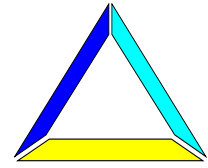




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**AgWP1**

## Working Paper

# Restructuring of the Sugar Sector in Ukraine

### Disclaimer:

This paper was prepared by the authors using publicly available information and data from various sources. All conclusions and recommendations included in this working paper in no circumstances should be taken as the reflection of policy and views of the German Federal Ministry of Food, Agriculture and Consumer Protection.

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## **ANNEX**

Presentations from the sugar seminar dated 4 April 06  
Methodological explanations

## 1. Introduction

The overall objective of this working paper is to develop recommendations for restructuring the sugar sector in Ukraine taking into consideration international sugar market developments, future WTO membership of Ukraine and lessons from other Eastern European countries.

The development of recommendations for the sugar sector has been requested by the 1st Vice Minister Ivan Demtshak of the Ukrainian Ministry of Agriculture Policy based on the decision of the Cabinet of Ministers dated 24th December 2005 „On Approval for the Development of a Restructuring Programme for the Sugar and Sugar Beet Sectors for the Period until 2010“. The analysis and development of recommendations involved various experts from the private and public sector in Ukraine and Germany. The German Federal Ministry of Agriculture provided expertise to report on the latest developments of the reform of the EU sugar market. The sugar industry in Germany provided valuable information on the restructuring of the sugar sector in Eastern Germany, Moldova and Poland as well as on recent world market trends. The sugar industry and sugar beet growers in Ukraine have been involved with the Ukrainian Agrarian Confederation and the Ukrainian Sugar Association UKRZUKOR. The project team took part in various meetings, seminars and conferences to identify the needs of the sector. The project team further analysed various statistics provided by Ukrainian public authorities, available at the Institute and various other sources. This work builds upon previous studies of the Institute for Economic Research and Policy Consulting as well as policy papers of the German Advisory Group. The study team significantly extended the analysis of the issues by applying different methods at farm and factory level. This concerns in particular analysis of gross margins, efficiency coefficients and density functions.

The paper first analyses the current state of the sugar sector in Ukraine with its production and consumption, efficiency, market regulations and trade. The study team put particular emphasis on the analysis of the variation of efficiency in sugar beet and sugar production at different locations as well as between different sugar beet growers and sugar factories in Ukraine.

The international part of the working paper starts with a description of recent world market trends and the impact of the EU sugar market reform. Three case studies from Poland, Eastern Germany and Moldova complete the picture with important experiences and lessons learnt. The study ends with conclusions and specific recommended actions for the Ukrainian Government.

The analyses of future energy market opportunities for the sugar industry, impact on input markets (seed, fertilizers, agro-chemicals) as well as the analysis of isoglucose markets were outside the scope of this study.

## 2 The sugar sector in Ukraine

### 2.1 Sugar beet production

Sugar beet has been the major resource base for domestic sugar factories. Thus, the competitiveness and efficiency of sugar beet production in Ukraine is one of the most important questions to be considered for sustaining the whole sugar value chain.

Despite high production of the sector during the Soviet times (Ukraine was the biggest producer of sugar and consequently of sugar beet in the former USSR), transition to the market became the real challenge for beet sugar production. Due to loss of former Soviet Union markets and limited international competitiveness production of sugar beet fell by almost two-thirds since the beginning of transition, from 44.3 m t of sugar beets in 1990 to 15.6 m t in 2005 (table 1).

**Table 1: Production of sugar beet in Ukraine, 1990-2005**

	1990	1995	2000	2001	2002	2003	2004	2005	2006*
Seeding areas, thd ha	1605.4	1022.1	855.6	970.3	896.6	773.4	732.0	625.5	667.0
Yield (simple average), t/ha	27.57	15.63	17.67	18.26	18.93	20.12	23.80	24.97	22.53
Gross harvest, m tons	44.3	14.1	13.2	15.6	14.5	13.3	16.6	15.6	15.4

Source: State Statistics Committee of Ukraine, Ukragroconsult

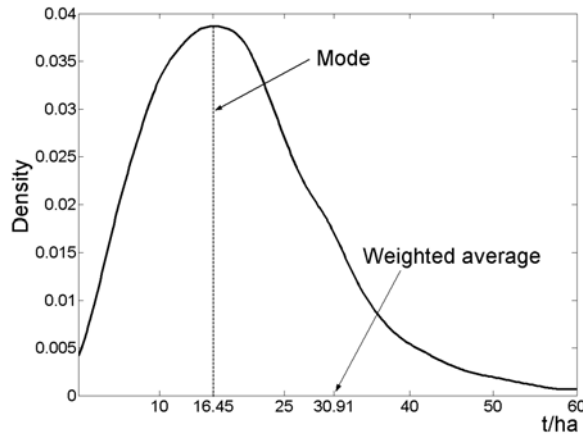
\* 2006 preliminary estimates

This decline, however, has not been stable. After the ever-lowest harvest in 2000 the sector somewhat improved its performance, yet, there has been no clear positive trend. However, slightly increasing seeding areas and growing yields look encouraging, signalling some positive adjustments in the sector.

It should be noted that yield records in Table 1 are only simple average estimates and they do not capture the whole variability of yields within the sector. The weighted average yield (weighted by the production shares) provides more accurate estimates, which, according to our estimations was considerably higher than simple average in 2004, i.e. 30.91 t/ha versus 24.97 t/ha.

The estimated distribution of yields in 2004 (Figure 1) shows a huge dispersion, with a bulk of producers ranging from very low yields to some 30-40t/ha, and a few achieving yields of 40t/ha or more. The mode of the distribution is at 16.95t/ha, showing that the majority of producers had yields in the proximity of that estimate in 2004. If we consider the areas under sugar beet grouped according to the yield bands (as in Table 2), one would notice a positive correlation between the areas harvested and yields. In other words, producers cultivating more sugar beet were capable to achieve higher yields. However, this result should not be mis-interpreted to assume that large-scale production of sugar beets is generally more productive, since as Table 2 also witnesses, producers having the same land area under sugar beets perform differently, with yields belonging to the "worst" as well as to the "best" performing producers.

**Figure 1: Estimated distribution<sup>1</sup> of farm sugar beet yields, 2004**



Source: Own estimations based on IER database

**Table 2: Distribution of areas harvested according to yield bands, 2004**

Yield, t/ha	Area harvested, ha			
	Min	Mode	Mean	Max
0÷10	2	19.7	63.9	2437
10÷20	1	30.1	100.6	1823
20÷30	1	60.0	147.8	2265
30÷40	2	68.3	194.4	3854
40÷50	2	105.4	275.7	1615
>50	10	114.7	309.1	2114

Source: Own estimations based on IER database

Figure 2 shows the estimated distribution of farm level output technical efficiency scores in the sector<sup>2</sup>. Efficiency scores show how far producers are located from the best producers given production costs they have. In other words, the best producers have 100% efficiency ('1' efficiency score as in Figure 2), the worst producers are located to the left from 1. So, if a producer has 0.8 efficiency score (or 80% efficient), it is said that he can expand the output by 20% further at the same costs by improved farm practice, adjusting capital/labour ratios and enhanced farm management.

As Figure 2 reveals, the majority of sugar beet producers are only efficient at a level of 43%. Despite a slightly higher weighted average efficiency score (59%), it is evident that domestic producers underutilise their potential, or use resources at hand inefficiently. It occurs due to various reasons, e.g. poor farm management, sub-optimal farm practices (low quality seeds, high seeding density, low input use), inadequate machinery etc. outside the scope of this paper. So potentially, provided enhanced efficiency, Ukraine could have produced about 26.94 m t of sugar beet, i.e. about 10 m t more than actually produced, at the same costs in 2004.

Figures 3 and 4 provide information on the costs of producing sugar beets. One might notice that the majority of farms invested about UAH123/t or UAH 2392/ha of sugar beet. The average figure was about UAH176/t or UAH 2782/ha of sugar beet in 2004. The distribution of costs is rather broad, ranging somewhat near UAH 1000/ha to more than 5000 UAH/t. Unsurprisingly, producers putting more money into production received higher yields. Table 3 shows a positive correlation between production costs and yields (i.e. mode and mean of the production costs distribution of each yield band show a positive trend). So, producers achieving more than 50t/ha yield spent UAH5532/ha, and the majority within this yield band spent UAH5177/ha.

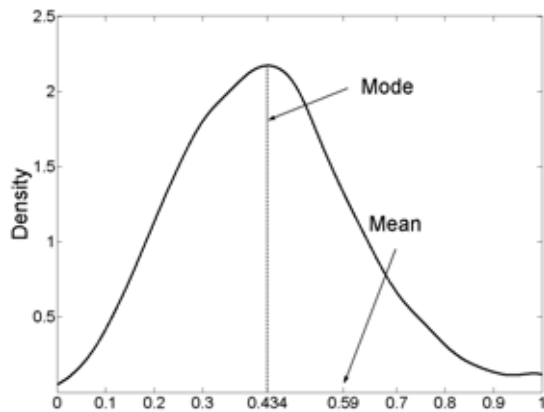
In a further step we compared the above production costs with world market prices to infer whether and how many sugar beet farmers would be competitive on world markets, assuming an efficient sugar processing industry. Figure 3 shows the theoretical sugar beet world market price (UAH165/t) deducted from the sugar world market price (EUR192/t) in 2004 assuming an average EU extraction rate coefficient (13%). It may be concluded that about half of the Ukrainian sugar beet growers would have been produced competitively.

From the above analysis it can be concluded that a huge efficiency potential exists not only through investments but also through improved farm practices and farm management. It may further be concluded that discussions on average production costs are of limited use because of the broad variation of production costs.

<sup>1</sup> We used kernel density estimation using Gaussian density as a kernel function (see Annex A.1 for details)

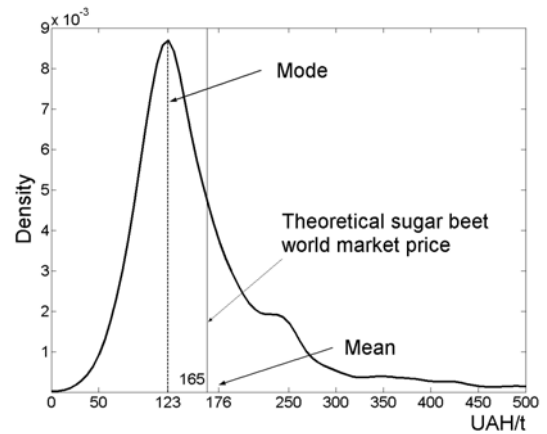
<sup>2</sup> Technical efficiency scores were estimated using Data Envelope Analysis (DEA) with one output (Output) – two inputs (Land, Gross value of inputs) model. For the method description see Annexes A.2 and A.3

**Figure 2: Estimated distribution of farm efficiency scores, 2004**



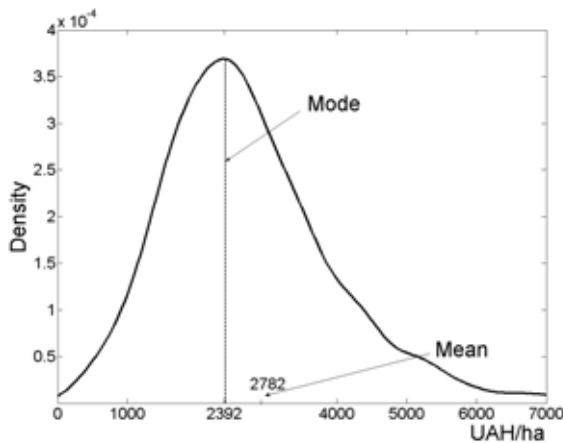
Source: Own estimations based on IER database

**Figure 3: Estimated distribution of sugar beet production costs per ton, 2004**



Source: Own estimations based on IER database

**Figure 4: Estimated distribution of production costs per hectare, 2004**



Source: Own estimations based on IER database

**Table 3: Distribution of production costs according to yield bands, 2004**

Yield, t/ha	Production costs, UAH/ha	
	Mode	Mean
0÷10	1442	1814
10÷20	2184	2468
20÷30	2732	3050
30÷40	3792	3874
40÷50	4399	4627
>50	5177	5532

Source: Own estimations based on IER database

Analysing the regional pattern and efficiency of sugar beet production map 1 shows that production is mostly concentrated in the Central part of Ukraine. Vinnytska, Poltavska, Cherkaska, Kyivska have been the leading oblasts by volumes and land areas under sugar beet. The same relates to yields, except Kherson oblast, which gives the highest weighted average yield. However, the efficiency of production scores does not go in line with other figures among oblasts on the map. For example, Dnipropetrovsk region had approximately the same efficiency score as Vinnytska or Poltavska oblasts in 2004, although natural conditions are less favorable for sugar beet growing in Dnipropetrovsk. Although it would require additional studies to analyse this phenomenon in detail, one conclusion is still possible: availability of good natural potential does not necessarily guarantee efficient use of it.

**Map 1: Regional distribution of sugar beet production in Ukraine**



Source: Own presentation and estimates using IER database

## 2.2 Competitiveness of sugar beet production vis-à-vis other crops

The relative competitiveness of sugar beet production against other crops plays a decisive role in the future of the sugar production value chain. The trend shown in Table 1 is mainly explained by the fact that Ukrainian farmers have been reducing the seeding areas under sugar beet opting for more profitable and less capital-intensive crops such as grains and oil seeds. So, it is important to know conditions (price, yields etc.) under which sugar beet production is competitive within Ukrainian farms from the farmers' point of view.

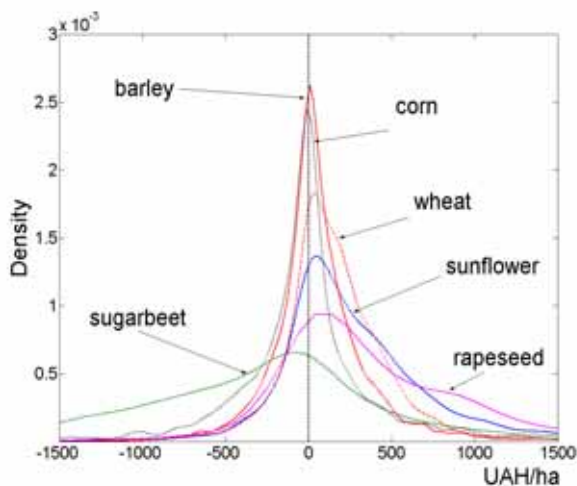
To analyse competitiveness of sugar beet production we apply gross margin calculations. The gross margin per hectare is defined as the revenue per hectare plus any revenues from the sale of by-products plus any relevant subsidies per hectare, minus the sum of all variable costs. The results show the marginal competitiveness of crops, i.e. if a farmer had additional land and other production factors available the gross margin would give him an indication in which crop to invest. In the long-term perspective, however, gross margins must be adjusted for fixed costs such as purchasing machinery or labor costs. Due to the data limitation at hand we are not able to extract a 'clean' gross margin figure. For example, data on revenues from the sale of by-products and the potential impact on subsequent crops are lacking. However, we can approximate gross margins with a sufficient degree of accuracy required for the comparison of the profitability of different crops (see Annex C for data description). We carried out these calculations for six crops: sugar beet, sunflower seed, rapeseed, wheat, barley, and corn.

From the results presented in Figure 5 to 8 we may draw the following conclusions. Figure 5 shows that other crops outperformed sugar beet in terms of gross margin in 2004. More probability mass is located in the negative segment of the gross margin scale, suggesting that producers have greater risks of incurring losses with sugar beet

vis-à-vis other crops. The 'champions', as expected, were sunflower and rape seed. Of course, as figure 5 shows, there are some producers having similar gross margins with sugar beet as with other crops, but this can be achieved under the conditions considered below.

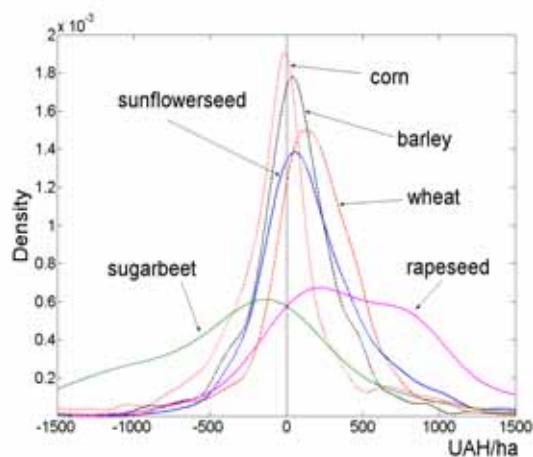
Location-specific factors (soil, rainfall distribution) are expected to be important, suggesting that sugar beet might be more competitive vis-à-vis other crops in the most favorable sugar beet growing areas. Unfortunately, we did not find justification for such argument. We analysed Vinnytska oblast – the leading area in terms of sugar beet production and natural conditions for sugar beet growing (see Figure 6) – and compared gross margin scores for crops in that oblast. As a result we received a similar picture as for the whole Ukraine. Sugar beet gross margin distribution for Vinnytska oblast shows a similar pattern compared to the whole Ukraine pattern. The only exception is rapeseed, clearly improving its competitiveness in this oblast. Two important conclusions follow from these results. First, favorable nature conditions for sugar beet growing might not necessarily lead to higher competitiveness. Second, provided that the sugar beet production performance indicators do not improve, other crops (especially rape seed) will gradually 'squeeze out' sugar beet production.

**Figure 5: Estimated distributions of gross margins for different crops in Ukraine**



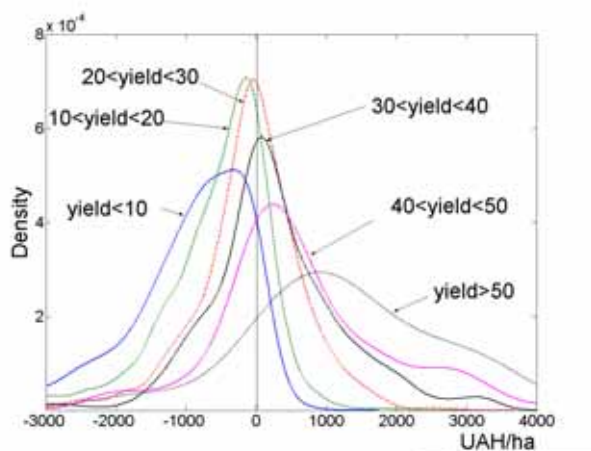
Source: Own presentation based on IER database

**Figure 6: Estimated distributions of gross margins for different crops in Vinnytska oblast**



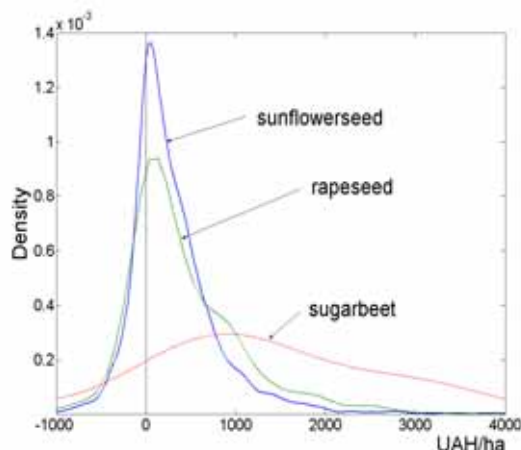
Source: Own presentation based on IER database

**Figure 7: Estimated distributions of gross margins for sugar beet within different yield bands in Ukraine**



Source: Own presentation based on IER database

**Figure 8: Estimated distributions of gross margins for sugar beet within '>50 t/ha' yield band vs. other crops**



Source: Own presentation based on IER database

If we group gross margins of sugar beet production according to the yield bands (see Figure 7) it becomes obvious that high yield producers having higher scores. Figure 7

shows that if we move from the lowest to the highest yield bands we receive more probability mass in the positive sector of the gross margin scale. Moreover, as Figure 8 witnesses, sugar beet production achieving more than 50t/ha yield might be even more competitive than, say, rape seed or sunflower seed from the farmers perspective. These results are basically consistent with previous studies, for example Benecke and Cramon-Taubadel (2001). This leads to the conclusion that increasing sugar beet yields is a necessary pre-condition to sustain sugar beet and sugar production in Ukraine. Efficiency gains in sugar beet production are a key element to make the whole sugar production value chain more efficient. However, the interpretation of gross margins as a competitiveness indicator on farm level should not be mis-interpreted with international competitiveness. Even with efficient sugar beet production beet sugar production is uncompetitive from the national point of view, because in this view the costs of national sugar production, including sugar beet production, have to be compared with opportunity costs on world markets (see section 3 for further details).

### 2.3 Structure of the sugar beet producers

There are more than 3000 agricultural enterprises producing sugar beet in Ukraine. However, as Table 4 shows, their share in the total production volume gradually decreased in the course of transition to about 77%, and households produced the rest of 23% in 2004. Most of the enterprises producing sugar beet are private (75% of the total volume in 2004) for the time being, whereas the state owned enterprises produced about 1.5% of the total sugarbeet volume. Table 4 also provides some information on the shares of each enterprise type in the total production where private companies take the leading position producing about 42%. These are joint stock or limited liability companies, increasingly vertically integrated with sugar holdings processing and marketing sugar.

**Table 4: Structure of sugar beet producers by production shares, %**

	1995	2000	2001	2002	2003	2004
Agricultural Enterprises	97.4	87.8	79.7	73.8	77.4	76.9
Private:	Na	Na	Na	Na	Na	75.3
<i>Companies (of different types)</i>	Na	Na	Na	Na	Na	42.1
<i>Private farms</i>	Na	Na	Na	Na	Na	22.4
<i>Cooperatives</i>	Na	Na	Na	Na	Na	7.2
<i>Others</i>	Na	Na	Na	Na	Na	3.6
State:	Na	Na	Na	Na	Na	1.5
Households	2.6	12.2	20.3	26.2	22.6	23.1

Source: State Statistics Committee of Ukraine and own estimates based on IER database

### 2.4 Sugar production

Ukraine inherited from the former USSR a huge sugar industry with almost 200 sugar factories producing more than 5 m tons of refined sugar per year in the beginning of the transition. However, in the course of transition the sector output dropped below 1.8 m tons, recovering somewhat to 1.91 m tons last year. From the sugar balance in table 5 we might infer that current domestic production of beet sugar is not sufficient to cover domestic demand, placing Ukraine in a net-import situation.

**Table 5: Sugar balance in Ukraine, 2002-2005 marketing years, m t**

	2002/03	2003/04	2004/05	2005/06
Beginning stocks	0.14	0.12	0.17	0.15
Production of refined beet sugar	1.41	1.44	1.77	1.91
Import of cane sugar	1.34	0.59	0.50	0.45
Production of refined cane sugar	0.74	0.68	0.48	0.21
Total domestic production	2.15	2.12	2.25	2.12
Total import	1.72	0.97	0.68	0.60
TOTAL SUPPLY	2.67	2.62	2.32	2.59
Total export	0.50	0.33	0.32	0.30
Domestic industrial consumption	0.57	0.63	0.67	0.73
Domestic human consumption	1.48	1.48	1.47	1.47
TOTAL DOMESTIC CONSUMPTION	2.05	2.11	2.14	2.19
Ending stocks	0.12	0.17	0.15	0.10

Source: UkrAgroConsult(2005)

The efficiency of the sugar value chain depends on sugar beet production as raw material, but also on the efficiency of sugar processing itself. The number and density of sugar factories in Ukraine is extremely high compared with other European countries (Zorya and Nivyevskiy, 2005). For example, Vinnytska oblast has about 35 (23 operating so far), whereas Germany (with about twice the Ukrainian production volume) has only 26 sugar factories. Out of 190 factories, 119 are currently operating and 71 sugar factories are closed. 30 sugar factories have already been liquidated so that the total number of sugar factories in Ukraine is currently 160. The remaining factories effectively operate less than 90 days per campaign/year leading to huge fixed costs of production and thus lower competitiveness. The average sugar plant in Ukraine processes about 2700 tons of sugar beet per day, which is about three times less than in Europe. Only 14 out of the 119 left factories in Ukraine have more than 5000 t daily capacity. The average daily capacity of the restructured East Germany sugar industry is about 11000 t per day.

As the competitiveness of sugar production – besides cost efficient production of sugar beets - is mainly determined by realising economies of scale by maximising the number of campaign days, the daily capacity of the processing plant and the efficient use of energy, it is evident that the sugar industry itself has to significantly improve efficiency.

**Map 2: Distribution of sugar factories in Ukraine**



Source: Zuckerwirtschaft Europa (2006)

**Table 5: Some performance indicators of the sugar industry in Ukraine, 2004**

Oblast	Procured sugar beets, m MT	Processed sugar beets, m MT	Production sugar, m MT	Extraction coeff., %	Avg. daily capacity, KMT	Avg. campaign period per factory, days	Number of factories *)	
							Operated	Closed
Vinnitsia	2.5	2.4	0.3	10.9	1.9	64.3	23	17
Volyn	0.9	0.8	0.1	12.2	3.8	62.3	4	0
Zhytomyr	0.6	0.6	0.1	11.2	1.9	66.8	5	1
Kyiv	1.7	1.6	0.2	11.4	2.0	67.1	14	2
Kirovograd	0.6	0.6	0.1	12.2	2.6	58.8	4	7
Lviv	0.5	0.5	0.1	11.8	3.8	43.1	3	2
Mykolaiv	0.2	0.2	0.0	10.8	5.0	58.8	1	1
odessa	0.5	0.5	0.0	10.5	2.9	61.1	3	0
Poltava	1.6	1.6	0.2	11.9	2.8	78.5	8	3
Rivne	0.5	0.5	0.1	11.8	2.4	59.6	4	2
Sumy	0.7	0.6	0.1	12.6	1.9	63.0	6	11
Ternopil	1.4	1.3	0.1	11.0	3.7	49.4	8	1
Kharkiv	1.6	1.6	0.2	12.1	2.6	75.6	10	2
Khmelnyskiy	0.9	0.9	0.1	11.5	2.2	44.3	10	6
Cherkasy	1.2	1.2	0.1	10.8	2.2	60.4	10	13
Chernihiv	0.5	0.5	0.1	12.8	1.6	85.5	4	1
Chernivtsi	0.2	0.2	0.0	11.0	2.4	43.8	2	2
<b>UKRAINE</b>	<b>16.0</b>	<b>15.5</b>	<b>1.8</b>	<b>11.6</b>	<b>2.7</b>	<b>61.3</b>	<b>119</b>	<b>71</b>

Source: Ukrtsukor (2005) \*) 30 are liquidated

Current capacity of the Ukrainian sugar industry is estimated at 0.32 m tons of sugar beets per day, or around 37 thd tons of refined sugar per day. So, to process the 2004 harvest, provided full capacity utilization, Ukrainian sugar plants would have needed around 50 days. However, due to practical technical problems, the sugar campaign lasted about 61 days (see table 5).

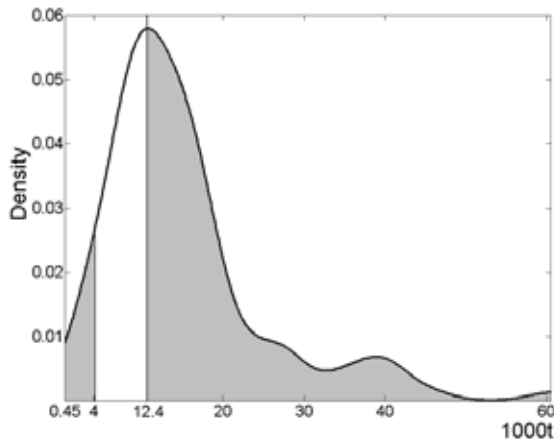
Looking particularly at the variability of sugar production performance indicators provides additional insights. Figure 9 shows the estimated distribution of the plant beet sugar production volumes. The majority of factories produced around the vicinity of 12.4 KMT in the 2004 campaign, although there was a group producing around the vicinity of 40 KMT and one refinery produced more than 60 KMT.

In the next step we analyzed those factories located in the shadowed area of the production scale (because of incomplete data sets). Altogether, the chosen factories produced about 70% of the total sugar output in 2004. The results show that although there were several factories over-utilizing their capacities the majority of factories utilized their daily capacities by around 91%, and the average capacity utilization score was 82.6% in the 2004 campaign.

The sugar extraction coefficient may be taken as a further efficiency indicator of sugar beet processing in Ukraine. As Figure 11 shows it is characterized by broad variability and is ranging from about 7% to some 13% within the group considered in the 2004 campaign. The majority of factories had 11.65% extraction coefficient and the average was about 11% within the group considered. This is comparatively low by international standards. Low sugar content in sugar beets is probably one reason; on the other hand the broad variation of extraction coefficients (from 7% to 14%) proves the high potential for efficiency improvements of factories in Ukraine.

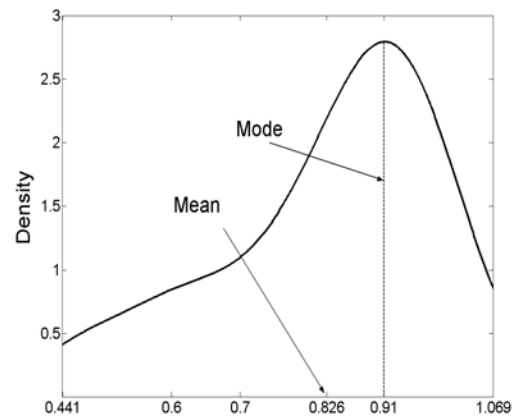
The distribution of plant campaign days gives an indication of the provision of factories with sugar beets. Figure 12 shows a huge variability. Some factories processed sugar beets in less than a month, but some were able to operate more than a hundred days. The majority of factories within the group considered operated about 71 days, and the average campaign was 66 days. As the number of campaign days is one of the decisive factors of the profitability of sugar production also this result shows a high potential for improvement of raw material supply.

**Figure 9: Estimated distribution of plant beet sugar production**



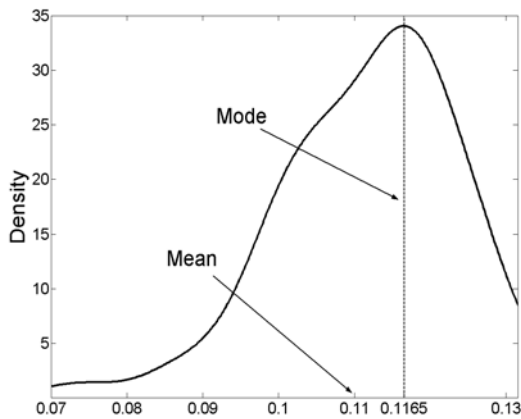
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**Figure 10: Estimated distribution of daily plant beet sugar production to capacity ratio**



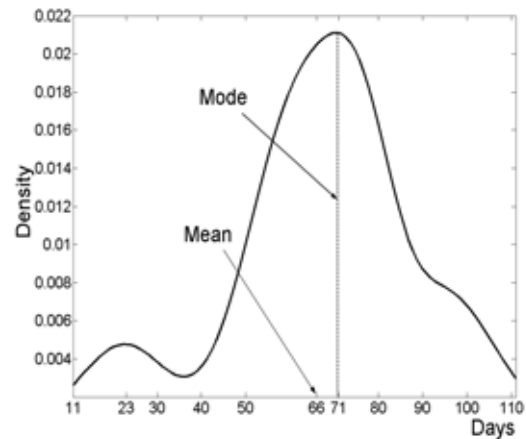
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**Figure 11: Estimated distribution of plant sugar extraction coefficient**



Source: Own presentation

**Figure 12 Estimated distribution of plant campaign days**



Source: Own presentation

## 2.5 Structure of the sugar industry

The sugar industry in Ukraine has been fully privatized. Table 6 shows the current structure of the sector. There are two leading sugar holdings producing about 25 % of the market share, followed by some medium-sized companies. Despite fewer sugar processing plants in possession, UkrRos seems more technologically advanced than UPK, having close to its rival market share figures. The same applies to the quickly growing companies Astarta-Kyiv and UkrPromInvest. None of the companies has a dominating market share. Foreign investors have been kept outside for the time being.

The leading sugar holdings can be characterized as financially strong, usually also involved in other businesses and sectors. Vertical integration is increasing with a tendency to extend operations from sugar production and marketing also to sugar beet production to ensure raw material supply as the decisive factor for making the whole value chain profitable.

**Table 6 The structure of the sugar industry in Ukraine, 2004 and 2006**

COMPANY (MAJOR SHARE HOLDER)	No. of plants 2004	No. of plants 2006	Production of sugar, KMT	Market share, % 2004
Ukrainska prodovolcha kompania (UPK)	15	-	229.22	12.82
UkrRos	6	-	198.71	11.11
Astarta-Kyiv	3	5	79.09	4.42
UkrPromInvest/Agroproinvest	2	5	75.98	4.25
Dubnotsukor	6		67.85	3.79
SumyAgroTsukor	4		50.92	2.85
InTsukorProm-K	3		49.19	2.75
Euroservice-Ukraine	3		45.42	2.54
Salivonky sugar plant	1		41.14	2.30
Lokhvytskiy sugar plant	1		38.71	2.16
<b>Other producers</b>	<b>75</b>		<b>911.92</b>	<b>51.00</b>

Source: Ukrtsukor

## 2.6 Sugar market organization in Ukraine and trade regime

**Table 7: Basic characteristics of the Sugar Market Organization in Ukraine**

	2003/04	2004/05	2005/06
Domestic marketing quota ("A") m tons	1.8	1.8	1.8
Minimum prices:			
Sugar beet UAH/t	165.0	165.0	170.0
White sugar (wholesale, including VAT) UAH/t	2370.0	2370.0	2370.0
Import Duty:			
Sugar	50%, not less €300/t	50%, not less €300/t	50%, not less €300/t
Sugar beet	50%, not less €125/t	50%, not less €125/t	20%
Sugar beet seeds	€22/kg	€22/kg	€22/kg
Machinery	10-40%	10-40%	10%

Source: Own presentation based on Ukrainian legislation

The sugar market organization in Ukraine emulates the EU's sugar market regime, but without export subsidies. The sugar quota was introduced in 2000<sup>3</sup> allocating the overall national quota annually to regions and then to sugar factories and sugar beet growers within each particular region. The allocation of quota has been exercised not on a competitive basis, but according to the Ministry of Agriculture Policy regulation. The main criterion is the contracted sugar beet area per region explaining partly the above tendency towards vertical integration. The quota is not tradable so far, forcing inefficient factories to further produce although it does not make sense either financially (from the factory's point of view) or economically (from the national economy's point of view). Each year the Government sets the minimum price of white sugar and derives the sugar beet price. Minimum prices are mandatory and if any agent diverts from minimum prices, he is substantially fined. In fact, the volume of quota and minimum prices remained unchanged since 2002.<sup>4</sup> In order to protect high domestic prices, the import tariffs are set at a prohibitively high level (300 €/ton). The fundamental difference between the situation in the EU and that in Ukraine is that the former has a net sugar surplus, while

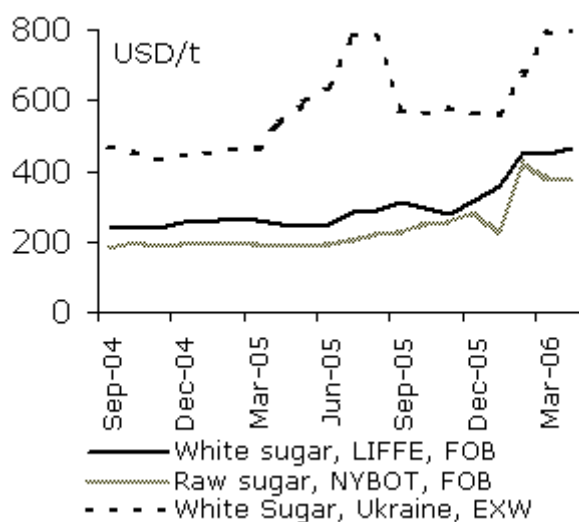
<sup>3</sup> The Law of Ukraine No. 758-XIV "On State Regulation of Sugar Production and Marketing" as of June 17, 1999.

<sup>4</sup> Resolution of the Cabinet of Ministers of Ukraine # 1977 "On State Regulation of Sugar Production and Marketing", as of December 25, 2002 (with amendments).

the latter is a net importer of sugar. Since domestic sugar production in Ukraine is lower than domestic consumption, from year to year the Government set temporary import tariff-rate quotas (TRQ) with very low in-tariff rates. In 2003, for example, the Verkhovna Rada of Ukraine authorized TRQ totaling 560 KMT: 200 KMT with a specific import duty of EUR60/t, and additional 360 KMT at EUR6/t. The TRQ for raw cane sugar was auctioned. This method will have to be changed in future to make it consistent with WTO rules.

Domestic market prices usually equaled minimum prices, which were twice over the indicative world market prices (Figure 15). However, mostly due to fact that there was no TRQ opened last year domestic prices surged much higher minimum prices. In the beginning of 2006 there is no TRQ as well and current price jump has also been heated by a considerable world market price increase.

**Figure 10 Domestic and world market sugar prices, Sep. 2004 – Apr. 2006**



Source: Ukragroconsult, APK-Inform

**Table 8 Tariff rate quotas for the import of raw cane sugar in Ukraine**

Year	Established quota, KMT	Actual imports, KMT
1998	300	96
1999	60	217
2000	260	229
2001	260	260
2003	560	380
2004	125	125
2005	-	-
2006	-	-

Source: State Statistics Committee of Ukraine  
 Note: The auctions are held on a competitive base. However, eligible for auctioning participants have to pay an accreditation fee, an auction duty, and transfer in advance the established minimum price of one lot (e.g. €600,000 per lot (10,000 tons) in 2003) to a special account at the State Treasury. Successful bidders settled the difference. Purchased lots could not be traded. None of the applicants could buy more than 50 per cent of the import volume, and 20 per cent of the tariff rate quota was reserved for new entrants.

Also, raw sugar can get to Ukraine on tolling contracts, with further mandatory re-export of refined cane sugar. For example, in the 2003/04 marketing year Ukraine imported 646 thousand tons of raw sugar using the tolling scheme (Zorya and Nivjevskiy, 2005). Only 299 thousand tons were re-exported, leaving 347 thousand tons in the country. This is achieved by re-exporting "empty" wagons of refined sugar or by artificially lowering the extracting coefficient from raw sugar (which is normally 95%). Finally, high domestic prices in Ukraine and high out-of-quota tariffs encourage sugar smuggling. The amount of illegal imports fluctuates in a range of 200-400 thousand tons of cane sugar per year. As Table 7 shows Ukraine had prohibitive import tariffs on sugar beet until 2005, which effectively restricted trade. However, in the beginning of 2005 in the course of WTO membership preparations Ukraine reduced most of its agricultural tariffs, including sugar beet. So, with the beginning of the 2005/2006 campaign the first ever imports of sugar beets arrived for processing. According to the official statistics about 113 thd tons of sugar beets were imported from September 2005 to January 2006. Imports came from Belarus (71 thd tons), Poland (21 thd tons) and Lithuania (20 thd tons). Since the Government of Ukraine is determined to increase the minimum price to UAH195/t (EUR32/t), but EU gradually cuts its sugar beet price to EUR25/t it is very likely that sugar beet imports will take place further.

The situation with sugar import tariffs is different. The Ukrainian Government was not yet able cutting its prohibitively high tariff rate (see Table 7). As a result, the legal import mostly takes place when there is a tariff rate quota or when world prices are high enough, e.g. as it was last summer. The major exporters of sugar to Ukraine (including

raw cane sugar) were Brazil, Cuba, United States, Germany, UK, Poland, and Belarus (see Table 8). The small amount of export of Ukrainian sugar has been limited to CIS countries.

### 3 Competitiveness of sugar production in Ukraine before and after WTO membership

Despite relatively favorable current market conditions for the sugar industry, it seems that future WTO membership of Ukraine would be a real challenge for the current sugar market organization in Ukraine. It seems that the protection of the sugar industry does not lead to serious restructuring and improved competitiveness. According to the preliminary results of the WTO negotiation process, Ukraine is going to provide a tariff-rate quota for raw sugar at 260 thousand tons (although some countries have been insisting on 400 thousand tons) to be imported at 2% import duty. Out-of-quota tariff would decrease to 50%. Moreover, Ukraine together with other WTO members can already now anticipate further restrictions on its sugar market organization in the case of a successful completion of the Doha round negotiations. Most likely the Swiss formula<sup>5</sup> of tariff reduction will be adopted, meaning a further sharp cut in sugar import duty.

**Table 9 comparative summaries of Doha Round offers on agriculture (market access) by EU, US and G-20**

Market access	EU	US	G-20
Tariff reductions	<b>Tariff level:</b> 0-30% = 20% cut 30-60% = 30% cut 60-90% = 40% cut 90% + = 50% cut	<b>Tariff level:</b> 0-20% = cut of 55% to 65% 20-40% = cut of 65% to 75% 40-60% = cut of 75% to 85% 60% + = cut of 85% to 90%	<b>Tariff level:</b> 0-20% = 45% 20-50% = 55% cut 50-75% = 65% cut 75% + = 75% cut
Tariff cap	100%	75%	100%
Sensitive products	Max. 8% of tariff lines	Max. 1% of tariff lines	-

Source: Agra Europe (2005c)

According to these proposals Ukraine may face further sugar import tariff cuts from 30% to 85%, meaning effective import tariff at 38-27% after completion of the Doha round and WTO membership. Ukraine would most likely negotiate sugar as a 'sensitive' product to avoid maximum tariff cuts, but new tariff quotas would have to be opened to compensate exporters and guarantee market access (Agra Europe, 2005c). This means that in a case of treating sugar as 'sensitive product' Ukraine would be required to increase its sugar tariff rate quota (probably to 400 KMT).

Furthermore, domestic support will be subject to reductions, meaning the 'amber' box constraints for Ukraine. All these future constraints imply that it is hard to imagine that the sugar market organization in Ukraine will not further change.

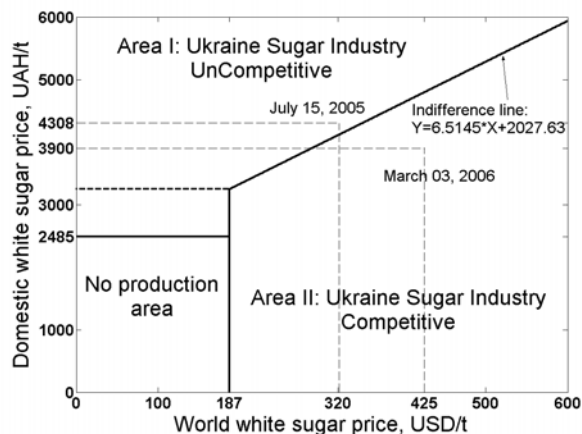
Figures 15 and 16 provide graphical presentations whether Ukraine's sugar industry is competitiveness under different world vs. domestic sugar price ratios. For detailed information on how these diagrams were built please refer to the Annex B. Consider first Figure 15 with current effective sugar import tariff at EUR300/t. If we take the last summer world vs. domestic sugar price ratio (e.g. point July 15, 2005), when domestic prices surged by 75%<sup>6</sup> Ukraine's sugar industry becomes on average uncompetitive since imports become profitable. Of course the most efficient producers might survive in such a situation. A similar situation happened in the beginning of this year, when domestic prices surged again (see the point March 03, 2006), but accompanied by significant world market price increases. In this case we find domestic sugar industry competitive. However, assuming that WTO accession most likely would leave Ukraine with 50% import tariff only, this will put more pressure on its sugar industry. Figure 16 basically illustrates the same result as Figure 15 under the reduced import tariff and the same price ratios. However, one very important conclusion could be drawn: Ukraine's sugar industry

<sup>5</sup> Swiss Formula means higher tariffs are cut more than lower tariffs.

<sup>6</sup> Year over year calculation

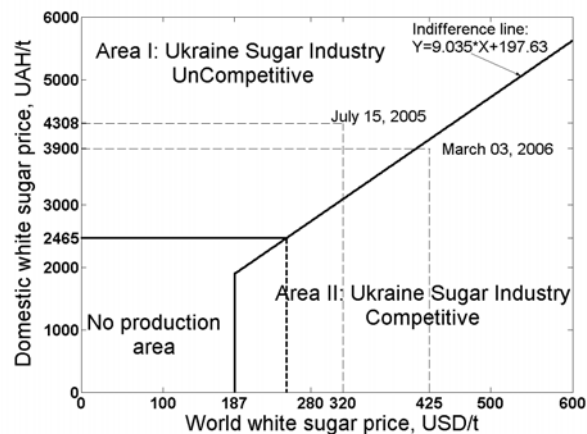
protection is very vulnerable to low world market sugar prices. Currently world market conditions with high prices are relatively favorable for the industry, however it will not last forever. Sooner or later world sugar prices will return to their equilibrium, implying a real challenge for Ukraine's sugar industry, provided no significant restructuring taking place by that time.

**Figure 11: Sugar market regime before WTO membership**



Source: Own presentation

**Figure 12: Sugar market regime after WTO membership**



Source: Own presentation

## 4 Further considerations: economic costs, employment, inflation, and poverty

### 4.1 Consumers' transfer to sugar producers

World market price has always been the opportunity cost for consumers of a commodity in any country. In other words, this is the cost of a commodity that consumers would pay provided no production of that commodity takes place in a country. The same applies to sugar. The economic costs of border protection can be measured comparing domestic prices with import parity prices. However, there is no such term as "one world market price" in the sugar world (von Cramon-Taubadel, 1999). There are many of them depending on different factors such as quality and refinement of sugar, marketing terms, etc. The most frequently used price as an indicator of the world sugar price is so called ISA (International Sugar Organization) price, being the average of several raw-sugar prices. Raw sugar is traded more intensively than white sugar, because white sugar is very sensitive to long distance transportation. The ISA price is lower than the white sugar price on the London Exchange (LIFFE) that is shown in figure 13.

As figure 13 shows domestic sugar prices are much higher than indicative world sugar market prices, demonstrating that consumers support domestic sugar producers in Ukraine. In order to quantify this support we calculated the import parity price of white sugar on a domestic market and compared it to the domestic white sugar price. Table 10 provides a detailed description of these calculations. The choice of white sugar price at European ports as a relevant world or border price reflects the real situation with white sugar import options for Ukraine. Moreover OECD uses these border prices in its Producer Support Equivalent (PSE) calculations not only for Ukraine, but for many other Black Sea basin countries. Since Ukrainian white sugar is of relatively lower quality, it could be sold only at discount. We accounted for this fact as well.

**Table 10 The estimation of consumers' transfer to the Ukrainian sugar industry**

	2004	2005

Domestic Consumption, m t	2.15	2.19
Domestic Price (minimum price), UAH/t	2370.00	2998.41
Import parity (reference) price, UAH/t:	1744.53	1818.82
<i>Border reference price*, USD/t</i>	239.54	261.00
<i>Official exchange rate, UAH/USD</i>	5.30	5.05
<i>Handling and processing costs, UAH/t</i>	184.27	197.63
<i>Import VAT, %</i>	20.00	20.00
Market price differential, UAH/t	625.47	1179.59
<b>Consumers' transfer to sugar producers, m UAH</b>	<b>1341.64</b>	<b>2583.30</b>

Source: Own calculations; Notes: \*-White sugar, Paris, European ports in bags of 50 kg;

The volume of the transfer is considerably high in a country with a high share of food products in the consumer basket (64 %). Table 10 shows that consumers transferred to sugar producers more than UAH 1.3 and 2.5 bn per year in 2004 and 2005 respectively by paying the price for the protection of the domestic sugar industry.

## 4.2 Sugar price and poverty

As Table 11 demonstrates each citizen of Ukraine transferred UAH28.36 and UAH55.02 to sugar producers in 2004 and 2005 respectively. Although the daily transfer its not that high, i.e. 8 and 15 kopecks respectively it should be considered that Ukraine is a country with a relatively high share of poor people. According to IER poverty study<sup>7</sup> 11.79% of the whole Ukrainian population are considered as 'poor' if we apply the 'one dollar per day' absolute poverty line. However, the same study estimated the Income Gap Ratio (IGR) at 21.13%, showing the depth of the poverty. In other words, the IGR at the poverty line 'one dollar per day' indicates that on average poor households in this group were 21.13% below the poverty threshold, or lived for UAH4.18 per day (0.83 cents per day) in 2004. We assumed the same order of magnitude in 2005, implying the same figures. So dividing the average income of poor group population (according to the poverty line chosen) by consumers' transfers per capita per day we received a 'sugar tax' that poor consumers pay to allow Ukrainian sugar industry operating. In 2004 and 2005 this 'tax' was 1.86% and about 3.6% respectively. Although cutting domestic sugar prices to the level of world market prices would not solve the poverty problem in Ukraine, however, the estimated implicit taxation seems significant, especially for the poorest population.

**Table 11 Consequences of high sugar prices for poverty in Ukraine**

	2004	2005
Consumers' transfer to producers, m UAH	1341.64	2583.30
Population of Ukraine, m	47.30	46.95
<b>Transfers per capita, UAH</b>	<b>28.36</b>	<b>55.02</b>
<b>Transfers per capita per day, UAH</b>	<b>0.08</b>	<b>0.15</b>
<b>Poverty Line "one dollar per day":</b>		
People affected, % of population	11.79	
Income gap ratio, %	21.13	
or =, UAH/day	4.18	4.18
<b>"Sugar Tax"</b>	<b>1.86%</b>	<b>3.61%</b>

Source: Own presentation

## 4.3 Sugar price and inflation

The inflation rate as measured by the consumer price index (CPI) is a very important macro economic indicator for Ukraine. The relatively high rate of inflation that Ukraine experiences so far should not be mainly explained by monetary factors or by monetary policy alone (Giucci and Bilan, 2005). High protection from foreign competition seems

<sup>7</sup> Handrich and Bettly (2006)

...serving one of the main reasons behind the inflation problem, and sugar has been one of the potential triggers of inflation.

As explained above the Ukrainian sugar market has been successfully protected from foreign competition, which drives a wedge between domestic and world prices. However, according to the sugar balance the domestic production has not been sufficient to meet the domestic demand. Also, the sugar demand is relatively inelastic (due to its low substitutability), making sugar prices very sensitive to temporarily market imbalances. Therefore, under the current sugar trade regime in Ukraine there is a high risk of sugar price jumps.

Table 12 shows the share of sugar in the consumer basket in Ukraine. 64% consists of food with sugar at 2.6%. If we assume the sugar contained in confectionary goods at about 30%, then sugar takes up additional 0.96% ( $3.2\% \times 0.3$ ) of the consumer basket.

**Table 12 Consumers basket composition in Ukraine**

	Share of goods, %	Share of group, %
<b>Food goods</b>	64.0	64.0
<i>Sugar containing food goods:</i>		8.0
<i>sugar</i>	2.6	
<i>confectionary</i>	3.2	
<i>jams, honey</i>	0.4	
<b>Other food goods</b>		56.0
<b>Nonfood goods</b>	15.5	15.5
<b>Services</b>	20.5	20.5

Source: Ministry of Economy

Sugar accounts for approximately 3.56% of the consumer basket. This implies for example that a 75% increase in sugar prices (as in last summer) contributed with 2.7% to inflation effectively reducing the real income of the population, raising macroeconomic stability and food security concerns.

#### 4.4 Employment and social aspects

**Table 13: Employment in the sugar factories of the EU and Ukraine**

Country	2003/2004			2004/2005		
	Permanent	Campaign	N of factories	Permanent	Campaign	N of factories
Germany	-	6778	27	-	6721	26
France	6664	9347	34	6112	8606	30
Poland	11079	21948	56	8807	15578	43
Ukraine	Na	Na	Na	Na	35000-70000	160

Source: Zuckerwirtschaft (2006); Notes: Na – not available

Restructuring the sugar industry in Ukraine will inevitably lead to a significant reduction of employment in the industry (see the experience of EU countries in table 13), raising important social concerns in the sector as well as for policy makers. The analysis of this issue requires additional extensive studies. However, the degree of the problem might be sketched at this stage.

We believe that three main points are important in this regard:

1. The social sphere should be separated from the sugar industry. Any business entity cannot effectively serve the social infrastructure and be efficient and competitive at the same time in business, since it implies additional costs and leads to conflicts of interests (maximizing profits versus maximizing access to communities' utilities). This is especially relevant for the sugar industry, often the only employer in a particular location (many district towns in Ukraine grew around sugar factories).
2. Sugar beet growers should be of the least concern in this context. Of course sugar beet is an important element in the crop rotation for the farmer, however there are other often more lucrative (see chapter 2.2 for details) and less capital intensive crops than sugar beet that farmers might opt for production. So one

should not expect significant employment and social problems with sugar beet growers in the course of sugar industry restructuring.

3. The sugar industry workforce should be of the primary concern for policy makers. In 2005 campaign labour costs ranged from 0.08 to 0.16 man/day per each ton of processed sugar beet. Including all existing factories (160) we receive daily processing capacity of about 0.43 m tons of sugar beet. So the total estimated workforce employed in the sugar industry would range from 35 thd to 70 thd workers. If the Ukrainian sugar industry would be restructured efficiently it will end up with a workforce comparable to that of France or Germany, i.e. 7-8 thd people. About est. 28-63 thd people would loose their job. The Government should facilitate their efforts in finding new jobs (re-training programs, lay off payments). Assuming the average monthly wage at USD200 (about the level reported by the official statistics), about USD67-151.2 m would be required to pay the annual salary to those losing thier jobs from the State Budget (or better from the restructuring fund proposed in the recommendations).

## 5 World market trends

From a global point of view the competitiveness of sugar production is mainly influenced by natural conditions (climate, soil), production efficiency in the value chain, quality of farm management and management of sugar processing and marketing as well as the availability of competitively produced raw materials. Looking at the raw material supply only it is commonly accepted by experts and the sugar industry that sugar production based on sugar cane is more competitive than sugar production based on sugar beet for various reasons. This is reflected by global production trends (revealed comparative advantages). Even with highly protected sugar beet markets world production trends clearly show the competitiveness of cane sugar. Without protection of sugar beet production it would cease to exist in the long term in Europe, including Ukraine.

**Table 14: Global production of cane and beet sugar**

Year	Beet sugar (t)	%	Cane sugar (t)	%	Total
1900/01	5,963,200	53.0	5,296,800	47.0	11,260,000
1960/61	24,306,000	39.7	36,848,000	60.3	61,154,000
1980/81	32,788,00	33.1	66,147,000	66.9	98,935,000
1995/96	36,566,000	26.9	99,540,000	73.1	136,106,000
2004/05	35,876,000	23.2	119,223,000	76.8	155,099,000

Source: Zuckerwirtschaft (2006)

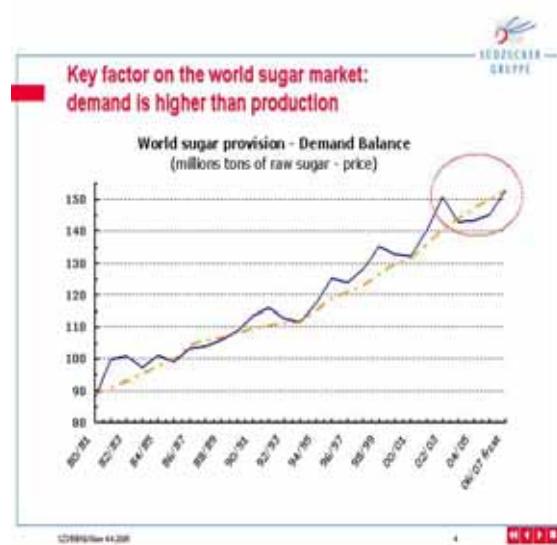
This production trend reveals the fundamental advantage of sugar cane and the fundamental dis-advantage of sugar beet. Even with highly efficient sugar beet production and modernised sugar factories in Europe this fact should not be overlooked in all policy considerations. From an economic perspective Ukraine would buy sugar on the world markets and phase-out sugar production based on sugar beet as raw material. Ukraine as a whole would benefit and become richer.

The sugar world market prices have been highly volatile in the past. This is reflected in the following graphical presentations.

**Figure 13: Sugar world market prices, demand and supply**



Source: Kirchberg, Suedzucker. 2006



Currently, prices are relatively high due to the following factors influencing the world sugar balance:

- 2005/2006 world production: 145 mln t (+1.5 % compared to 2004/5);
- 2005/2006 world consumption: 149 mln t (+2 % compared to 2004/05);
- sugar stocks are decreasing because of third deficit year;
- decrease of exports from Brazil due to higher domestic ethanol production.

The world deficit of about 4 mln t leads to rising prices. If trends persist a new balance would be reached in 2006/7 probably leading to price decreases. However, there are also strong factors leading to increased global consumption. The main demand comes a) from Asia, and b) from increasing ethanol production in Brazil, the most important global sugar producing and exporting country. It is therefore difficult to predict future sugar prices. It is likely that in future floor prices for sugar may be determined by fuel prices. On the production side, the EU sugar market reform will lead to reduced sugar production in the EU (minus 5 mln t are expected; see next chapter for detailed explanations).

What are the most likely trends?

- Sugar world markets have been and will most likely continue to be volatile;
- there are strong indications that future sugar world market prices fluctuate at a higher level than in the past;
- demand from Asia and ethanol production are the most important demand factors;
- EU sugar market reform will reduce sugar exports from Europe and will increase import opportunities to Europe

## 6 Reform of the sugar market in the EU

On 24th November 2005 the EU Council decided on the reform of the EU sugar market regime. The EU sugar market regime set stable framework conditions for sugar and sugar beet producers since 1968 at a comparatively high price level compared to world markets. Although consumers of sugar and scientists frequently complained that consumers had to pay the price of the EU sugar market regime, the political influence of sugar and sugar beet producers was always high in Europe and ensured a stable policy framework for almost 40 years. This had a positive impact on investments, e.g. in Eastern Germany after German unification.

The reasons for the recent reform are due to international developments in trade and development negotiations. In the course of 2004 the conflict resolution panel of WTO decided that the EU export subsidies for sugar do not comply with WTO rules. It followed the reasoning and complaint of Brazil, Thailand and Australia with the following justification: The annual export of about 3 mln. t of not directly subsidised sugar (so-called C sugar) is dumping because the subsidised prices for sugar quota (so-called A sugar) are set at such a high level that these prices do not only cover the costs of A sugar but also the costs of C sugar. This cross subsidisation goes against WTO rules. WTO considers these cross-subsidies as export subsidies. Principally, export subsidies are not allowed (Agra Europe (2005a and 2005b), Strubenhoff and Lissitsa, 2006).

Re-export of about 1.6 mln t of sugar from former EU colonies (so-called ACP countries)<sup>8</sup> will also be banned from 22nd May 2006 onwards because these exports are considered as subsidies of exports not allowed under WTO rules.

Additionally, the EU signed the agreement „Everything but Arms“ with 50 least developed countries. This agreement will allow participating countries to sell sugar to the EU without paying import duties from 2009 onwards.

The EU had to react on these international developments aiming to reduce production by about 5 mln t of sugar to avoid further exports and to make the sugar sector more competitive in view of future sugar imports to the EU. These aims were at the end also acknowledged by the European sugar industry, in particular in countries with competitive sugar and sugar beet production, e.g. France and Germany. The EU will thus in future limit its sugar production and distribution to the domestic market.

#### What has been decided?:

- reduction of the sugar price by 36 % and reduction of the sugar beet price by 39.7 % until 2009 (2006: - 20 %; 2007: - 27.5 %; 2008: - 35 %; 2009: - 36 %)
- sugar beet farmers receive direct decoupled payments equivalent to 64.2 % of the price reduction based on the final price cuts
- the quota system will be simplified by merging A and B quotas because of future marginal exports
- introduction of a private sugar stock holding system and replacement of intervention prices by reference prices (the intervention mechanism will be abolished after a 4 year phase-out period)
- restructuring support for sugar producers deciding to end sugar production (handing over production quota rights to the restructuring fund) with payments for the year of ending production (2006 and 2007: 730,- E/t; 2008: 625,- E/t; 2009: 520,- E/t; once only!)
- the restructuring fund is financed by a levy on holders of quota, i.e. the sugar industry and keeps the consumer prices at the current level for the transition period
- sugar beet farmers get at least 10 % of the restructuring support to sugar producers
- the volume of the restructuring fund is estimated at about 5 bln. Euro
- sugar producers may buy sugar quota at a total volume of 1.1 mln t (maximum) from the restructuring fund at a price of 730 E/t
- additional support for affected regions will be available to diversify production (109 E/t sugar)
- if the restructuring fund would not get sufficient quota from the sugar industry to reduce production by the volume of current exports the EU will decide to introduce general quota cuts from the year 2010 onwards

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<sup>8</sup> More than 40 countries from Asia, the Caribbeans and the Pacifics (ACP) mainly former colonies of EU member states with privileged access to EU markets

- increase of isoglucose quota in three steps
- sugar beet production will benefit from EU measures for the development of renewable energy (sugar for bioethanol, pharmaceutical and chemical purposes does not fall under the quota system)
- the new EU sugar market regime will be valid until 2015

**Table 15: New sugar and sugar beet prices in the EU**

	before reform	July 06/ Sept. 07	Oct. 07/ Sept. 08	Oct. 08/ Sept. 09	Oct. 09/ Sept. 10	Oct. 10/ Sept. 15
Intervention /reference price (E/t sugar)	631.9	631.9	631.9	541.5	404.4	404.4
Restructuring fund (E/t sugar)	-	126.4	173.8	113.3	0	0
Net sugar price (E/t sugar)	631.9	505.5	458.1	428.2	404.4	404.4
Production levy (E/t sugar)	-	12	12	12	12	12
Sugar beet price (E/t sugar beet)	43.6	32.9	29.8	27.8	26.3	26.3

NB: Production levy equally shared by sugar and sugar beet producers  
Source: European Commission and Suedzucker, 2006

**Table 16: Restructuring fund payments**

	July 06/ Sept. 07	Oct. 07/ Sept. 08	Oct. 08/ Sept. 09	Oct. 09/ Sept. 10	Oct. 10/ Sept. 15
Decoupled payments (E/t sugar)	730	730	625	520	0
For sugar industry (E/t sugar)	max. 657	max. 657	max. 562.5	max. 468	0
For sugar beet growers (E/t sugar)	min. 73	min. 73	min. 62.5	min. 52	0

NB: Payments per ton of sold sugar  
Source: European Commission and Suedzucker, 2006

#### What is the expected impact?

According to the expectations of the European Commission and the Governments of the Member States it is expected that the restructuring fund will receive about 5 to 6 mln t of sugar quota out of a total of 17.4 t. This amount would be sufficient to avoid future sugar exports and to allow for increased sugar imports. The restructuring fund is conceived in a way that the sugar consumer prices will remain at the current level for a transition period of 4 years. This will strengthen the most competitive sugar producers in the EU and it is expected that in particular regions in South and North Europe reduce production.

The European Commission and the sugar industry expect that Greece, Ireland, Italy, Portugal, Finland, Latvia, Slovenia will give up sugar production (source: European Commission, assessment report 2004 and various personal communications, 2006). Czech and Slovak Republic, Denmark, Hungary, Spain are expected to considerably reduce production. Austria, Belgium, France, Germany, The Netherlands, Poland, Sweden, Great Britain are expected to marginally reduce production. The remaining sugar and sugar producers are forced to continuously further increase competitiveness by reducing costs and increasing productivity. Production will go to the most competitive regions and the most competitive producers.

To ensure further stable policy framework conditions in a capital intensive industry, the European Commission intends to further keep the external protection level at the border at the level of the sugar prices in the EU. This implies that the EU has to ensure that the future price level of about 400,- Euro will be guaranteed by import duties and – if necessary – by WTO safeguard clauses.

Also, the European Commission intends to introduce adequate measures to reduce sugar imports if the sugar imports from least developed countries would grow by more than 25 % per year.

In future, further pressure on prices are likely. The Doha Round will be completed and another round of international trade negotiations will begin. Even with new energy market opportunities in sight this will not fundamentally change the economic disadvantage of European sugar production.

## 7 Restructuring of the sugar sector in Eastern Germany – Lessons for Ukraine

Following the privatisation of the sugar industry of the former GDR in 1991 the Eastern German sugar industry has been restructured by support of 4 West German and 1 Danish sugar holding. The restructuring strategy has been worked out jointly by the Government, the German privatisation agency and the involved sugar holdings.

As Eastern Germany became after German unification immediately member of the EU without membership negotiations, the EU sugar market regime was applied with prices of about 630 Euro/t sugar and about 33 Euro/t sugar beet. The sugar quota was fixed at 847.000 t sugar and distributed mainly to the most promising regions. It is important to note that the sugar quota was made tradeable to allow necessary future structural change.

The restructuring strategy had the following elements:

- regional focus on most promising and competitive regions;
- immediate closing of 15 sugar factories with further intentions to decrease the number of sugar factories;
- each sugar holding concentrated on specific regions with limited overlapping;
- investments in new sugar factories (green field investments; 10.000 – 18.000 t/d);
- prolongation of sugar campaign to 90 days;
- specific investments in the sugar factory to improve technical efficiency;
- specific investments in sugar beet production (advisory services and input supply);
- introduction of modern management, marketing and costing concepts.

The volume of investment has been estimated at about 1.3 bln. Euro. 170 mln. Euro have been provided by the German Government as a grant.

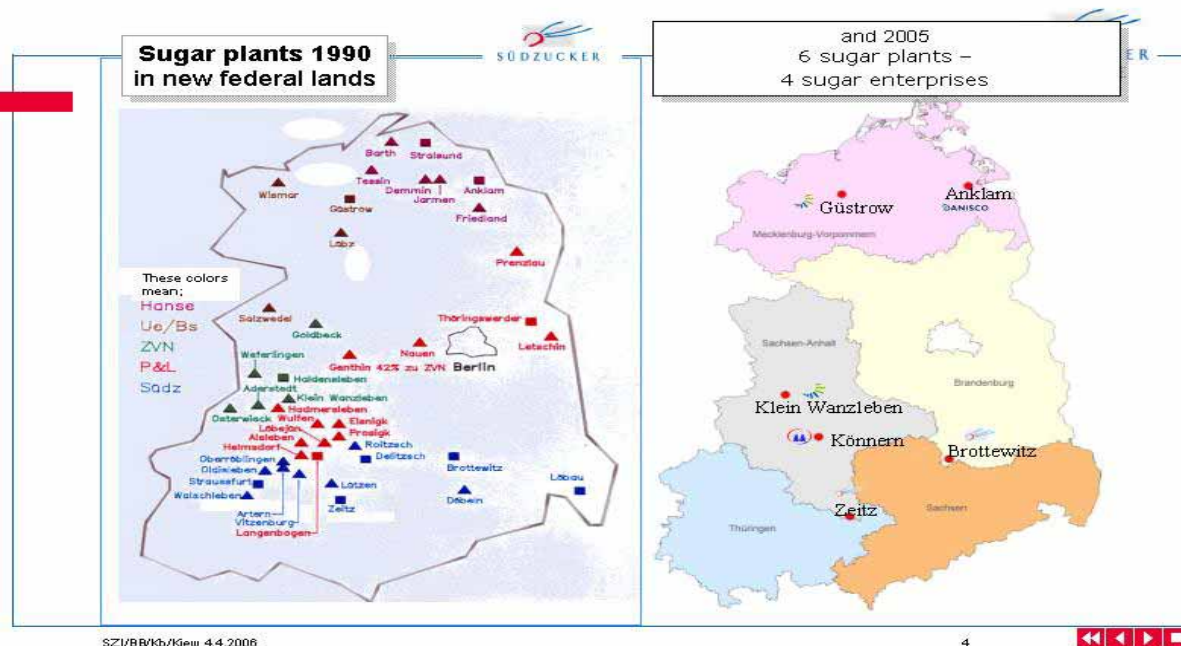
This led to the following development during the last 15 years:

**Table 17: Restructuring of the sugar industry in Germany**

	GDR 1998	East Germany 2004/5	Units
Sugar factories	43	6	
Average capacity	1.604	10.900	t/d
Workers	14.534	1.300	
Sugar beet yield	31.3	51.8	t/ha
Sugar yield	4.3	8.6	t/ha
Energy use	4.100	1.020	kWh/t sugar
Labour productivity	43	844	t sugar/worker
No. of sugar holdings		4	

Source: Suedzucker, Nordzucker, 2006

Figure 14: Location and number of sugar processing plants in Eastern Germany



Source: Kirchberg, Suedzucker, 2006

The restructuring of the sugar sector involved also important changes in sugar beet production. The major changes were:

- Increase of number of sugar beet growers caused by the farm restructuring process
- Reorganized transport of sugar beets from farms to factories by the factories themselves (25 t truck transport capacity, no rail transport, no farm transport)
- Improved logistics (sugar beet storage, cleaning and handling)
- Improved farm practices (cultivation, seeding, improved seeds, optimal use of fertilizers, pesticides)
- Investments in farm machinery (cultivation, seeding, spraying, harvest)

These measures with considerable investments from the sugar industry in farm advisory services led to steadily increasing sugar beet yields.

A further important aspect concerned measures in sugar distribution and marketing. Here, the following steps were made:

- Sugar quality improvement according to EU standards
- Introduction of western trade marks
- Improvement of packaging
- Broadening of product range
- Improvement of logistics and packaging for key accounts

As a result, through huge investments and know how transfer, focusing on a) investments in the sugar factory including green field investments, b) investments in raw material supply and sugar beet production, and c) investments in distribution and marketing increased efficiency and profitability of the East German sugar industry to a level that it is highly likely that it will survive the latest EU sugar market reform.

What are the specific Eastern German lessons learnt for Ukraine?

It is evident that the amount of money injected by the EU and the German Government into the East German sugar sector 15 years ago was based on exceptional historical circumstances based on political considerations rather than on economic reasoning. The Government of Ukraine will certainly not be able to mobilise funds in this order of magnitude for green-field investments.

## 8 Restructuring of the sugar sector in Poland – Lessons for Ukraine

After privatisation of the sugar industry during the years 1989 to 1994 there have been a few years of stagnation in the Polish sugar sector before the restructuring process actually started. The process was supported by a clear Government strategy designed in 2000/2001. The strategy development was partly influenced by EU membership perspectives. Part of the strategy was the invitation of foreign investors to contribute to the restructuring process. After implementation of the strategy the Polish sugar sector changed drastically during the last years.

**Table 18: The sugar sector in Poland**

		1989	2001	2002	2003	2004	2005
Sugar factories	No.	78	71	65	57	43	40
Sugar companies	No.		Na	Na	Na	Na	5
Campaign days	days		49	67	64	77	79
Sugar beet yield	t/ha	33.2	Na	Na	Na	Na	42.8
Sugar yield	t/ha	Na	6.04	4.86	6.66	6.8	6.55

Source: Koziolok, Nordzucker Polska, 2006; Na – not available

The most important elements of the restructuring strategy were:

- increase of production and reduction of the number of sugar factories;
- investments in capacity (no green-field, brown-field only), storage, energy efficiency and quality;
- increase of labour productivity and investments in human resource development;
- increase of sugar beet yields
- stable legal and policy framework

The restructuring process is ongoing but it is highly likely that the Polish sugar sector will survive even after EU sugar market reform.

What are the specific Polish lessons learnt for Ukraine?

In the Polish case the EU membership perspective with access to the sugar market regime support mechanisms has been the key for mobilising funds from the public and private sector, including foreign direct investment, for restructuring the industry. EU membership is not a realistic option for the next 10 years. Also, negotiations about a possible EU-Ukraine Deep Free Trade Agreement will most likely exclude access to the EU sugar market regime.

## 9 Restructuring of the sugar sector in Moldova – Lessons for Ukraine

The sugar sector in Moldova went through a painful restructuring process during the last years. Some of the lessons learnt may be of specific importance for Ukrainian policy makers.

After WTO accession of the Republic of Moldova in 1997 the import tariff was reduced to 15 % leading to increased imports of raw sugar. Additionally, „grey import schemes“, illegal trade and erratic tax free imports of raw sugar destabilised the Moldovan sugar market.

This was a constant concern of the Moldovan Government and the sugar industry so that the external protection was increased in two steps from 15 % to 35 % and further to 45 % using WTO safeguard clauses for the second step in 2004. Furthermore, the Moldovan Government increased its efforts to combat illegal trade and smuggling and set incentives to reduce barter trade between sugar factories and sugar beet growers.

The sugar industry – including foreign investors – supported this process by the development of stable long-term relationships with sugar beet growers. Investments were made in the remaining sugar plants but also in raw material supply. Western concepts of sugar distribution and marketing have been introduced to stabilise the sugar market.

In particular the investments in the whole vertical value chain from the sugar beet grower to the sugar processing plant to the sugar market have been important to slowly increase efficiency of the sugar sector in Moldova. This is reflected by the German investor Suedzucker supporting sugar beet growers with farm advisory services, pre-financing of necessary inputs (seed, fertilizers, pesticides), agricultural machinery services and payment of sugar beets according to quality.

**Table 19: Sugar beet yields and production structures of farms producing for Suedzucker Moldava**

		2001	2002	2003	2004	2005
Yield	t/ha	21.7	28.3	20.5	31.2	36.2
Farms above 5 ha sugar beets	No.	605	366	282	293	229
Farms >30t/ha sugar beet yield	%	5	16	10	38	58
Share of farms >30t/ha at total area	%	11	29	19	51	66
Highest yield	t/ha	48	55	66	72	65
Share of farms >30t/ha at total supply	%	19	38	32	65	73

Source: Mueller, Suedzucker Moldova, 2006

It should be noted that even with heavy investments the time needed for efficiency gains is considerably long. Sugar beet growing is a complex enterprise. Technical as well as farm management issues should not be underestimated. In this view the long-term commitment of the investors – including foreign ones – is important to increase efficiency in the whole value chain.

**Table: Sugar production in Moldova**

		1999	2000	2001	2002	2003	2004	2005
Sugar yield	t/ha	1.7	2.2	2.2	2.8	2.7	3.7	6.7
Energy consumption	KWh/t sugar	6069	5161	4632	4831	4464	3542	2861
Sugar production	1000t	94.4	102.4	116.3	113.8	83	110.8	133.5
Domestic sugar price	US\$/t		309	329	290	353	405	531
Sugar producers	No.		Na	Na	Na	Na	Na	2
Sugar plants	No.		Na	Na	Na	Na	Na	5

Source: Suedzucker Moldova, 2006

The restructuring process of the sugar sector is still ongoing but perspectives have been slightly improving through consolidated actions of the Moldovan Government in close collaboration with the Moldovan sugar industry, Moldovan sugar beet growers and foreign investors.

Whether this policy is sustainable will mainly depend on future efficiency gains in the sector and world market developments.

### What are the lessons learnt from these three country cases?

1. Restructuring of the sugar sector needs a clear Government strategy with important basic decisions on import regime, internal market regime, long-term support mechanisms and stability to minimise external shocks.
2. Government, sugar industry and sugar beet growers have to work in close collaboration to improve the whole vertical value chain from sugar beet production to sugar processing, sugar distribution and marketing.
3. If the volume of production is limited by the domestic market or international trade obligations the number of sugar factories has to be reduced drastically and the efficiency of the remaining sugar factories has to be increased rapidly.
4. The Government has to ensure that production goes to the best locations and best producers to make the sector efficient.
5. Foreign direct investment may play an important role to increase efficiency by investments, know how transfer and market transparency.

## 10 Conclusions

### 10.1 Policy options: Phasing-Out or Stability Pact?

To stimulate structural change after years of stagnation of the Ukrainian sugar sector, policy makers in Ukraine in principle have two choices, a) to abolish import tariffs as well as production quota and minimum prices and allow free sugar trade and production, or b) to protect domestic production according to WTO negotiations and to produce sugar for domestic consumption only. According to WTO restrictions the second option rules out sugar exports since extensive export of beet sugar is not possible without export subsidies and Ukraine offered no recourse to export subsidies in its WTO accession negotiations.

Following the first option would most likely lead to quickly shrinking production of sugar in Ukraine due to limited competitiveness of beet sugar on world markets. It would however have the advantage of lower sugar prices for consumers. During phases of low world market prices the sugar industry in Ukraine would die, a few islands of production may survive subject to world market price fluctuations and efficiency of the remaining production. From an economic point of view this option would bring the highest return to the Ukrainian economy. However, if this economic 'first best' scenario would not find a political majority in Ukraine an alternative scenario will have to be developed. A second scenario would involve a strategy development process where the Government, in close cooperation with the sugar industry, sugar beet farmers and other relevant stakeholders would work out a domestic sugar sector strategy following principles of competitiveness, transparency, efficiency and selected investment.

Both strategies would not involve green-field investments in new sugar factories but would make the best use of the quasi-fixed capital stock in the industry until its complete use and amortization.

The second strategy would have the objective to produce sugar for the domestic market only and would provide stability to increase the efficiency of the sector. All stakeholders would have to agree on such a „stability pact“.

The following issues would be crucial for implementation:

#### **a) external protection set by the WTO negotiation process**

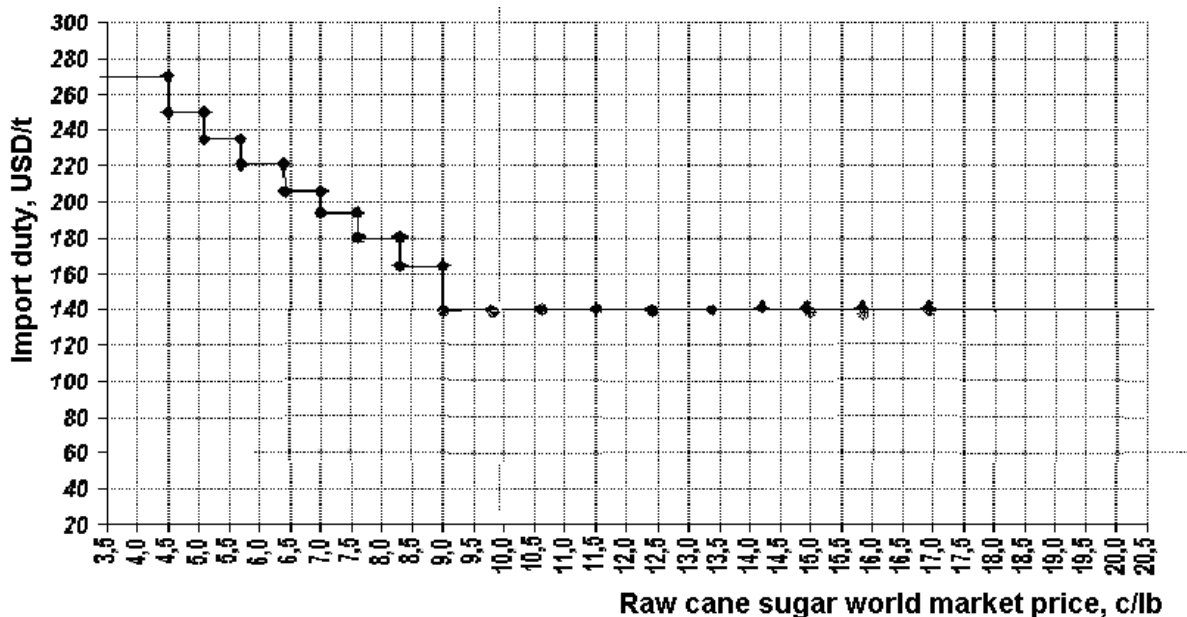
Ukraine negotiated a Tariff Rate Quota at 260,000 tons of raw sugar imported at 2 % tariff from the year of Ukraine's accession to WTO. Over-tariff quota would be 50 %.

The maximum bound rate for refined sugar will be 50 % of the border price (ad valorem).

The implementation period of the introduction of this import regime has not been defined yet but it is highly likely that the WTO would not accept a period exceeding a limited number of years.

The replacement of the previous import regime (with a prohibitively fixed amount of 300 Euro/t minimum) by the above import tax regime has important implications for the competitiveness of the sugar sector in Ukraine. If prices on world markets are high (as in 2006) this would provide a sufficient protection. However, if prices are low (as in 2005) this regime would not be sufficient to provide effective protection for Ukrainian sugar production at its current low efficiency (see chapter 3 for further details). It may be worthwhile to reconsider this issue during the negotiation process. The Russian variable import regime for sugar may be a model to provide effective protection even with high world market price fluctuations for a transition period even if not compatible with WTO rules in the long run. The following graphical presentation shows the import tariff steps for import of sugar into Russia according to the world market price.

**Figure 15: The Russian border protection**



Source: Rylko, 2006

If the Russian model of sugar border protection cannot be re-negotiated with WTO, the expected tariff of 50 % will not be sufficient for all producers to survive (see chapter 3). The import regime after WTO accession will increase competition and force the less efficient producers to make production more efficient or to go bankrupt.

**b) annual sugar consumption is estimated at about 2.1 to 2.2 mln t**

Deducting the above import of raw sugar (260.000t), annual domestic production for domestic consumption could be about 1.8 mln t of sugar. This is almost the current production. At this moment, about 120 sugar factories are producing this annual volume (about 15.000 t / factory on average). In future, 30 to 40 sugar factories (with about 50.000 t / factory) will be sufficient to produce for the domestic market. The Government will have to develop a market based mechanism to support both (i) those factories at sub-optimal locations to phase-out production, and (ii) those factories with good perspectives at good locations to upgrade their production – including sugar beet production - by necessary selective investments, e.g. in processing and energy efficiency.

**c) annual distribution of quota has to be replaced by a new transparent long-term mechanism reducing planning risks for investors**

The current system of annual allocation of production and import quota by the Ministry of Agriculture Policy increases investment risks and provides no incentives for investments and improvement of efficiency. It provides incentives for corruption.

The first best solution would be to abolish domestic production quotas. This would lead to better allocation of production factors to the best regions and best producers. Efficiency would be most likely increase quickly. However, potential efficiency gains may lead to future over production of sugar beyond domestic consumption. As sugar exports are excluded under the currently negotiated WTO agreement a mechanism has to be introduced to ensure both a) rapid efficiency gains, and b) limitation of future production to domestic consumption.

In case of continued production quotas annual allocation of quota would have to be replaced by a new system of long-term quota allocation. Quota have to be made tradeable to ensure that production goes to the most efficient producers and locations. According to EU experiences the first allocation may be based on a sensible reference period based on previous production. After the first allocation the market mechanism will stimulate necessary re-allocation and productivity increases.

With the introduction of tradeable quota minimum prices should be abolished to speed up the restructuring process.

**d) a restructuring fund should be available to support affected regions, factories, farmers and factory workers**

Similar to the implemented restructuring funds of the EU after the sugar market reform, a Ukrainian restructuring fund would have to be established. Funds would be provided to those factories deciding to phase-out production. The remaining sugar industry should finance this fund by a levy on sugar prices if import tariffs will remain at the 50 % level. This is justified because the sugar industry would benefit most of long-term stability. The restructuring fund would provide incentives for rapid structural change so that sugar beet and sugar production goes to the most efficient locations and producers.

The order of magnitude of such a restructuring fund is estimated at USD100-200 m. This figure includes the annual salary compensation for workers losing their job in the sector (USD67-151.2 m, see chapter 4.4 for discussion) and USD40 m to support sugar plants deciding to end sugar production (handing over production quota rights to the restructuring fund) with payments for the year of ending production at about USD40/t or UAH200/t. Assuming 30 factories in the sector and further assuming they produce 0.8 m tons of sugar, 1 m tons of sugar quota would likely be transferred to the restructuring fund, implying USD40 m of compensation. Combining compensation for loss of employment and handing over of the sugar quota the order of magnitude of restructuring fund payments would roughly be estimated at USD140-240 per ton of sugar. The necessary levy on sugar prices would be in the range of USD50 to 100 per ton.

## 10.2 Recommendations and necessary actions

**A: If the Government opts for the Phasing-Out Scenario, then the following recommendations are given:**

### **Recommendation A1:**

Reduce import tariffs in a first step to the level required by WTO, in a second step to zero. Abolish input tariffs on inputs (e.g. seeds).

Output: Sugar available for consumers at world market prices

### **Recommendation A2:**

Abolish production quotas and minimum prices.

Output: Unbiased production, consumption and trade according to market principles

### **Recommendation A3:**

Support competitiveness of remaining sugar beet producers and the sugar industry by market information and advisory services.

Output: Transparent and efficient production and markets mainly reacting on world market opportunities

### **Recommendation A4:**

Attract Foreign Direct Investment

Output: Competitive and transparent investment climate and innovation

### **Recommendation A5:**

Support closing of sugar factories, factory workers and sugar beet growers by restructuring fund.

Output: Accelerated structural change and social protection

This Phasing-Out Scenario would produce the highest return for the Ukrainian economy as a whole by improved allocation of production factors, rapid structural change and closing of inefficient sugar factories. At the same time it would make surviving producers more competitive, agile and strong.

**B: If the Government opts for the Stability Pact Scenario, then the following recommendations are given:**

### **Recommendation B1:**

Initiate discussion process with relevant stakeholders (sugar industry, sugar beet growers, Government, consumers associations) to develop „stability pact“ for the sugar sector. Make the discussion process transparent and publish results in a Government strategy document. Make the results binding for all stakeholders for a period of at least five years.

Output: Sugar development strategy document

### **Recommendation B2:**

Assess impact of external protection mechanism after WTO accession. Adapt import regime according to the Russian model to ensure sufficient protection if world market prices are low.

Output: Revised import tariff regime for a transition period after WTO accession

**Recommendation B3:**

Abolish production quotas

**Or**

Replace annual domestic production quota distribution for sugar and sugar beets by transparent and efficient long-term quota allocation. Make the quota tradeable to increase productivity in the value chain. Abolish minimum prices.

Output: Long-term quota allocation of tradeable quota

**Recommendation B4:**

Design and implement restructuring fund providing funds for closing of sugar factories. Define priority regions, timing and distribution mechanism. Funds should be provided by the remaining sugar industry to those sugar companies deciding to phase-out production (including sugar beet growers and factory workers) similar to the recently established EU mechanism. The order of magnitude of such a fund is estimated at USD100-200 m.

Output: Restructuring fund financed by the sugar industry

**Recommendation B5:**

Reduce import tariffs for necessary inputs, e.g. sugar beet seeds, to improve production.

Output: Higher input quality and sugar beet production efficiency

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Lektor: Stephan von Cramon-Taubadel

Date: 3<sup>rd</sup> May 2005

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## ANNEX A: Methodology used description

### A.1 KERNEL DENSITY ESTIMATION

In this paper we estimate unknown distributions of random variables — sugar beet yields, efficiency scores, gross margins, campaign days etc. For this, we use ROSENBLATT (1956) kernel-based estimate of unknown univariate density function  $f(u)$ , of a random variable  $u$ , from the sample or realizations of  $u$ ,  $\{u_j : j = 1, \dots, n\}$ , defined as

$$\hat{f}(u) = \frac{1}{n h} \sum_{j=1}^n K\left(\frac{u_j - u}{h}\right),$$

where  $K$  is a kernel function (e.g. Gaussian density in our case) and  $h$  is the bandwidth. The obtained density estimates were plotted for visual presentation and comparison of distributions.

### A.2 EFFICIENCY CHARACTERIZATIONS

Assume  $n$  firms operate in a region  $r$  ( $r=1, \dots, R$ ) at question. Each firm  $k$  ( $k=1, \dots, n_r$ ) in region  $r$  uses  $N$  inputs, denoted with  $x^k = (x_1^k, \dots, x_N^k)' \in \mathfrak{R}_+^N$ , to produce  $M$  outputs, denoted with  $y^k = (y_1^k, \dots, y_M^k)' \in \mathfrak{R}_+^M$ . We assume that within a region, all  $n$  firms have access to the same technology  $T^r$ , defined in general terms as

$$T^r \equiv \{(x, y) : x \text{ can produce } y\}, \quad r=1, \dots, R \quad (1)$$

that satisfies standard regularity axioms of production theory (e.g. see FÄRE, GROSSKOPF AND LOVELL (1994). Technology is allowed to differ between regions. Under these axioms we can use the *output oriented* SHEPHARD'S (1970) distance function

$D_o^r : \mathfrak{R}_+^N \times \mathfrak{R}_+^M \rightarrow \mathfrak{R}_+^1 \cup \{\infty\}$ , defined as

$$D_o^r(x, y) \equiv \inf\{\theta : (x, y/\theta) \in T^r\} \quad (2)$$

to completely characterize technology set  $T^r$  of region  $r$ . This distance function can be used to define *Farrell-type* output oriented technical efficiency measure for firm  $k$

$$TE^r(x^k, y^k) \equiv 1/D_o^r(x^k, y^k) \quad (3)$$

Whenever we state that  $D_o^r(x^k, y^k) = 1$  or  $TE^r(x^k, y^k) = 1$ , we assert that firm  $k$  is

*technically* efficient relative to frontier of region  $r$ , otherwise, when  $TE^r(x^k, y^k) > 1$ , it is *technically* inefficient. For convenience, one can represent efficiency score of a firm  $k$  in percentages, i.e.  $(1/TE^r(x^k, y^k)) * 100\%$  and its inefficiency score would then be

$(1 - 1/TE^r(x^k, y^k)) * 100\%$ . While aggregating individual efficiencies into the sub-group or group levels within a region we accounted for *contribution* of particular firm in total group (region) score (FÄRE AND ZELENYUK, 2003). In particular, their aggregate efficiency for *sub-group*  $l$  is obtained as

$$\overline{TE}^l \equiv \sum_{k=1}^{n_l} TE(x^{l,k}, y^{l,k}) \cdot S^{l,k}, \quad S^{l,k} \equiv \frac{p y^{l,k}}{p \bar{Y}^l}, \quad \bar{Y}^l = \sum_{k=1}^{n_l} y^{l,k}, \quad l=1, \dots, L \quad (4)$$

By the same manner, the aggregate efficiency score for entire group (i.e., aggregated over all the sub-groups of a region) is given by

$$\overline{TE} = \sum_{l=1}^L \overline{TE}^l \cdot S^l, \quad S^l = p \bar{Y}^l / p \sum_{l=1}^L \bar{Y}^l \quad (5)$$

Particularly for our study, this formula tells us that technical efficiency for region's production of sunflower seeds is obtained by averaging the group efficiencies over all enterprises (regions) with weights being the shares of each firm in total regional revenue. It is worthwhile to note that for a single-output case (as ours), the weights become the corresponding output-shares.

### A.3 DEA (DATA ENVELOPE ANALYSIS) ESTIMATION

The technology set  $T^r$  for each region  $r$  ( $r=1, \dots, R$ ) is unobservable but can be (under certain assumptions) consistently estimated using *Activity Analysis Model*, with the following set

$$\hat{T}^r \equiv \left\{ (x, y) : y \leq \sum_{k=1}^{n_r} z_k y_m^k; x \geq \sum_{k=1}^{n_r} z_k x_i^k; \sum_{k=1}^{n_r} z_k = 1; z_k \geq 0; \right. \\ \left. k = 1, \dots, n_r; m = 1, \dots, M; i = 1, \dots, N; r = 1, \dots, R \right\} \quad (6)$$

The boundary of this set defines what is called the *observed 'best-practice frontier'*. Such approximation of the true technology can be done for each region and then the individual efficiency can be estimated relative to the observed best practice frontier of the corresponding region. In particular, solving the following linear programming problem

$$\hat{T}E^r(x^j, y^j) \equiv \max_{\Theta, Z_1, \dots, Z_K} \left\{ \Theta : \Theta y^j \leq \sum_{k=1}^{n_r} z_k y_m^k; x^j \geq \sum_{k=1}^{n_r} z_k x_i^k; \sum_{k=1}^{n_r} z_k = 1; z_k \geq 0; \right. \\ \left. k = 1, \dots, n_r; m = 1, \dots, M; i = 1, \dots, N \right\} \quad (7)$$

for each observation (firm)  $j=1, \dots, n$  in the sample gives estimate of technical efficiency for the particular firm  $j$ . The estimates of aggregate efficiency scores are obtained by replacing (in formulas (3) and (4)) the unknown individual technical efficiency scores with their DEA estimates.

### ANNEX B: Description of the calculations used to build Figures 15-16 from chapter 3

The idea behind the presentations is based upon the formulas:

$$Pd_i = (1 + VAT_i) * (1 + ImpT_i) * EX_i * Pw + MktC_i \quad (1)$$

Or

$$Pd_i = (1 + VAT_i) * EX_i * Pw + (MktC_i + ImpT_i) \quad (2)$$

where  $Pd_i$  - domestic price,  $ImpT_i$  - import tariff,  $VAT_i$  - value added tax,  $EX_i$  - exchange rate,  $Pw$  - world price,  $MktC_i$  - marketing and transport costs. The first equation applies to the Figure 16, since after Ukraine joins WTO it will have 50% import tariff, thus it must be calculated from the world market price. The second equation applies to the Figure 15, since now Ukraine has EUR300/t specific import tariff.

As long as  $Pd_i \leq (1 + VAT_i) * ImpT_i * EX_i * Pw + MktC_i$  the import of sugar good is not profitable, thus the domestic industry stays competitive.

Based on historical data we learned that sugar world market prices did not fall below USD187/t over the last 20 years (see World Bank and OECD, 2004). Therefore, this price constitutes the lower bound for the world market price in both figures.

On the other hand we have chosen the EU sugar reference price for 2009-10 (EUR404/t or appr. UAH2465/t) as the lower bound for the Ukrainian domestic sugar price. From our point of view there are at least two arguments in favour of this. The EU Commissions' decision was based on detailed calculations justifying EU sugar industry competitiveness at that price level. So, we assume that this price may serve as a reference and achievable point for Ukraine. Moreover, according to the Ukrtsukor Association data, the minimum sugar production costs were at USD356/t or UAH1816/t. So adding marketing costs and reasonable margins we deduct the same order of magnitude, i.e. UAH2465/t.

### ANNEX C: Database and sugar beet profitability descriptions

The analysis of the sugar beet sector is done using enterprise level data provided by Derzhkomstat (Ukrainian Statistics Committee). The database covers agricultural enterprises operating in 2004. The data were "cleaned" for missing data, possible outliers and nonsensical data, producing a *cross-section* of 3546 agricultural enterprises. Data available for sugar beet production includes *Production cost*, *Land used*, *Labor employed (man-hours)*, *Output*, and *Revenue*. Unfortunately, we cannot extract the quantity or the value of each particular input used in production. However, according to the database description we have the list of inputs

included into the production cost calculations. Table 14 shows the list of inputs accounted in the production cost calculations, as well as gross margin calculations.

**Table 14 Presentation of gross margin calculations**

+ Sales revenue
+ Per hectare subsidies
<b>+ = Revenue</b>
- Seed costs
- Fertilizer costs
- Pesticides and herbicides costs
- Machinery costs (seeding, production, and harvest)
- Transport costs
- Interest payments on short-term credits
- Labor costs
<b>- = Gross value of inputs</b>
<b>= Gross margin</b>

Source: Own presentation

The estimation of efficiency scores employed one output (Output in tons) and two inputs (Gross value of inputs and Land used) model.

The analysis of sugar industry performance was based upon the database collected from different sources – Ukragroconsult, Ukrtsukor, and Zuckerwirtschaft (2006).