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Impacts of feed ingredient subsidy removal and concurrent trade liberalization in Tunisia

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ABSTRACT

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This article summarizes findings from a recent agricultural policy study examining the impacts of trade liberalization and removal of feed ingredient subsidies in Tunisia. A linear programming model was used to simulate private sector response to these policy changes. Increased feedgrain prices result from subsidy removal but effects are lessened if subsidy removal is coupled with trade liberalization. Induced long-term effects are improved efficiency in production of feedgrains, feedgrain substitutes, and livestock.

INTRODUCTION

Like many other governments, Tunisia is currently moving away from state control of trade and pricing of agricultural commodities towards a more market-oriented economy. Agricultural policies are a particular target for reform in the desire to stimulate agricultural productivity. The government is planning to remove subsidies on feed ingredients to livestock

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producers and to liberalize state-controlled imports. This paper summarizes the findings from a recent agricultural policy study which examined the impacts of trade liberalization and removal of feed ingredient subsidies in Tunisia (Kristjanson et al., 1990). A linear programming model was used to simulate private sector response to these policy changes, and options regarding the timing and sequence of policy reforms were explored.

THE FEED INDUSTRY AND AGRICULTURAL POLICY IN TUNISIA

During the 1970s, Tunisia pursued a price policy under which the price of agricultural products was controlled and both factors of production (fertilizer, animal feed) and final consumer products (meat, milk, cereals) were subsidized. A major effort was made to strengthen the poultry and feed milling industries. All feed blending was done by parastatals or private firms acting as contractors for the state. The government set margins which were very lucrative. The feed industry grew rapidly as a result of incentive investment policies coupled with subsidies on feed ingredients (between 1978 and 1984, the government subsidized two-thirds to three-fourths of the cost of feed ingredients). In the early 1980s, the government allowed private firms to sell blended feed under their own labels instead of as contractors.

Tunisia's Office des Céréales (OC or cereals marketing board) imports and distributes animal feed ingredients in Tunisia. Feed blending companies purchase maize, soybean meal, and barley from the OC to mix in varying proportions with vitamin/mineral supplements for the different blended feeds for each livestock and poultry enterprise. The government fixes the price at which the ingredients are sold to the feed manufacturers, which in recent years has provided an indirect subsidy to livestock producers.

The number of feed mills grew from two in 1970 to 284 by 1990, with a total processing capacity of 1.8 million t per year. Since annual feed production fluctuates around 500 000 t/year, considerable over-capacity exists. Of the 284 feed mills, 109 are operations integrated with livestock production, and 175 are solely industrial feed plants. The capacity of these units varies widely, from 1 to 160 t/day, with varying degrees of automation. In 1988, one firm, Poulina, used 34% of total imports of maize, soybean meal, and barley.

The growth in production of blended animal feed coincided with a significant expansion of the poultry sector, which absorbs 70% of the feed used in Tunisia. The poultry sector contributes 35% of total meat production in Tunisia; its fast growth is also due mainly to incentives created by

government policies. These policies have contributed to several distortions in the livestock sector, including weak development of forage crops and poor integration of livestock and cereal production; limited interest in pasture development in the center and south of the country; relatively undeveloped livestock production techniques; poor allocation of resources; and pressure on public finances, strongly felt recently because of large world price increases for imported barley, maize, and soybean meal.

At the same time the domestic feed industry was expanding, so were imports of feed ingredients. In 1988, a year of shortfall in production due to drought, over 200 000 t of corn, 100 000 t of soybean meal, and 450 000 t of barley were imported. The inordinate growth in demand has outstripped the growth in supply of locally produced raw materials used in the processing of blended feed. As a result, the industry has increasingly depended upon outside supply sources. Approximately 80% of feed ingredients are now imported. Faced with severe budgetary constraints, the Government began pursuing a structural adjustment program in 1985 involving changes of certain agricultural policies, particularly the liberalization of prices of animal products (beef, poultry meat, agricultural products). In 1982, feed subsidies were reduced drastically in one action that had severe repurcussions for the feed and poultry industries. In November 1982, feed prices more than doubled, and poultry production fell by over 30% the following year. Many small feed plants went out of business. As of 1987, however, feed ingredients were still subsidized.

In 1987, the Tunisian government reached an agreement with the World Bank to gradually eliminate subsidies on feed ingredients. Unfortunately, 1988 and 1989 were severe drought years. Barley production dropped from 536 500 t in 1987 to 60 000 t in 1988. As a result, the program of subsidy reduction was frozen, and subsidies have increased substantially since 1987. In 1989, feed grain subsidies cost the government 50 million dinars ($45 million), representing 13% of government expenditures on subsidies (Redjeb and Lahouel, 1990). Subsidy reduction resumed in 1990 when production conditions returned to normal.

ANALYSIS OF THE IMPACT OF SUBSIDY REMOVAL AND TRADE LIBERALIZATION

The objectives of this study were to estimate the impacts of two important policy changes on the agricultural sector in Tunisia:
(1) removal of subsidies on livestock feed ingredients, and
(2) trade liberalization for livestock feed ingredients.
While the two policy changes are not necessarily linked, the analysis demonstrated the importance of linkage to minimize adverse impacts of

subsidy removal. The impacts of proposed policy changes, trade liberalization and removal of subsidies on animal feed ingredients were analyzed by simulating the response of the private sector using linear programming (LP) feed blending models. Optimal feed rations were formulated for before and after policy change scenarios. Changes in feed costs from the feed LP's were fed through enterprise budgets for the livestock products to estimate changes in total cost of production of red and white meat, milk, and eggs.

ANIMAL FEED RATIONS

Under current procedures in Tunisia, the government specifies both the nutritional qualities and the ingredient composition of animal feed rations. That is, the government specifies the minimum levels of energy, protein, fiber, and the percentage of ingredients such as maize and soybean meal. In practice, however, regulations are not well enforced.

The current broiler rations consist entirely of maize, soybean meal, and a vitamin-mineral supplement called 'CMV'. The layer rations have some bran and additional calcium but no other ingredients. Hence, the current rations have a very limited range of mostly imported feed ingredients. Two major problems were found to apply to the rations being used by poultry producers: the soybean meal received in Tunisia is normally substantially below accepted international quality standards and the fiber content is higher than accepted standards (40% instead of 44% protein, and 10% instead of 7% fiber) [1]. The resulting poultry rations are low in energy for broilers, layers, starters and pullets, and, in some cases, considerably lower than accepted international standards, resulting in lower feed conversion efficiencies. For the broiler starter and finish rations, the protein levels were found to be considerably higher than those needed in the diets. The layer rations were low in both protein and energy. These deficiencies result in considerably reduced feed conversion efficiency and lower egg production.

RATION OPTIMIZATION

Optimal animal feed rations were formulated as previously noted using a linear programming model. Mathematically, the LP feed ration problem

[1] Personal interviews with Tunisian poultry industry sources.

may be represented as follows:

$$\text{Min} \sum_{i=1}^{n} p_i x_i$$

$$\text{Subject to} \sum_{j=1}^{n} a_{ij} x_j \geqslant b_j \qquad \begin{matrix} i = 1, \ldots, m \\ j = 1, \ldots, n \end{matrix} \qquad x_j \geqslant 0$$

where p_i are the prices of the n feed ingredients x_i, a_{ij} are the nutritional components of each feed ingredient, and b_j are the nutritional requirements (energy, protein, etc.) associated with the m constraints.

RESULTS OF IMPACT ANALYSIS

The direct impact of subsidy removal was calculated using several sets of alternative assumptions. The change in cost of the optimal rations estimated using the LP model was calculated. Then new optimal rations were created assuming a wider variety of available feed ingredients (due to liberalized imports). Finally, the impact of subsidy removal assuming the wider ingredient availability was calculated.

The results showed that non-subsidized rations generally cost about 19% more than those subsidized. To test the quantitative importance of the limitation on feed ingredients, the basic rations dictated by the government were reformulated using a wider variety of feed ingredients. The presumption is that with trade liberalization, the private sector would be free to import whatever ingredients were needed to produce the best poultry rations. Clearly, all possible feed ingredient imports could not be considered. For this analysis, the models included maize, soybean meal, wheat bran, barley, $CaCO_3$, and CMV, in addition to animal fat, soybean oil, tapioca, and fish meal. These additional ingredients are sufficient for testing the importance of a greater diversity of ingredients.

The results of this analysis showed that the rations for the case with subsidies retained were very similar to the optimal base case poultry rations (Table 1). This occurs because with subsidized maize, soybean meal, and barley available, it is most profitable to continue to use these low cost ingredients. However, the availability of soybean oil or animal fat enabled the model to meet the nutritional requirements for energy for all four rations (whereas previously, the energy requirements were not met for the starter or layer rations). While there were no major differences in the rations when the subsidy was retained, there were marked differences in the rations when it was removed (Table 2). In the no-subsidy case, the higher maize, soybean meal, and barley prices provided incentives to use

TABLE 1

Optimal rations with subsidies retained and import liberalization

Feed ingredient/ Nutrient level	Starter	Broiler	Pullet	Layer
Soybean meal (%)	29.8	24.1	14.2	22.5
Maize (%)	65.6	70.9	62.8	62.1
Barley (%)	0	0	12.0	0
Wheat bran (%)	0	0	6.0	0
Soybean oil (%)	0.6	0	0	4.9
$CaCO_3$ (%)	0	0	0	5.5
CMV (%)	4.0	5.0	5.0	5.0
Ration cost (dinar/t)	208	201	180	196
Energy (kcal/kg)	2900	2902	2800	3000
Protein (%)	19.0	17.0	14.0	15.5
Fiber (%)	3.7	3.5	3.8	3.1

TABLE 2

Optimal rations without subsidies and import liberalization

Feed ingredient/ Nutrient level	Starter	Broiler	Pullet	Layer
Soybean meal (%)	25.2	20.4	15.8	20.0
Maize (%)	25.9	25.6	0	9.6
Barley (%)	12.0	12.0	12.0	12.0
Wheat bran (%)	5.0	5.0	10.0	5.0
Soybean oil (%)	4.0	3.6	3.2	8.8
Tapioca (%)	19.0	23.4	49.0	29.1
Fish meal (%)	5.0	5.0	5.0	5.0
$CaCO_3$ (%)	0	0	0	5.5
CMV (%)	4.0	5.0	5.0	5.0
Ration cost (dinar/t)	245	236	208	227
Energy (kcal/kg)	2900	2900	2800	3000
Protein (%)	19.0	17.0	14.0	15.5
Fiber (%)	5.0	5.0	6.5	5.0

other ingredients in an effort to reduce total feed costs. The models were able to substitute other ingredients for the three current imports and thereby reduce total feed costs.

The impact in terms of percentage change in the price of feeds under the two scenarios is shown in Table 3. It shows that allowing free trade in feed inputs potentially reduces the impact of subsidy elimination by about

TABLE 3

Difference in subsidy elimination impact with substitution (percent change in price of feeds)

Case	Starter	Broiler	Pullet	Layer
Subsidy elimination impact with original feed ingredients [a]	19.3	18.9	18.1	19.5
Subsidy elimination impact with substitution of new ingredients	17.6	16.1	13.7	22.6

[a] The rations in the substitution case all meet the nutritional requirements, whereas the starter and layer rations in the no-new-ingredients case do not meet the nutritional requirements for energy. That explains why the layer ration impact is greater with substitution.

one-sixth. That is, holding quality constant, the increased feed cost would drop from about 19% to about 16%.

The reduction in direct subsidy impacts is probably not the greatest advantage of trade liberalization, however. The greatest gain is associated with the improved poultry rations that could result from a greater variety of inputs being available. It is impossible to precisely quantify this gain, but the order of magnitude can be estimated. In Tunisia today at least 190 g of feed are required to produce one egg, whereas only about 150 g are needed in Europe. This lower conversion efficiency may be partly due to factors such as amino acid imbalances, but the low level of energy in the layer diet is certainly a major cause. In fact, it is reasonable to assume that at least half this difference in feed conversion efficiency is due to feed quality. If a well-balanced layer ration would improve the feed conversion in Tunisia to yield one egg for each 170 g of feed (half the difference), the overall feed cost of producing eggs would fall by 20 g of feed per egg or 11%. Hence, over half the increased feed cost due to subsidy removal could be recouped through improved feed conversion efficiency. It is important to note, however, that this efficiency gain can be achieved only by removing trade restrictions so that feed blenders have access to the ingredients needed to produce well-balanced, high energy rations.

IMPACTS OF POLICY CHANGES ON COST OF PRODUCTION

Representative cost-of-production estimates were used to translate the changes in input costs into impacts on animal product costs. The largest impact was on the poultry sector since feed costs constitute 67% of the total cost of producing broilers and 85% of the cost of producing eggs. Since most eggs and a substantial part of broiler production are controlled by large producers, they will be the most affected by the elimination of

subsidies. The analysis showed that a complete removal of subsidies tomorrow would result in a 13% increase in the cost of producing broilers, and a 14% increase in the cost of producing eggs. If, however, subsidy removal were linked with trade liberalization, broiler costs would increase by only 2.6%, and the cost of eggs would increase by 8%. In other words, subsidy removal causes much smaller price increases if coupled with trade liberalization.

The direct impact of subsidy removal on other livestock – dairy, beef, and sheep – would be low for most producers. The cost of blended feed is typically less than half of the total cost of feed (since forage crops are also fed to livestock), and less than one-third of the total cost of production. This is especially true for smaller, family-run enterprises. Tracing the impact of higher feed costs through the cost structure to determine the impact on the cost of producing milk (no possibility of improved or cheaper rations through import diversification was considered in this case) showed an increase of 4–6% in the cost of production. The smallest impact was found to be on the cost of production of beef (1.5%), since the share of concentrated feed in total cost only ranged from 7% to 11%. The impacts on sheep and other ruminants would be quite small as well ($< 2.0\%$).

CONCLUSIONS

Although this study has focused on the Tunisian livestock sector, the constraints faced and policy implications are similar for many countries undergoing market liberalization. Morocco, Egypt, and Pakistan are all currently facing similar issues. The major objective of subsidy removal and trade liberalization is to improve the efficiency of the agricultural sector. A secondary objective is to reduce budgetary outlays. Removing subsidies will lead to higher costs in the short run, and better allocation of resources and increased efficiency (and lower costs) in the long run. The Tunisian analysis has shown, however, that major linkages between subsidy removal and trade liberalization need to be considered. Subsidy elimination should occur at the same time as trade liberalization to avoid more severe impacts of subsidy removal without improved efficiency in feed production arising from diversification in input use.

The impacts of subsidy removal will be the greatest for the poultry sector since feed costs constitute 67% of the total cost of producing broilers and 85% of the cost of producing eggs. Since most eggs and a substantial part of broiler production are controlled by large producers, they will be the most affected by the elimination of subsidies. The analysis shows that a complete removal of subsidies tomorrow would result in a 13% increase in the cost of producing broilers, and a 14% increase in the cost of producing

eggs. If, however, subsidy removal were linked with trade liberalization, broiler costs would increase by only 2.6%, and the cost of eggs would increase by 8%. In other words, the impacts of subsidy removal would be much larger without trade liberalization.

The direct impact of subsidy removal on other livestock – dairy, beef, and sheep – would be low for most producers. The cost of blended feed is typically less than half of the total cost of feed (since forage crops are also fed to livestock), and less than one-third of the total cost of production. This is especially true for smaller, family-run enterprises. Therefore it is the largest producers who will be affected the most.

One negative impact of the feed subsidies (and particularly for small family operations) has been the lack of development of domestic production of crops such as barley, triticale, and forage crops going into feed. Access to cheap feed has led to overgrazing in some instances since the availability of cheap feed provided little incentive to limit herd size. With subsidies eliminated and higher purchased feed costs, farmers would have an incentive to be more efficient in producing substitutes for feed concentrates such as forage crops. A recent FAO study emphasizes the need for more diversified forage crops, improved varieties and production techniques, and improved conversion ratios in Tunisia (FAO, 1989). The study predicts that the demand for forage will be far greater than supply by the year 2001 unless production increases significantly. Producers will have little incentive to increase forage crop production, however, as long as they have access to cheap imported feed ingredients. Subsidy reduction on imported feeds will provide an incentive for greater productivity in domestic products.

REFERENCES

FAO, 1989. Programme de developpement des productions fourrageres et de l'élevage. Food and Agriculture Organization, Rome.

Kristjanson, P., Tyner, W.E., Schrader, L.F., McEllhiney, R.R., Majdoub, A. and Balti, M., 1990. Impact of removal of feed grain subsidies and import liberalization. APIP Rep. 90–7, Agricultural Policy Implementation Project, Abt Associastes, Bethesda, MD.

Newman, M., 1991. Seasonal pricing and institutional reform options for Tunisia's grain marketing system. Work. Pap. 90–13, Agricultural Policy Implementation Project, Abt Associates, Bethesda, MD.

Newman, M., Ladd, J., Boughzala, M. and Ben Amar, B., 1989. A plan of action for Tunisia's cereals sector: first phase report. Final Rep. 90–9, Agricultural Policy Implementation Project, Abt Associates, Bethesda, MD.

Redjeb, M. and Lahouel, M., 1990. Etude sur la caisse générales de compensation. Work. Pap. 90–1, Agricultural Policy Implementation Project, Abt Associates, Bethesda, MD.