed, and electricity) are disaggregated into tradable input and domestic factor components.

The first row of the PAM contains the calculation of private profitability, which represents the competitiveness of the agricultural system given technologies, observed market input and output costs, and policy transfers. The second row defines social profitability, representing comparative advantage or efficiency in the agricultural commodity system. Social prices (measured at the international market level) reflect valuation of domestic factors; positive

social profits are indicative of socially efficient usage of resources, and negative social profits indicate production at social costs that exceed the costs of importing results in inefficiencies).

The final row of the PAM represents transfers; vertical divergences must be explained by the effects of distorting policy or the existence of market failures. The net transfer caused by policy and market failures ($L = (D - H)$) is the sum of the separate effects in the factor and product markets.

Theoretically, social prices are those that would exist in perfect market situation. Practically, such prices are estimated using different methods such as identification of quantifiable market interventions that make the differences in the observed and free market price, calculation of border equivalent or parity prices, and estimation of shadow prices (Gittinger, 1982; Monke and Pearson, 1989; Staal, 1995; Yao, 1997). Following standard PAM procedure, the following indicators of comparative advantage, protection and policy impacts would be calculated: private cost ratio (PCR), domestic resource cost (DRC) and social cost-benefit (SCB) ratios, nominal protection coefficient on tradable outputs (NPC), nominal protection coefficient on tradable inputs (NPI), effective protection coefficient (EPC).

The Policy Analysis Matrix (PAM)

	Revenues	Costs		Profits
		Tradable inputs	Domestic factors	
Private prices	A	B	C	D
Social prices	E	F	G	H
Effects of divergences and efficient policy	I	J	K	L

Where: $D = A - B - C$ = Private profits $H = E - F - G$ = Social profits
 $I = A - E$ = Output divergences $J = B - F$ = Input divergences
 $K = C - G$ = Factor divergences $L = D - H = I - J - K$ = Net divergences.

NPC= Nominal protection coefficient on tradeable outputs= A/E

NPI= Nominal protection coefficient on tradable inputs= B/F

EPC= Effective protection coefficient of products= $(A-B)/(E-F)$

PCR= Private cost ratio= $C/(A-B)$

DRC= Domestic resource costs $G/(E-F)$

SCB= Social cost-benefit ratio $(F+G)/E$

Source: Monke and Pearson, 1989; Masters and Winter-Nelson 1995.

An NPC > 1 reveals that producers are protected for the product. Similarly using input costs, the nominal protection coefficient of tradable inputs (NPI), measures the ratio of the private cost of tradable inputs to their social cost. Where NPI < 1, producers experience protection or subsidization for input purchase prices.

The effective protection coefficient (EPC) is a measure of the net effect of distortions or negative protection on outputs and tradable inputs. For an EPC > 1, producers are protected for the value-added produced.

A DRC or SCB ratio less than one indicates a value-adding activity which has some comparative advantage relative to world-market competitors. An SCB or DRC greater than one indicates that the activity is value-subtracting, as the opportunity cost of resources used exceeds the value of what is gained. Within each category, activities ranked by SCB contribute more value addition (or less value subtraction) per unit of resources used.



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