YEMEN: Agricultural Policy Review

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Policy Simulations (Sources of Growth)

by

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YEMEN: Agriculture Strategy

Working Paper on Policy Simulation

A. General

The Government of Yemen and the International Monetary Fund as well as the World Bank agreed on a reform program of adjustment measures to revitalize Yemen's economy. The reform program aims to achieve macroeconomic stabilization and to lay the basis for sustainable growth. The reforms include the trade policy, privatization of public enterprises and the regulatory system. The current subsidy system for the agricultural sector is also affected by this program as it represents a severe drain on the budget and distorts the domestic markets. Subsidies for wheat, for instance, benefit the consumers but discourage local production, encourage wheat smuggling to neighboring countries and the use of superior wheat products as animal feed.

The ongoing adjustment program will have an impact on the relative as well as absolute price level in the agricultural sector. Prices for input and outputs will be affected through the removal of diesel subsidies and the replacement of the import ban for vegetable and fruits with a tariff system. While the former will increase the on-farm cost of irrigation and machinery, the latter could reduce the price of vegetables and fruits.

The implications of the policy changes on agricultural production, prices and farmers' incomes have not yet been studied. This working paper analyzes the impact of the described policy changes on farmers' incomes, i.e. gross margins; the current data base does not allow the estimation of changes in net profits.

The model used for the policy simulation is based on land use data for the three agro-ecological zones, gross margins for priority crops, and assumptions for changes in the policy environment. The model used for the simulation has a static character, i.e. it does not consider adjustments in production through changes in prices, and is partial as it does only capture the immediate effects on the crops included in the model. The model analyzes the short-term effects of the policy change. Thus, farmers cannot adjust their production to the new price level. In the medium to long-term, however, farmers will adjust their production technology and their cropping patterns according to the changed policy environment.

Income effects are measured as the difference between the incomes with and without policy change, i.e. gross margins for the current and the changed price level. The income effects are first simulated on a hectare basis and the results of this analysis are subsequently multiplied by the area planted to the respective crop in each agro-ecological zone (for a structure of the simulation model, see attached chart). The effects of changes in policy are simulated for the current and improved production technology.

B. Effects of a Removal of Diesel Price Subsidies:

The Government is committed to remove the diesel subsidies in the coming years. The IMF has estimated that the removal of the subsidies would lead to an increase in the diesel price of 80 percent compared to its current level. This will have direct effects on the agricultural sector through higher cost of irrigation and machinery and, indirect effects through increasing input as well as declining output prices on the farmgate level due to higher transport costs. This analysis deals only with the direct effects.

Analytical work carried out under the Agricultural Strategy for Yemen (1993) shows that the cost of irrigation and machinery comprise outlays for equipment, labor and energy. The share of the energy component, which is equivalent to the cost of diesel, on the total irrigation costs is estimated at 46 percent, and for machinery at 60 percent. For the policy simulation and the estimation of the income effects, the cost of energy is adjusted to the price level without subsidies which is 80 percent above the current price level. In 1998 prices, this would increase the price of one liter diesel from YR 10 to YR 18.

The effects on the gross margins will vary depending on the intensity of the irrigation and machinery input for the production of a certain crop. The direct effects on the gross margins of rainfed crops and crops that are produced using animals instead of machinery will be rather small or zero. In contrast, a sharp drop in gross margins is likely for crops which are fully irrigated and which are produced under a high machinery input.

<u>On Gross Margins:</u>

The analysis proved that a removal of diesel subsidies would reduce the gross margins of water intensive crops under the current production structure (see table 1). The results of the simulation indicate that the gross margins of bananas and cotton could become negative and their gross margins could be reduced by more than 100 percent. The effects on the gross margins of onions, tomatoes and dates is lower as these would be reduced by only 10 percent. Effects on the gross margin of rainfed crops are small. Nevertheless, the gross margin of rainfed wheat in the highland is estimated to decline by 9 percent due to the increasing cost of machinery.

Compared to the current technology, an improved production technology could reduce the negative impact of the policy adjustments on gross margins. Bananas and cotton, for instance, crops that would be severely affected by a removal of diesel subsidies under the current production technology, could benefit significantly from an improved production technology (see table below). The results of all crop budgets confirm this observation. For that reason it is of high importance for the farmers that they are provided with technical assistance and extension during the adjustment process to minimize their income losses. An improved production technology would increase the robustness of the gross margins to changes in diesel prices and, in addition, would increase the gross margins compared to their current level.

Table 1: Gross Margin of Selected Crops after the removal of diesel price subsidies (per hectare)*

Crop	Region	Current Technology		Improved Technology	
		In YRls	relative change to situation with subsidy	In YRls	relative change to situation with subsidy
Bananas**	CA	-98,580	-280%	79,522	-36%
Bananas**	CA	-21,935	-142%		
Cotton	CA	-2,660	-117%	27,034	-40%
Citrus, Oranges**	CA	48,460	-43%	135,900	-25%
Alfalfa	HL	241,867	-27%	449,617	-17%
Tomatoes	CA	82,642	-25%	148.398	-15%
Tomatoes	HL	150,609	-25%	349,760	-9%
Alfalfa	EP	326,563	-18%	454,778	-13%
Qat**	HL	326,010	-17%		
Onions	HL	382,224	-16%	561,098	-12%
Potatoes	HL	243,100	-12%	444,272	-6%
Tomatoes	EP	277,584	-10%	515,636	-4%
Onions	EP	228,945	-10%	306,151	-10%
Onions	CA	179,749	-9%	345,510	-6%
Wheat - rainfed	HL	18,472	-9%	22,377	-7%
Grapes**	HL	522,890	-8%	716,800	-7%
Potatoes	EP	294,152	-6%	616,628	-4%
Sorghum - rainfed	HL	35,125	-2%	39,218	-3%
Dates**	EP	--	--	94,537	-11%
Papaya	CA	--	--	553,661	-9%
Dates**	CA	--	--	83,980	-6%
Qat**	HL	--	--	593,283	-3%

(*): water supply: controlled irrigation.
(**): production without machinery.

On Regional Incomes:

This chapter deals with the regional income effects of a removal of diesel subsidies. The analysis is based on the results for the adjustments in gross margins as presented above. It provides information on the absolute changes in income in the three agroecological zones, i.e. the Coastal Area, the Highland and the Eastern Plateau, as well as on the total income effect for Yemen. The results presented in this chapter are *tentative* for (i) information about the importance of the different types of water supply is not available, and (ii) only fruits and vegetables are included.

The analysis is based on the assumption that the total area planted to fruits and vegetables is irrigated. The following crops are included in the regional analysis: potatoes, tomatoes, onion, grapes, dates, bananas, papaya, citrus (oranges). Cereals and cash crops will also be affected by changes in diesel prices. However, while the selected products are generally irrigated, cereals are commonly produced under rainfed production system. Because of the lack of information on the share of irrigated and rainfed cereals in the different agro-ecological zones, the current analysis does exclude these crops. They will be included in the analysis as soon as the respective information is available.

Although the results are tentative, they indicate the scope of adjustments which the agricultural sector will have to cope with (see table 2). Farmers' income from the eight products included in the analysis would be reduced by YRls 2,701 million, or 13 percent, under the current production system and by YRls 2,448 million, or 8 percent, under improved production technology (see table below). This would reduce the total value added of agricultural production (based on 1995 figures) by roughly 3 percent. Including other products, e.g. cereals and cash crops, in the analysis could increase this number to 5 percent or more.

Table 2: Regional Income Effects of a Removal of Diesel Subsidies

		Current Technology			Improved Technology		
		In million YRls			In million YRls		
Crop	Region	with subsidy	without subsidy	change in Gross Margin	with subsidy	without subsidy	change in Gross Margin
Potatoes	HL	3,235	2,834	-12%	5,507	5,179	-6%
	EP	453	412	-9%	901	863	-4%
Tomatoes	CA	785	588	-25%	1,261	1,056	-16%
	HL	999	745	-25%	1,911	1,730	-9%
	EP	319	289	-10%	562	537	-4%
Onion	CA	255	231	-9%	475	445	-6%
	HL	1,241	1,047	-16%	1,738	1,536	-12%
	EP	96	86	-10%	127	115	-10%
Grapes	HL	11,353	10,469	-8%	15,457	14,352	-7%
Dates	EP	554	490	-11%			
Banana	CA	(223)	(627)	-281%	789	506	-36%
Papaya	CA	1,919	1,737	-9%	281	264	-6%
Citrus	CA	38	21	-43%	80	60	-25%
Total		**21,024**	**18,323**	**-13%**	**29,097**	**26,650**	**-8%**
Difference in gross margins with and without subsidy				**YRls -2,701 million**			**YRls -2,448 million**

C. Effects of Lifting the Import Ban for Vegetables and Fruits

In the early 1980s, the Government imposed an import ban for vegetables and fruits to protect the domestic producers. Under the reform program to revitalize and stabilize Yemen's economy, the import ban will be replaced by a tariff system based on import duties during the next few years. While this will provide some protection for the domestic producers, the protection level will be lower than under the current strict import ban. The main effects of a removal of the import ban on the domestic markets could be a growing supply through imports and, subsequently, lower market and farmgate prices. The policy simulation looks into the effects of a 5 percent as well as 10 percent reduction in vegetable and fruit prices on gross margins.

Results:

Gross Margins:

For several products, the reduction in gross margins through lower output prices is quite remarkable. A 5 percent and 10 reduction in output prices would yield in a (see table 3):

أ. high reduction in the gross margin of bananas of respectively more than 40 percent and 80 percent under the current production technology. This is the largest impact on gross margins for all crops which are covered in the analysis. An improved production technology would reduce the decline in gross margins to 16 percent and 33 percent;

ب. reduction in the gross margin of oranges. A 10 percent reduction in output prices would lead to a 34 percent decline in gross margin. An improved production technology could reduce this decline to 13 percent.

ج. modest reduction in the gross margins of grapes and papaya with a maximum of 14 percent under the current production technology. In contrast to other crops, an improved technology for grapes would not lower the relative reduction in gross margins compared to the current production technology.

د. relatively low reduction in the gross margins of vegetables. The highest decline is simulated for potatoes, followed by tomatoes and by onions. Under the current production technology, a 10 percent reduction in output prices would reduce the gross margin of potatoes by 23 percent, an improved production technology would lower this decline to 18 percent.

The results indicate that a lift of the import ban of fruits and vegetables could have significant effects on the gross margins and, hence, on farmers income. It will force farmers to adjust their production and to develop coping strategies.

Table 3 Policy Simulation: Relative Changes in Gross Margins of Vegetables and Fruits through a Price Reduction of 5% and 10%

	Region	Current production Intensity		Improved Production Intensity	
		Price Reduction by			
		5%	10%	5%	10%
Bananas	CA	-43%	-86%	--	--
Bananas	CA	-40%	-81%	-16%	-33%
Oranges	CA	-17%	-34%	-12%	-24%
Potatoes	HL	-12%	-23%	-9%	-18%
Tomatoes	CA	-11%	-22%	-9%	-18%
Potatoes	HL	-11%	-23%	-8%	-17%
Tomatoes	HL	-10%	-20%	-7%	-15%
Potatoes	EP	-10%	-19%	-7%	-15%
Onions	CA	-8%	-16%	-7%	-14%
Onions	HL	-8%	-17%	-8%	-15%
Onions	EP	-8%	-15%	-7%	-15%
Tomatoes	EP	-7%	-15%	-6%	-13%
Papaya	CA	-7%	-14%	--	--
Grapes	HL	-7%	-13%	-6%	-13%

Regional Incomes:

This chapter deals with the regional income effects of a lift of the import ban for fruits and vegetables. The analysis uses the above presented results of adjustments in gross margins and follows the same approach and covers the same set of crops as the regional income analysis for the removal of diesel subsidies. It provides information on the absolute changes in income in the three agroecological zones, i.e. the Coastal Area, the Highland and the

Eastern Plateau, as well as on the total income effect for Yemen. The results are *tentative* for (i) information about the importance of the different types of water supply is not available, and (ii) only fruits and vegetables are included.

A 5 percent decline in output prices would reduce the aggregated regional gross margins by 8 percent under the current production technology and by 7 percent under an improved production technology, respectively (see table 4). Thus, the relative decline in income is slightly lower under an improved production technology and the current technology. A 10 percent reduction in output prices would double these effects and would have severe impacts on farmers income.

There are no significant differences in the income effects between the regions, i.e. Coastal Area, the Highland, and the Eastern Plateau.

The relative decline in income is slightly lower under an improved production technology and the current technology.

D. Next Steps

Expand model to include cereals and cash crops in the analysis

Obtain estimates on the different types of water supply for each agro-ecological zone and for each product

train staff in the MAI to use the crop budgets and gross margins as a tool for policy analysis

Table 4 Regional Income Effects of a Lift of the Import Ban for Fruits and Vegetables - First Results

5% Reduction in Output Prices							
		Current Technology			Improved Technology		
		In million YRls			In million YRls		
Crop	Region	with subsidy	without subsidy	change in Gross Margin	with subsidy	without subsidy	change in Gross Margin
Potatoes	HL	2,560	2,267	-11%	4,369	3,992	-9%
	EP	453	409	-10%	901	834	-7%
Tomatoes	CA	785	697	-11%	1,261	1,147	-9%
	HL	999	899	-10%	1,911	1,772	-7%
	EP	319	296	-7%	562	527	-6%
Onion	CA	255	234	-8%	475	442	-7%
	HL	1,241	1,137	-8%	1,738	1,606	-8%
	EP	96	88	-8%	127	118	-7%
Grapes	HL	11,353	0,610	-7%	15,457	14,466	-6%
Dates	HL	-	-				
Banana	CA	55	(61)	-211%	394	330	-16%
Papaya	CA	1,919	1,785	-7%	-	-	
Citrus	CA	38	31	-17%	80	71	-12%
Total		**20,074**	**18,392**	**-8%**	**27,275**	**25,304**	**-7%**
Difference in gross margin with and without subsidy				**YRls -1,682 million**			**YRls -1,971 million**

10% Reduction in Output Prices							
		Current Technology			Improved Technology		
		In million YRls			In million YRls		
Crop	Region	with subsidy	without subsidy	change in Gross Margin	with subsidy	without subsidy	change in Gross Margin
Potatoes	HL	2,560	1,973	-23%	4,369	3,616	-17%
	EP	453	365	-19%	901	768	-15%
Tomatoes	CA	785	609	-22%	1,261	1,032	-18%
	HL	999	799	-20%	1,911	1,633	-15%
	EP	319	273	-15%	562	492	-13%
Onion	CA	255	213	-16%	475	409	-14%
	HL	1,241	1,034	-17%	1,738	1,473	-15%
	EP	96	81	-15%	127	109	-15%
Grapes	HL	11,353	9,867	-13%	15,457	13,475	-13%
Dates	HL	-	-				
Banana	CA	55	(178)	-421%	394	266	-33%
Papaya	CA	1,919	1,651	-14%	-	-	--
Citrus	CA	38	25	-34%	80	61	-24%
Total		**20,074**	**16,711**	**-17%**	**27,275**	**23,334**	**-14%**
Difference in gross margin with and without subsidy				**YRls -3,364 million**			**YRls -3,942 million**