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ESA Working Paper No. 06-03

February 2006

Agriculture and Economic Development Analysis Division

The Food and Agriculture Organization
of the United Nations

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An assessment of the impact of increasing wheat self-sufficiency and promoting cash-transfer subsidies for consumers in Egypt: A multi-market model[1]

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Abstract

Wheat is central to the government of Egypt's food security policy which is based on increasing self-sufficiency in wheat on the one hand and subsidizing bread for consumers on the other hand. This paper uses a multi-market approach to assess the impact of increased self-sufficiency in wheat and a switch to a cash-transfer subsidy on cropping patterns, food consumption, production, input use, and income. The findings show that raising self-sufficiency in wheat would reduce reliance on imports but would also adversely affect other sectors, in particular livestock. At full self-sufficiency in wheat, berseem the main animal feed would nearly vanish, with negative repercussions for livestock production. The simulations also show that a move to a cash transfer subsidy system would improve targeting of the poor and eliminate distortions on the consumption side. Finally, under the current wheat policy an increase in the world price of wheat would intensify the adverse consequences of both self-sufficiency and consumer subsidies at the agricultural sector level and economy wide.

Key words*:* Egypt, agriculture sector, wheat, multi-market model, wheat self-sufficiency, bread subsidy, policy scenario impact analysis.

JEL: Q11, Q18

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1. INTRODUCTION

Many countries equate food self-sufficiency with food security. Policy makers are typically concerned about the risk and uncertainty with regard to availability and prices when having to purchase in the future. Unforeseen events such as major purchases by another country, war or political boycott are considered a potential threat to food security. This is – to a large extent - true for Egypt which is one the largest importers of wheat in the world. As a consequence Egypt has adopted a food security policy based on ensuring maximum self-sufficiency for wheat as this is the most important staple food in the country.

This study aims to quantify the effects of increasing self-sufficiency in wheat production on cropping patterns, producer and consumer prices, income distribution and other variables related to wheat policy. The study also aims to explore the effects of shifting from the current system of bread subsidy at the consumer level to cash transfers. Furthermore the study includes an analysis of the effects of increasing self-sufficiency ratios (domestic production/total availability) from the current level of 55 percent to 65 percent and higher. Finally, a world price shock will also be analyzed in terms of its impact on consumption, production and income distribution.

2. WHEAT POLICY IN EGYPT

Wheat as the major cereal crop in Egypt is the core of the government's food security policy. Efforts to increase food production, in particular wheat, have received top priority in the agricultural development programs since the implementation of the first Five-year Development Plan starting in 1983. In the context of Egypt's food security policy, wheat policy has two main dimensions: 1) The food availability dimension, where the main focus is to increase the self-sufficiency ratio of wheat production from the current level: 55 percent to full self-sufficiency. 2) The second is that of accessibility to ensure that the low-income households are able to acquire food.

2.1 Producer policy

To achieve the first target mentioned above, the government of Egypt (GOE) encourages wheat production using a mechanism that is based mainly on producer price support and the voluntary procurement of wheat. The government procurement ranges from 2 to 3 million tons annually, i.e. about 30-40 percent of wheat production, at farm prices that are mostly higher than world equivalent prices. During the late nineties the nominal protection coefficient (NPC) for wheat reached about 1.4 indicating that wheat producers enjoyed an implicit subsidy equal to 40 percent over the world price. Recently, particularly after the depreciation, the NPC decreased to 1.05, i.e. about 60 Egyptian pounds (L.E.) per ton as implicit support. With a procured amount of domestically produced wheat of 2.4 million tons in 2004 the total subsidy for wheat producers is about L.E. 144 million.

In addition to the price support mechanism the government has implemented a successful research program that generated high yield varieties (HYVs) which significantly contributed to the growth of wheat production in the last decade. As a result of this policy, wheat production has grown at about 4 percent throughout the period 1980-2004. As shown in table 1, wheat

production increased from 4.3 million tons in 1990, implying a 42.5 percent self-sufficiency rate, to 6.8 million tones, or 55 percent self-sufficiency in 2003.

Table 1: Wheat consumption, production, procurement and self-sufficiency in selected years

	1985	1990	1995	2000	2003
Total consumption (million MT*)	6,238	10,033	12,100	12,093	12,839
Domestic production (million MT)	1,872	4,268	5,080	6,455	6,840
Voluntary procurement (million MT)	600**	1,064	1,524	2,200	2,400
% of production	32.0	25.0	30.0	34.5	35.0
Self-sufficiency ratio	30.0	42.5	42.0	53.4	53.3

Source: Computed from: The Ministry of Supply and Home Trade, Cairo.
*MT denotes metric tones.
** Mandatory procurement: before the implementation of the structural adjustment program i.e. before 1987, wheat producers had to deliver 0.30 ton per feddan (acre).

2.2 Consumer policy

Food accessibility is promoted by subsidizing *baladi* bread and wheat flour in addition to two other commodities in the current food subsidy system: Sugar and cooking oil. While *baladi* bread and wheat flour are available at subsidized prices to all consumers without restriction, sugar and cooking oil are supplied at subsidized prices but with ration cards. The cost of the subsidy for *baladi* bread is about L.E. 6 billion (2004) which represents about 60 percent of the total cost of the food subsidy. The subsidy for wheat flour represents about **15** percent of the total subsidy. The total subsidy for *baladi* bread and wheat flour represents about 5.1 percent of national expenditure and around 1.3 percent of GDP (2004/05). The increase in the cost of the food subsidy in the last years is due to the increase in the subsidy of *baladi* bread.

The poor and non-poor have equal access to the subsidized bread. About 75 percent of the non-poor and 66 percent of the poor receive subsidized bread. Clearly the subsidy does not target poor households properly. However, despite the poor targeting of subsidized bread in Egypt studies confirm that subsidized bread is one of the most effective means of alleviating poverty in Egypt. The World Bank also points out that subsidizing *baladi* bread is one of the most efficient food subsidies: and has helped 730,000 people out of poverty in fiscal year 2001-2002. The bread subsidy has been particularly effective in rural areas where it has helped 11 percent of the poor out of poverty. This is due to the large dependency of poor households on bread as the basic source of nutrition, as it accounts for 27 percent of their total caloric needs (this compares to 22 percent for those better off). In Cairo the poor obtain about 38.5 percent of their caloric needs from subsidized bread.

Research by Ahmed and Bouis (2003) indicates that although the current system of food subsidies is generally effective as a social safety net that helps protect the poor during economic restructuring, it has major problems and weaknesses. Firstly, the current system is not well targeted towards the poor with almost 60 percent of benefits go to higher-income households (i.e. those constituting the top 60 percent of the population in terms of income). Studies show that

while 11.5 million people qualify for subsidized bread a large number of people considered non-poor also receive it. This threatens the efficiency of the bread subsidy in decreasing poverty in Egypt. Secondly, limited outlets for subsidized bread lead to a significant amount of time being spent queuing. Thirdly, a considerable portion of the benefits is misappropriated in the distribution system. Estimates suggest that leakages in the Egyptian food subsidy system accounted for about 16 percent of the total cost of food subsidies.
The flow of wheat supplies and subsidized wheat flour (82 percent extract) for both *baladi* bread and flour to consumers is different from that of non-subsidized wheat. The total amount of wheat grains supplied to the subsidy system is about 6.8 million tons (2004); 35 percent of which (2.4 million tons) is procured from domestic production and 65 percent (4.4 million tons) is imported. These supplies are administrated by the General Authority for Supply Commodities (GASC) which is affiliated to the Ministry of Supply and Home Trade (now the Ministry of Trade and Industry). Subsidized wheat is distributed between urban and rural sectors with 4.6 million tons for the former and 2.2 million tons for the latter, i.e. 68 and 32 percent, respectively. Additional amounts of 1.4 million tons are imported by private traders and used by urban consumers.

3. THE MODEL

The multi-market model allows one to assess the impacts of alternative subsidy policies on the production and importation of wheat, the real income of rural and urban households by income level, and the government's budget balance. Policies that can be evaluated with this basic model include: changes in subsidies on wheat and fertilizers, changes in input and output prices, as well as other actions. The multi-market model fully integrates production and consumption decisions, and incorporates feedback from income changes on consumption and production patterns both within and across different crop sectors. Using this model it is possible to evaluate both direct and indirect (unintended positive and negative) consequences of policy changes.

The multi-market model includes considerable refinements in the specification of demand equations and income distributional consequences. For example, the model incorporates detailed income-and price substitution effects across commodities and can track changes in real income across producer and consumer groups stratified by income level. The multi-market model can be used to evaluate the effects of alternative arrangements for targeting food subsidies on the welfare of different income groups and its repercussions on the government budget, the latter objective of which will be used in this paper. We begin with a description of the structure of the model and the equations that make it up.

3.1 Product categories

The product categories are: 1) food items, 2) non-food consumption items, and 3) agricultural inputs. More specifically, these items include:

Wheat (WHS = subsidized, and WHNS = non-subsidized): Wheat is the backbone of the food security policy in Egypt. About half of the total consumption of wheat is *baladi* bread

which is subject to subsidy. Since wheat in Egypt has two markets, subsidized wheat and not-subsidized wheat, we include wheat as two commodities.

Rice (RICE): Rice is the only exportable cereal crop and it is the third crop after wheat and maize in terms of cultivated area. Rice cultivation is very water intensive and uses about 10 billion cubic meters of water a year, representing 20 percent of the total water used by agriculture.

Maize (MZ): This product is the second cereal crop after wheat in terms of cultivated area. Locally produced maize is used partially for food (500,000 tons of maize are mixed with wheat to improve the rate of wheat self-sufficiency) and partially for animal feed. Imported maize (about 4.7 million tons) is used as feed in poultry production.

Livestock (LIVSTK): Livestock production contributes about one third of the value added originating in agriculture. Meat and dairy are the main products of this sub-sector. In this study, we assume that livestock production is only for meat.

Berseem (BERSEEM): This product (Egyptian clover) is used entirely as a feed input for livestock production.

Two agricultural inputs are modelled explicitly:

Fertilizers (FERT): This is an aggregation of the use of nitrogen and phosphoric fertilizers.

Mechanical Traction (MECH): This is an aggregation of the use of tractors and other uses of traction.

The two other obvious agricultural inputs are: Land and water, which are included as variable inputs but are not incorporated into the model as traded commodities.

3.2 Households

Production and consumption patterns are distinguished among four broad types of household groups: urban non-poor (URBRICH), urban poor (URBPOOR), rural non-poor (RURRICH) and finally rural poor (RURPOOR). Each of the household groups is assumed to be involved in all of the production activities.

3.3 Structure of the model

There are six blocks of equations in this multi-market model: prices, supply, input demand, consumption, income and equilibrium conditions.

3.3.1 Price block

The price block is comprised of 42 equations that reflect the relationship between producer prices (PP), consumer prices (PC) and world prices (PW). For tradable goods, domestic prices are related to world prices; however, these prices are determined exogenously by fixed world prices while prices of non-tradable goods are determined by supply and demand conditions which mean that these prices adjust endogenously to equate supply and demand as described later in the discussion of the equilibrium conditions.

The first 8 equations in this block thus describe the relationship between producer prices (PP_i) and consumer prices (PC_i) :

$$PP_i = \frac{PC_i}{1 + MARG_i} \qquad (1-8)$$

where the subscript *i* denotes a specific commodity and MARG denotes the domestic marketing margin.

The border prices (PM) of the four importable products, *im* - wheat, maize, livestock, and fertilizer - are linked to the world price by the exchange rate, *er*, producer subsidies ($PSUB_{im}$), and the international marketing margin ($MARG_{im}$):

$$PM_{im} = \overline{PW}_{im} * er * (1 + MARG_{im}) * (1 + PSUB_{im}) \qquad (9-12)$$

The border prices (PX) of the only exportable product, rice (*ix*), is linked to the world price by the exchange rate:

$$PX_{ix} = \overline{PW}_{ix} * er \qquad (13)$$

The consumer prices (PC) for the five importable items (*im*) - not-subsidized wheat (WHNS), subsidized wheat (WHS), maize, livestock, and fertilizer - are related to the border price by the commodity specific border-to-market marketing margin and by potential consumer subsidies ($CSUB_{im}$).

$$PC_{im} = \overline{PM}_{im} * (1 + MARG_{im}) * (1 + CSUB_{im}) \qquad (14-18)$$

We assume that rural consumer prices and user prices do not differ from urban consumer prices and user prices (marketing margin that reflects transportation and marketing costs equal zero (8 equations).

$$PC_{i,rural} = PC_{i,urban} \qquad (19 - 26)$$

We assume that poor and non-poor households within any given milieu face the same prices. Thus there is one urban price for each commodity during each season (8 equations):

$$PC_{i,urbpoor} = PC_{i,urbrich} \qquad (27-34)$$

and one rural price (8 equations):

$$PC_{i,rurpoor} = PC_{i,rurich} \qquad (35-42)$$

4.3.2 Supply Block

The supply block represents the domestic production of food and non-food crops (WHS, WHNS, RICE, MZ, BERSM) and livestock (LIVSTK). Output supply is a function of:

$$q_i^s = q_i^s\left(p, w, z^s\right)$$

where: q_i^s is agricultural product supply, p is product price, w is input price and the z^s are shifters in the product supply equations. The supply equations for the five products are written as:

$$dq_i^s / q_i^s = e_{ii}\left(dp_i / p_i\right) + e_{ij}\left(dp_j / p_j\right) + e_{if}\left(dp_f / p_f\right) + e_{iE}\left(dE / E\right) \qquad (43-47)$$

where: q_i^s is quantity supplied, e refers to elasticities, p to prices, E is a fixed factor such as educational attainment, and subscripts are as follows: i refers to crop where i = 1, 2, …, 5 and j = 1, 2, …, 5 , $i \neq j$, f refers to inputs (fertilizers, pesticides, and mechanical traction). Thus e_{ij} refers to the supply response of elasticity of crop i to changes in crop j prices, and finally e_{ii} refers to own price elasticity.

4.3.3 Input Demand Block

The input demand block describes the demand for agricultural inputs (fertilizers, and mechanical traction). Input demand is a function of:

$$x_i^d = x_i^d\left(p, w, z^d\right)$$

where: x_i^d is the input demand, p is product price, w is input price, and the z^d are shifters in the input demand equations. The total demand TX_i^d for the two inputs is simply the sum of household demand HS_i^d:

$$TX_i^d = \sum_h HX_i^d \qquad (48-49)$$

Total water demand (TWD) is:

$$TWD = \sum_h HD_w \qquad (50)$$

Total land demand (TlD) is:

$$TLD = \sum_{h} HD_{l} \qquad (51)$$

4.3.4 Consumption Block

The consumption block shows the demand for food and non-food consumption items (WHS, WHNS, RICE, MZ, BERSM, LIVSTK). Demand is a function of:

$$q_i^d = \sum_{h} N_h q_{hi}^d \left(y_h, p, t, z^d \right)$$

where: q_i^d is the final demand for crop *i*, N_h is population in household class h, *t* is consumer tax rate, y_h is household class *h* per capita income, q_{hi}^d is the final demand for crop *i* in household class *h*:

For wheat:

$$q^d = q^{sd} + q^{nsd} \qquad (52)$$

$$q^{sd} = g * q^s + M^g \qquad (53)$$

$$q^{nsd} = (1-g) * q^s + M^v \qquad (54)$$

$$M^t = M^g + M^v \qquad (55)$$

where: q^d is wheat consumption, q^{sd} is subsidized wheat, q^{nsd} is non-subsidized wheat, q^s is total wheat production, M^g are wheat imports by the government, M^v are wheat imports by private sector, and M^t denotes total wheat imports.

Total demand for the six consumption commodities is the sum of the household demands:

$$q_i^d = \sum_{h} q_i^d \qquad (56-61)$$

4.3.5 Income Block

Agricultural income in the four household groups (YAI_h) is the sum of the values of crop and livestock production less input costs:

$$YAI_h = \sum_{i} \left(PP_i * q_i^s \right) + \left(PP_i * q_{livstck}^s \right) - \sum_{i} \left(PC_i * TD_i^d \right) \qquad (62-65)$$

Total household incomes (YH_h) are the sum of agricultural incomes and exogenously determined non-agricultural income:

$$YH_h = YAI_h + \overline{YNAI}_h \qquad (66-69)$$

4.3.6 Equilibrium Conditions

Equilibrium conditions on crop and input markets depend upon the tradability of each crop and input. For a non-tradable, the equilibrium condition is the equality between supply and demand. Any trade in non-tradables is taken as an exogenous difference between domestic supply and demand. This equilibrium condition determines both the equilibrium price and quantity. For tradables, by contrast, prices are the exogenous border prices (the nominal exchange rate is exogenous) corrected by trade distortions (in our case, import tariffs) and the international marketing margin.

The balance of trade (*BOT*), the balance of government revenues and expenditures (*G*), changes in the Consumer Price Index (*CPI*), and changes in real income (real *y*) are residuals. They are used to indicate the magnitude of the deficits or surpluses of a particular multi-market equilibrium with no feed back on the exchange rate or the domestic price system.

Based on the above, for each of the five commodities (WHS, WNHS, RICE, MZ, LIVSTK) the total quantity supplied (sum of domestic supply and net imports) is equal to the total quantity demanded (demand by households as well as animal feed):

$$q_i^s + M_i = q_i^d + \overline{FEED}_i \qquad (70-74)$$

Note that animal feed is fixed at zero for livestock products. Supply of BERSM is derived from current local supply:

$$q_{berseem}^s = q_{berseem}^d \qquad (75)$$

Supply of inputs - fertilizers and mechanical traction - is derived from imports and current local supply:

$$M_{ix} + x_{ix}^s = TX_{ix}^d \qquad (76-77)$$

Finally, the balance of trade (BOT), changes in the Consumer Price Index (CPI), changes in real income (real y) are:

$$BOT = \sum_i NE_i \qquad (78)$$

Where: *NE* = Net Exports

$$\Delta \text{Re}\, al \quad y = \Delta y - \Delta CPI \qquad (79)$$

5. DATA REQUIREMENTS

Three types of data are needed to calibrate the model to a baseline solution. These are:

1. **Levels:** production, consumption, income, and input levels must be defined for all commodities and household groups.

2. **Prices:** consumer, producer, user, and border prices must be defined for all commodities. They also define the marketing margins.

3. **Parameters:** these are the demand and supply elasticities, all of which are best guesses in the absence of reliable data.

6. BASELINE SOLUTION

The baseline solution corresponds to wheat production of 6.2 million tons per year. This corresponds to 2.5 million feddan of land, and 4 billion m^3 of water, and imports of 5.8 million tons of wheat per year. After subtracting losses the total supply of wheat is 11.3 million tons.

Berseem, as a winter crop, is highly competitive with wheat (cultivated on a similar amount of land). Production is over 65 million tons a year, all for local consumption, and there are no imports. By subtracting losses, estimated at 3,260,000 tons, the quantity of berseem supplied reaches 62 million tons.

At the level of producer prices, the government used to subsidize the producer by setting a producer price of wheat that is much higher than the world price, in order to encourage producers to cultivate wheat. Recently however, and following the government's total liberalization of exchange rates, the world price has come very close to the producer price leading to the complete erosion of the subsidy of wheat producers. This effectively limited the government subsidy to consumers.

The government supports consumers by setting the price of wheat flour at about L.E. 300 per ton (equivalent to L.E. 238 per ton of wheat) which makes the total cost of the bread subsidy (support for consumers) L.E. 6.2 billion.

7. POLICY SIMULATIONS

Three policy simulations are analyzed using the multi-market model. The first is performing a sensitivity analysis for wheat self sufficiency in Egypt. In this exercise, we put to test three cases: self sufficiency at 65 percent, self sufficiency at 75 percent, and at 100 percent. This was to observe how these different rates of self sufficiency affect imports, cultivated areas of wheat and other crops, prices (producer and consumer), and real income.

The second is replacing the price subsidy by cash income (transferring from in-kind transfer programs to cash transfer programs). And the third policy simulation is a 20 percent increase in the world price of wheat.

7.1 Self-sufficiency scenarios

Results of the multi-market model with respect to self-sufficiency policy scenarios are presented in Annex table 1. Decreasing the production of berseem (the main competitor to wheat) to an almost very low 5 million tones negatively affects the production of meat, which highly depends on berseem as the main source of fodder, which leads to a significant increase in the import of meat. The difference in water needed for wheat as opposed to berseem cultivation is about 2 billion m^3 and this could be used in the further cultivation of new land. This scenario also leads to increased use of fertilizers by about 400,000 tons a year due to the difference between the wheat and berseem feddan.

On the level of producer prices, there is a huge jump in the price per ton of berseem and meat from L.E. 152 to L.E. 860 in the case of berseem and from L.E. 20.000 to L.E. 38.000 for meat, due to the lower rate of production. The user price of berseem rises from L.E. 167 to L.E. 876 while the consumer price of meat increases from L.E. 30.000 to L.E. 57.000.

As a further consequence of the change in the produced quantity of wheat, there is a decrease in the nominal income in rural areas that ranges between 5 percent for the rural poor to over 8 percent for the rural non-poor. This is due to the profitability of the berseem feddan being higher than that of the wheat feddan. Therefore, consumer demand for wheat and livestock also decreased following their respective income elasticities. The total government budget cost increased from L.E. 8.5 billion to L.E. 8.8 billion.

Secondly, we consider the scenario of 65 percent wheat self-sufficiency. This scenario implies that the amount of locally produced wheat increases to 7.8 million tons, which in turn implies imports of 4.2 million tons.

This scenario results in the following: A decrease in the production of berseem to 48 million tons, which negatively affects the production of meat as livestock production relies heavily on berseem as the main source of fodder, which in turn leads to an increase in the import of meats. This scenario also leads to the increased use of fertilizers by about 158,000 tons a year. On the level of producer prices, there is a jump in the price of a ton of berseem and meat from L.E. 153 to L.E. 244 in the case of berseem and from L.E. 20.000 to L.E. 25.000 for meat due to the lower rate of production, and also a rise in the user prices of berseem from L.E. 167 to L.E. 260.

A further consequence of the change in the produced quantity of wheat is the decrease in nominal income in rural areas of between 2 percent for the poor to about 4 percent for the rural non-poor. Therefore, consumer demand for wheat and livestock also decreases following their respective income elasticities. The real income of the rural poor and non-poor decreased by 2.2 and 4.8 percent, respectively. The total government budget cost rises from L.E. 8.5 billion to L.E. 8.7 billion. The balance of trade also decreased from L.E. 6.8 billion to L.E. 4.9 billion.

Thirdly, we consider the scenario of 75 percent wheat self-sufficiency. This scenario implies that the amount of locally produced wheat be raised to 9 million tons, which implies imports of 3 million tons.

This scenario results in the following: Production of berseem falls to 35 million tons which negatively affects the production of meat, leading to an increase in the imports of meat. This scenario also leads to increased use of fertilizers by about 283,000 tons a year. With regard

to producer prices there is a rise in the price of a ton of berseem from L.E. 153 to L.E. 457 due to the lower rate of production, and also a rise in the user prices of berseem from L.E. 167 to L.E. 472. As a further consequence of the change in the produced quantity of wheat, there is a decrease in the nominal income in rural areas that ranges between 3.6 percent for the poor to about 6.1 percent for the non-poor. Therefore, the consumer demand for wheat and livestock also decreased following their respective income elasticities. The real income decreased for the rural poor and non-poor by 3.8 percent and 6.2 percent, respectively. The total government budget cost increased from L.E. 8.5 billion to almost L.E. 8.8 billion. The balance of trade also decreased from L.E. 6.8 billion to L.E. 3.5 billion.

7.2 Cash transfer scenario

This scenario is based on the idea of replacing the current bread and flour price subsidy program with cash transfers that target the poor. This could help resolve many problems for the government, including the way of identifying target groups, how to make the cash transfers, and the freedom with which the recipients can use the cash (coupons system). In this scenario it is assumed that there are no subsidies for wheat producers and that the producer price is determined by the world price.

Recent experience in Egypt shows that the cash transfer system has been very well accepted since it targets only poor households in rural and urban areas; it does not affect the preferences of producers and consumers, and most importantly, it does not put unrealistic prices on bread. This serves the national plans for the economic policies in Egypt, which are based on a move towards an open economy and limiting price distortions.

Results are presented in Annex table 2. There is a decrease in the quantity of wheat produced from 6.2 million tons to 5.7 million tons. This is due to the fall in the producer price from L.E. 1175 to L.E. 1021. There is also a rise in the production of the competing crop, berseem, from 65 million tons to about 70 million tons. All this leads to an increase in wheat imports from 5.8 million tons to 6.2 million tons, leading to an increase in the balance of trade by 5.3%.

In this scenario, we also assume that the government has distributed the L.E. 8.5 billion, that would have previously been used in subsidizing consumers (see baseline solution), on the rural and urban poor. Results show that the nominal income would rise by 1.4 and 1.6 percent for the rural and the urban poor, respectively.

Consumer demand for wheat and livestock also increased following their respective income elasticities. The rise in livestock demand induces a rise in livestock production, and in turn also induces a rise in berseem demand. In this scenario the rural and urban rich had neither a positive or negative effect on their income.

7.3 World price of wheat increase scenario (+20 percent)

As mentioned earlier in the section covering the price block, the producer price of wheat is related to its world price. Therefore, an increase in the world price of wheat will lead in turn to

an increase in the producer price from L.E. 1175 to L.E. 1410. Results for this scenario are presented in Annex table 2.

The mechanism involved shows the importance of taking into account substitution effects in production and consumption in order to fully assess the result of such a price policy. The direct effect of an increase in the producer price of wheat is an increase in production from 6.2 million tons to almost 7.1 million tons. Therefore, imports of wheat have decreased from 5.8 million tons to 4.8 million tons. This direct effect improves the balance of trade by about 16 percent.

We can also find a decrease in the quantity of berseem produced from 65 million tons to 54 million tons. The production switch is also accompanied by an increase in the nominal income by 0.6 and 2.4 percent of rural poor and rural non-poor respectively.

8. CONCLUSION

A wheat policy focused on self-sufficiency would have many economic implications at the sector level. Government intervention aimed at increasing self-sufficiency in wheat, thus alleviating dependency on imports through diverting resources toward wheat production would place a greater burden on agricultural resource allocation.

First, support prices provided to wheat farmers encourage rice cultivation since the rotation of wheat (in winter) followed by rice (in summer) generates higher profits when compared to other rotations. The issue here is that expansion of rice cultivation contradicts GOE policy towards rice which specifies a maximum area of 1 million feddan (about 0.4 million hectare) in its efforts to rationalize water consumption. The other major summer crop that could complement wheat is maize but since it is less profitable it is less also popular with farmers.

Second, expansion of wheat area will necessarily reduce the area under berseem (winter crop) which is the main livestock input. This would lead to an increase in the price of berseem and reduces the incentives to produce this crop. Considering that livestock production accounts for about 30 percent of the value added in agriculture and makes up a major part of farm household's incomes, the social cost of increasing wheat self sufficiency would be high. In addition, consumer's welfare in both urban and rural areas would be reduced because of higher prices for livestock products.

Third, the wheat subsidy for consumers through subsidizing *baladi* bread is a policy which has a number of economic implications. With respect to the public budget the wheat subsidy (L.E. 7 billion annually) constitutes a major (and increasing in recent years) part of government expenditure. Consumers generally enjoy subsidized prices of *baladi* bread; however, because of differential access to this commodity, the main benefit goes to urban consumers. Also, because the subsidy system is not targeted the non-poor acquire part of the subsidized baladi bread which leads to some distributional inefficiency in the system.

Fourth, analysis of a world price scenario shows that increasing the wheat import price would worsen matters in terms of public budget, allocation of agricultural resources, non-wheat growers, and distributional effects. With the subsidized price for *baladi* bread fixed at L.E. 0.05 per loaf which is equivalent to L.E. 240 per ton of wheat grains, any increase in the wheat import price (L.E. 1200 per ton) would increase the value of the current subsidy (L.E. 990 per ton) by the same percentage. If the increase in the world price is transferred to farm prices additional

agricultural resources will be directed more and more towards wheat production at the cost of competing crops, in particular berseem in winter and to some extent cotton. Also, more land and water will be used for rice cultivation, the complementary crop in the rotation. More negative effects on livestock production are also expected. Again, a greater part of the subsidy will be acquired by urban consumers.

Fifth, shifting from the current in-kind subsidy system to a cash system would result in eliminating some of the current systems deficiencies, particularly on the distributional side. First: The cash subsidy will be allocated to the poor, thus eliminating leakage to the non-poor. This implies that the subsidy could be extended to a larger number of the poor than in the case of the in-kind subsidy system. Second: The cash subsidy represents an incremental income for poor households; it is thus not allocated to a specific commodity but rather distributed among commodities according to household preferences. Therefore, greater efficiency is realized on the consumption side under a cash subsidy system.

9. REFERENCES

Ahmed, A. and Bouis, H., 2003, Proxy Indicators of Income for Targeting Food Subsidy, in Ender, Gary and Holtzman, John (eds.), *Does Agricultural Policy Reform worked? The impact on Egyptian agriculture 1996-2002*. Cairo: USAID.

Amin, Khaled Z., 2005, "Food Subsidy Policy in Egypt: Reality & Correction Alternatives" *Consultation Center & Public Administration Research, Public Policies Seminar, Series 26*, March 2005.

Braverman, A. and J.S. Hammer, 1986, "Multimarket Analysis of Agricultural Pricing Policies in Senegal," Chapter 8 in Singh, I., L. Squire and J. Strauss (eds.), *Agricultural Household Models: Extensions, Applications, and Policy*, Baltimore, MD.: The Johns Hopkins University Press.

Braverman, Avishary, Jeffrey S. Hammer, and Choong Yong Ahn, 1987, "Multi-market Analysis of Agricultural Pricing Policies in Korea," in N. Stern and D. Newberry (eds.), The Theory of Taxation for Developing Countries, New York: Oxford University Press.

Sadoulet, E.; de Janvry, A., 1995, *Quantitative Development Policy Analysis*, Baltimore: The Johns Hopkins University Press.

Annex Table 1: Baseline solution and model results: Self-sufficiency scenarios.

Variable	Baseline solution	65% self-sufficiency of wheat	75% self-sufficiency of wheat	100% self-sufficiency of wheat
Domestic production (tons)				
Wheat	6,183,210	7,800,695	9,000,802	12,001,069
Rice paddy	5,600,000	6,159,999	6,720,001	7,280,000
Maize	6,500,000	5,908,958	5,317,911	4,726,868
Livestock (meat)	1,442,225	1,081,669	807,646	129,800
Berseem	65,214,020	48,375,535	35,882,103	5,247,956
Net imports				
Wheat	5,817,859	4,200,374	3,000,267	0
Rice paddy	2585	0	0	0
Maize	4,741,639	5,332,681	5,923,728	6,514,771
Livestock (meat)	141,570	502,126	776,149	1,453,995
Berseem	0	0	0	0
Input demand				
Fertilizer (tons)	4,238,384	4,396,112	4,521,495	4,638,384
Traction (in use)	89,7	102,7	111,7	122,7
Consumption (final demand) tons				
Wheat (subsidized)	5,070,232	5,067,697	5,066,683	5,065,162
Rural poor:	1,521,069	1,520,435	1,520,182	1,489,070
Rural non-poor:	507,023	506,389	506,136	491,813
Urban poor:	2,281,604	2,280,970	2,280,717	2,319,934
Urban non-poor:	760,534	759,900	759,647	764,336
Wheat (not-subsidized)	6,930,837	6,927,372	6,896,183	6,861,529
Rural poor:	1,386,167	1,385,301	1,377,503	1,337,651
Rural non-poor:	2,079,251	2,078,385	2,070,587	2,058,458
Urban poor:	693,083	692,217	684,419	693,083
Urban non-poor:	2,772,334	2,771,468	2,763,670	2,772,334
Berseem	65,214,020	65,732,011	66,028,132	66,214,021
Maize	10,454,724	10,322,556	10,264,110	10,154,123

Annex Table 1: continued

Variable	Baseline solution	65% self sufficiency of wheat	75% self sufficiency of wheat	100% self sufficiency of wheat
Rice	5,200,539	5,257,239	5,311,002	5,369,128
Livestock	1,582,696	1,275,776	1,041,334	966,869
Land share (feddan)				
	Area	**Area**	**Area**	**Area**
Wheat	2,506,178	3,161,777	3,648,204	4,864,297
Maize: white	1,580,070	1,436,395	1,292,719	1,151,165
yellow	77,949	70,861	63,773	54,564
Rice	1,507,634	1,658,397	1,809,161	1,959,924
Berseem short season	572,916	424,987	315,230	0
long season:	1,966,167	1,458,496	1,081,826	180,964
Water use	**(1000m^3)**	**(1000m^3)**	**(1000m^3)**	**(1000m3)**
Wheat	4009885	5058843	5837126	7782835
Maize	4,476,651	4069591	3662528	3,255,468
Rice	8,442,750	9287023.2	10131301.6	10,975,574
Berseem short season	1489581	1104966	819598	0
long season:	5,112,034	3792089	2812748	470,506
Producer prices (L.E./ton)				
Wheat (subsidized)	1175	1175	1175	1175
Maize	800	816	824	865
Berseem	153	244	457	860 lc
Rice	1120 lc	1075	1045	1008
Wheat (not-subsidized) import Price	1175 lc	1175 lc	1175 lc	1175 lc
Livestock	20,000	25,000	28,800	38,000
Consumer prices (L.E./ton)				
Wheat (subsidized)	270	270	270	270
Wheat (not-subsidized)	2000	2011,2	2022,4	2033,6 lc
Rice urban	1840	1789	1701	1656
rural:	1780 lc	1710	1677	1602
Berseem	167	260	472	876

Annex table 1 continued.

Variable	Baseline solution	65% self sufficiency of wheat	75% self sufficiency of wheat	100% self sufficiency of wheat
Livestock	30,000	37,500	43,200	57,000
Maize	1000 lc	1022	1056	1081
Rural poor	816	837	869	882
Consumer subsidy (L.E. million)				
Wheat	8546	8706	8762	8818
Government budget cost (Producer subsidy)				
Wheat	0	0	0	0
Total government budget cost	8546	8706	8762	8818
Balance of trade	6835	4935	3525	0
Share of population	**%**			**%**
Rural poor	45,1	45,1	45,1	45,1
Rural non-poor	0,7	0,7	0,7	0,7
Urban poor	48,8	48,8	48,8	48,8
Urban non-poor	5,4	5,4	5,4	5,4
Base income per capita (L.E. /head)				
Rural poor	6000	6000	6000	6000
Rural non-poor	16000	16000	16000	16000
Urban poor	9000	9000	9000	9000
Urban non-poor	25000	25000	25000	25000
Nominal income		**%**	**%**	**%**
Rural poor	6000	-2,1	-3,6	-5,2
Rural non-poor	16000	-3,9	-6,1	-8,5

Annex table 1:continued

Variable	Baseline solution	65% self sufficiency of wheat	75% self sufficiency of wheat	100% self sufficiency of wheat
Urban poor	9000	0	0	0
Urban non-poor	25000	0	0	0
Consumer price index (CPI)				
Rural poor	100	-0.11	-0.16	-0.22
Rural non-poor	100	-0.9	-0.12	-0.17
Urban poor	100	-0.11	-0.16	-0.22
Urban non-poor	100	-0.9	-0.12	-0.17
Real income (L.E./ year)		%	%	%
Rural poor	6000	-2.21	-3.76	-5.42
Rural non-poor	16000	-4.8	-6.22	-8.67
Urban poor	9000	-0.11	-0.16	-0.22
Urban non-poor	25000	-0.9	-0.12	-0.17

Source: results of the multi-market model

Annex table 2: Baseline solution and model results: Cash transfer program and world price increase scenarios

Variable	Baseline solution	Cash transfer programs	+20% World price
Domestic production			
Wheat	6,183,210	5,750,385	7,110,692
Rice paddy	5,600,000	5,208,000	6,440,000
Maize	6,500,000	6,955,000	5,525,000
Livestock (meat)	1,442,225	1,514,197	1,370,114
Berseem	65,214,020	69,779,000	54,909,910
Net imports			
Wheat	5,817,859	6,250,683	4890377.5
Rice paddy	2585	394,585	0
Maize	4,741,639	4,286,639	5,716,639
Livestock (meat)	141,570	69,598	213,681
Berseem	0	0	0
Input demand			
Fertilizer	4,238,384	4,178,384	4,349,125
Traction (in use)	89,7	122,7	134,5
Consumption (final demand) tons			
Wheat (subsidized)	5,070,232	0	5,151,355
Rural poor:	1,521,069	0	1,577,817
Rural non-poor:	507,023	0	531,400
Urban poor:	2,281,604	0	2,281,604
Urban non-poor:	760,534	0	760,534
Wheat (not-subsidized)	6,930,837	12,193,086	7,041,730
Rural poor:	1,386,167	2,955,240	1,463,792
Rural non-poor:	2,079,251	2,634,278	2,112,519
Urban poor:	693,083	3,022,691	693,083
Urban non-poor:	2,772,334	3,580,872	2,772,334
Berseem	65,214,020	6,671,402	6,540,966

Annex table 2: continued

Variable	Baseline solution	Cash transfer programs	+20% World price
Maize	10,454,724	10,481,225	10,214,417
Rice	5,200,539	5,465,114	5,500,655
Livestock	1,582,696	1,604,854	1,308,652
Land share (feddan)			
	Area	**Area**	**Area**
Wheat	2,506,178	2,330,745	2,882,104.7
Maize: normal	1,580,070	1,685,683	1,356,668
yellow	77,949	83,134	63,927
Rice	1,507,634	1,396,836	1,745,058
Berseem short season:	572,916	572,916	572,916
long season:	1,966,167	2,141,600	1590240.3
Water use	**(1000m^3)**	**(1000 m^3)**	**(1000 m^3)**
Wheat	4009885	3729192	4611368
Maize	4476651	4775806	3835607
Rice	8442750	7822282	9772325
Berseem short season:	1489581	1489581	1489581
long season:	5112034	5568160	4134630
Producer prices (L.E./ton)			
Wheat (subsidized)	1175	1175	1540
Maize	800	765	865
Berseem	153	141	175.7
Rice	1120	1207	1095
Wheat (not-subsidized) Import price	1175	1175	1410
Livestock	20,000	20055	23152
Consumer prices (L.E./ton)			
Wheat (subsidized)	270	0	300
Wheat (not-subsidized)	2000	2000	2023,7
Rice urban	1840	1920	1765
rural:	1780	1860	1677

Annex table 2: continued

Variable	Baseline solution		Cash transfer programs	+20% World price
Berseem	167		167	172
Livestock	30,000		30,055	34500
Maize	1000		965	1045
Rural poor	816		816	816
Consumer subsidy (000000)				
Wheat	8546		8575 (Cash)	8618
Government budget cost (Producer subsidy)				
Wheat	0		0	910
Total government budget cost	8546		8575	9528
Balance of trade	5939 lc		6250	4992
Share of population	**%**	**number**	**%**	**%**
Rural poor	45,1	31,5	45,1	45,1
Rural non-poor	0,7	0,5	0,7	0,7
Urban poor	48,8	34	48,8	48,8
Urban non-poor	5,4	4	5,4	5,4
Base income per capita (L.E. /head)				
Rural poor	6000		6000	6000
Rural non-poor	16000		16000	16000
Urban poor	9000		9000	9000
Urban non-poor	25000		25000	25000
Nominal income (L.E./head/year)			**%**	**%**
Rural poor	6000		1,4	0,55

Annex table 2: continued

Variable	Baseline solution	Cash transfer programs	+20% World price
Urban poor	9000	1.6	0
Urban non-poor	25000	0	0
Consumer price index (CPI)			
Rural poor	100	-0.15	-0.12
Rural non-poor	100	-0.15	-0.09
Urban poor	100	-0.14	-0.12
Urban non-poor	100	-0.14	-0.09
Real income (L.E./year)		%	%
Rural poor	6000	1.25	0.43
Rural non-poor	16000	-0.15	2.31
Urban poor	9000	1.46	-0.12
Urban non-poor	25000	-0.14	-0.09

Source: results of the multi-market model

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