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Belarus

Agricultural Productivity and Competitiveness

Impact of State Support and Market Intervention

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Currency Equivalents
(Exchange Rate Effective September 15, 2009)

Currency Unit	=	Belarusian Rubel (BYR)
BYR 1	=	US$ 0.000358
US$ 1	=	BYR 2,794

Fiscal Year
January 1 – December 31

Weights and Measures
Metric System

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Acronyms and Abbreviations

AgPER	public expenditure review in the agricultural sector
BCI	Business Competitiveness Indicator
BYR	Belarusian ruble
BY	Belarus
CAP	Common Agricultural Policy (of the European Union)
CEM	Country Economic Memorandum
CF	conversion factor
c.i.f	cost, insurance and freight
CIS	Commonwealth of Independent States
DB	Doing Business
DEA	data envelopment analysis
EBRD	European Bank for Reconstruction and Development
ECSSD	Environmentally & Socially Sustainable Development Sector Unit
EU	European Union
FAO	Food and Agricultural Organization of the United Nations
FDH	Free Disposal Hull
FDI	Foreign Direct Investment
FEAR	Frontier Efficiency Analysis with R
fob	free on board
GAO	gross agricultural output
GATT	General Agreement on Tariffs and Trade
GCI	Growth Competitiveness Indicator
GDP	gross domestic product
GOB	Government of Belarus
IBRD	International Bank for Reconstruction and Development
LC	local currency
LCU	local currency units
MAFRB	Ministry of Agriculture and Food of the Republic of Belarus
MFN	Most favored nation
MPD	market price differential
NBB	National Bank of Belarus
n.e.s.	not elsewhere specified
NSC	National Statistics Committee of the Republic of Belarus

OECD	Organization for Economic Co-operation and Development
PAM	Policy Analysis Matrix
PCB	Private Cost Benefit ratio
PSE	Producer Support Estimate
RB	Republic of Belarus
RCA	Revealed Comparative Advantage
R&D	research and development
RU	Russian Federation
SCB	Social Cost Benefit
SFA	stochastic frontier analysis
SITC	Standard International Trade Classification
SME	small and medium enterprises
SPS	Sanitary and Phytosanitary Measures
SRDP	State Program for the Revitalization and Development of Rural Areas
SSCU	State Statistics Committee of Ukraine
TBT	Technical Barriers to Trade
TE	technical efficiency
TFP	Total Factor Productivity
UA	Ukraine
UN COMTRADE	UN COMTRADE database
UNCTAD	United Nations Conference on Trade and Development
URAA	Uruguay Round Agreement on Agriculture
US	United States
USDA	United States Department of Agriculture
USSR	Union of Soviet Socialist Republics
VAT	Value Added Tax
WEF	World Economic Forum
WP	Working Party
WTO	World Trade Organization
ΔPE	pure efficiency change
ΔSE	scale efficiency change
ΔTC	Technical change
ΔTFP	Total Factor Productivity change

Executive Summary

Productivity in Belarus' agricultural sector has improved considerably, but large parts of crop and livestock production are not internationally competitive. The state's regulatory and fiscal support system for agriculture has been instrumental in improving the sector's performance. But the massive distortions to agricultural incentives it creates prevent the sector from reaching its full potential. And the high costs it causes to the state budget may be difficult to sustain in view of a shrinking fiscal space. Agricultural sector efficiency and competitiveness in Belarus can be increased by re-orienting the sectoral policy framework towards less distortive measures and reallocating associated budget expenditures to support sustainable agricultural growth. Assistance programs could be provided to buffer against structural adjustment shocks. The government would thus achieve its sectoral goals to a higher degree, without compromising on other important policy areas such as food security and rural livelihoods, and possibly even at lower cost to the state budget. This Note provides an economic justification for such reforms and outlines some potential elements.

Agriculture plays an important role in the Belarusian economy and has experienced considerable productivity increases, …

Agriculture continues to be an important sector in the Belarusian economy and trade, with crucial contributions to rural livelihoods, food security, and rural and economic growth. After a steady decline of roughly 35% over the first nine years of transition, gross agricultural output in Belarus has recovered almost completely to its 1990 level. Some sub-sectors experienced considerable export growth, and import dependence has dropped considerably. Agricultural yields and aggregate output have experienced considerable growth, but capital productivity and labor productivity increased less than in the rest of the economy. Total factor productivity increased for most large commercial farms with an impressive annual growth rate, driven by efficiency gains and technical change. But differences between farms are large, i.e. while many farms became much better (i.e., more productive through increased efficiency), many farms became much worse.

… but large parts of crop and livestock production are not internationally competitive …

The improved productivity does not (yet) show positive effects in the sector's international competitiveness which continues to be low, albeit with large differences between crops, years, and farms. Barley and potatoes were Belarus's internationally most competitive crops until high global market prices allowed wheat to capture this position in 2007. In general, livestock production in Belarus is less competitive than crop production from both the economic and financial perspectives. Factors other than capital investments seem to be key constraints to Belarus' further agricultural development.

… due to structural and regulatory constraints.

Most of the large commercial farms in Belarus have remained under state control without much deep restructuring, and many farms do not seem to evolve towards their optimum size. The large farms are specialized in product groups that benefit from scale efficiencies and where high investment are needed, while the large household farming sector manages small plots cultivated with labor intensive crops. Small private farms make negligible and declining contributions to gross agricultural output. The positive performance results are achieved with a narrow focus on a few products and a limited number of markets with high dependence on Russia. Factor and output markets play a limited role in managerial decisions of agricultural enterprises as the state continues to involve itself in the management of agricultural enterprises, sets production targets, arranges input supply and output procurement, undertakes or finances investments, regulates prices and controls wages. These structural and regulatory constraints limit private initiative and (domestic and foreign) investment.

The state's involvement in the agriculture sector is costly, …

Budgetary expenditures for agriculture account for nine percent of the total state budget, which is more than in many other countries, and have grown faster than gross agricultural output and agricultural value-added. And where products of subsidized sub-sectors are largely exported, a considerable part of the related governmental expenditures effectively become subsidies to the importing country. Against the background of the current global economic crisis and the resulting shrinking fiscal space in Belarus, the current nature and level of support can only be maintained at the expense of other budget expenditure categories, which might become socio-politically undesirable.

… causes massive distortions to agricultural incentives, and creates a considerable burden to the economy overall.

While the agricultural policy framework with its regulatory and fiscal measures provides support but also implicitly taxes the sector ("one foot on the gas pedal and one on the break at the same time"), the net effect is in support of the sector. However, while these measures seem to contribute to sectoral productivity and efficiency achievements on some farms, they create market and price distortions that lead to resource misallocations within the sector and tax the rest of the economy. In addition, at least two thirds of the budgetary support to agriculture is provided through measures that are regarded as distorting trade. This results in a situation where agricultural productivity and contribution to growth and rural incomes is lower than it could be.

Through a re-orientation of the agricultural policy framework towards less distortive measures, Belarus could achieve higher efficiency, competitiveness and growth without compromising on its food security and rural incomes objectives, and could possibly even reduce budgetary expenditures.

Elements of such a re-oriented policy framework could include:

i) Increasing the efficiency of resource use through less state control

- Through *price liberalization for agricultural inputs and outputs*, productive resources

can be guided to their most efficient uses, with positive implications for employment generation and agricultural growth and ultimately for the provision of attractive income opportunities as a sustainable basis of rural livelihoods in the long term.

- A *reduction of state control over farm management* is critical to enable agricultural producers to respond to market signals by adjusting the nature, scope, intensity, and technology of their production and the nature of their business relations for purchases and sales, which will ultimately result in increased efficiency and competitiveness.

ii) Supporting sustainable agricultural growth through non-distorting measures

- *Agricultural education, training, and advisory services:* Educational measures – especially in the field of market-oriented farm management – would be essential to provide farm managers with the knowledge that would allow them to make the best use of new opportunities, i.e. adjusting production technologies and farm management practices to market signals including quality and other requirements. Farmers would further benefit from market-oriented information systems.

- *Food safety system modernization:* Modern agri-food markets are becoming increasingly sophisticated in their food safety and quality requirements, demanding appropriate control structures in the countries of origin. This is especially true for access to the common market of the European Union. To the extent that exports to the EU are an option for Belarus, the adoption of relevant food safety legislation and establishment of institutional arrangements would become necessary.

iii) Providing income support and adjustment assistance through de-coupled payments

- *De-coupled payments to agricultural producers:* The phasing-out of (a part of) the trade-distorting measures currently in effect would create a burden for agricultural producers that could be reduced or entirely compensated for by introducing direct payments to producers that are de-coupled from their production volumes, leaving in place financial assistance to farmers but reducing their distorting effects. While such an arrangement would obviously provide less fiscal relief, it would increase the acceptability of reform measures.

- *Structural adjustment assistance through producer retirement or retraining programs* could substantially reduce the hardship caused by, and hence increase the acceptability of, a reform program that might result in the elimination of less profitable lines of production, or the scaling-down or closing of enterprises altogether.

Introduction and methodology

Background

The agriculture sector of Belarus continues to show considerable output growth, but this growth is created through a governmental support scheme that has been growing at an even larger rate. Against the background of a shrinking fiscal space as a consequence of the global financial and economic crisis and Belarus' ambitions of further economic integration and access to new markets, Belarus' state support to agriculture seems to be on a path towards fiscal unsustainability. It also creates a distorted incentives framework causing sub-optimal resource allocation that leads to lower efficiency and competitiveness and ultimately to a lesser degree of achievement of the government's own objectives. An average of 98.9 percent of Belarus' agricultural enterprises were profitable in 2005-2007[1]. However, this profitability (at financial prices) is achieved at the cost of very high budgetary support which has remained at about 4 percent of GDP with a slight tendency to increase. Against the background of the financial crisis of 2008 and its fallout that will be felt for a few more years, the Government of Belarus (GOB) is likely to revisit its public expenditures. Given that agriculture currently accounts for 9 percent of these expenditures, pressure has risen to seek the most efficient use of state resources in fulfillment of governmental sector targets. In addition, Belarus is reviving its interest in concluding its negotiations for WTO accession where domestic support in agriculture will feature prominently.

Export diversification is urgently needed. Russia's share in Belarus' exports overall has generally been declining since the break-up of the Soviet Union, down to 32% in 2008 from 65% in 1998[2], while its share in imports has been relatively stable. The EU's share in total exports has increased from 16% to 43% in the same period of time. In agriculture, however, the opposite trend can be observed. Russia's share in agricultural exports has been maintained at 83% to 93% over the last decade, while the EU's share declined, most notably in dairy products from an absolute high in 2000 (48%) to 0.2% in 2008. Export diversification into new markets with rigorous demand for high quality products, such as the EU, would require substantial increases of efficiency in production, processing and trade logistics, and a heightened attention to market-required quality and food safety aspects in Belarus' agricultural sector, which will likely require fundamental changes to farm management practices and the overall state support system for agriculture.

The overall objective of the State Rural Development Program (SRDP) – which broadly guides state expenditures for agriculture and the related policy framework in general – is "to establish a sound agrarian economy that will ensure food security of the country and better livelihoods for rural households" through improvements in the social and economic infrastructure of rural areas and through enhanced efficiency and competitiveness of the agro-industrial sector. Belarus, however, is only at the beginning of a longer reform process to which it has committed itself. Until now, important sectors of the economy – including and particularly agriculture – have not participated in the urgently needed, fundamental reforms observed in other parts of the economy.

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[1] Statistical Yearbook Agriculture of the Republic of Belarus 2008, Table 7.2.
[2] 1998 is the first year for which import and export data is available in the COMTRADE database.

Objectives

Enhancing the competitiveness of the Belarusian economy (including the need to increase productivity and to diversify the economy and trade) and improving the effectiveness of government (including the need to improve the effectiveness of public expenditure) are two of the key challenges facing Belarus today[3]. In response, analytical and advisory work continues to form a core element of the Bank's program, as a basis for the discussion of policy options. At the request of the Government of Belarus, and based on the work undertaken in 2005, the Bank has committed itself to the preparation of an update to the Country Economic Memorandum (CEM), focusing on the transition challenges facing Belarus including the economy's competitiveness. As an integral part of this CEM, this Policy Note analyses productivity and competitiveness of agriculture in Belarus and how sector performance is influenced by state interventions (fiscal and regulatory support). Against the above-described background, priorities and mechanisms of Belarus' state support for agriculture need to be re-assessed and likely reformed, with a view towards (i) enhancing competitiveness and creating opportunities for sustainable growth, (ii) achieving greater efficiency in public expenditure management, and (iii) facilitating Belarus' further economic integration including its accession to the WTO.

The analytical work presented in this Note attempts to provide some quantitative evidence with established international methodologies, as an analytical basis for further discussions (nationally and with international partners) of future policy reform options and public investments. The orientation of governmental expenditures and the width and depth of policy reforms – if any – are obviously the sovereign choices of a country, and this Note will not prescribe an "ideal" reform path. Its intention, however, is to document the current agricultural policy framework, to quantify its impact on the structure and performance of the sector, to outline options for a higher degree of achievement of the government's own objectives, and to estimate (in qualitative terms) their expected effects, providing an economic justification for regulatory and fiscal reforms in the agriculture sector if and when they become socio-politically or economically desirable.

The analytical work presented in this Policy Note has been undertaken in close collaboration with Belarusian authorities with a view towards contributing to capacity building efforts aiming to create the knowledge and experience within Belarus to understand and apply internationally established methodology for policy analysis.

Methodology and data sources

A farm-level analysis of the competitiveness of agricultural sub-sectors and a public expenditure review in the agricultural sector (AgPER) are the two main pillars of this analytical work. In particular, the work includes the following methodological elements:

- Analysis of productivity and structural trends: Tabular and graphical trend analysis for key productivity and structural indictors.
- Evolution of policy and institutional framework: qualitative analysis based on the review of governmental policies and other relevant documents.

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[3] Country Assistance Strategy (CAS) for Belarus, dated November 7, 2007.

- State support for agriculture: diagnostic analysis of agricultural public expenditures, including WTO boxes decomposition.
- Overall sector performance: calculation of key parameters such as output growth, land and labor productivity, yields, based on official statistics.
- Farm level performance indicators: disaggregated calculation – and presentation of distributions – of ***Total Factor Productivity (TFP)*** change and ***Private and Social Cost Benefit (PCB, SCB)*** ratios at farm level, based on the Belarusian farm database comprising panel data for all Large Commercial Farms. The links between TFP change and a set of explanatory variables describing the farms, including the subsidies received, were analyzed using ***regression*** methods. The change in TFP (ΔTFP) for each farm is equal to the product of *pure efficiency change* (ΔPE) (measuring how far a farm is from the 'best-practice' maximum output level), *scale efficiency change* (ΔSE) (measuring to which extent a farm has moved closer to the optimal scale of production) and *technical change* (ΔTC) (measuring the effect of new technology onto the best-practice frontier), or: ΔTFP = ΔPE * ΔSE * ΔTC. The PCB ratio is a measure of profitability at financial prices and the SCB ratio is a measure of competitiveness at economic prices (for an in-depth presentation of the methodology, inclunding the difference between financial and economic prices, see Technical Appendix 1 and 2).
- Domestic support schemes for agriculture in selected countries, principles and instruments of modern agricultural policies: review of relevant documents, including OECD and EU sources.

The Government of Belarus – through the State Statistics Committee of the Republic of Belarus – made its comprehensive farm database available for this analytical work, which allowed enterprise-level analyses of unprecedented detail in Belarus. This database contains country-wide farm-level accounting data for the 1617 (in 2007) large commercial farms in an unbalanced panel of 9232 observations over the period 2003-2007 (each observation representing a farm in one of the five years). For 1523 farms, data is available for all 5 years. Input costs were disaggregated based on each crop's share in total production costs on each farm (for more details, see Table 1 and Technical Appendix 1 and Technical Appendix 2).

Table 1: Database description: number of farms producing key crops and livestock products

	Number of farms producing:									
	Wheat	Corn	Barley	Rapeseed	Sugar beet	Potato	Beef	Pork	Poultry	Milk
2003	1,108	8	821	585	1,460	949	2,090	944	68	2,084
2004	1,076	11	1,111	604	1,290	1,276	1,854	825	61	1,847
2005	1,302	118	1,575	608	1,168	1,256	1,653	728	50	1,644
2006	1,250	227	1,540	578	1,039	1,174	1,574	679	45	1,566
2007	1,184	803	1,440	477	966	1,312	1,473	614	41	1,467

Source: Belarusian farm database.

Outline

In response to the key issues described above, this Policy Note provides first insights into the linkages between state support programs (and the broader incentives framework) and farm-level competitiveness (and its impact on growth opportunities). Hence, the competitiveness of key agricultural sub-sectors and the summary of public expenditure and other measures of state support of the agricultural sector are the two main pillars of this work. These analyses will be embedded into recent trends in the agricultural policy framework, structural changes, and overall sectoral performance. The Note covers in Part A some recent trends observed in the agriculture sector, in Part B the agricultural policy framework and state support for agriculture including international comparisons, in Part C a quantitative analysis of key performance indicators including productivity and competitiveness, establishing the concept of opportunity costs and the distinction between financial and economic pricing, in Part D an overview of principles and instruments of modern agricultural policy to enhance agricultural productivity and competitiveness, and in Part E a discussion of some options for consideration by Belarusian policy makers, discussing the effectiveness of the current policy and public expenditure framework in achieving stated objectives and proposing key reform areas.

A. Recent trends in the agriculture sector

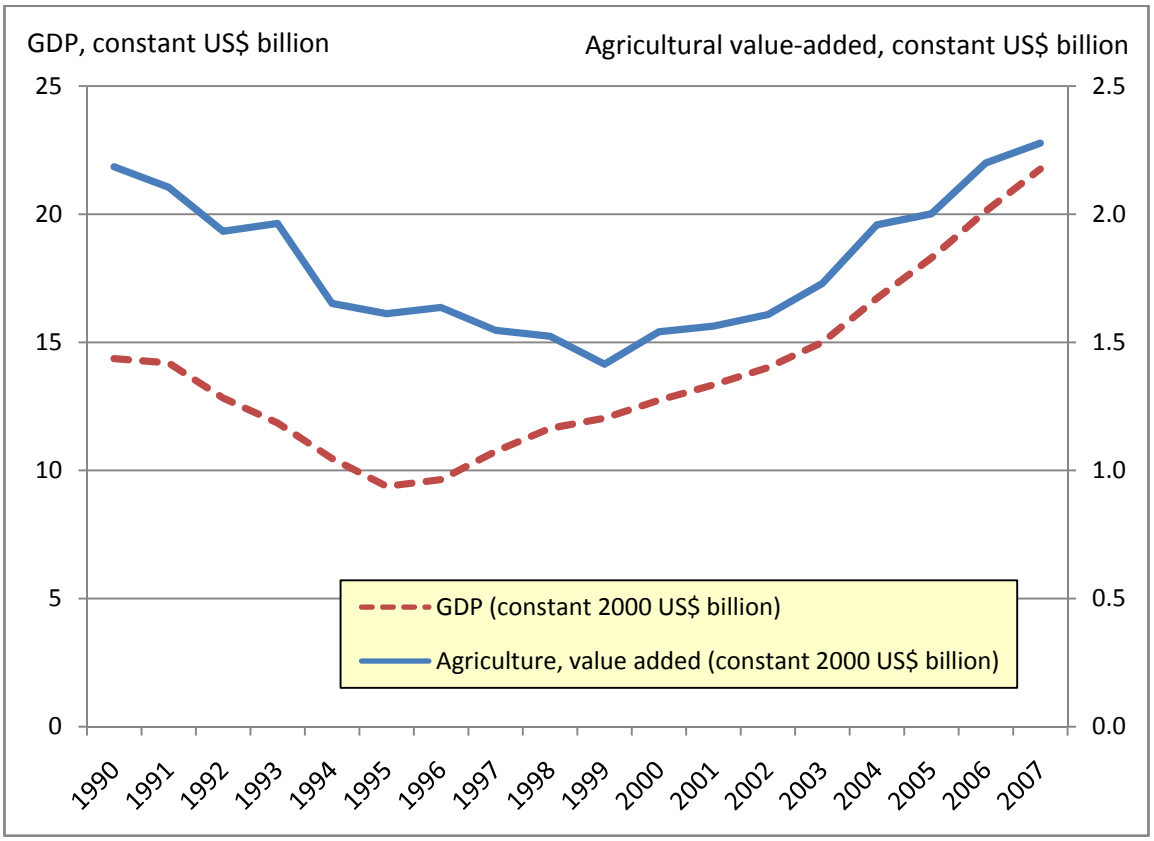
Summary: *The agriculture sector continues to play an important role in the Belarusian economy and was growing with an annual rate ranging between 1.4 and 13.2 percent since 2000. While the sector's shares in GDP and total employment are lower than in the rest of the CIS and declining, they are still much larger than in Western Europe. Some sub-sectors have experienced considerable export growth. While agricultural exports overall have grown at a considerably higher rate than agricultural imports since 2000, narrowing the agri-food trade deficit that existed since the early years of transition, Belarus overall continues to be a net importer of agri-food products. Belarusian agri-food exports in particular depend heavily on Russia as a trading partner. Belarusian agriculture is characterized by a strongly dualistic[4] farm structure that is typical of CIS countries. But unlike in Russia and Ukraine, the large majority of Belarus' large commercial farms has remained under state control and there has been little deep restructuring of the large commercial farms. After a steady decline of roughly 35% over the first nine years of transition, gross agricultural output (GAO) in Belarus has recovered almost completely to its 1990 level. There is a notable specialization on key product groups between types of farms. Crop production that can strongly benefit from scale efficiencies (i.e, grains, flax, sugar beet) and animal production that requires considerable investments in infrastructure and machinery (dairy and pigs, also poultry) is mainly undertaken on large commercial farms, whereas labor intensive products, such as potatoes, vegetables and sheep (wool) are produced on household plots. Private farms have negligible shares but tend to follow the pattern of household plots. While Belarus' cereals production does not quite meet domestic demand, the sub-sector's import dependence has dropped considerably. In the dairy sub-sector, however, as the share of exports to domestic production grows, dependence on export markets increases. Soil fertility management and marketing are among the key technical and managerial challenges facing agricultural producers in Belarus.*

The role of agriculture in the national economy

After a period of contraction during the first nine years of transition, reaching its minimum in 1999, agricultural value-added has grown steadily. Since 2000, agricultural value-added has continuously grown with an annual rate ranging between 1.4 and 13.2 percent[5]. This development mirrored the general trend of Belarus's economic development illustrated by strong GDP growth, however with a notable delay of the start of recovery by four years. (Figure 1). The Belarusian economy performed particularly strongly since 2004, due to a combination of improved external environment, strengthened domestic demand and improved performance of domestic enterprises. Improved export prices, particularly in fertilizers, food products and metals, were a key factor in this development. However, the impact of the global financial and economic crisis has become increasingly visible in Belarus since October 2008, requiring significant macro-economic adjustments, including tighter fiscal policies and price liberalization.

[4] A small number of large farms and a large number of small farms.
[5] Belarusian statistics report growth rates ranging between 1.6 and 13.7 percent in the same period of time.

Figure 1: GDP and agricultural value-added in Belarus, 1990 - 2007, in constant 2000 US$ billion



Source: World Bank (2009). World Development Indicators.

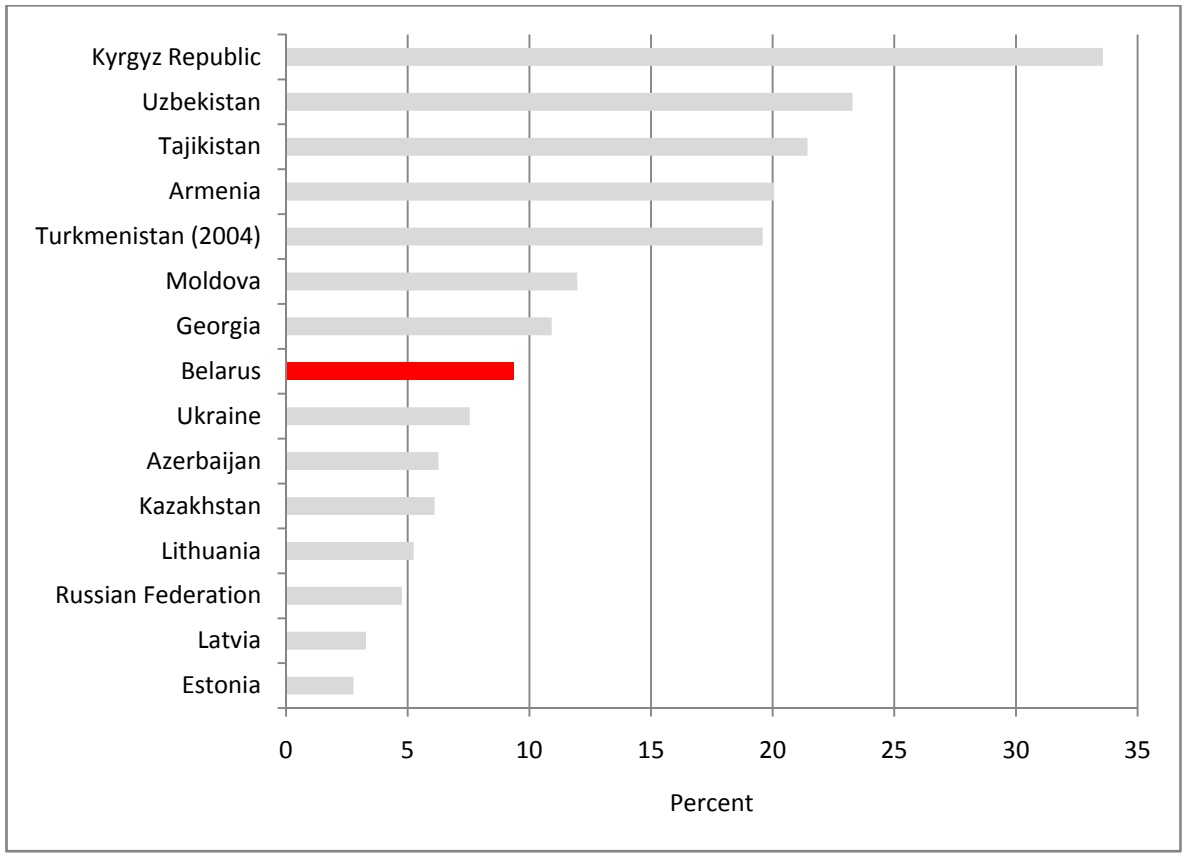
Agriculture continues to play an important role in the Belarusian economy, but – in line with the expected trend – the sector's relative weight has been declining. Agriculture's contribution to GDP fell from 23.6 percent in 1992 to 9.1 in 2008, projected to decline further to about 5 percent by 2015[6], illustrating the relatively mature nature of the economy compared to many countries of the Former Soviet Union where the agricultural sectors are larger (Figure 2). According to the (more detailed) Belarusian statistics, agriculture's share in employment fell from 14.1 percent in 2000 to 9.8 percent in 2007 (9.4 percent in 2008 based on preliminary data), and due primarily to government support (see section B below), the share of agriculture in fixed capital investment has increased rapidly over the same period, from as low as 5 percent in 2002 to over 17 percent in 2006. As a result, agriculture's share in total fixed assets in Belarus has fallen by considerably less than its share in GDP and employment in recent years (Figure 3).[7] The trend in agricultural

[6] World Bank projections. This decline (in terms of share in GDP), while generally expected to occur in growing economies, might be slower than projected given the collapse in the manufacturing sector as a result of the current economic downturn.

[7] Appendix table 1 provides information on major economic indicators and agricultural production in Belarus.

employment is particularly noteworthy. Between 2000 and 2007, the agriculture sector has shed 30.3 percent of its labor force, reducing the number of employees from 625,100 to 435,400. This process is a necessary adjustment to the previous under-employment ("hidden unemployment") situation in the sector. As efficiency and labor productivity increase, this process is likely to continue to some extent. The (rural) economy increasingly faces the challenge of absorbing labor that is released from the agriculture sector.

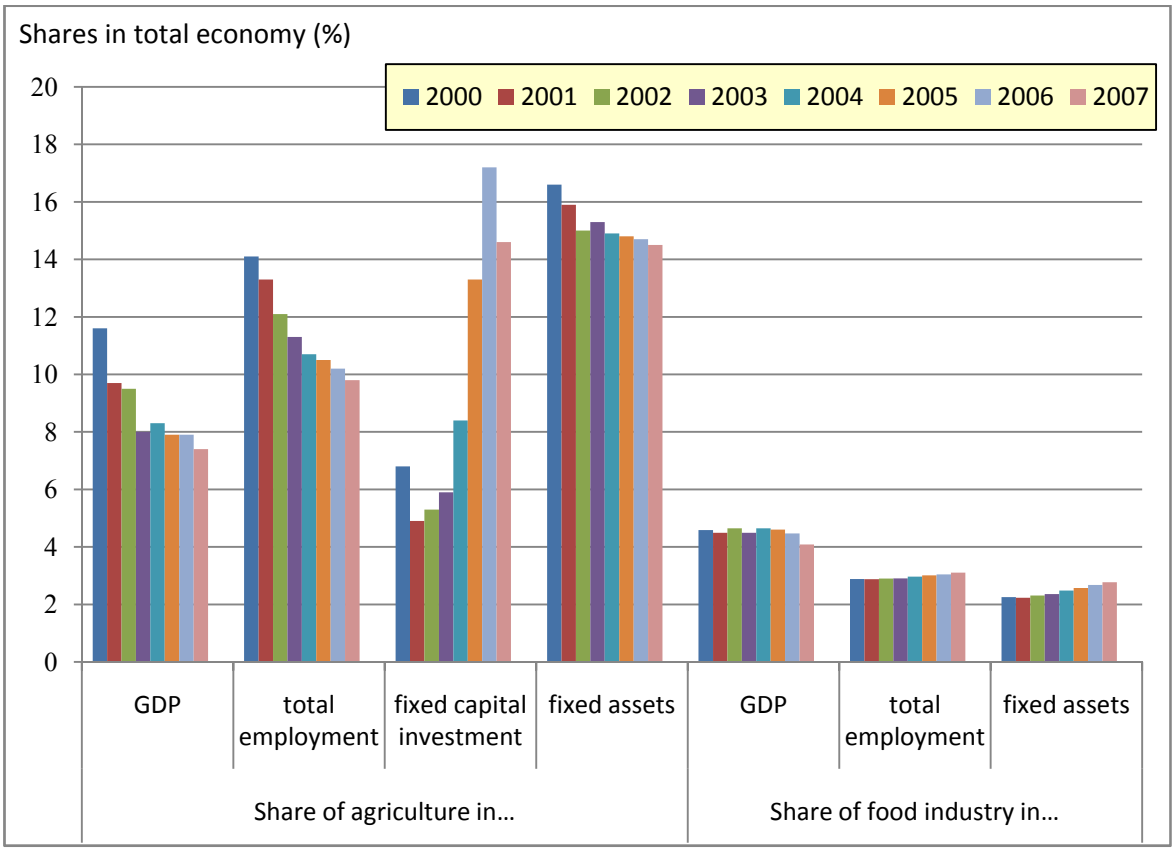
Figure 2: Agricultural value-added as percent of GDP, 2007



Source: World Bank (2009). World Development Indicators.

The food industry plays a smaller role in the Belarusian economy than primary agriculture, but – unlike agriculture – its relative importance has not declined as sharply in recent years. Between 2001 and 2008, the food industry's share of GDP in Belarus remained almost constant at roughly 4.5 percent, while its employment and fixed asset shares both increased somewhat (Figure 3).

Figure 3: The shares of agriculture and the food industry in Belarus in GDP, employment, and fixed assets in Belarus (2000-2007, in %)



Source: National Statistics Committee of the Republic of Belarus (2008a); authors' calculations.

Note: Fixed asset shares refer to stocks as of the end of the year.

The role of agriculture in trade

Agriculture plays a visible role in Belarusian foreign trade, accounting for 6.8% of total exports and 7.9% of total imports in 2008 (Table 2). While the share of agriculture in total exports has remained roughly constant in recent years, the share of agriculture in total imports has fallen from over 12% to 8%. "Food and live animals"[8] accounted for 6% of Belarus' total imports in 2008. Thereof, major imports were: vegetables and fruit (19%), dairy products and eggs (18%), fish and shellfish (14%), and cereals and cereal preparations (13%). Belarus' major agricultural exports are dairy products and eggs (53%), meat and meat preparations (22%), sugar and sugar preparations and honey (8%), and fish and shellfish (7%) (these percentages only refer to SITC Rev. 3 code 0 (food and live animals)).

[8] UN COMTRADE database, SITC Rev. 3 nomenclature, code "0".

Table 2: The structure of Belarusian trade in goods (million US$ unless otherwise specified)

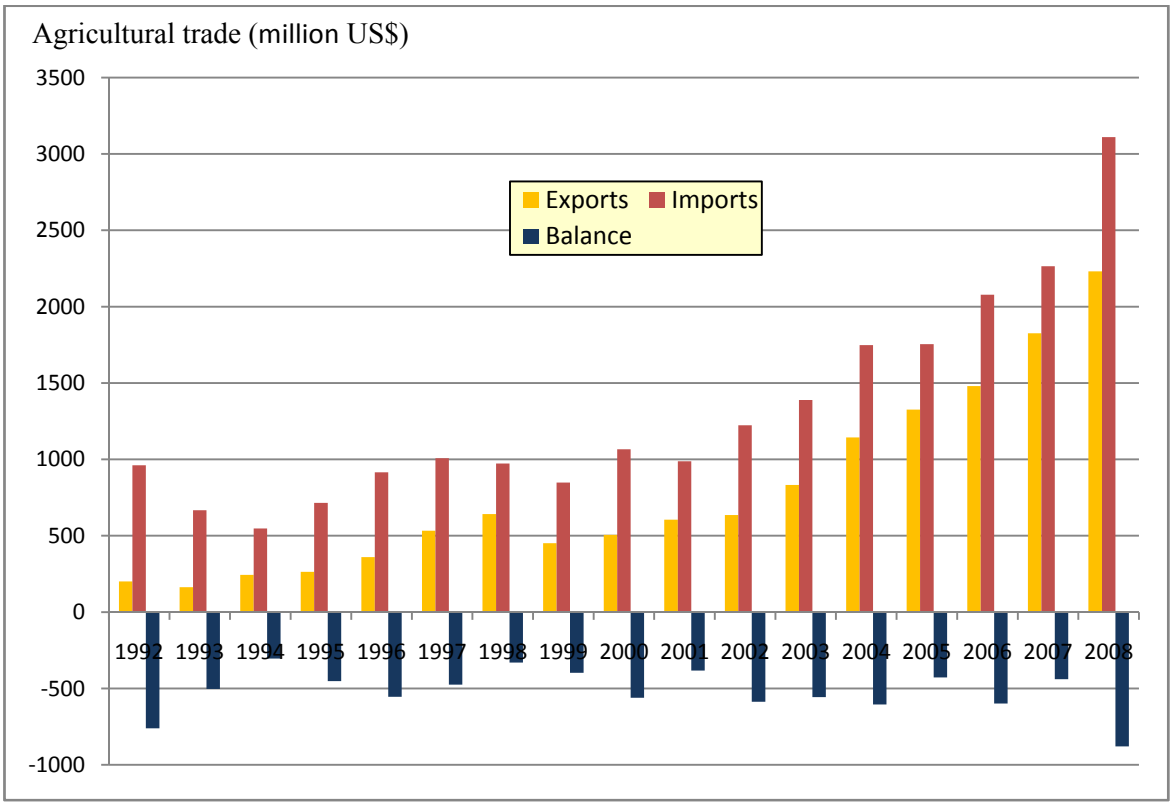
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total exports	**7,326**	**7,448**	**8,021**	**9,946**	**13,774**	**15,979**	**19,734**	**24,339**	**32,902**
of which: to CIS	4,399				7,318	7,060	8,609	11,231	14,406
CIS (%)	*60.0*				*53.1*	*44.2*	*43.6*	*46.1*	*43.8*
to Russia alone	3,710				6,485	5,716	6,845	8,887	10,585
Russia (%)	*50.6*				*47.1*	*35.8*	*34.7*	*36.5*	*32.2*
to non-CIS	2,927				6,456	8,919	11,125	13,108	18,496
non-CIS (%)	*40.0*				*46.9*	*55.8*	*56.4*	*53.9*	*56.2*
Agri-food exports (volume)	505	605	635	832	1,143	1,326	1,480	1,825	2237
Agri-food exports as a share of total exports (%)	6.9	8.1	7.9	8.4	8.3	8.3	7.5	7.5	6.8
Total imports	**8,646**	**8,178**	**9,092**	**11,558**	**16,491**	**16,708**	**22,351**	**28,674**	**39,483**
of which: from CIS	6,070				11,883	11,142	14,512	18,997	26,054
CIS (%)	*70.2*				*72.1*	*66.7*	*64.9*	*66.3*	*66.0*
from Russia alone	5,605				11,219	10,118	13,099	17,187	23,604
Russia (%)	*64.8*				*68.0*	*60.6*	*58.6*	*59.9*	*59.8*
from non-CIS	2,576				4,608	5,566	7,839	9,677	13,429
non-CIS (%)	*29.8*				*27.9*	*33.3*	*35.1*	*33.7*	*34.0*
Agri-food imports (volume)	1,066	987	1,223	1,389	1,748	1,754	2,079	2,265	3119
Agri-food imports as a share of total imports (%)	12.3	12.1	13.5	12.0	10.6	10.5	9.3	7.9	7.9
Trade balance	**-1,320**	**-730**	**-1,071**	**-1,612**	**-2,717**	**-729**	**-2,617**	**-4,335**	**-6,581**
of which: with CIS	-1,671				-4,565	-4,082	-5,903	-7,766	-11,647
CIS (%)	*126.6*				*168.0*	*559.9*	*225.6*	*179.1*	*177.0*
with Russia alone	-1,895				-4,734	-4,402	-6,254	-8,300	-13,019
Russia (%)	*143.6*				*174.2*	*603.8*	*239.0*	*191.5*	*197.8*
with non-CIS	351				1,848	3,353	3,286	3,431	5,067
non-CIS (%)	*-26.6*				*-68.0*	*-459.9*	*-125.6*	*-79.1*	*-77.0*
Agri-food trade balance	-561	-383	-588	-557	-605	-428	-599	-440	-882
Agri-food trade balance as share of agri-food imports (%)	**-52.6**	**-38.8**	**-48.1**	**-40.1**	**-34.6**	**-24.4**	**-28.8**	**-19.4**	**-28.3**

Source: National Statistics Committee of the Republic of Belarus (2009), authors' calculations.

Agricultural exports overall have grown at a considerably higher rate than agricultural imports since 2000, narrowing in relative terms the agri-food trade deficit that existed since the early years of transition. While agricultural imports have tripled since 2000 (from US$ 1.1 billion to US$ 3.1 billion), exports have quadrupled (from US$ 0.5 billion to US$ 2.2 billion) (Table 2 and Figure 4). As a result, the ratio of the agri-food trade balance to agri-food imports has continuously declined, from 53 percent in 2000 to currently 28 percent. While the agri-food trade deficit, roughly constant at around US$ 600 million, accounted for a large proportion of the country's overall trade deficit (up to 59 percent in 2005) with

strong impact on the country's balance of payments, this share has now been much lower for three consecutive years (13 percent in 2008). While these trends are commendable in that they represent the partial fulfillment of governmental objectives, Belarus's agri-food trade structure shows two critical weaknesses: a strong focus on few products and on few trading partners.

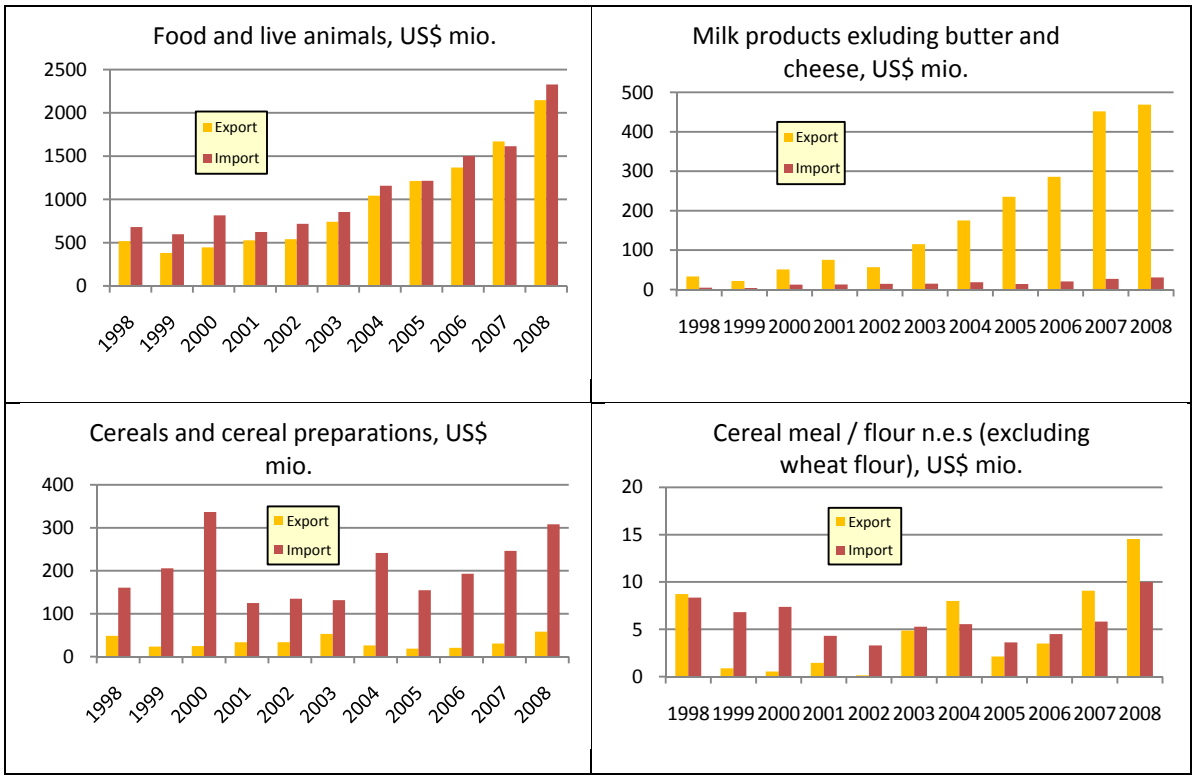
Figure 4: Belarusian agricultural exports, imports and trade balance



Source: National Statistics Committee of the Republic of Belarus (2008a) and Institute for Systemic Research in Agriculture of the NASB (personal communication, 2009); authors' calculations.

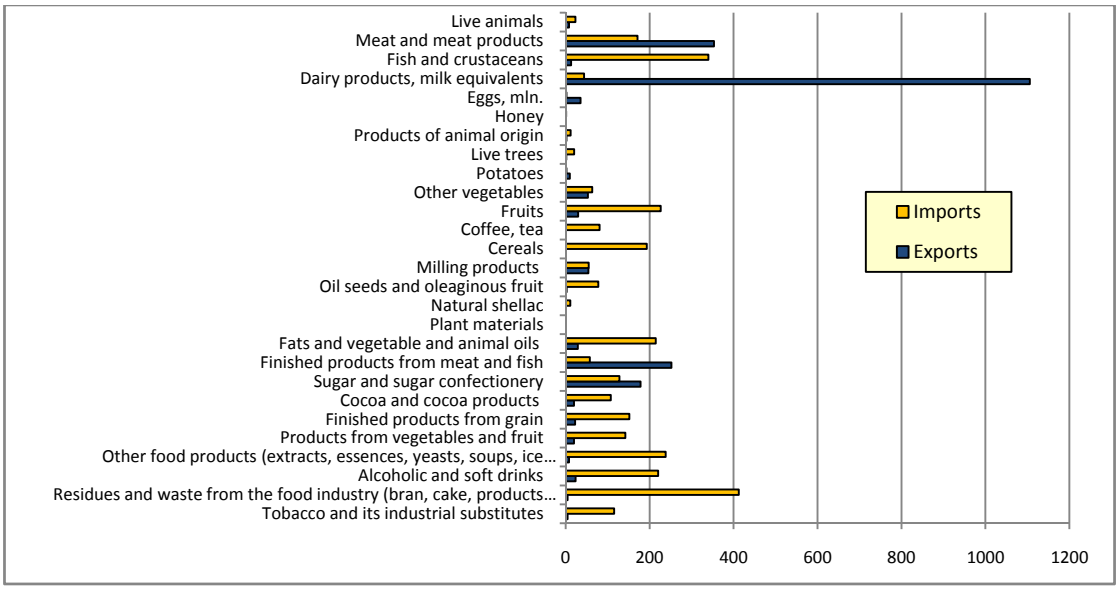
The narrowing gap in the agri-food trade balance masks the fact that this result is achieved with a narrow focus on a few export products, most notably in the dairy sub-sector. Figure 5 illustrates the striking differences in trade by sub-sector with data taken from the UN COMTRADE database, SITC Rev. 3 nomenclature (volumes in US$, fob) and Figure 6 presents trade balances for all agricultural products as per Belarusian customs code. While overall trade in food and live animals is nearly balanced, the dairy sub-sector has seen a remarkable growth in exports and overall (positive) trade balance. And although cereals and cereal preparations have always been major import goods over the last 10 years, cereal meal and flour (excluding wheat flour) has seen a recent rise in exports with now a positive trade balance.

Figure 5: Value of selected agricultural exports, imports, and trade balances, Belarus (US$ million)



Source: UN COMTRADE database, SITC Rev. 3 nomenclature (volumes in US$, fob).

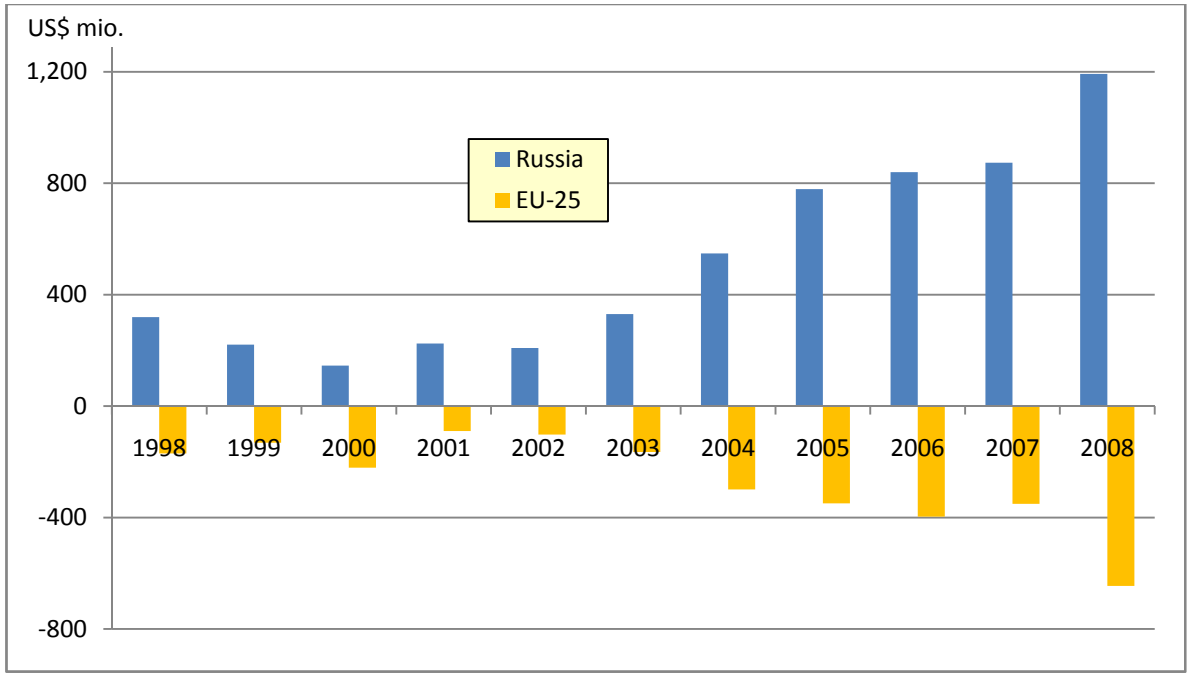
Figure 6: Belarusian trade balances for all agricultural products as per Belarusian customs code (US$ million), 2008



Source: Institute for Systemic Research in Agriculture of the NASB (personal communication, 2009). Calculations based on data of the State Customs Committee of Belarus.

Belarus' trade in agri-food products is highly dependent on CIS countries – and on Russia in particular. The CIS as a whole is the destination for 44% of Belarusian exports and the source of 66% of Belarusian imports; corresponding shares for Russia are 32 and 60% (Table 2). EU, Russia, and Ukraine together have accounted for more than 80% of Belarus' total exports over the last decade (82%-88%), and about 90% of imports (87%-91%). Russia's share in Belarus' exports has generally been declining since the break-up of the Soviet Union, down to 32% in 2008 from 65% in 1998, while its share in imports has been relatively stable. The EU's share in total exports has increased from 16% to 43% in the same period of time. In agriculture, however, the opposite trend can be observed. Russia's share in agricultural exports has been maintained at 83% to 93% over the last decade, while the EU's share declined, most notably in dairy products from an absolute high in 2000 (48%) to 0.2% in 2008. Russia's share in every major category of Belarusian agri-food export (Table 3) has been at least 53 percent between 2000 and 2007, but this share has been about 100% for five of the ten most important categories. Belarusian agri-food imports are more diversified, coming from a variety of CIS and non-CIS sources, with most meat products (frozen beef, pork and poultry) coming from non-CIS, and most grain and oilseed products coming from CIS sources (Russia and Ukraine).[9]

Figure 7: Belarus' trade balance in "food and live animals" with Russia and the EU-25 (US$ million), 1998-2008



Source: UN COMTRADE database, SITC Rev. 3 nomenclature (volumes in US$, fob).

[9] A detailed depiction of the composition and the sources of Belarusian agricultural imports is presented in Appendix Table 2.

Table 3: Total Belarusian agricultural exports (thousand tons), and the share of these exports that is destined for Russia (%), by product

Product	2000	2001	2002	2003	2004	2005	2006	2007
Frozen beef	6	16.1	23.8	32.1	43.5	46.6	58.4	48.1
	100%	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*87%*
Pork	14.4	28.6	16.9	13.6	14.7	23.4	36.8	14.9
	100%	*100%*	*100%*	*100%*	*100%*	*94%*	*100%*	*99%*
Poultry	6.8	7.5	7.6	15.7	13.2	10.5	9	7.9
	100%	*99%*	*100%*	*100%*	*100%*	*100%*	*97%*	*100%*
Condensed milk & cream	49.9	57.6	57.6	75.7	94.3	119	153	161
	57%	*73%*	*82%*	*98%*	*97%*	*93%*	*90%*	*73%*
Butter	17	27.4	29.7	29.7	46.8	51.3	53.6	49.5
	100%	*100%*	*100%*	*100%*	*100%*	*99%*	*100%*	*97%*
Cheese & cottage cheese	16.9	25.8	28.3	38.3	53.5	65.1	82.6	99
	98%	*98%*	*97%*	*98%*	*100%*	*100%*	*100%*	*100%*
Eggs (million)	908.4	766.8	523.9	515.9	531	441.8	516.4	437.9
	99%	*100%*	*100%*	*99%*	*98%*	*100%*	*100%*	*100%*
Sugar	256.3	244.7	332.1	311.8	383.9	481.6	250.5	272.1
	76%	*53%*	*100%*	*100%*	*97%*	*100%*	*95%*	*66%*
Confectionery of sugar	31.4	30.3	25.9	24.6	25.8	21.1	18.1	12.4
	100%	*99%*	*99%*	*99%*	*99%*	*98%*	*96%*	*84%*
Potatoes	101	41	17.7	49.9	103	16.9	9.9	31.1
	89%	*95%*	*97%*	*93%*	*98%*	*97%*	*56%*	*71%*

Source: National Statistics Committee of the Republic of Belarus (2009), authors' calculations.

The agriculture sector benefits from some tariff protection. Belarus' simple-average MFN applied tariff rate (including add-valorem equivalents) was 13.8 percent in agriculture in 2008 compared to 10.7 percent for non-agricultural goods; and the corresponding trade-weighted averages were 8.5 percent and 2.7 percent, respectively[10]. These figures indicate that Belarus's agriculture sector benefits from some external trade protection that is higher than for non-agricultural goods. However, the level of protection in agriculture is comparable to that in other countries in the Region, while the protection for petroleum and industrial goods, albeit lower than for agriculture, is higher than both the regional and WTO averages. The simple-average tariff rate for agricultural goods continuously increased from 9.9 percent in 1995-1999 (average) to 13.8 percent in 2008, indicating an increasing level of protection in the agriculture, while the corresponding rates decreased from 12.7 to 10.7 percent for non-agricultural goods.[11] About 60 percent of all agricultural imports (in value terms) are protected at tariff rates of 10 percent or higher, while this is the case for only about 16 percent of non-agricultural imports.[12] Beverages and tobacco,

[10] World Bank (2009d). World Trade Indicators. Trade-at-a-Glance.
[11] World Bank (2009c). World Trade Indicators, see: http://www.worldbank.org/wti2008
[12] WTO (2009). Tariff Profiles (http://stat.wto.org/TariffProfile/WSDBTariffPFReporter.aspx?Language=E). Tariff data at the HS 2007 6-digit level. All data as of 2006.

cereals and preparations, animal products, and sugars and confectionery enjoy particularly high levels of protection. In 2008, MFN rates were at a maximum of 20 percent for the "food and live animals" product group, with the highest trade-weighted average at the 2-digit level for dairy products and eggs at 13.85 percent (Table 4). Trade with Russia, Kazakhstan and Ukraine benefits from preferential rates at zero percent.

Table 4: Tariff rates (MFN) for Belarusian imports, selected groups, 2008.

Product Name	SITC code	Simple Average	Weighted Average	Min. Rate	Max. Rate	No. of Total Lines	Imports Value ($ '000)
Food & live animals	0	9.39	7.84	0.00	20.00	1,990	2,223,960.500
Live animals except fish	00	3.45	4.14	0.00	5.00	68	23,209.500
Meat & preparations	01	6.82	5.03	0.00	15.00	297	170,098.700
Dairy products & eggs	02	13.78	13.85	5.00	15.00	244	50,789.400
Fish/shellfish/etc.	03	10.48	11.05	5.00	20.00	314	218,404.300
Cereals/cereal preparations	04	8.71	5.17	0.00	15.00	161	308,111.800
Vegetables and fruit	05	11.01	9.51	0.00	15.00	580	435,294.100
Sugar/sugar prep/honey	06	6.92	8.65	5.00	15.00	83	130,180.900
Coffee/tea/cocoa/spices	07	5.27	6.44	0.00	15.00	105	238,868.000
Animal feed except unmilled cereals	08	4.70	4.07	0.00	5.00	70	412,601.600
Misc food products	09	13.01	13.88	5.00	15.00	68	236,402.200
Beverages and tobacco	1	14.36	14.97	5.00	20.00	205	334,869.600

Source: UNCTAD (2009). UNCTAD TRAINS database. All tariff lines in SITC Rev. 3 nomenclature.

WTO accession process is in progress but will likely be completed as a member of the customs union with the Russian Federation and Kazakhstan. Belarus applied for membership in the World Trade Organization (WTO) in September 1993. The Working Party (WP) on Belarus' accession to the organization was established in October 1993. Since then, the WP has met seven times with its most recent meeting in May 2005. The negotiations have until recently focus on the following key areas: legislative changes to comply with WTO rules and regulations; market and service access; and the state support to agriculture. In June 2009, however, Russia, Belarus and Kazakhstan announced that they would seek joint accession to the World Trade Organization as one customs bloc. This decision effectively brings to an immediate halt the national-level accession negotiations of the three individual countries.

Farm structures

Agriculture in Belarus has a strongly dualistic structure similar to that found in other CIS countries such as Russia and Ukraine. At one end of the spectrum, about 1,600 large commercial farms – descended from the former Soviet Kolkhozes and Sovkhozes – farm 86.3 percent of the agricultural land in the country (Table 5). The average size of these

farms is nearly 4,000 hectares. At the other end, over one million household plots with an average size of just below one hectare account for most of the remaining agricultural land (12.5 percent). In between, about 2,000 private farms (with an average size of 53 ha) farm 1.2 percent of the agricultural land in Belarus. The share of these private farms in gross agricultural output has continuously decreased since 1995 (compiled from CIS, 2009).

Table 5: Number and average size of farms in Belarus, by type of farm and size, 2007

	Size category (ha)	Number	Land use (ha)	Average size (ha)
Private farms		2,016	107,800	53
Household plots		1,130,000	1,095,200	0.97
	<5	57	8	0.14
	10-20	4	53	13
	20-50	6	187	31
	50-100	5	307	61
	100–500	18	4,375	243
	500–1,000	6	4,225	704
Large	1,000–2,000	82	133,450	1,627
Commercial	2,000–3,000	309	786,190	2,544
Farms	3,000– 4,000	363	1,262,600	3,478
	4,000 – 5,000	278	1,244,800	4,478
	5,000 – 7,000	275	1,596,100	5,804
	7,000 – 10,000	124	1,005,500	8,109
	> 10,000	35	406,650	11,619
	Without land	55	0	0
	Total	1,617	6,444,445	3,985

Source: National Statistics Committee of the Republic of Belarus (2008a) and Belarusian farm database; authors' calculations.

Note: There is a large discrepancy between the total agricultural area used on large commercial farms as per Belarusian farm database (6,444,445 ha) and the total agricultural land of these farms noted in the official statistics (7,584,000 ha) possibly due to enterprises not included in the farm database or due to fallow land not accounted for in the farm database. In order to reflect the proportion of the farm types consistently, the figures as presented in the official statistics were used for the calculation of the shares of each farm type.

Unlike in other countries of the Former Soviet Union with the dominance of large-scale agricultural producers (Kazakhstan, Russia, Ukraine), the large majority of Belarus' large commercial farms has remained under state control. By early 2004, state and collective farms had practically ceased to exist in Belarus, replaced by new commercial forms such as join-stock companies. The state – however – typically holds the majority share which

fundamentally leaves the companies under state control.[13]

A notable characteristic of farm structures in Belarus is that the average size of the commercial farms has increased slightly since transition began, while it has fallen considerably in other CIS countries. Between 1990 and 2006, the size of the average commercial farm in hectares grew by 14.4% in Belarus, but fell by 58.3%, 34.6% and 54.3% in Moldova, Russia and Ukraine, respectively (Table 6). Hence, restructuring has led to considerable downsizing of farms over the last roughly 15 years in the other CIS countries, but not in Belarus. As a result, only 3.6% of the commercial farms in Ukraine, for example, measured 5,000 hectares and larger in 2006 (World Bank, 2008), compared with 26.8% in Belarus. Farms in Ukraine remain large by international standards, but their average size of 1,325 hectares (World Bank, 2008) is only roughly one-third of the 3,985 hectare average in Belarus. Lerman et al. (2004) present evidence of even stronger downsizing of large commercial farms in the 1990s in Central and Eastern European countries such as Poland, the Czech Republic, Hungary, Slovakia, Bulgaria and Romania.

Farms remain especially large in Belarus because they have undergone comparatively little 'deep' restructuring. In Belarus, Kolkhozes and Sovkhozes were still the dominant types of agricultural enterprise in 2000. By 2003, most of these had been transformed into other legal forms, mainly cooperatives. But this transformation was not accompanied by significant restructuring (World Bank, 2005), and there is little evidence that such restructuring has taken place in the years since. The average size of the commercial farms has slightly increased; it was 3,884 hectares in 2003 (World Bank, 2005) and is 3,985 today. Over the same period, the number of private farms has actually fallen from almost 2,500 to just over 2,000, and the average size of these farms has fallen from 72 to 53 hectares.

Table 6: The average size of large commercial farms in selected CIS countries (in hectares)

Country	1990	2000	2006*	Change 1990-2006
Belarus	3,482	3,824	3,985	+14.4%
Moldova	2,200	950	918	-58.3%
Russia	8,100	5,400	5,298	-34.6%
Ukraine	2,900	2,100	1,326	-54.3%

Source: Lerman et al. (2004, p. 129); Cimpoies et al. (2008, p. 5); World Bank (1994, Table 12); Ministry of Agriculture of the Russian Federation (2008).

* 2007 for Belarus, 2003 for Moldova.

[13] The "Plan of Privatization of Objects owned by the Republic" for 2008-2010, as per governmental decree #1021 of June 14, 2008, makes a small but visible step in the direction of privatization, envisaging the privatization of about 40 production facilities including poultry factories, fish farms, and other types of large-scale enterprises.

The relatively static distribution of farm sizes over time in Belarus suggests that there has been little leeway for farms to change size in an attempt to improve efficiency and profitability. This is not to say that there is a unique optimal farm size in Belarus or elsewhere. Optimal farm size varies with soil and climate conditions, cropping patterns, proximity to input and output markets and, most critically, management ability. Moreover, the size that is optimal for managing day-to-day production activities on the farm is not necessarily optimal for other activities such as purchasing inputs or marketing outputs, for which various forms of cooperation between farms, or vertical integration with upstream and downstream enterprises might be advantageous, as the emergence of agri-holdings in parts of the CIS suggests. Nevertheless, the overwhelming evidence from Central and Eastern Europe and other CIS countries suggests that the former collective farms in the region were, for the most part, too large. Hence, while some farms might grow and others shrink given greater freedom to restructure, restructuring would most likely lead on average to smaller farm structures in Belarus.

Agricultural production

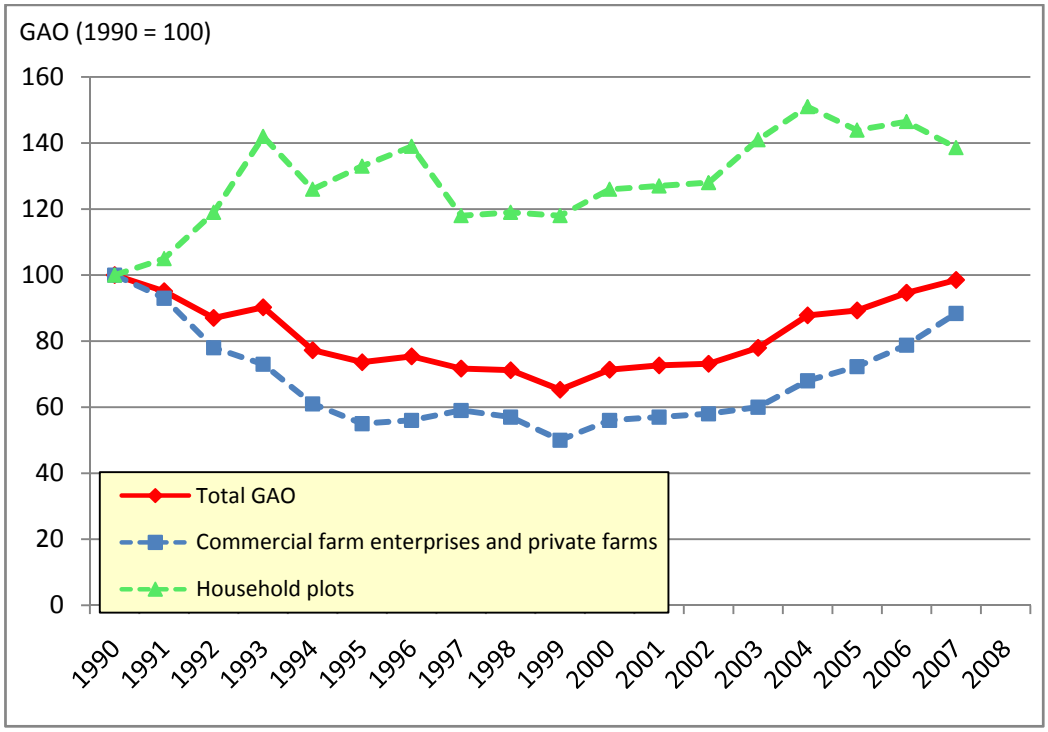
After a steady decline of roughly 35% over the first nine years of transition, gross agricultural output (GAO) in Belarus has recovered almost completely to its 1990 level. However, there is a notable difference between types of farms. Production on household plots in 2007 had exceeded its 1990 level by about 39 percent, while production on commercial farms remains roughly 12% below (Figure 8). Household plots continue to show an exceptional productivity, with 34.6 percent of GAO produced on 12.5 percent of all agricultural land[14]. However, it is common practice that these household plots have close ties with and receive transfers in the form of inputs and services from state-managed, large commercial farms. This household sub-sector is therefore either exceptionally productive, or not all of these transfers are entirely accounted for in the available statistical data.

There is a notable specialization on key product groups between types of farms. Crop production that can strongly benefit from efficiency gains through scale (i.e, grains, flax, sugar beet) and animal production that requires considerable investments in infrastructure and machinery (dairy and pigs, also poultry) is mainly undertaken on large commercial farms, whereas labor intensive products, such as potatoes, vegetables and sheep (wool) are produced on household plots. Private farms have negligible shares but tend to follow the pattern of household plots (Figure 9).

There has been a slight but notable shift in the structure of agricultural output in value terms in Belarus since 2000, with the share of output from animal production (especially milk) expanding from 36 to 44%, and output from crop production (especially potatoes and to a lesser extent grains) correspondingly contracting from 64 to 56% (Figure 10). Measured relative to average production in 1995-97, especially sugar beet but also wheat, fruit, vegetable and poultry production have grown especially strongly (Figure 11). Compared with the years 2000-2002, beef, pork and milk production have also increased notably.

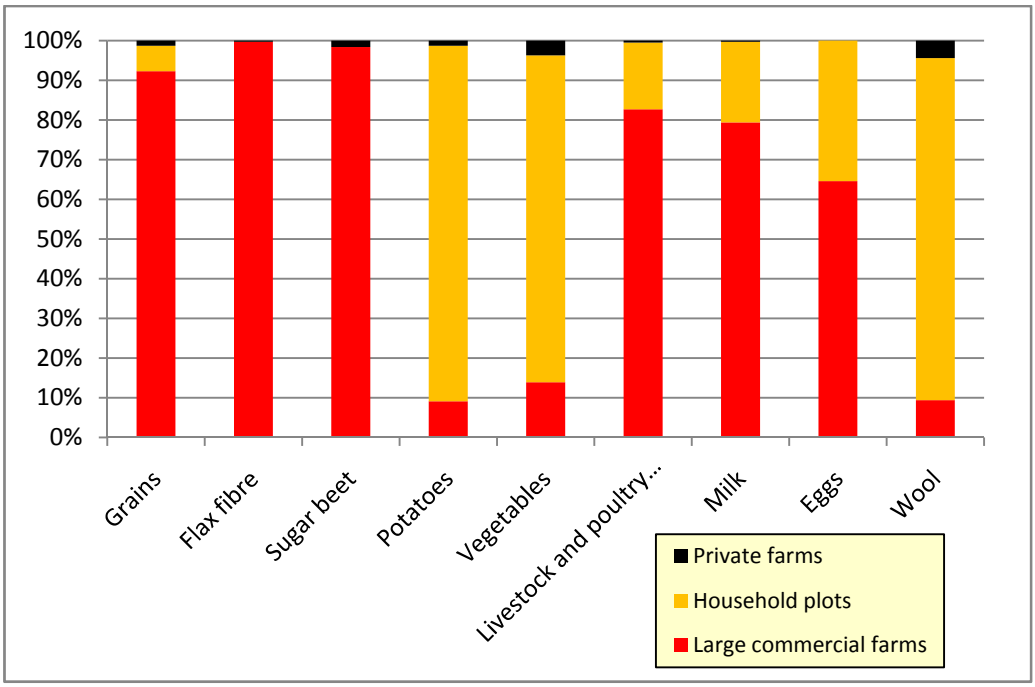
[14] National Statistics Committee of the Republic of Belarus (2008).

Figure 8: Gross agricultural output in Belarus by type of farm (1990=100)



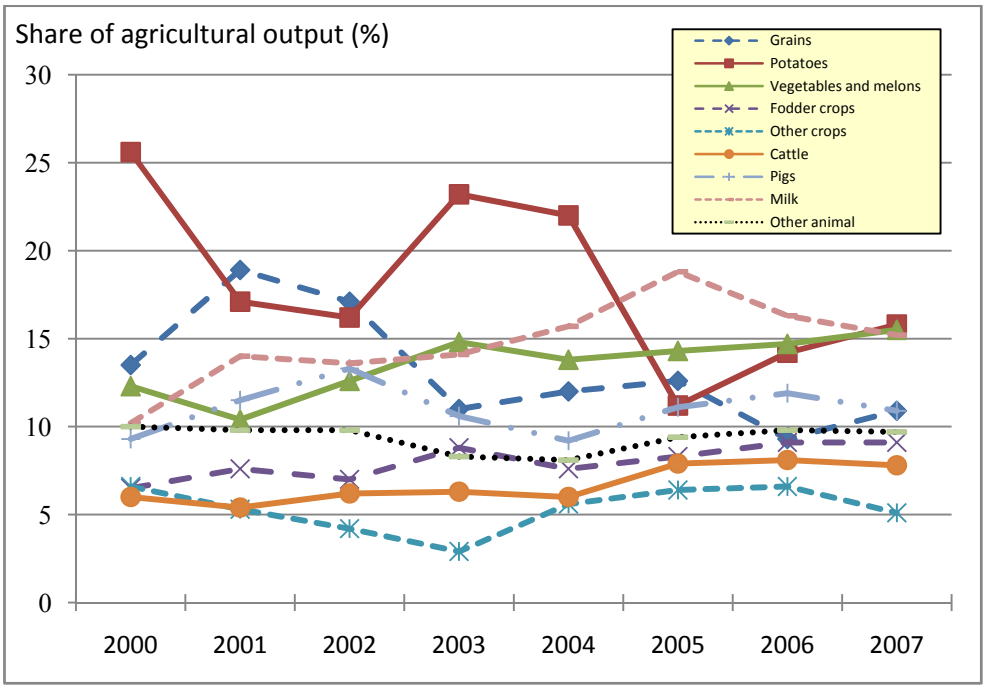
Source: National Statistics Committee of the Republic of Belarus (2008b) and National Statistics Committee of the Republic of Belarus (2009b).

Figure 9: Share (%) of farms (by type) in the production (harvested volume) of key agricultural products, 2007



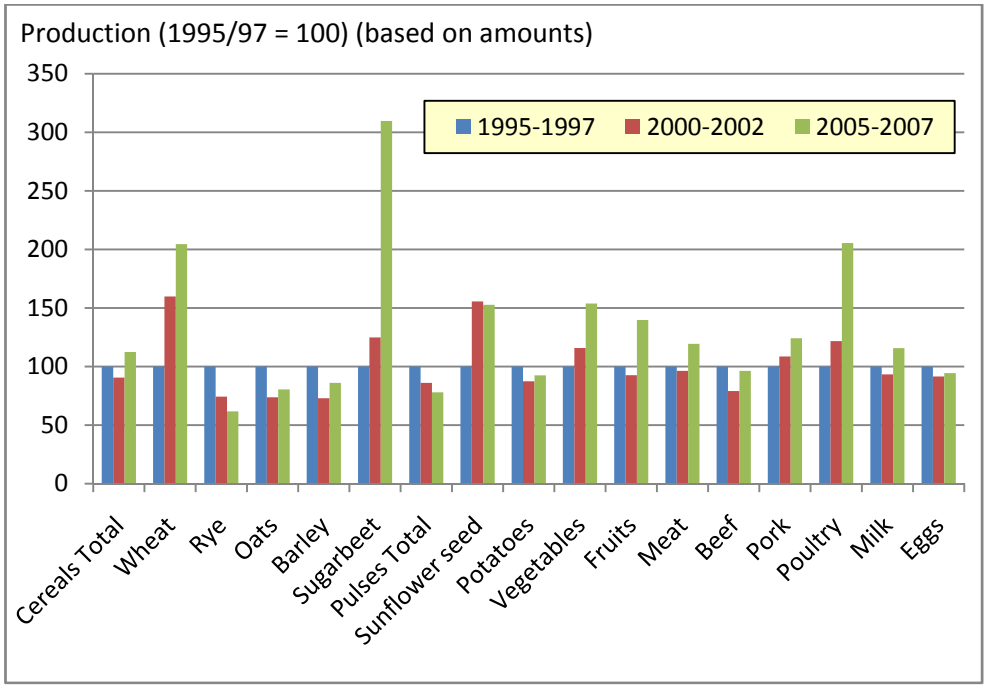
Source: National Statistics Committee of the Republic of Belarus (2008a).

Figure 10: The share (%) of selected major products in total value (at constant prices) of agricultural output



Source: National Statistics Committee of the Republic of Belarus (2008a); authors' calculations.

Figure 11: Changes in the production of major agricultural products in Belarus – three-year averages (1995-1997, 2000-2002 and 2005-2007) (1995-1997 = 100)



Source: Authors' calculations with data in Appendix Table 1.

Note: Between 1995-97 and 2005-2007, triticale production increased by 626% from 0.15 to 1.11 million tons, and corn production increased by almost 6000% from 0.005 to 0.28 million tons. Figure 11 does not include triticale and corn individually, as these large changes from low initial levels would obscure other developments.

Table 7: Production, exports and imports of dairy products in Belarus (in 1000 t), 2000 – 2007

	2000	2001	2002	2003	2004	2005	2006	2007
Total production, milk	4490	4834	4773	4683	5149	5676	5895	5904
Domestic private consumption	2,953	3,026	2,826	2,617	2,422	2,530	2,473	2,423
Domestic industrial consumption	776	856	873	808	790	832	806	805
Exports								
Milk and dairy products (non-milk dairy products in milk equivalents)	786	1,078	1,182	1,349	2,018	2,366	2,677	2,725
thereof:								
"Milk prod. excl. butter/cheese"	61	92	81	156	220	285	314	293
"Butter and cheese"	17	27	30	30	47	51	54	50
"Cheese and curd"	17	26	28	38	53	65	83	92
Imports								
Milk and dairy products (non-milk dairy products in milk equivalents)	54	42	59	82	86	50	86	65
Thereof:								
"Milk prod. excl. butter/cheese"	10	12	12	11	12	12	15	17
"Butter and cheese"	0	1	1	1	1	1	1	0
"Cheese and curd"	0	0	1	1	2	2	4	4
Exports (in milk equivalents) in relation to domestic production (%)	18	22	25	29	39	42	45	46

Source: National Statistics Committee of the Republic of Belarus (2008a), National Statistics Committee of the Republic of Belarus (2009b), UN COMTRADE database, SITC Rev. 3 nomenclature, and authors' calculations.

As the share of exports to domestic production grows in the dairy sub-sector, its dependence on export markets increases. From 2000 to 2007, Belarus' dairy exports (in milk equivalents) – in their relative proportion to domestic milk production – increased from 18 to 46 percent (Table 7). With Russia being the main trading partner for Belarus' dairy products, an import stop by Russia would immediately put at risk half of Belarus' dairy industry. However, with both Russian and Belarus planning to join the WTO, such

decisions[15] will need to be based on scientific methods and empirical evidence and need to be applied in a non-discriminatory manner (i.e. equally to all trading partners).

While Belarus' cereals production does not quite meet domestic demand, the sub-sector's import dependence has dropped considerably. From 2000 to 2007, the proportion (amount) of imported wheat, barley, corn and other cereals in relation to total domestic cereals production dropped from 45 to 8 percent (Table 8). In 2008, this proportion dropped further to 5 percent.

Table 8: Production, exports and imports of cereals in Belarus (in 1000 t), 2000 - 2007

	2000	2001	2002	2003	2004	2005	2006	2007
Total production, cereals	4,565	4,872	5,711	5,116	6,590	6,089	5,685	7,014
Exports								
Wheat/meslin	2	0	2	5	0	0	0	0
Barley grain	1	1	0	2	0	0	0	0
Maize except sweet corn.	0	0	0	0	0	0	0	0
Cereal grains n.e.s.	0	18	86	207	6	3	4	1
Flour/meal wheat/meslin	36	8	1	3	1	0	0	1
Cereal meal/flour n.e.s	2	9	1	35	47	15	26	47
Cereal etc flour/starch	37	85	86	93	33	45	45	32
Imports								
Wheat/meslin	1152	402	503	327	314	217	247	263
Barley grain	326	170	152	118	248	2	55	75
Maize except sweet corn.	185	154	137	68	212	280	233	204
Cereal grains n.e.s.	377	21	4	11	4	1	7	3
Flour/meal wheat/meslin	89	28	29	27	88	68	67	53
Cereal meal/flour n.e.s	20	18	15	12	15	13	12	12
Cereal etc flour/starch	15	36	50	55	67	73	78	78
Wheat, barley, corn and other cereals imports in relation (%) to total domestic production	45	15	14	10	12	8	10	8

Source: National Statistics Committee of the Republic of Belarus (2008a and 2009b), UN COMTRADE database, SITC Rev. 3 nomenclature, and authors' calculations.

[15] On June 6, 2009, Russia banned the import of almost 500 dairy products from Belarus, claiming that Belarusian producers failed to comply with new regulations introduced in December 2008. On June 9, 2009, the list of banned products was expanded to now more than 1000 items, comprising almost all dairy products from Belarus. At the time of writing it was too early to assess the impact of this new development which is only the most recent intensification of a long-standing dispute between Russia and Belarus over quality issues in agricultural trade. In October 2008, for example, Russia had already issues a partial ban of dairy and poultry imports from Belarus, quoting flaws in quality control. The issue, however, probably also has to be seen against the background of Russia's growing discontent over Belarus' provision of considerable subsidies to the agriculture sector which in the case of dairy products, half of which are exported to Russia, effectively constitute an export subsidy (benefitting Russian consumers but hurting producers).

Soil fertility management and marketing are among the key technical and managerial challenges facing agricultural producers in Belarus. Agricultural land in Belarus has historically been known to provide much less favorable conditions than the Chernozems (black soils) in neighboring Ukraine, Russia, and Kazakhstan. Agricultural production therefore requires particular attention to and investments into building and maintaining soil fertility with specific regard to organic matter content. While large commercial farms are constrained by their limited managerial freedom to react to market signals, small private farms face particular issues related to marketing. Small volumes, inefficient (hence costly) production, and product quality issues severely constrain marketing options for private farms and households. This is especially the case for the dairy sub-sector where consumer demand in higher-priced markets requires certain technical arrangements in production and marketing (e.g. related to temperature, smell and animal health management). Russia, key importer of Belarusian dairy exports, requires for example that milk from household farms be collected (and processed) separately from large commercial farms.

B. The agricultural policy framework and state support for agriculture in Belarus

Summary: *After the breakup of the Soviet Union, Belarus started the same type of agricultural reforms as most other transition economies. But this reform process was later discontinued, leaving in place the key tools of the centrally planned economy such as state-controlled management of agricultural enterprises, state production targets, state procurement and state input supply, state lending and investment, as well as price regulation and control over wages. State support to farmers is provided through fiscal measures, including budgetary expenditure and tax privileges, and through regulatory measures, in particular price regulation. These measures provide support to but also implicitly tax the sector at the same time, leading to major distortions of agricultural incentives and – since the net effect is in support of the agriculture sector – a considerable burden to the economy overall. Public expenditures for agriculture, accounting for 9 percent of total state budget expenditures, are directed by more than 20 state programs including and especially the State Program for the Revitalization and Development of Rural Areas for 2005-2010 (SRDP) whose overall objective is "to establish a sound agrarian economy that will ensure food security of the country and better livelihoods for rural households" through social and economic investments in rural areas and enhanced efficiency and competitiveness of the agri-food sector. The measures listed under the agricultural development part of the SRDP, however, are for the most part dirigistic in nature. At least two thirds of Belarus' budgetary support to agriculture is provided through measures that are regarded as distorting trade, i.e. that are included in the 'amber box' category in WTO terminology. At the farm level, the provision of inputs continues to represent a large proportion of governmental support. Between 2002 and 2007, however, the composition of this support changed considerably. Input provision dropped from above 60 percent to about 30 percent in 2007, while direct investments and price premiums have increased in importance. Compared to GDP, total budgetary expenditures, and total agricultural land, budget expenditures for agriculture are considerably higher in Belarus than in many other countries and have grown faster than GAO and agricultural value-added.*

Overview of agricultural policy instruments applied in Belarus

After the breakup of the Soviet Union, Belarus started the same type of agricultural reforms as most other transition economies. But this reform process was later discontinued, leaving in place the key tools of the centrally planned economy such as state-controlled management of agricultural enterprises, state production targets, state procurement and state input supply, state lending and investment, as well as price regulation and control over wages. Already in the former Soviet Union, Belarus was considered to be the "least favorable" area for agricultural production due to its comparatively poor soil condition (the "non-black-soil" area) and was therefore a recipient of substantial subsidies in the last decades of the Soviet era. Belarus was able to turn this support into notable productivity gains, resulting in an agri-food sector that was more productive than the Soviet average. Between 1985 and 1990, agricultural labor productivity increased by about one third compared to a Soviet average of less than 20 percent. Concern about the country's food security (to be achieved through self-sufficiency) and the past experience of productivity

increases in response to subsidies provide the rationale for governmental support to the agriculture sector and continue to shape to a large degree the agricultural policy framework in today's Belarus. The major instruments of Belarus agri-food policy today are the following:

Domestic prices

- Domestic prices regulation along the entire food chain (setting state prices, capping margins; special additional payments for quality products and products delivered by households);

Foreign trade (protection of domestic market)

- Import tariffs on agri-food products (and domestic price regulation);

Cost of production

- Investment support (direct budget investment; budget loans; budget guarantees for bank loans; debt write-offs; interest rate subsidies; direct regulation of banks);
- State supply of inputs (state purchase and distribution of key inputs and compensation for some input purchases by farms; subsidized leasing of machinery; preferential prices for fuel);
- Tax concessions for agriculture;
- Mandatory and subsidized insurance;

Marketing

- State procurement of agricultural products;

Other production-based and direct income support

- Support for rural households.

1) Price regulation

Agricultural prices in Belarus are subject to extensive state regulation as established by the Law On Price Regulation[16] which stipulates the role of the state in regulating prices but also describes the co-existence of free and regulated prices. Prices are generally set at a level that allows agricultural enterprises to generate "normal" profits, also taking into consideration state subsidies and compensations, and are largely considered as performing a social function. State prices are set for goods provided by monopolies and for socially important goods and services. Prices can be regulated by the national government and by regional authorities. The major tools for prices regulation are: fixed prices; price ceilings; capping margins (absolute terms or rates); and fixed price formula and price declaration. Companies violating state price regulations are subject to confiscation of the revenues in excess of the correct prices.

[16] Law # N 255-3 of May 10, 1999, and Gvt Decree # 943 from 18 June 1999.

Farm gate prices

The government of Belarus determines procurement prices for almost all agricultural products at the beginning of each agricultural season. The legal basis for the regulation of farm-gate prices is the "Instruction for Defining the Procurement Prices for Agricultural Products" adopted by the Government[17]. In accordance with this Instruction, the state fixes prices for products that are sold to the state through state procurement which still accounts for a considerable share of total sales. For all other sales, the government sets "recommended" prices. While these prices are not mandatory, prices should be established on the basis of the normative cost of production (norms of input use) and need to be agreed between producers and buyers. Price formulas and price agreements need to be reported to and agreed by the local committees of agriculture.[18] Quality differences (for example milk fat content) justify price differentiation. One special feature of the dairy sub-sector is that milk delivered by households is to be paid as "class 1" milk regardless of its actual quality.

Consumer prices

The Law On Price Regulation of 1999 established the list of socially important products the prices of which are regulated by the state. At its core, this list is still valid today and includes: bread flour, bread and bread products; milk, kefir, sour cream and cottage cheese; meat (beef and pork); milk formulas; canned meat-based baby food; sugar and sweeteners for diabetics; and potatoes and horticultural products. The government sets ceiling wholesale prices for the listed "socially important" products. These prices are reconsidered by the state from time to time. In retail sales, ceiling trade margins apply.

Input prices

The system of input supply is still based on state purchases and distribution of key inputs to the farms. These state purchases are made at regulated prices. In 2006, the suppliers of agricultural machinery and equipment were released from import duties and VAT if they reduced prices to agricultural producers by 12-18% (depending on the type of machinery)[19]. Fuel is sold to agriculture at preferential prices.

2) Foreign trade (protection of domestic market)

While Belarus' agriculture sector benefits from some tariff protection, as described above, this protection does not seem to be particularly strong (para. 17). Much more effective protection of the domestic market is created through the combination of state-set, low domestic prices compensated (for domestic producers) by direct state support. Exports of principal types of agri-food products from Belarus can only be undertaken through – and are hence controlled by – the Belarus Universal Commodity Exchange, which was founded by the State and four state-owned enterprises. Moreover, almost all agri-food products may be subject to temporary export restrictions or complete export bans if deemed necessary to prevent a deficit on the domestic market.

[17] Gvt Decree # 19/8 from 31 Jan. 2006.
[18] Letter of the MAFRB #03-4-8/6553 from 2 July 2008.
[19] Decree of the President of RB #765 from 31 Dec. 2006.

3) Investment support

Every year, the government adopts a plan of direct state investments on grant basis into government-selected enterprises. These investments are funded by the national budget and the Agricultural Producer Support Fund[20] and guided by the government's state program for rural development described further below. In addition to this regular investment program, the government undertakes special investment projects such as the dairy farm expansion project the set out to construct 118 new dairy farms.[21]

In addition to these direct investments, the state provides loans financed from the budget and budget-financed guarantees for bank loans to agricultural enterprises, funds occasional debt write-offs, provides interest rate subsidies, and provides additional support through direct regulation of banks. The decision on the selection of enterprises that are to receive such support appears to contain a considerable discretional element for governmental authorities. The six largest banks that lend to the agri-food sector account for about 85 percent of all lending to agriculture. Since these banks belong to the state, the state can (and does) provide preferential financial services to agricultural enterprises by directly regulating the terms of lending of these state-owned banks. In addition, since the National Bank of Belarus (NBB) is under state control, the NBB can be directed to provide commercial banks with financial resources at preferential conditions. For the government's leasing program (see below), the banks are obliged to provide credit at zero interest. The costs incurred are compensated from the Agricultural Producer Support Fund at three percentage points above the rate of refinancing.

4) State supply of inputs (other than credit)

Input supply program are the financially largest part of the state support to agriculture, as described in more detail further below. These programs include governmental coverage of mineral fertilizer and pesticide costs, the cost of machinery and machinery maintenance and repair, energy costs, the cost of seeds and livestock breeding material, the cost livestock feed, and the cost of land amelioration. While other transition economies have similar programs, they tend to function differently. In most cases, producers get compensated for input purchases they have made based on their own managerial choice. In Belarus, however, the state procures inputs it selects and provides them at preferential prices to the producers, reducing the managerial freedom of farmers.

The machinery leasing program – implemented by *Belagroservice* – accounts for a large part of input support by the government and is the major form of credit support provided to agricultural producers, accounting for about half of all debts accumulated by agricultural producers. The program has been very effective in modernizing the machinery park of agricultural enterprises. Over the lifetime of the program, about 60 percent of grain harvesters, 40 percent of fodder harvesters, and up to 30 percent of other machinery were

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[20] The "Agricultural Producer, Foodstuff, and Agricultural Science Support Fund". Contributions to this Fund are generated through a tax on non-agricultural businesses, the last turnover tax still applied in Belarus. From 2010, this tax will be abolished, requiring a new mechanism for funding support activities that currently receive resources from the Fund.

[21] Decree of the President of RB #332 from 13 June 2008 "On Construction of Dairy Farms". The selected farms are equally distributed across Belarus, with farm per Rayon.

replaced. Annually, around 40-50% (for grain harvesters and some other items this share is even higher) of total deliveries of machinery to farms are made under the leasing program. This is much more than in other countries of the CIS that implement state leasing programs (Kazakhstan, Russia, Ukraine). While the technical results of the program have been impressive, the state dominance in the program has constrained the emergence of a private, competitive leasing services market, and the governmental distribution of the machinery likely causes inefficiencies in its use.

5) Tax concessions for agriculture

In 2000 Belarus introduced the unified agricultural tax which – for agricultural producers who opt for this tax scheme – replaces all taxes except VAT and payments to the Social Protection Fund and the Innovation Fund by a uniform tax of 2 percent. VAT and payments to the two Funds are reduced (from 18 to 10 percent for VAT). The unified tax scheme is not obligatory for producers, but most producers (97%) in Belarus chose this tax scheme[22]. The remaining 3 percent pay regular taxes, including corporate profit tax; income tax, assets tax, land tax, road tax and other taxes. They are, however, still eligible for certain tax concessions.[23]

6) Mandatory and subsidized insurance

Since 2008, insurance for crops and livestock has been mandatory for agricultural producers (it was mandatory in the Soviet time) and is provided by *Belgosstrakh*, a state agency. Most (95 percent) of the insurance premium, however, is covered by the governmental Agricultural Producer Support Fund. In addition, the government also defines the terms of the insurance contracts, such as the part of the losses that are to be covered by the insurer and the margin that the insurer can charge (6%).

7) State procurement

State procurement is carried out by procurement organizations of the Ministry of Agriculture and Food for grains and flax and by procurement organizations of the corporate group "Belgospischeprom" for rape and sugar beet. In 2007, 15 percent of total grains production (33 percent of rye, 31 percent of wheat, and 5 percent of other grains), 99 percent of flax, 69 percent of rape, and 96 percent of sugar beet production were procured by state agencies (National Statistics Committee of the Republic of Belarus, 2008a). Beef and milk are also primarily sold to state agencies, with about 85 percent and 100 percent in total sales, respectively. State-fixed production targets, state procurement prices and fixed orders to deliver to pre-identified procurement agencies complement the system of state procurement. Since the state-set prices do not necessarily cover the cost of production, farm enterprises receive considerable state support (see individual policy areas above).

[22] Institute for Systemic Research in Agriculture of the National Academy of Sciences of the Republic of Belarus.
[23] For more details, see Appendix Table 4 and Appendix Table 5.

8) Support of household farming

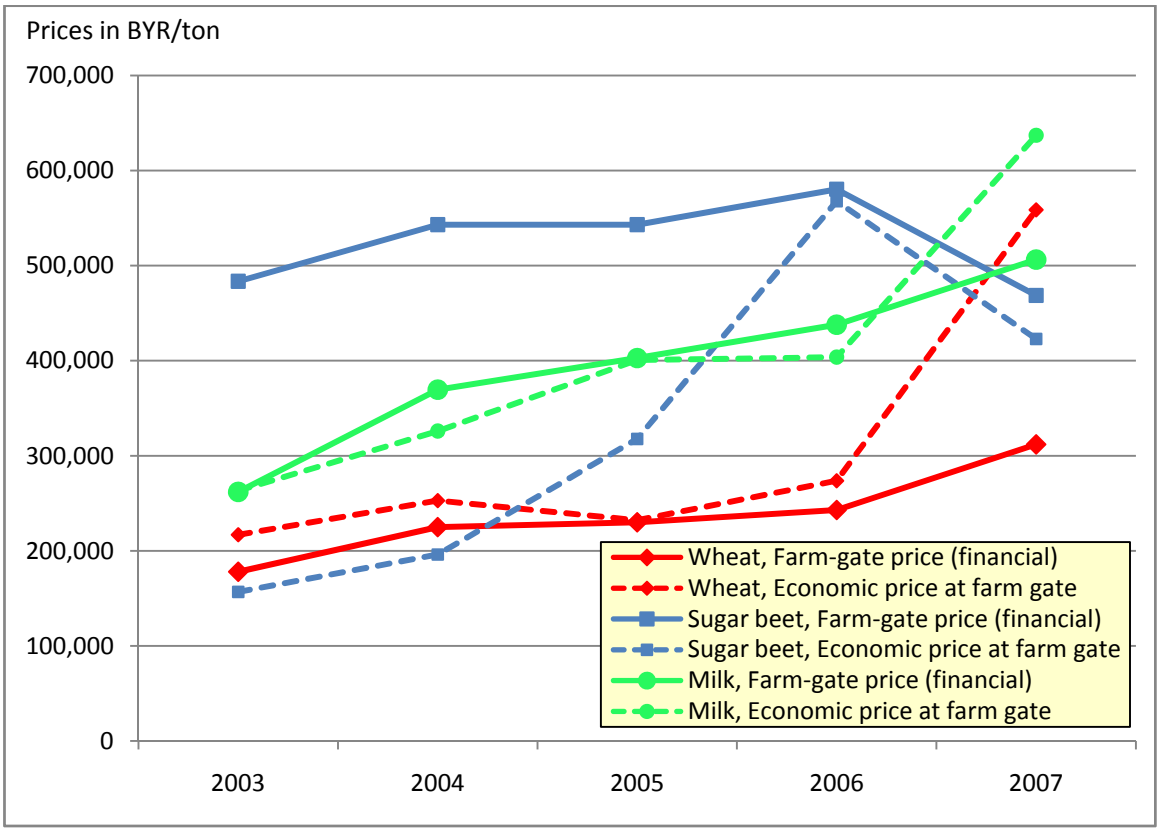
In 2006, the "Special Program of Development and Support of the Household Subsistent Farms in 2006-2010" was adopted. In prices of 2006, this program was estimated to cost almost BYR 400 billion, 31 percent of which were to be financed from the national budget, 59 percent from the Agricultural Producer Support Fund (and the rest to be financed through bank loans). This program primarily supports farm-gate prices for household farms, mainly for milk. Farm households receive the price of "class 1" milk quality irrespective of the actual quality delivered. Other program elements include the distribution of calves, cost compensation for seed potatoes, and direct payments.

Impact of agricultural policies on domestic prices

Belarusian policies affecting the agriculture sector provide support to and implicitly tax the sector at the same time, leading to major distortions of agricultural incentives. Appendix Table 18 and Appendix Table 19 present[24] the market price differential (or, related, conversion factors between financial and economic prices), following OECD (2008) methodology[25] in which the difference between the domestic market price in the presence of the policies (the "financial" price) and a border reference price (adjusted for within-country transaction costs), representing the opportunity price (cost) for domestic market participants, is calculated. The market price differential (MPD) (if calculated as the difference in absolute terms) and the conversion factor (CF) (if calculated as the ratio of the reference price divided by the market price) capture in a single indicator the combined impact on domestic prices of a complex set of price policies and quantify the resource transfer between producers and consumers (and the taxpayer to the extent that policy measures involve transfers to or from the governmental budget). If the CF is larger than 1, agricultural producers receive a net transfer (a subsidy) in the case of agricultural inputs and are implicitly taxed in the case of outputs. The above-referenced tables show that in Belarus agricultural inputs are heavily subsidized, while the situation for agricultural outputs depends on the sub-sector. Wheat, barley and rapeseed, potatoes, beef and milk are implicitly taxed on the product side[26], while poultry, sugar beet and corn receive price support (Figure 12). The net effect of these policies depends on the quantities involved but in the case of Belarus is in support of the agriculture sector, as will be shown in Section C below presenting the competitiveness calculations. Hence, the current policy framework generates considerable transfers from taxpayers to farmers in order to benefit the producers and consumers. It would seem that the same effect could be achieved with less administrative cost by simplifying the tax regime / reducing taxes overall, increasing direct payments to the poorer segments of society, and liberalizing agricultural prices.

[24] For additional details including calculations, see Appendix table 13 through Appendix table 19.
[25] The PSE Manual, OECD (2008).
[26] More recently, in response to the international economic crisis, milk prices were reduced further by 20 percent.

Figure 12: Price developments in Belarus compared to global price trends, prices assessed at farm gate in Belarus, 2003-2007



Source: Authors' calculations. Data source see Appendix Table 18 and Appendix Table 19.

Structure and trends in Belarus' fiscal support for agriculture

Fiscal support to farmers is provided through: (i) budgetary expenditures from the national budget, governmental specialized funds and local budgets and (ii) tax preferences and exemptions. Budgetary expenditures include all payments made by the state to agricultural producers or to agricultural input providers and processors of agricultural products in benefit of agricultural producers (see overview of agricultural policy measures above). Against the background of the state's dominant role in the ownership of agricultural assets and farm management, budgetary expenditures of the state for instruments that directly support agricultural production form a regular source of the budget of the large commercial farms and may therefore be seen as "budgetary transfers". Economically, however, these payments are subsidies to agricultural enterprises. Income effects of non-budgetary regulatory measures are not estimated and hence not included in this support category. While support from the state budgets is documented, the value of tax privileges – which represents tax revenue foregone by the state – is difficult to quantify. Estimates of the magnitude of tax privileges are presented in Appendix Table 4 and Appendix Table 5, but these are ceteris paribus estimates that do not account for the fact that farms would attempt to modify their behavior, and thus their tax bases, if tax preferences and exemptions were abolished.

Public expenditures for agriculture are directed by more than 20 state programs including the State Program for the Revitalization and Development of Rural Areas for 2005-2010 (SRDP), the State Program for Supporting Rural Households, and the State Program for Innovative Development in the Republic of Belarus. The SRDP is the main program which was developed based on the rationale that agriculture is the main economic activity for rural populations that occupy 90 percent of the Belarusian territory and that are key to preserving and developing Belarusian national traditions. Foremost, agriculture is considered as the basis of Belarusian food security. The Belarusian government[27], concerned about the sharp decline in agricultural output observed in the early reform years of the 1990s, therefore accorded special priority to agricultural production and its development. The multi-dimensional nature of the problem requires cross-sectoral and inter-agency collaboration and coordination.

The overall objective of the SRDP is "to establish a sound agrarian economy that will ensure food security of the country and better livelihoods for rural households"[28]. The program is based on two major pillars: (i) Enhancing rural livelihoods through improvements in social services and economic development in rural areas; and (ii) Enhancing the efficiency of agro-industrial production with special attention to the competitiveness of agricultural production operating in a market environment and matching production with agro-ecological potential, the performance of agro-processing, technical modernization and human resource development, and increased efficiency of production. These objectives provide a powerful motivation for the state's continued involvement in the agriculture sector. The separation of the two pillars is a reflection of the government's attempt to free the agricultural sector from its traditional requirement to support social and cultural infrastructure in rural areas and to transfer these obligations to local authorities, allowing the agro-food sector to focus on enhancing its efficiency.[29]

In 2007, expenditures of all government agencies to implement the SRDP amounted to 7.6 trillion BYR (3.54 billion US$), of which about 4.2 trillion BYR (1.96 billion US$, or 55%) fell under the heading 'agricultural development'. The SRDP is complex and covers a broad range of objectives and measures. Appendix Table 3 provides an overview of the 23 specific SRDP objectives under the two broad objectives listed above. While many of the objectives listed under 'development of social infrastructure' (e.g. development of housing, transportation, education, health services, culture and recreation in rural areas) will affect agriculture by providing public goods (e.g. roads that can also be used in agricultural production) and increasing the attractiveness of employment in agriculture, they do not – by the government's own counting (Table 9) – fall under the remit of agricultural policy as such (also compare OECD, 2008).

The measures listed under the agricultural development part of the SRDP are for the most part dirigistic in nature and contain many elements that are reminiscent of planning under

[27] The Ministry of Agriculture and Food develops and approves the procedural details for spending the agricultural budget determined by the President of the Republic. At the local level, farm enterprises send requests for governmental budget based on their production program, including target figures for production, approved by the municipality. An Oblast executive committee sends the requests to the Ministry.
[28] Government of the Republic of Belarus (2005).
[29] Also compare World Bank (2005).

the former Soviet system (also see policy overview above). Specific quantitative goals for input use including land to be dedicated to individual crops are prescribed, as are projected numbers of different types of livestock facilities and "economically appropriate" levels of output both for agriculture and the food processing industry.

Budgetary support for agriculture accounts for a large proportion of total state spending in Belarus. In 2005-2007, agricultural expenditures – with a share of 8-9 % in total state budgetary expenditures – outweighed national defense and law enforcement spending combined, and were slightly smaller than spending on health care (Table 9). Adding the estimated fiscal value of tax exemptions to the budgetary expenditures (see Table 10) raises Belarus' fiscal support to farmers by about 26-35 percent (between 2005 and 2007).

Table 9: State budgetary expenditures in the Republic of Belarus

	2005		2006		2007	
	Billion BYR	Share	Billion BYR	Share	Billion BYR	Share
Agriculture*	2,415	8%	3,370	9%	4,203	9%
Health care	2,966	10%	3,509	10%	4,325	9%
Education	3,980	13%	4,775	13%	5,547	12%
National defense	720	2%	991	3%	1,206	3%
Law enforcement	1,383	5%	1,719	5%	2,063	4%
Other expenses**	18,844	62%	22,499	61%	29,554	63%
Total consolidated expenses	30,308	100%	36,863	100%	46,898	100%

Sources: Ministry of Finance; Law on the State Budgets of the Republic of Belarus 2005-2006; authors'calculations.

* The Ministry of Finance reports lower levels of agricultural spending (e.g. 3,886 billion BYR in 2007). This discrepancy is due to the fact that the Ministry of Finance does not consider some budget lines as support to agriculture. These are: i) financing/maintenance of budget organizations; ii) compensation of costs on leasing operations; iii) agricultural science financing; iv) re-equipment of enterprises in the processing sector; v) subsidies to Minsk city; vi) financing of environmental programs; vii) sanitary and phytosanitary measures; and viii) financing the purchase of samples of new machines.

** Industry, transportation, housing, utilities, social and other expenses. Corrections for agricultural expenditures, see note above, included in this category.

Belarus' fiscal support to agriculture is also large if measured in proportion to output and value-added in the sector. In 2007, the state's total fiscal support for agriculture (including tax privileges) was equivalent to 5.4 percent of national GDP, 29 percent of gross agricultural output (GAO), about three-quarters of agricultural GDP, and 462 percent of net profits in agriculture (Table 10). Even if the estimated fiscal value of tax privileges is excluded, the corresponding shares remain large and have increased steadily since the SRDP 2005-2010 was introduced.

Table 10: Fiscal support to agriculture in Belarus relative to agricultural GDP and net profits in agriculture

		2005	2006	2007
Budget expenditure in agriculture (bill. BYR)		2,415	3,370	4,203
Tax privileges for agriculture (bill. BYR)		847	965	1,092
Total fiscal support (bill. BYR)		3,262	4,335	5,295
GDP (bill. BYR)		65,067	79,267	97,165
Gross agricultural output (bill. BYR)		12,826	15,544	18,102
Agricultural GDP (bill. BYR)		5,114	6,238	7,283
Net profits in agriculture (bill. BYR)		756	944	1,147
Budget expenditure relative to … (%)	… GDP	3.7	4.3	4.3
	… gross agricultural output	19	22	23
	… agricultural GDP	47	54	58
	… net profits in agriculture	319	357	366
Total fiscal support relative to … (%)	… GDP	5.0	5.5	5.4
	… gross agricultural output	25	28	29
	… agricultural GDP	64	69	73
	… net profits in agriculture	431	459	462

Sources: Ministry of Finance, National Statistics Committee, Ministry of Agriculture and Food; authors' calculations.

Note: Also see Note under Table 9. Due to a considerable increase in GAO to BYR 26,852 billion in 2008, and despite a further nominal increase in budget expenditures to BYR 4,637 billion and tax privileges to BYR 1,369 billion, the shares of budgetary expenditures and total fiscal support to GAO dropped to 17.2 percent and 22.4 percent, respectively.

Compared to GDP, total budgetary expenditures, and total agricultural land, fiscal support to agriculture in Belarus is considerably higher than in many other countries. Table 11 compares the level of fiscal support to agriculture with GDP and agricultural value-added in Belarus and a selection of other industrialized and emerging economies. Belarusian fiscal support remains exceptionally high even if the sector's contribution to GDP is accounted for, i.e. when comparing fiscal support to agricultural value-added. The ratio of fiscal support to agriculture to agricultural value-added in Belarus was about twice as high in Ukraine and about 10 percentage points higher than in the EU-27, for example. Agriculture's share in total budgetary expenditures (Table 9) in Belarus is also considerably higher than, for example, in Germany[30] (2.0%), USA (3.7%), or Russia (2.6%, consolidated budget). Even if compared to Regions with high agricultural budgets within Russia – Stavropol (6.3%) and Volgograd (6.6%), for example – Belarus's agricultural expenditures are considerably higher (8%) (all numbers of the year 2005)[31].

[30] Germany, as a member of the EU (with the EU defining the agricultural policy for all its member states), also pays to and receives resources from the EU.

[31] Source: Compiled from: http://en.wikipedia.org/wiki/German_budget_process; http://www.whitehouse.gov/omb/budget/fy2005/budget.html; http://www.maf.ge/pdf/MoA_Budget_Review_2000-2007.pdf; http://indiabudget.nic.in/ub2004-05/eb/stat02.pdf;

Budget expenditures for agriculture per hectare of agricultural land are considerably higher than in other CIS countries such as Russia and Ukraine, in other emerging economies such as Mexico and Turkey, and in industrialized countries such as Australia, Canada and New Zealand (Table 12), but less than in many other OECD countries. In 2007, the 226 US$/ha recorded in Belarus exceeded the US average of 214 US$/ha, and was only roughly 20% lower than the 272 US$/ha paid in the EU's 12 New Member States. Only the EU-15, Japan and Switzerland provide (much) more budget support per hectare to agriculture than Belarus. However, a high and growing percentage of the EU's support is now decoupled from the agricultural output from this land. In 2007, 57% of the EUs budget outlays fell into this category (compared with 12.4% in Belarus). Some high-income countries with small agricultural sectors, such as Japan and Switzerland, afford themselves very high support levels (in per-hectare terms). Given the considerable differences in structure and relative size of the agriculture sector and the capacity of the economy overall, however, the agricultural support schemes in these countries are of limited relevance as benchmarks for Belarusian agricultural policy.

Table 11: International comparison of fiscal support for agriculture (2007, or latest available)

	Agriculture, value added (% of GDP)	GDP (current, LCU million)	Transfers to the agr. sector from taxpayers (LCU million)	Transfers to the agr. sector from taxpayers/GDP (%)[32]	Fiscal support / agr. value-added (transfers) (%)
Australia	2.41	1,045,674	3,307	0.32	13
Canada	2.20	1,428,430	7,390	0.52	24
Mexico	3.73	11,177,530	59,258	0.53	14
Turkey	8.67	853,636	9,031	1.06	12
EU-27	1.23	12,355,359	74,708	0.60	49
USA	1.08	13,751,400	62,760	0.46	42
Ukraine	7.55	712,945	16,038	2.25	30
Russia	4.76	32,987,400	150,001	0.45	10
Belarus	9.35	96,087,201	5,295,000	5.51	59

Source: *Agriculture value added:* World Bank (2009),World Development Indicators. Latest available (2007 if not noted otherwise). For Canada: 2004, for USA: 2006. For EU: Eurostat data on "Gross value added of the agricultural industry in basic prices" (http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&init=1&pcode=tag00056&language=en); GDP data from Eurostat, see next column). *GDP:* WB WDI. For EU: http://epp.eurostat.ec.europa.eu/tgm/refreshTableAction.do?tab=table&plugin=1&init=1&pcode=tec00001&language=en. *Transfers from taxpayers* (in Total Support Estimate): OECD PSE database. Latest available (2007). Total transfers to agriculture from taxpayers (i.e. budgetary expenditures plus tax privileges) are equivalent to total fiscal support. Column 5 and 6: Authors' calculations based on data presented in this table. GDP and fiscal support for Belarus as presented in Table 10. Note that Table 10 presents "agricultural GDP" whereas this table (Table 11) presents "agricultural value-added" (value-added plus taxes minus subsidies equals GDP).

http://www.budget.gov.au/2004-05/bp1/download/bst6.pdf;
http://www.statsbudsjettet.dep.no/upload/Statsbudsjett_2005/pdf/budget2005.pdf.

[32] Calculated as "transfers from taxpayers" in the OECD's Total Support Estimate (TSE) from which transfers to consumers are excluded. For Russia, implicit support through debt restructuring and the leasing program is also excluded.

Table 12: Fiscal support to agriculture per hectare of agricultural land in selected countries (US$/ha)

Country	2000	2001	2002	2003	2004	2005	2006	2007
Japan	3691	3596	3470	3798	3416	3134	2931	3463
Switzerland	1369	1513	1639	1982	2028	2005	1974	2087
EU-15	381	402	421	520	583	585	616	657
EU-27	270	287	302	374	472	479	514	556
EU New Member States	-	-	-	-	186	205	234	272
Belarus	**47**	**51**	**51**	**84**	**103**	**127**	**180**	**226**
USA	189	193	183	195	219	234	224	214
Turkey	120	93	91	62	69	100	133	168
Canada	52	52	60	74	76	91	86	102
Mexico	30	34	32	40	36	44	46	52
New Zealand	7	6	7	9	11	14	12	14
Australia	3	3	4	4	4	4	5	6
Russia	11	13	14	16	16	18	n.a.	n.a.
Ukraine	11	16	20	21	36	46	n.a.	n.a.

Source: OECD (2009); FAO (2009); authors' calculations.

Note: Fiscal support for Belarus as presented in Table 10. Budget support in the other countries from OECD estimates of total transfers to agriculture from taxpayers. Estimates for Russia and Ukraine for 2006 and 2007 not available at the time of writing.

While GAO and agricultural GDP have grown since 2000, fiscal support for the sector has grown even faster. While indexed GAO and real agricultural GDP increased by 39% and 48%, respectively, between 2000 and 2007 (see Figure 8 and Figure 1 above), real consolidated budget expenditures in agriculture alone (i.e. without considering tax privileges) increased by 203%[33]. Although the share of agriculture in gross domestic products (GDP) has fallen from 12.1% in 2000 to 10.5% in 2007[34], budgetary expenditures for agriculture continued to grow in absolute terms and stayed at about nine percent of the consolidated state budget. Between 2005 and 2007, both GAO and agricultural GDP grew (in nominal terms) by about 40 percent, but budgetary expenditures in agriculture by 74 percent and total fiscal support incl. tax privileges by 62 percent, reducing the ratio of GAO to total fiscal support from 3.9 to 3.4 (BYR/BYR). This means that BYR 1 spent in 2007 was able to create less (i.e. only BYR 3.4) in GAO than BYR 1 spent two years earlier (BYR 3.9). While the three years of observation are too short to draw broader conclusions from these numbers alone, two factors are likely to contribute to this effect: While the share of expenditures for farm inputs and price support in total budgetary support, provided to large commercial farms, fell from 68 to 54 percent, about half of all budgetary expenditures are still provided to cover recurrent farm expenditures with highly distortive effects. Only in 2007, capital investments captured a considerable share in the

[33] Source: World Bank (2005) for 2000-2004; data from the Ministry of Finance (2009) for 2005-2007; authors' calculations.
[34] World Bank (2009). World Development Indicators (in constant 2000 US$).

state budget for agriculture (Figure 13), with productivity effects likely to become visible in later years.

At least two thirds of Belarus' budgetary support to agriculture is provided through measures that are regarded as distorting trade, i.e. that are included in the 'amber box' category in WTO terminology. 'Amber box' measures are subject to reduction commitments under WTO since they distort production and trade. Price supports and input subsidies are typical amber box measures. 'Green box' measures, in turn, are measures of domestic support in favor of agricultural producers that have no, or at most minimal[35], trade-distorting effects or effects on production – qualifying under the general and specific criteria of Annex 2 of the Agreement on Agriculture (see text box) – and are therefore exempt from reduction commitments. In Belarus, the share of 'green box' measures even fell slightly from 11 percent in 2005 to 9 percent in 2009 (Table 13). At the farm level, the provision of inputs continues to represent a large proportion of governmental support. Between 2002 and 2007, however, the composition of this support changed considerably. Input provision dropped from above 60 percent to about 30 percent in 2007, while direct investments and price premiums have increased in importance (Figure 13).

The objective of the **'Agreement on Agriculture'** reached during the Uruguay Round of GATT / WTO multilateral negotiations is to make the policies more market-oriented and to increase predictability, which would ultimately increase security for both importing and exporting countries. The agreement covers three areas: (i) market access (import restrictions); (ii) domestic support; and (iii) export subsidies. Under **domestic support**, the agreement differentiates two fundamentally different categories, often referred to as boxes:

"Amber box": Domestic support measures that are considered as trade-distorting and hence subject to reduction commitments. All support exceeding "de minimis" levels is combined in the *Total Aggregate Measurement of Support* (Total AMS) for which most WTO members have scheduled reduction commitments.

"Green box": Domestic support measures in favor of agricultural producers that have no, or at most minimal, trade-distorting effects or effects on production. These measures are exempt from reduction commitments. Support needs to be provided through a publicly-funded government program (including government revenue foregone) not involving transfers from consumers and must not provide price support to producers. Measures include (i) governmental services including research, extension advisory services, market information, pest control, inspection services, infrastructure; (ii) public stockholding for food security purposes; (iii) domestic food aid; (iv) direct payments to producers and decoupled income support; (v) government contribution to income insurance and income safety net programs; (vi) natural disaster relief including gov. contributions to crop insurance schemes; (vii) structural adjustment assistance through producer or resource retirement programs and investment aids; (viii) environmental programs; and (ix) regional assistance programs (see Annex 2 of the Agreement on Agriculture).

[35] It is debatable whether any policy is entirely non-distortive, and as a result, the distinction between amber and green box measures is not always clear cut (Blandford and Josling, 2007).

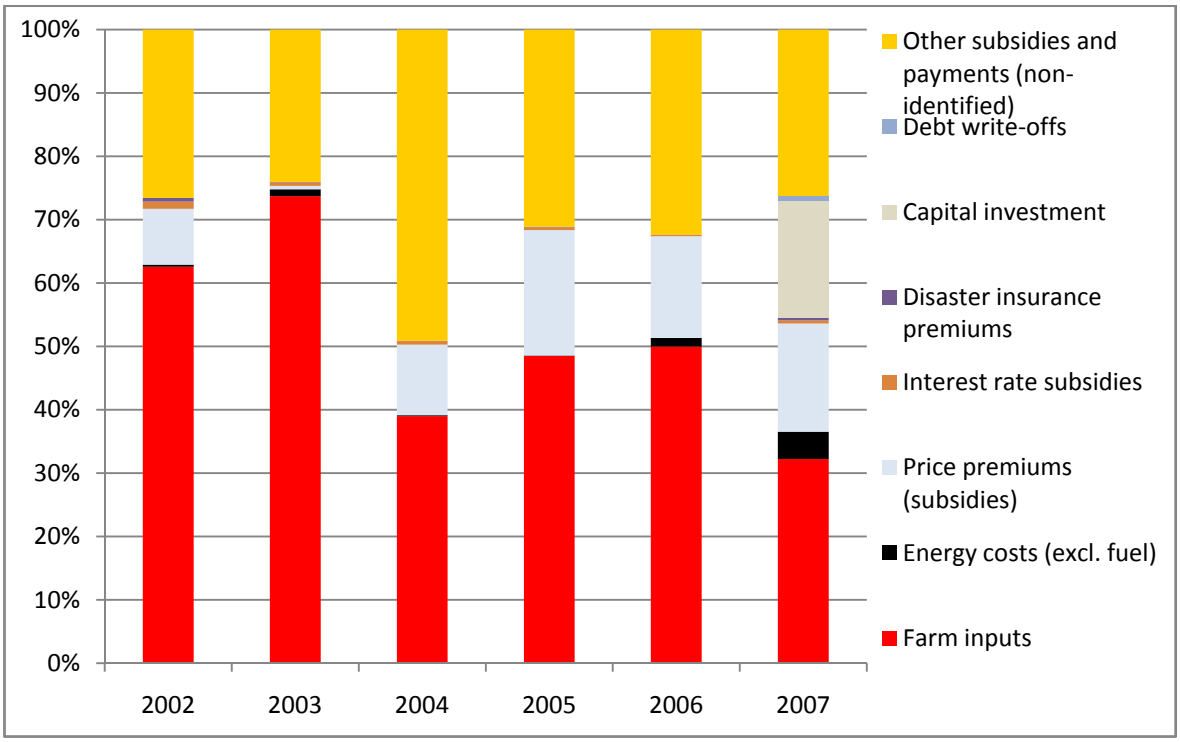
Table 13: Purpose of budgetary expenditures, categorized by WTO "boxes", by budget source (%-shares of total nominal expenditures)

	2005	2006	2007	2008
Republican budget				
'Green' (incl.: liming of acid soils and other land improvement measures, agricultural institutions)	8.6	7.4	6.5	6.5
'Amber' (incl.: cost of agricultural production and processing, loans for inputs and machinery, construction (investments), and peasant farms support)	5.8	5.3	5.0	8.0
Unidentified (incl.: state programs and other measures)	2.7	2.0	2.2	1.7
Republican budget, total	17.1	14.7	13.8	16.3
Agricultural producer support fund				
'Green' (incl.: state programs, agricultural research, agricultural education and other expenditures unrelated to agricultural production)	1.6	1.4	2.2	1.5
'Amber' (incl.: loan repayments, payments under state guarantee programs, payments to banks to cover losses from unpaid loans, machinery leasing support, livestock purchases, purchases of farm inputs, flax production support, price premiums for farm products, and other transfers)	40.0	42.7	35.9	34.6
Unidentified (incl.: capital investments, loans)	19.1	11.9	10.5	14.3
Agricultural producer support fund, total	60.8	56.0	48.5	50.4
Local budgets				
'Green' (incl.: Chernobyl program and agricultural institutions)	0.7	1.2	0.7	0.6
'Amber' (incl.: farm input and machinery purchases, machinery maintenance and repair, capital investments, loan repayments and repayment of outstanding debts, interest rate compensation)	16.6	22.6	31.9	21.8
Unidentified (incl.: state programs and other expenditures)	4.9	5.6	5.2	10.9
Local budgets, total	22.1	29.3	37.7	33.3
Grand Total				
'Green'	10.9	10.0	9.3	8.7
'Amber'	62.4	70.6	72.8	64.4
Unidentified	26.7	19.4	17.9	26.9
Total, US$ million	**100.0**	**100.0**	**100.0**	**100.0**
Total, US$ million	**1201**	**1605**	**1975**	**2091**
Exchange rate (BYR/US$)	*2155*	*2145*	*2146*	*2149*
Total, BYR billion	**2589**	**3444**	**4238**	**4494**

Source: Institute for Systemic Research in Agriculture of the National Academy of Sciences of Belarus (personal communication).

Note: Budget presentation in WTO boxes in US$ in order to facilitate international comparison. BYR equivalents added in the last line show slight and immaterial inconsistencies with Table 9 and Table 10 due to differences in BYR/US$ conversions during data compilation at the disaggregated level. "Unidentified" category presents data for measures that could not be allocated to "boxes" due to insufficient information.

Figure 13: Subsidies and other financial transfers funded from state expenditures received at farm level by large commercial farms in 2007 (all farms, percent of total)



Source: Authors' calculations based on Belarusian farm data base.

The distinction between 'green box' and 'amber box' measures is important in view of Belarus' aspiration to accede to the World Trade Organization (WTO). However, it is the trade distorting effect of the measures, not the share of governmental expenditures for the measures, that is of interest under WTO considerations.[36] Furthermore, given that 'green box' measures are notified to WTO, member countries have little incentive to include expenditures for measures that are unlikely to be ever challenged as "green". The SRDP for 2005-2010 comprises – under its first pillar – a number of activities that broadly benefit agricultural producers (like other rural citizens), e.g., funding for rural health care and schools. While these measures do have an impact on agriculture, they are not agriculture-specific and are therefore not included in the presentation of Belarus' agricultural support measures in Table 13. While it is the volume – and effect – of the 'amber box' measures that ultimately matters in WTO negotiations, the distribution of government expenditure between amber and green box measures nevertheless provides an indication of a government's policy priorities and what emphasis it places on facilitation as opposed to intervention (see Section D below). Across all countries that have notified their green box measures to the WTO, the share of 'green box' measures in 'amber' plus 'green' box

[36] Hence, the inflation of green box measures with non-agriculture-specific measures in order to cosmetically reduce the share of expenditures for trade-distorting measures in total governmental expenditures may not attract much attention.

support increased from 50% in the mid-1990s to roughly 70% in 2003. For the EU in particular, this share has increased from under 30% to almost 50% (Table 14). The large share of 'amber box' measures in the Belarus budget and the considerable distortions achieved suggest that Belarus will need to revisit the nature and structure of its state support to agriculture if it wishes to align its agricultural support with common practice among WTO members.

Table 14: Green and amber box domestic support in the EU and in total for all countries notifying to the WTO (bill. US$)

	1995	1996	1997	1998	1999	2000	2001	2002	2003
EU amber				52.3	49.7	39.5	35.8	30.8	30.3
EU green				21.5	20.8	19.8	18.3	20.9	26.1
EU green (%)				*29%*	*29%*	*33%*	*34%*	*40%*	*46%*
All notifying amber	125.0	118.9	101.2	77.6	81.1	68.2	60.7	50.1	54.2
All notifying green	131.6	131.0	116.4	111.9	134.6	108.5	141.3	173.3	119.8
Share of 'green' in total of 'all notifying'	*51%*	*52%*	*54%*	*59%*	*62%*	*61%*	*70%*	*78%*	*69%*

Source: USDA (2009); authors' calculations.

Note: For the marketing year 2005/2006, EU support in the 'green box' category increased further to 49 percent (Notification G/AG/N/EEC/59 of March 2, 2009).

The source and distribution of budget support

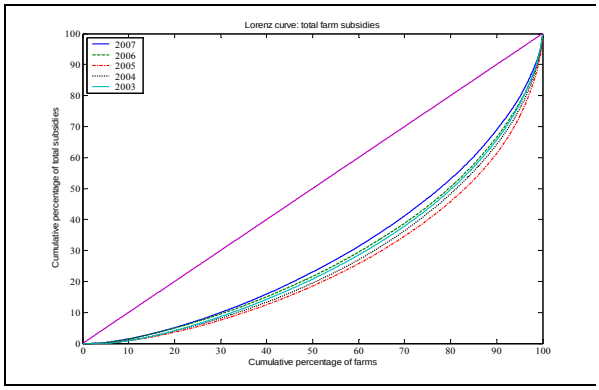
The importance of local budgets in state support for agriculture has increased in recent years. The main sources of budget expenditure are the Republican Budget, the Agricultural Producer Support Fund, and the local budgets. Between 2005 and 2007, local budget spending increased by over 200%, as opposed to roughly 32% for the Republican budget and 50% for the Fund. The increase in local budget expenditures to agriculture in 2007 is largely due to debt write-offs that are funded[37] from local budgets. The shares of the measures under the 'amber' and 'green' boxes vary according to the source of expenditure. More than half of Republican budget expenditure is allocated to 'green box' measures, in particular support for land improvement, while 'amber box' measures dominate expenditures from the Agricultural Producer Support Fund and local budgets (Table 13).

At the aggregate level, the distribution of budget support across commercial farms in Belarus appears to be relatively even. Figure 14 presents Lorenz curves of this distribution in the years 2003 to 2007, based on information on subsidies received by individual farms contained in the Belarusian farm data base. In this reference period, the 50% of the commercial farms in Belarus that receive the least budget support receive between 18 and 23% of the total volume of this support. Correspondingly, the 50% of the farms that receive the most support receive between 77 and 82%. While this is clearly uneven, it is

[37] See Degrees #36 and #138 of the President of the Republic of Belarus.

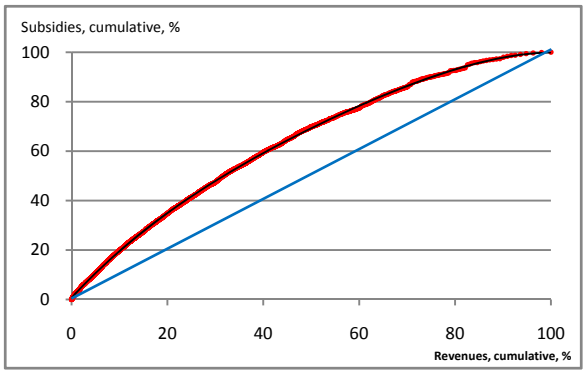
much less so than the '20/80' ratio often cited in connection with EU farm subsidies (20% of the farms collect roughly 80% of the subsidies – see for example alpmedia.net, 2002), or the '7/75' ratio measured for budget support to livestock producers in Ukraine (Borodina, 2006). Of course, the aggregated perspective in Figure 14 could mask unevenness in the distribution of individual subsidies in Belarusian agriculture.

Figure 14: Lorenz curves of the distribution of farm subsidies across commercial farms in Belarus



Source: Authors' calculations with Belarusian farm data base.

Figure 15: Distribution of farm subsidies in relation to farm revenue (cumulative, %) across commercial farms in Belarus



Source: Authors' calculations with Belarusian farm data base.

Farms with smaller revenues appear to receive preferential treatment in the subsidy allocation. Figure 15 shows the cumulative distribution of subsidies per cumulative farm revenue. While the smallest farms with 20 percent of the revenue together receive about 35 percent of all subsidies, the 28 largest farms that generate 20 percent of the revenue receive only about 7 percent of all subsidies paid to large commercial farms.

C. Agricultural sector performance: productivity, efficiency, and competitiveness

Summary:

Agricultural yields and aggregate output have experienced considerable growth, but this result was achieved at high cost to taxpayers and the economy overall. Despite a massive allocation of capital to agriculture, labor productivity and capital productivity in the agriculture sector increased less than in the rest of the economy. The majority of the large commercial farms in Belarus have experienced an increase in technical (pure) efficiency, albeit with considerable variation, and three quarters of all large commercial farms experienced positive technical change. But many farms are not evolving in the direction of more efficient size. Together, these effects resulted in total factor productivity improvements for two thirds of all large commercial farms, with a 3.3 percent annual increase for the median farm. While this is an impressive result, reflecting significant (state) investments in the sector, it masks the fact that many farms cannot keep up with the pace of technical change and that about one third of all farms experienced a net reduction in TFP. Factors other than capital investments seem to be key constraints to Belarus' agricultural development.

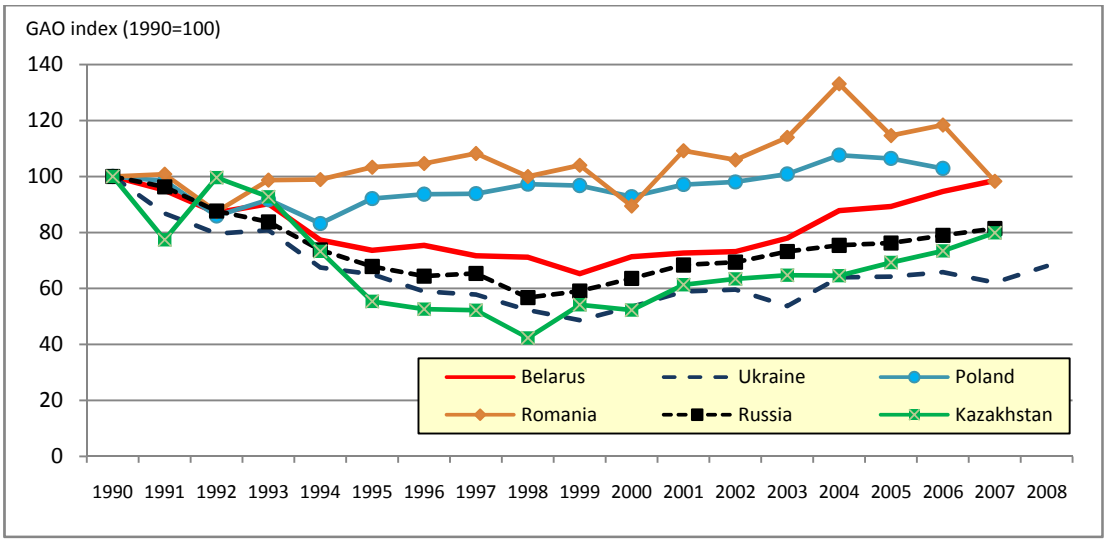
Agricultural competitiveness in Belarus shows large differences between crops, years, and farms. Wheat was Belarus' most competitive crop in 2007, capturing this position from barley and potatoes which saw a decline in competitiveness between 2003 and 2007. In 2007, about 65 percent of the wheat production, 48 percent of the potato production and 45 percent of the milk production was internationally competitive. Sugar beet production is not competitive. In general, livestock production is less competitive than crop production from both the economic and financial perspectives. With nearly half of its dairy products being exported, primarily to Russia, much of Belarus' state support provided to dairy production effectively becomes an export subsidy and (to some extent) a subsidy paid by Belarusian taxpayers to the importing country. The large difference between (economic) competitiveness and (financial) profitability indicates that the net effect of market and price distortions in Belarus is in support of the sector, taxing the rest of the economy. There is no evidence of 'across the board' improvements in competitiveness in Belarusian agriculture between 2003 and 2007.

Direct state support provided to large commercial farms appears to have a significant and positive, albeit small, effect on total factor productivity change on these farms; and the less efficient a farm, the less pure efficiency change and total factor productivity change it experiences, resulting in an increasing efficiency disparity. By inference this could also mean (but requires further analysis) that state subsidies are directed towards the more efficient farms, at least to some extent. If the observed performance dichotomy evolves further, possibly even fueled by the state's subsidy allocation mechanism, the sector will reach a point where many highly inefficient farms that can only survive with state support co-exist with comparatively efficient farms. At that point, adjustments to the structure of the state support system will become desirable even if the option of broader reforms is not considered. However, the low coefficients of determination of the regressions indicate that the few significant effects identified here explain only a very small portion of the variation in changes in TFP and its components.

Aggregate output

Measured in terms of aggregate output, agriculture in Belarus has performed well in comparison with other transformation economies and in particular other CIS countries such as Kazakhstan, Russia and Ukraine, but less well than those now forming part of the European Union (Poland, Romania). The initial reduction in production due to the 'transformation crisis' in the 1990s was less severe in Belarus (roughly -35%) than in these CIS countries (-40 to -60%), and the recovery since has been more complete (Figure 16). On the other hand, compared with countries in Central and Eastern Europe such as Poland or Romania, Belarus did experience a more pronounced and sustained initial decline in its agricultural output in the course of transition. While Belarus faced challenges similar to those faced by other CIS countries (disintegration of the Soviet economic system and transition from centrally planned to market economy, and the start of political reform processes), its experience is rather distinct in that the economy continues to be heavily state-controlled. But also, and most notably, Belarus has experienced strong economic growth that was broadly shared, leading to a reduction in the poverty headcount from 27.1 percent of the population in 2003 to 7.7 percent in 2007 and a gini coefficient of 25.3 percent that is on par with the Czech Republic, Sweden and Japan. The fact that Belarusian agriculture has performed well (in output terms) compared with its CIS peers, even though its agricultural policy has been much less market-oriented and its farm sector has undergone much less restructuring, is one facet of what is sometimes referred to as the 'Belarus puzzle'. While output is clearly important, a comprehensive picture of performance must consider productivity (i.e. the relationship between input use and output) and whether production is internationally competitive. To cast more light on the performance of agriculture in Belarus and the factors that influence it, the following sections present the results of detailed analyses of productivity, efficiency and competitiveness.

Figure 16: Gross agricultural output in Belarus and selected transition countries (1990=100)



Source: EBRD (2009); authors' calculations.

Productivity

Partial productivity indicators at farm level

> Productivity" is commonly defined as a ratio of a volume measure of output to a volume measure of input use. While this generic notion is broadly agreed, the productivity literature shows a wide range of applications and specific definitions with implications for its measurement. In agriculture, productivity is often measured as output – in physical or monetary units – per unit of fixed input (factor), for example kg wheat harvested per ha land cultivated, or kg milk per cow.

Productivity can be measured in different ways depending on whether partial productivity (output per unit of a specific input) or total productivity (output per unit of aggregated input) is of interest, and whether it is measured at the sector or enterprise level. At the farm level, yields (tons per hectare, milk per cow) are commonly used as partial indicators of productivity. Figure 19 presents distributions of the main crop yields in tons per hectare and the milk yield in tons per cow on the large commercial farms in Belarus from 2003 to 2007, and Table 15 presents information on average yields in each of these years.

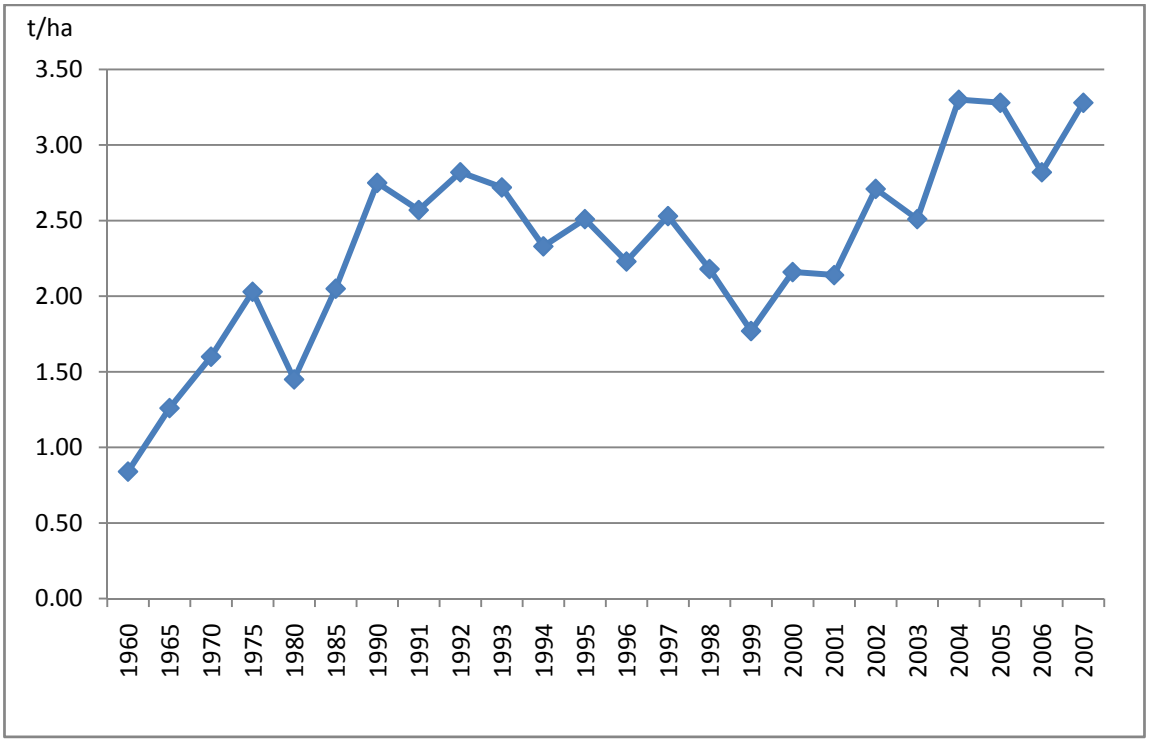
Table 15: Crop yields (tons per hectare) and milk yields (tons per cow) on large commercial farms in Belarus

	2000	2001	2002	2003	2004	2005	2006	2007
Wheat	2.18	2.13	2.70	2.47	3.33	3.28	2.79	3.28
Barley	1.93	2.28	2.52	2.52	3.27	3.04	2.66	2.81
Sugar beet	29.3	31.4	22.8	27.6	36.9	31.6	37.6	38.7
Potato	13.5	10.0	9.7	14.4	18.9	14.6	16.5	18.4
Rapeseed	0.71	0.88	0.82	0.90	1.17	1.23	1.07	1.22
Milk	2.154	2.408	2.507	2.611	3.102	3.685	4.019	4.112

Source: National Statistics Committee of the Republic of Belarus (2008a) and National Statistics Committee of the Republic of Belarus (2009b).

Average crop yields have increased substantially in recent years, yet with considerable annual variation. Average yields are generally higher in 2005-2007 than in 2000-2002 (Table 15). In Figure 19, presenting the farm level distribution of yields, the 2007 distribution generally lies to the right of the distributions from earlier years, suggesting a trend towards higher yields. However, crop yields vary considerably from year to year due to weather conditions.

Figure 17: Dynamics of wheat yields in Belarus, averages across all farm types (t/ha)



Source: National Statistics Committee of the Republic of Belarus (2008a).

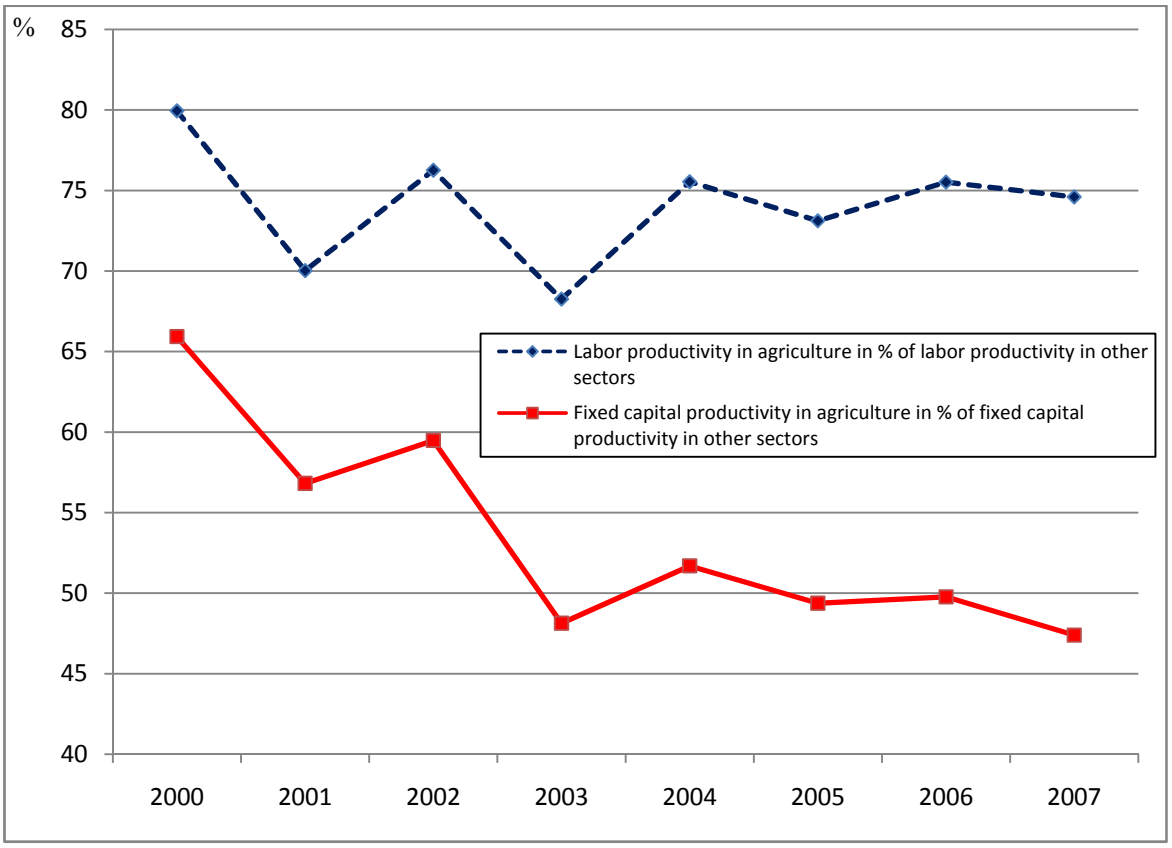
Milk yields have increased strongly, almost doubling on average from 2.2 to 4.1 tons per cow and year between 2000 and 2007, and increasing steadily year for year. The milk yields increased more steadily than field crops given that dairy production is somewhat less dependent on year-to-year weather variability (Table 15 and Figure 19).

Aggregate (partial) sector productivity

Labor productivity[38] in agriculture in Belarus has increased in absolute terms since 2000, but it has remained well below the average labor productivity in the rest of the economy. The calculations in Table 16 highlight the amount of labor or capital needed to produce one unit of GDP in Belarus, in agriculture and in the rest of the economy, with GDP measured in constant 2000 BYR. Figure 18 presents the development of these productivities in agriculture relative to the rest of the economy. Real productivity of labor in agriculture increased by 57% from 1.69 million BYR/worker in 2000 to 2.68 million BYR/worker in 2007. Over the same period, however, labor productivity in the rest of the Belarusian economy increased by 70% from 2.12 to 3.60 million BYR/worker. As a result of these trends, the productivity of labor in agriculture as proportion of labor productivity in the rest of the economy has broadly remained at around 75 percent.

[38] Calculated as the ratio of agricultural GDP divided by total number of persons employed in agriculture.

Figure 18: Labor and fixed capital productivity in Belarusian agriculture relative to the rest of the economy

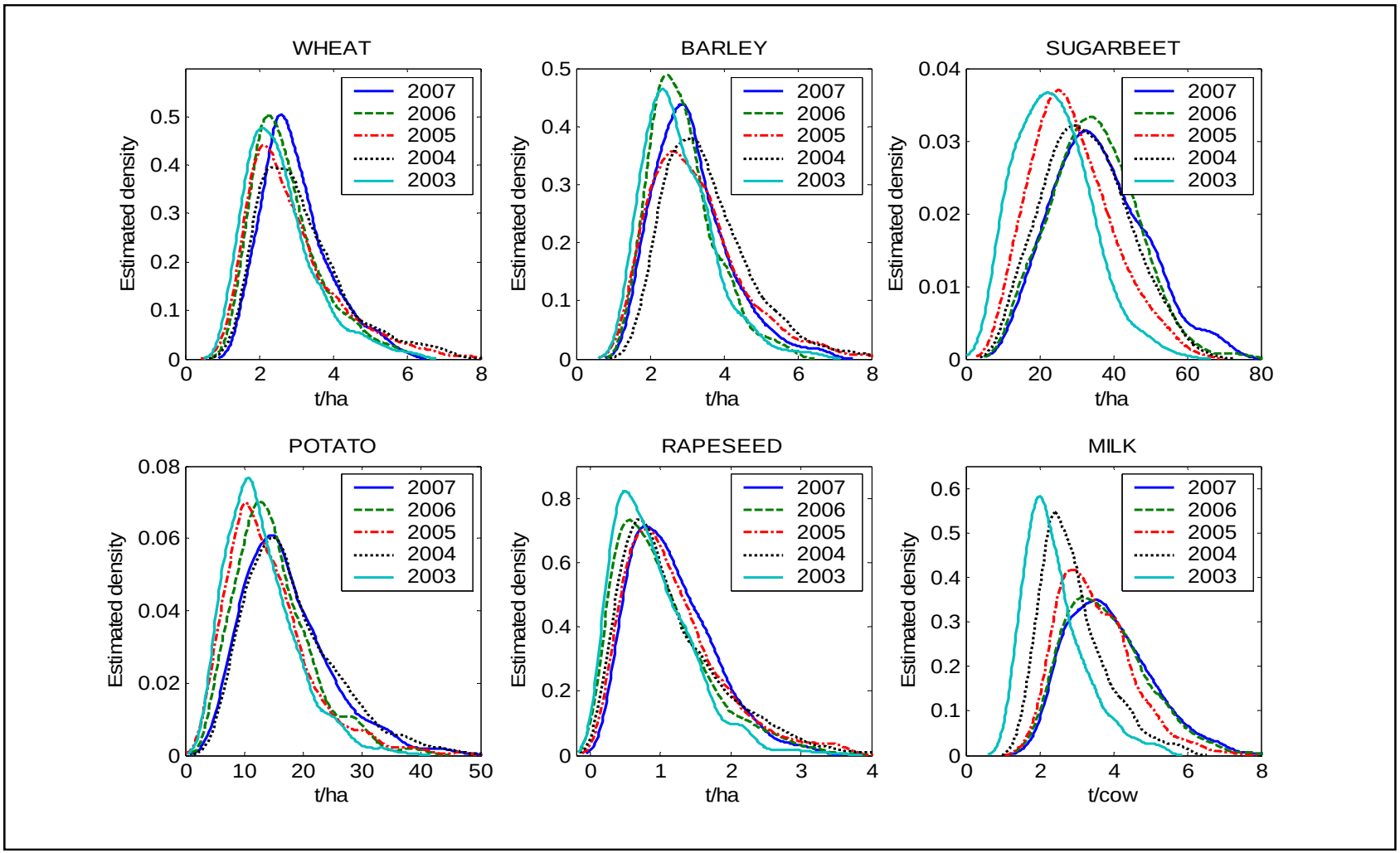


Source: National Statistics Committee of the Republic of Belarus (2008a); authors' calculations.

Similarly, while capital productivity[39] experienced a slight increase in the agriculture sector between 2000 and 2007, this increase was much stronger in the economy overall. In the agriculture sector, capital productivity increased by 13.5 percent, whereas in the rest of the economy it increased by 57.1 percent, from 11.2 percent to 17.6 percent. The combined effect of these changes is illustrated by the reduction in the ratio of capital productivity in agriculture to the productivity of capital in the rest of the economy from 66% to 47%.

[39] Calculated as the ratio of agricultural GDP divided by total fixed capital in agriculture.

Figure 19: Distributions of yield (tons of crop/hectare and tons of milk/cow) on the large commercial farms in Belarus, 2003-2007



Source: Authors' calculations with Belarusian farm data base.

Table 16: Share of agriculture in GDP, employment, and capital in Belarus, and corresponding measures of labor and capital productivity

	Item	Calculation	2000	2001	2002	2003	2004	2005	2006	2007
a	GDP (bill. 2000 BYR)		9,134	9,563	10,041	10,744	11,969	13,094	14,404	15,585
b	Labor force ('000 workers)		4,441	4,417	4,381	4,339	4,316	4,350	4,402	4,445
c	Fixed capital (trill. 2000 BYR)		86.6	86.3	87.2	88.8	90.1	91.9	94.2	95.7
d	Share of agriculture in GDP (%)		11.6	9.7	9.5	8.0	8.3	7.9	7.9	7.5
e	Share of agriculture in total employment (%)		14.1	13.3	12.1	11.3	10.7	10.5	10.2	9.8
f	Share of agriculture in fixed capital (%)		16.6	15.9	15.0	15.3	14.9	14.8	14.7	14.6
g	Labor productivity in agriculture (mill. 2000 BYR/worker)	(a*d)/(b*e)	1.69	1.58	1.80	1.75	2.15	2.26	2.53	2.68
h	Labor productivity in rest of the economy (mill. 2000 BYR/worker)	[a*(100-d)]/[b*(100-e)]	2.12	2.25	2.36	2.57	2.85	3.10	3.36	3.60
i	Relative labor productivity in agriculture (%)	g/h *100	79.9	70.0	76.3	68.3	75.5	73.1	75.5	74.6
j	Fixed capital productivity in agriculture (BYR/BYR)	(a*d)/(c*f)	0.074	0.068	0.073	0.063	0.074	0.076	0.082	0.084
k	Fixed capital productivity in rest of the economy (BYR/BYR)	[a*(100-d)]/[c*(100-f)]	0.112	0.119	0.123	0.131	0.143	0.154	0.165	0.176
l	Relative fixed capital productivity in agriculture (%)	j/k *100	65.9	56.8	59.5	48.1	51.7	49.4	49.8	47.4
m	Capital/labor ratio in agriculture (mill. 2000 BYR/agricultural worker)	(c*f)/(b*e)	22.96	23.34	24.68	27.70	29.07	29.78	30.84	32.08
n	Capital/labor ratio in rest of the economy (mill. 2000 BYR/ worker)	[c*(100-f)]/[b*(100-e)]	18.93	18.94	19.25	19.54	19.89	20.11	20.33	20.38

Source: National Statistics Committee of the Republic of Belarus (2008a) and National Statistics Committee of the Republic of Belarus (2009b); authors' calculations.

The government's policies supporting agriculture in pursuit of food self-sufficiency targets have led to a notable increase in agricultural output, but this result could only be achieved at considerable cost to the economy overall. The fact that capital is less than one-half as productive in agriculture as in the rest of the economy suggests that the government policies that have channeled large amounts of capital into agriculture have led to an inefficient allocation of resources from an economic perspective. Figure 3 showed that the share of agriculture in fixed capital investment in Belarus has increased sharply in recent years. Policies such as investment subsidies and directed state investments that have encouraged this trend have effectively drawn capital away from alternative uses that, by 2007, were on average twice as productive. Due to these policies, the capital/labor ratio in agriculture increased considerably from 23 to 32 million 2000 BYR between 2000 and 2007, while the capital/labor ratio in the rest of the economy increased much less (from 19 to 20 million 2000 BYR) (Table 16). Despite this massive reallocation of capital into agriculture, agricultural labor productivity stagnated at around 75% of its level in the rest of the economy. It seems that Belarus' current choice of policy objectives and related mechanisms for resource allocation prevents the country from increasing the efficiency of state expenditures.

"Efficiency" measures the extent to which a maximum possible output has been achieved with a given level of resources. The ratio of actual output to maximum output would be a measure of efficiency. Similarly to the definition of "productivity", the term "efficiency" has experiences a wide range of applications and related methods of calculation. In agriculture, the ratio of variable input (factor) per unit output is a frequently used concept of efficiency, e.g. kg rice harvested per m3 irrigation water applied. The total factor productivity calculations in this paper apply a different and more complex concept of efficiency, explained in some detail in Appendix 2.

Total factor productivity

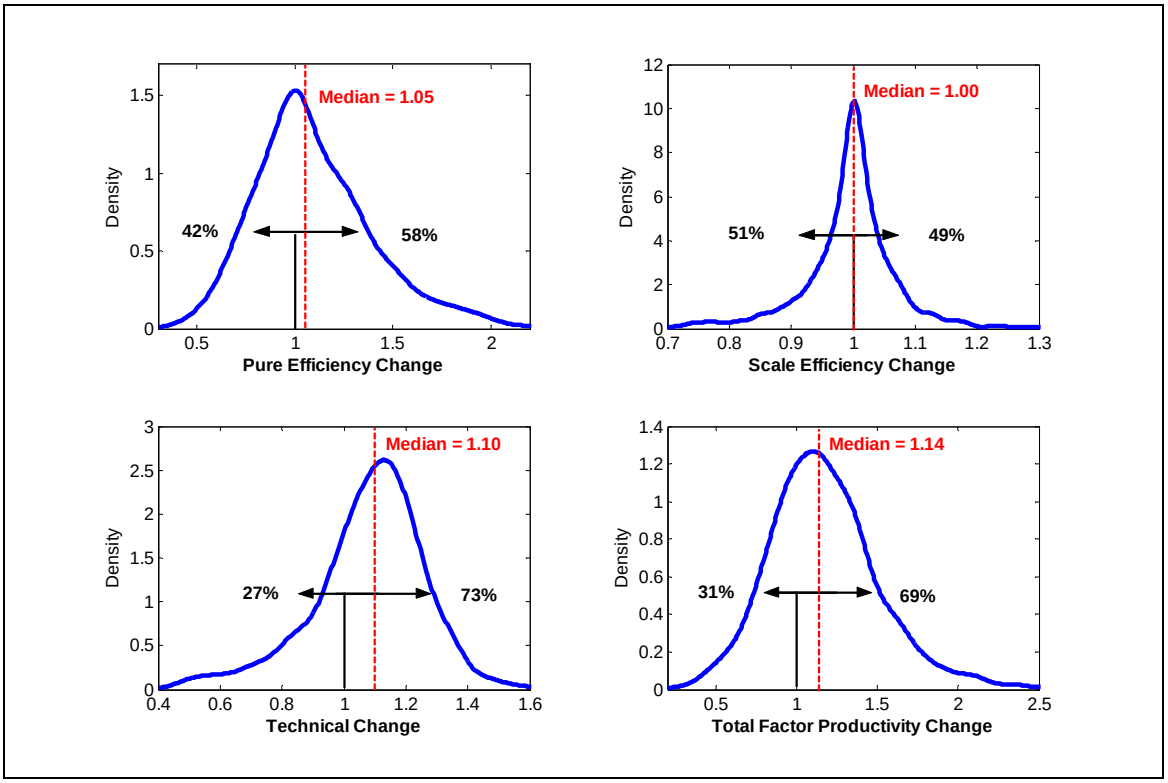
Partial measures of productivity such as those outlined above can be misleading because they only consider one input in isolation, while farms use a variety of input to produce more than one output simultaneously. What matters most for competitiveness is how efficiently farms convert inputs into output. The 'Total Factor Productivity' (TFP) is a measure of the relationship between a farm's aggregate input use and its aggregate output. Measuring TFP is not trivial because input and output prices, quantities and qualities change over time, making aggregation and comparison a challenging task. Nevertheless, methods for estimating TFP and for decomposing it into different components have been developed. Intuitively one can envision that there are three such TFP components: TFP can increase because i) farms become more efficient (they use a given level of inputs and a given technology more effectively and produce more output as a result), ii) they scale their operations up or down to move closer to the optimal scale of production, or iii) they implement a new technology that is able to produce more output from a given amount of inputs than the previous technology. This chapter presents the results of a TFP analysis[40] using the detailed farm-level accounting data for commercial farms in Belarus in the years 2003 through 2007.

Over the period 2003-2007, the majority (58 percent) of the large commercial farms in Belarus experienced an increase in technical (pure) efficiency (Figure 20). This means that these farms got closer to the best-practice frontier in 2007 than they were in 2003. The distribution of pure efficiency changes is relatively symmetric, with the modal or most frequent change at 0.99. This means that on average the farms in Belarus stayed at about the

[40] For references to the data and methodology used for this analysis, see the Introduction chapter and Technical Appendix 1.

same distance from the best practice frontier in 2007 compared to 2003. However, variation is considerable: while many farms became much better, many farms became much worse.

Figure 20: Changes in total factor productivity and its components for commercial farms in Belarus between 2003 and 2007 (order-m model)

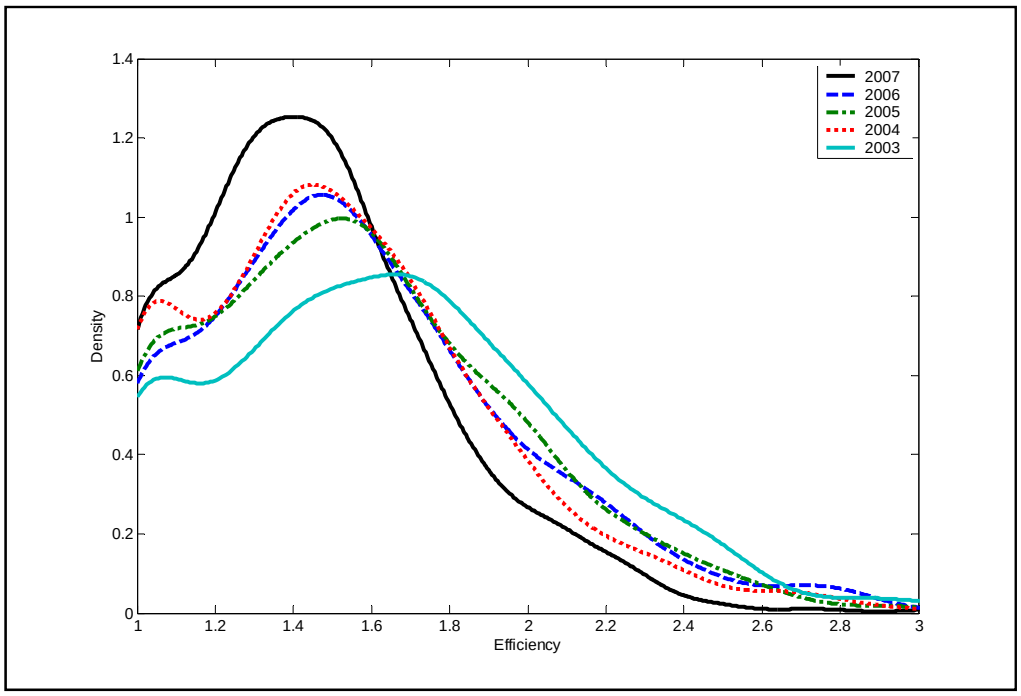


Source: Authors' calculations with Belarusian farm data base.

The technical efficiency distributions generated with the DEA model confirm the observation of gradual (technical, pure) efficiency increases on many farms. The technical efficiency (TE), calculated as a static score for each individual year between 2003 and 2007 using a DEA model[41] and depicted in Figure 21 and Table 17, is the ratio of the best-practice output that a farm could produce to the output that it actually did produce. Hence, a score of 1 indicates that the farm in question is on the best practice frontier and producing 100% of the maximum possible output at a given technology and its level of input, while a score of 2, for example, indicates that the farm is only producing one half of the best-practice output. In the period 2003-2007, one half of the farms in Belarus produced no more than about 60-70% of the best-practice output, and one quarter produced no more than 50-60% of this output. However, the efficiency distribution did improve over this period, illustrated (in Figure 21) by distributions that become increasingly concentrated on values closer to 1 over time and by TE scores for the boundaries of the upper quartiles (in Table 17) that become systematically smaller (despite a couple of years with insignificant changes).

[41] Refer to Technical Appendix 1 for more details on the methodology.

Figure 21: Technical efficiency distributions for commercial farms in Belarus



Source: Authors' calculations with Belarusian farm data base.

About equal numbers of commercial farms in Belarus experienced improvements/reductions in scale efficiency (51 and 49%, respectively). The distribution is symmetric and very tight, compared to other TFP components distributions; the modal scale efficiency change equals 1.00 which means that the scale efficiency of the most common type of farm did not change between 2003 and 2007. However, about one half of the farms moved further away from the optimal scale of operations.

Against the background of rather constant farm sizes in Belarus, while restructuring has led to smaller farm sizes throughout Central and Eastern Europe and the CIS (Table 6), the nature of the scale efficiency changes suggests that many farms in Belarus are too big and have not been able to scale down their operations to make the best possible use of available technologies. In general, large farms are expected to increase efficiency through scale effects, but many large commercial farms in Belarus do not seem to have evolved in the direction of more efficient size. Under more market-oriented conditions, not the complete break-up but some downsizing of some of the large commercial farms in Belarus would be expected to take place as a result of competitive forces. The result would be more manageable units in which it is easier to monitor complex operations (such as field work and herd management) and motivate workers, with the ultimate effect of increased efficiency. At the same time, restructuring might also lead to more specialization. If a large crop farm is encouraged or even obliged to maintain a dairy herd, for example, because local authorities are eager to maintain a supply of milk for the local dairy processing plant, the result can be a loss of overall efficiency as resources are taken from one area (e.g. crop production) to support the other (e.g. milk production). In this case, the freedom to specialize in crop production alone could lead to increased scale efficiency, not because the farm in question moves closer to its

optimal scale of operations by becoming smaller in hectare terms, but because the optimal scale of specialized crop production is larger and closer to the farm's current size.

Three quarters (73%) of all large commercial farms experienced positive technical change, meaning that they were employing more productive technologies in 2007 than they were in 2003. The distribution of technical changes is slightly skewed to the right, with the modal value at 1.14, which indicates that the most frequent or 'typical' technical change was positive. Only 27% of the commercial farms in Belarus did not experience technical progress.

Together, these effects resulted in total factor productivity improvements for 69 percent of all large commercial farms between 2003 and 2007 and a 14 percent increase in total factor productivity for the median commercial farm in Belarus between 2003 and 2007, or roughly 3.3% per year over this period. This increase is a remarkable performance comparable to that of China (at least for the five years covered in this analysis). For the period 1970 to 2001, Rao et al. (2004, p. 22) measure TFP increase in global agriculture of 1.5% per year, with North America and Australasia registering a rate of 2.2%, China 3%, Europe 1.9%, and Sub-Saharan Africa and Asia without China 0.3% per year. Rao et al. (2004) also present TFP calculations for the transition countries, but they stress that the results must be interpreted with caution because the composition of this group changes (i.e. the USSR ceases to exist while successor states such as Belarus enter the dataset) and there were major changes in accounting practices in some transition countries over the study period. For 1990-2000, Rao et al. (2004, p. 27) report annual average TFP growth of 1.2% for the transition countries as a group. Of course, this decade saw major reductions in agricultural production in these countries, while the results presented here for Belarus alone are for a much shorter period of time, and one in which Belarusian agriculture was rebounding from the reduction of the 1990s. Nevertheless, the results presented here point to above-average TFP growth in global comparison, and are similar to/slightly above the results achieved in other industrialized, temperate zone countries. The results on TFP change from the alternative DEA model confirm the findings from the order-m model (see Appendix Figure 3).

These results reinforce several observations made above. In particular, the large positive technical change reflects the impact of significant investment in agriculture and the resulting increases in the capital stock and the capital/labor ratio in Belarusian agriculture discussed above. Figure 20 shows that the median farm realized a positive technical change of 10% between 2003 and 2007. The farms that define the best-practice frontier have been able to take advantage of the availability of new technologies to increase their productivity considerably.

Many farms have not been able to keep up with the pace of technical change as evidenced by the distribution of the pure efficiency change. The 42 percent of farms for which the pure efficiency decreased may have better machines, animals, plant varieties and variable inputs at their disposal today than they did 5 years ago, but they are producing a smaller percentage of the maximum output that is possible with these machines, etc. than they did with the old machines and other inputs at their disposal in 2003. On these farms, it seems that management ability, training and education are not keeping pace with the rate of technical change. But there is another, even larger group of farms where pure efficiency was positive. For both the winners and losers in pure efficiency, the variability between farms appears to be considerable, which implies that the levels of skills and knowledge on farms – and the related management attention to staff training and overall modernization – vary accordingly.

The medial 14% increase in TFP over the period 2003-2007 masks strong performance by the best farms (the 25% of farms with the highest TFP changes realized increases of at least 36%, or over 8% per year), but also poor performance by 31% of the farms that experienced net reductions in TFP. The 25% of farms with the worst TFP performance realized TFP reductions of at least 5.5%, or 1.4% per year. Many of the farms in this bottom quartile realized positive technical change: since only 27% farms in the data base realized negative technical change, and assuming that these farms all experienced negative TFP growth, there remain almost 4% (31% – 27%) that experienced reductions in TFP despite positive technical change. On these farms, positive technical change was more than neutralized by reductions in pure and scale efficiency over the same period.

For these underperforming farms in particular, but also sector-wide, managerial ability and the freedom to engage (or lack thereof) in substantive restructuring appear to be much more limiting factors in Belarus' agricultural development than physical capital. Further improvements in physical capital would then lead to only limited, if any, improvements in farm performance (comp. Liebig's Law of the Minimum). The results also reinforce the finding (see Table 16 above) that the productivity of capital in Belarusian agriculture has declined considerably in recent years and is now less than one-half as high as the productivity of capital in the rest of the economy.

Table 17: Ranges of technical efficiency (TE) scores by quartile of the efficiency distribution

Year	Quartile of the efficiency distribution, from the most to the least efficient			
	0-25%	**25-50%**	**50-75%**	**75-100%**
2003	1<TE≤1.32	1.32<TE≤1.63	1.63<TE≤1.94	1.94<TE≤5.86
2004	1<TE≤1.24	1.24<TE≤1.49	1.49<TE≤1.75	1.75<TE≤3.28
2005	1<TE≤1.27	1.27<TE≤1.53	1.53<TE≤1.81	1.81<TE≤4.23
2006	1<TE≤1.27	1.27<TE≤1.52	1.52<TE≤1.80	1.80<TE≤3.90
2007	1<TE≤1.22	1.22<TE≤1.43	1.43<TE≤1.65	1.65<TE≤3.53

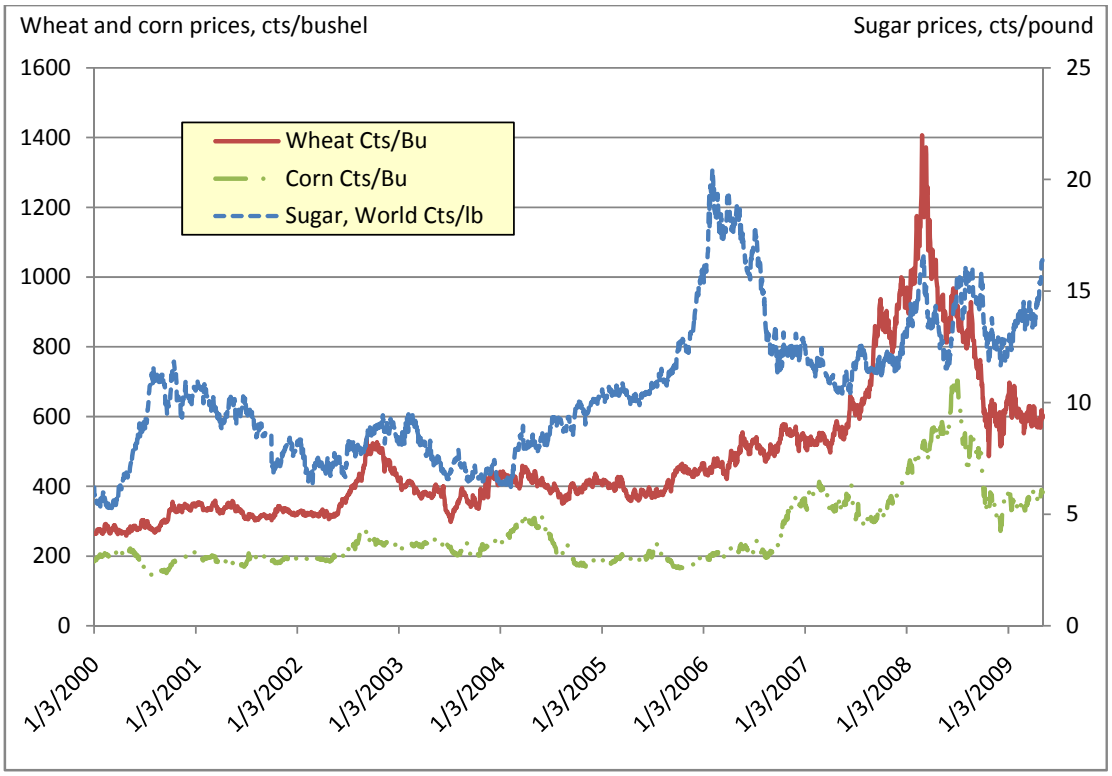
Source: Authors' calculations using Belarusian farm data base.

Competitiveness

Crop production in general

The competitiveness of crop production in Belarus shows large differences between crops, farms and years (Table 18, Table 19, Figure 23). Wheat was Belarus' most competitive crop in 2007, capturing this position from barley and potatoes which saw a decline in competitiveness between 2003 and 2007. In 2007, about 65 percent of farms producing wheat did so competitively, accounting for 69 percent of the wheat production (by volume). However this share varies considerably from year to year and was as low as approximately 11% just one year earlier, in 2006. This variation in competitiveness is – to a large degree – a reflection of variation in the world market price of wheat that saw a considerable increase in 2007/2008 (Figure 22). The best results for barley were recorded in 2005, when about 77% of the production (number of farms) in Belarus was competitive; in the other years this share varies between roughly 22% and 65%. The share of competitive production varies between 19% and 33% for rapeseed, and between 26 percent and 69 percent for potatoes. Corn and sugar beet production, however, display very low levels of competitiveness (close to zero) in all years.

Figure 22: Global price fluctuation and medium-term development for selected crops, daily data, 2000-2009



Source: World Bank (2009b).

This low level of competitiveness in crop production at economic prices contrasts with considerably higher levels of profitability at financial prices. This indicates that the net effect of market and price distortions on agricultural input and output markets in Belarus is to subsidize production. The share of crop production that is profitable at financial prices and costs is almost always larger than the share that is competitive at economic prices and costs (Table 18). The only notable exception is potato production which was implicitly taxed in the years 2003, 2004 and 2006. However, even under these subsidized conditions, a considerable share of crop production is – financially – unprofitable, with losses covered from the governmental budget. In 2007, for example, roughly 50% of the barley, potato and rapeseed producing farms in Belarus were making financial losses, as were about 40% of the sugar beet and approximately 20% of the wheat and corn producing farms.

Table 18: The shares of farms with competitive crop production in Belarus that are competitive at financial (0<PCB<1) and economic (0<SCB<1) prices in costs (in %, 2003-2007)

Profitable at financial prices (0<PCB<1)					
Crop	**2003**	**2004**	**2005**	**2006**	**2007**
Wheat	84.4	93.8	80.7	63.2	78.7
Corn*	0.0	0.0	68.6	60.4	80.0
Barley	72.5	86.0	56.6	39.7	53.5
Sugar beet	57.1	71.7	54.9	55.4	61.0
Potato	46.0	34.0	49.0	49.3	48.3
Rapeseed	66.2	74.5	63.9	44.1	51.5
Competitive at economic prices (0<SCB<1)					
Crop	**2003**	**2004**	**2005**	**2006**	**2007**
Wheat	28.3	25.0	11.2	10.5	64.7
Corn*	0.0	0.0	1.0	2.2	10.5
Barley	64.9	45.6	77.4	33.9	22.1
Sugar beet	0.0	0.0	0.2	2.7	0.0
Potato	59.8	69.2	25.6	64.7	47.5
Rapeseed	32.9	20.5	18.8	25.3	25.8

Source: Authors' calculations with Belarusian farm data base, see Technical Appendix 2.

* For corn in 2003 and 2004 there are not enough observations for the estimation of a distribution.

Table 19: The shares of crop production (by marketed volumes of production) in Belarus that is competitive at financial (0<PCB<1) and economic (0<SCB<1) prices in costs (in %, 2003-2007)

Profitable at financial costs (0<PCB<1)					
Crop	**2003**	**2004**	**2005**	**2006**	**2007**
Wheat	94.1	97.7	90.7	73.7	89.5
Corn*	0.0	0.0	74.7	51.4	89.0
Barley	72.2	91.5	65.7	40.2	59.2
Sugar beet	79.2	88.4	68.6	73.2	78.4
Potato	66.9	45.5	67.5	60.7	64.0
Rapeseed	78.5	87.5	79.9	62.4	66.6
Competitive at economic costs (0<SCB<1)					
Crop	**2003**	**2004**	**2005**	**2006**	**2007**
Wheat	26.8	16.8	12.6	11.5	69.4
Corn*	0.0	0.0	0.1	0.3	13.5
Barley	60.2	51.4	81.2	30.3	20.7
Sugar beet	0.0	0.0	0.0	5.9	0.0
Potato	78.7	83.2	42.4	74.7	62.1
Rapeseed	39.2	20.7	27.0	33.3	29.8

Source: Authors' calculations with Belarusian farm data base, see Technical Appendix 2.

* For corn in 2003 and 2004 there are not enough observations for the estimation of a distribution.

The special case of sugar beet

Sugar beet production is not competitive in Belarus, but the large share of farms and production that are financially profitable illustrate the preferential treatment and governmental support that this sub-sector receives. Sugar beet was identified further above as the agricultural product with the largest rate of growth in production in Belarus since the mid-1990s (Figure 11) and shows a financial profitability between 55 percent and 72 percent (between 2003 and 2007). The sub-sector's economic competitiveness, however, was zero for four of the five years analyzed, and only 3 percent in the fifth (and that even though world sugar prices were exceptionally high in that year, see Figure 22). While these numbers show the effectiveness of state support to boost production in a selected sub-sector, they also point to a particularly large policy-induced distortion in incentives for agricultural producers in Belarus. Under the given support scheme, sugar beet production is attractive for many farmers (in fact, they are expected to produce sugar beet), and productive resources are allocated in this direction. These resources, however, would add more[42] value to the economy (society) overall if reallocated to alternative production processes.

Livestock production

In general, livestock production in Belarus is less competitive than crop production from both the economic and financial perspectives. With the exception of milk, the share of farms producing livestock products competitively has never been above 13 percent in the five years analyzed (or 33 percent in terms of production volume). Financial profitability has been higher, indicating governmental support, but has never exceeded 43 percent of farms (again with the exception of milk) (Table 20, Table 21, Figure 24). As was the case for crop production, the net effect of market and price distortions is to subsidize production. With the (minor) exception of beef production between 2003 and 2005, the share of livestock production that is profitable at financial prices and costs is always larger than the share that is competitive at economic prices and costs.

Table 20: The shares of farms with competitive livestock production in Belarus that are competitive at financial (0<PCB<1) and economic (0<SCB<1) prices in costs (in %, 2003-2007)

Profitable at financial costs (0<PCB<1)					
Product	**2003**	**2004**	**2005**	**2006**	**2007**
Beef	3.7	6.7	7.0	6.1	4.2
Pork	17.3	18.8	26.9	23.9	21.5
Poultry	23.5	26.2	42.9	37.8	31.7
Milk	40.8	77.1	75.7	73.4	74.8
Competitive at economic costs (0<SCB<1)					
Product	**2003**	**2004**	**2005**	**2006**	**2007**
Beef	6.7	13.4	10.4	4.2	1.2
Pork	2.5	1.5	6.2	0.9	7.0
Poultry	7.4	4.9	0.0	0.0	0.0
Milk	13.6	5.2	7.2	10.9	45.3

Source: Authors' calculations with Belarusian farm data base, see Technical Appendix 2.

[42] In fact, they currently *deduct* value from the overall economic result.

Table 21: The shares of livestock production (by marketed volume of production) in Belarus that is competitive at financial (0<PCB<1) and economic (0<SCB<1) prices in costs (in %, 2003-2007)

Profitable at financial costs (0<PCB<1)					
Product	**2003**	**2004**	**2005**	**2006**	**2007**
Beef	16.2	21.9	22.9	18.9	15.3
Pork	56.4	73.1	84.6	82.2	74.5
Poultry	46.0	65.6	88.2	74.5	74.1
Milk	57.7	86.3	84.7	83.0	82.9
Competitive at economic costs (0<SCB<1)					
Product	**2003**	**2004**	**2005**	**2006**	**2007**
Beef	23.9	32.7	26.5	14.0	7.2
Pork	12.7	2.7	23.0	0.2	26.2
Poultry	11.0	-	-	-	-
Milk	22.6	9.2	9.9	15.1	58.5

Source: Authors' calculations with Belarusian farm data base, see Technical Appendix 2.

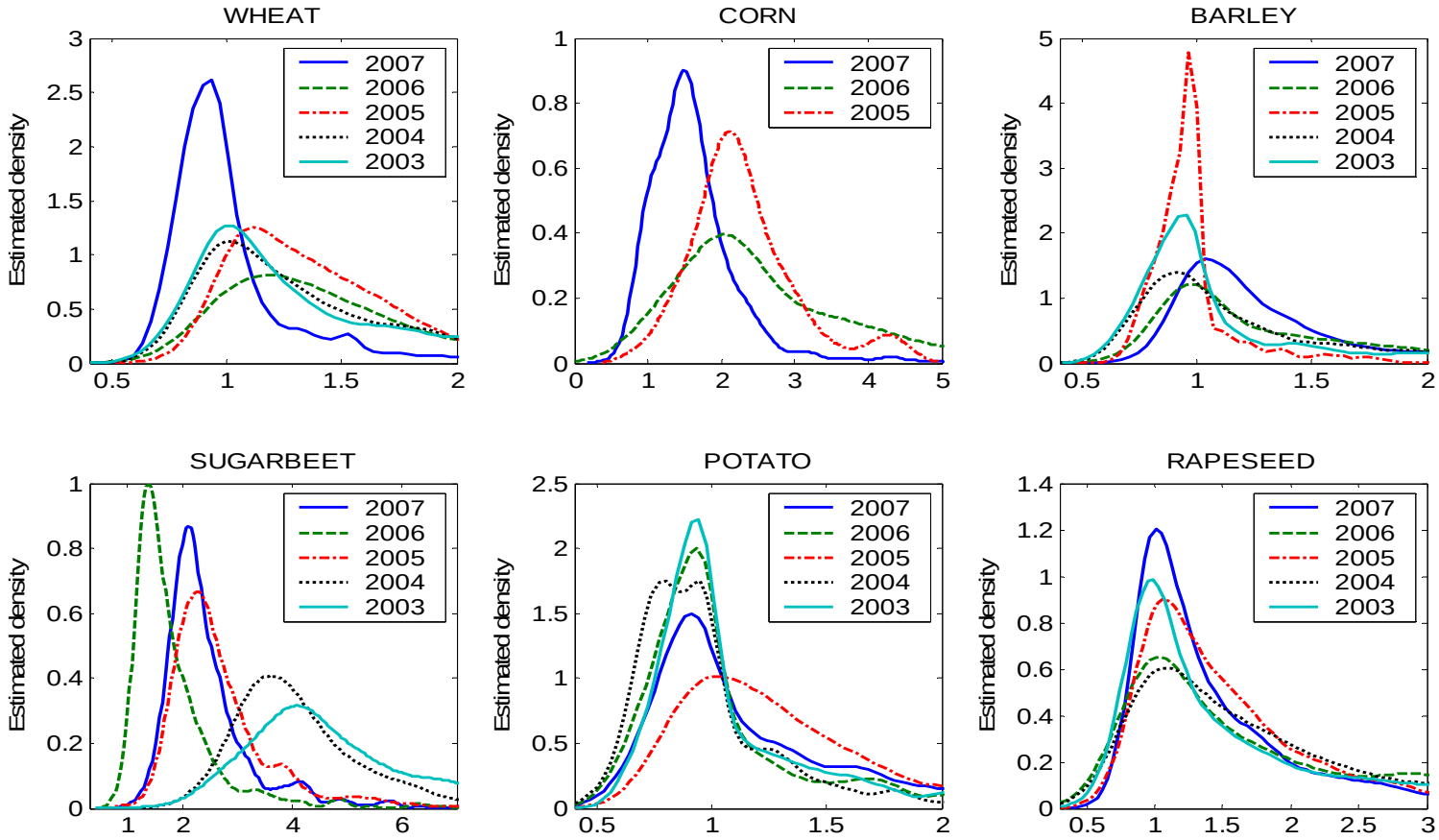
The special case of dairy production

Three quarters of dairy farms produced milk with financial profits, but only in the year 2007 has the economic competitiveness climbed as high as 45 percent from 5-14 percent in the four years before. Like sugar beet, dairy production has increased considerably over the last decade, with milk productivity (kg milk per cow and year) nearly doubling between 2000 and 2007 (Table 15). This impressive performance, however, was achieved through massive governmental support to dairy farms and despite an implicit taxation through artificially low product prices set by the government ("foot on the gas pedal and the brake at the same time") which provides the dairy processing industry with cheap inputs. The net effect, as illustrated by the difference between the PCB and SCB ratios of Table 20, was clearly in favor of dairy farms, taxing the rest of the economy. In 2007, like in the three years before, about 75 percent of dairy farms operated with financial profits, while – assessed at economic prices – only about 45 percent of the farms were actually competitive. Unusually high milk prices in that year, however, raised the share of competitiveness above the more typical level of around 10 percent (5.2 to 13.6 percent between 2003 and 2006). This means that in 2007, 39 percent of the financially profitable dairy farms would not have been profitable if economic prices had prevailed, i.e. in the absence of currently existing divergences (distorting policies and market failures). And in the more typical year 2006, this proportion would even have reached 85 percent[43]. Given that milk and milk products are Belarus's main agricultural export products, the striking discrepancy between competitiveness at economic prices and financial profitability has another important implication in addition to its impact on governmental expenditure. With nearly half (46 percent in 2007) of its dairy products being exported, much of Belarus' state support provided to dairy production effectively becomes an export subsidy and – due to Russia's large share in Belarus' dairy trade – (to some extent) a subsidy paid by Belarusian taxpayers to Russia[44]. Current plans foresee an expansion of Belarus' dairy production by 118 farms, which will increase the amount of milk produced (and exported) and hence transfer even more resources from Belarusian taxpayers to Russia.

[43] Assuming that all economically competitive farms are among the financially profitable farms. For 2006: (73.4% - 10.9%) / 73.4% = 85.1%.

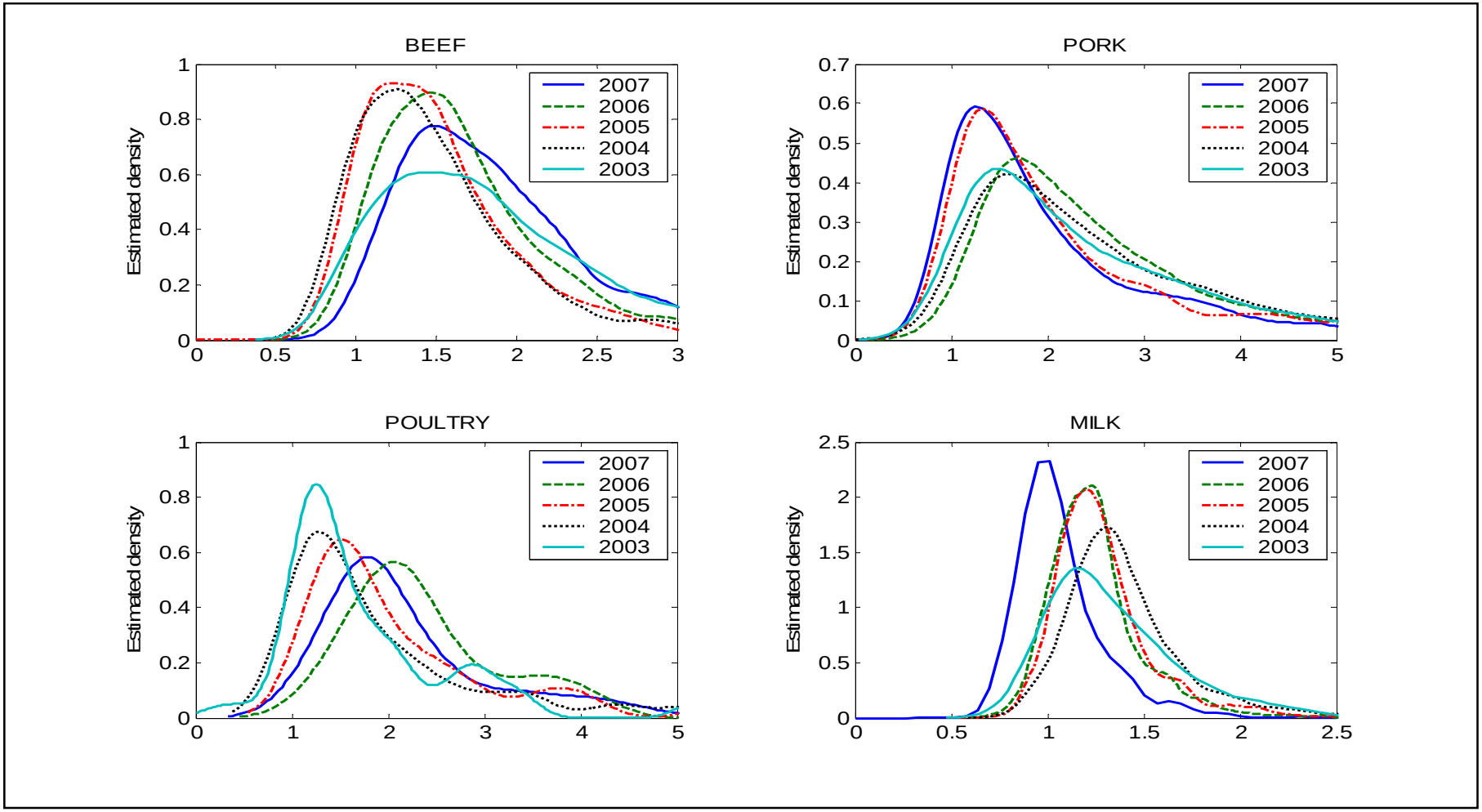
[44] To the extent that the additional supply affects the price level in the importing country/region.

Figure 23: Social cost benefit (SCB) distributions for crop products in Belarus (2003-2007)



Source: Authors' calculations with Belarusian farm data base. For details and assumptions, see Technical Appendix 2.

Figure 24: Social cost benefit (SCB) distributions for livestock products in Belarus (2003-2007)



Source: Authors' calculations with Belarusian farm data base. For details and assumptions, see Technical Appendix 2.

The impact of subsidies on performance at the farm level

One of the main objectives of the SRDP for 2005-2010 is the creation of a macro and micro economic business environment which allows for a stable increase in the efficiency of agriculture. The following paragraphs present a preliminary analysis of the extent to which extent the high level of state support provided to the agriculture sector was able to increase the performance of farms. While it is recognized that investments made in one year need time to become visible in improved performance, the 6-year time period covered in the analysis should allow seeing at least some partial effects.

Comparison of SCB distributions

There is no evidence of 'across the board' improvements in competitiveness in Belarusian agriculture between 2003 and 2007. The distributions of SCB ratios across all farms do not shift systematically towards the left (i.e. in the direction of greater competitiveness) over the 2003-2007 period (Figure 23 and Figure 24). For poultry there is even some indication of a loss of competitiveness, as the SCB distributions appear to shift to the right over the study period. In the two cases in which the 2007 distribution is clearly further to the left than the earlier distributions (wheat and milk), this was likely caused by high international prices in that year (2006 in the case of sugar beet). High prices also shift the 2007 distribution for corn sharply to the left, but even in that year, only about 10% of the corn production in Belarus is competitive (Table 18). These results may seem surprising, given the broad improvements in TFP described above. However, while the link between TFP change and SCB ratios is methodologically challenging, a few fundamental characteristics should be noted: (i) farms that start at a very low level of competitiveness may experience a positive TFP change without reaching the 'tipping point' (yet) where the production would become internationally competitive; (ii) SCBs are calculated at the crop level, whereas TFP changes are calculated at the farm level; (iii) SCBs include global reference price data; (iv) Overall, there are other factors beyond on-farm efficiency that influence international competitiveness and those factors may not evolve into the same direction.

Regression analysis

There is, however, a significant link between the volume of subsidies that a farm received between 2003 and 2007 and its performance in terms of TFP change over the same period[45]. Table 22 presents the coefficients with significant contributions to TFP change. Budgetary support received between 2003 and 2007 had a significant and positive effect on pure (technical) efficiency change (i.e. moving closer to their best-practice frontiers) and overall TFP change, but – somewhat surprisingly – not on technical change. Figure 25 presents scatter plots of the relationship between subsidies received and TFP change as well as its components, providing visual impression of the result. Furthermore, the impact of the efficiency score in 2003 on pure (technical) efficiency change and overall TFP change is statistically significant and negative. Recall, however, that higher efficiency scores are associated with lower efficiency. Hence, this result suggests that farms that were less efficient in 2003 experienced less pure efficiency change and overall TFP between 2003 and 2007. This means that the further away from its best-practice frontier a farm was operating in 2003, the less TFP improvements it was able to realize until 2007, resulting in an increasing efficiency disparity. While these results can only be considered as preliminary, requiring further in-depth analyses, they seem to indicate that budgetary support might be well-targeted towards the more-efficient farms. On the other side of the spectrum, the less efficient farms

[45] For methodological details see the Introduction chapter and Appendix Table 8.

would then fall further and further behind and eventually need to exit from production (possibly requiring assistance through a governmental producer or resource retirement program, see para. 116). However, some of the statistically significant coefficients are small in magnitude[46], and the low coefficients of determination (R^2) of the regressions indicate that the few significant effects identified here explain only a very small portion of the variation in changes in TFP and its components.

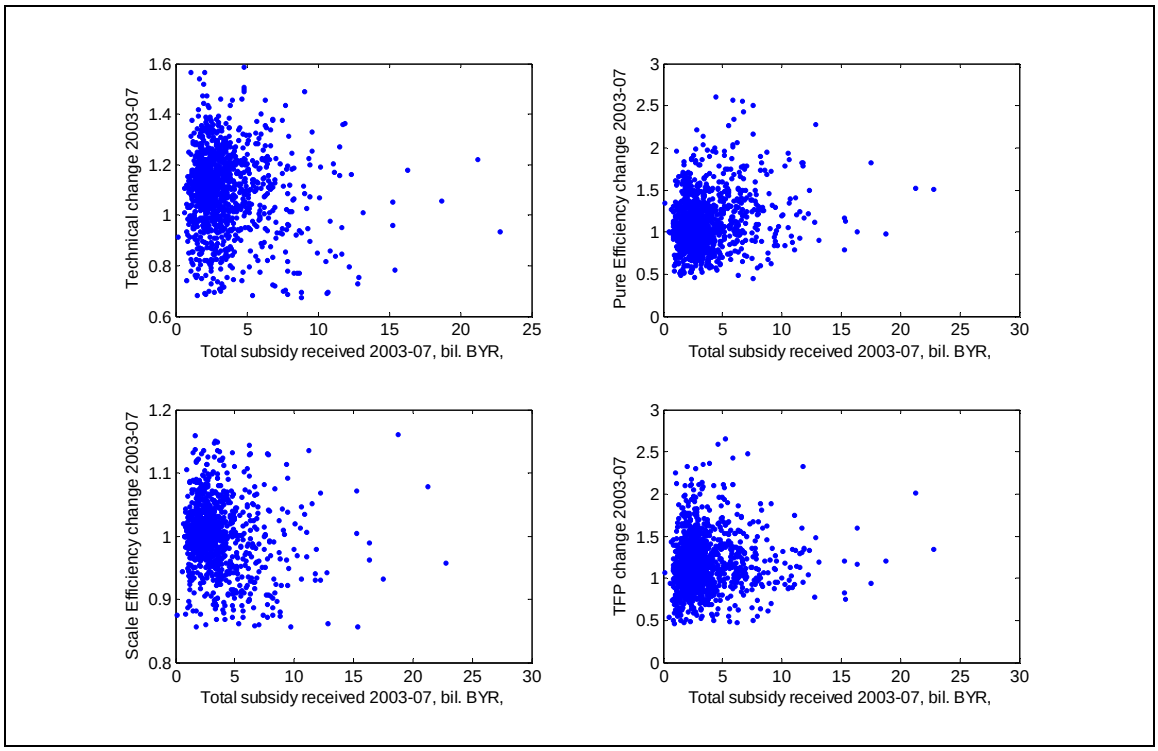
Table 22: Regression of TFP change and its components on farm characteristics and subsidies received by farms

Dependent variable	Δ(Pure efficiency)		Δ(Scale efficiency)		Δ(Technology)		Δ(TFP)	
Independent variable	**Coeff.**	**p-value**	**Coeff.**	**p-value**	**Coeff.**	**p-value**	**Coeff.**	**p-value**
Constant	**1.12**	**0.00**	**1.00**	**0.00**	**1.10**	**0.00**	**1.19**	**0.00**
Total subsidy received 2003-07	**0.12**	**0.00**	0.00	0.19	0.01	0.20	**0.10**	**0.00**
Arable land	-0.02	0.32	0.00	0.84	0.00	0.69	0.00	0.84
(Arable land)²	-0.01	0.41	0.00	0.54	0.00	0.73	**-0.02**	**0.01**
Animal units	**0.25**	**0.00**	**-0.03**	**0.00**	**-0.05**	**0.02**	**0.18**	**0.00**
(Animal units)²	**-0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**-0.01**	**0.00**
Arable land * Total subsidy	0.01	0.67	0.00	0.09	0.00	0.63	0.03	0.12
Animal units * Total subsidy	0.00	0.95	**0.01**	**0.00**	-0.01	0.47	-0.02	0.16
Capital/labor ratio	0.00	0.25	0.00	0.21	**0.00**	**0.04**	0.00	0.58
Animal units / hectare	0.00	0.81	0.00	0.14	0.00	0.91	0.01	0.30
Crop costs as % of total costs	-0.02	0.14	**-0.01**	**0.00**	**0.06**	**0.00**	**0.05**	**0.00**
Order-m Efficiency score in 2003	**-0.23**	**0.00**	0.00	0.00	**0.02**	**0.00**	**-0.23**	**0.00**
Order-m Scale efficiency in 2003	0.00	0.00	**0.02**	**0.00**	0.00	0.00	0.00	0.00
R^2	31.1%		17.6%		19.7%		27.0%	
Number of observations	1151		1080		1113		1142	

Source: Authors' calculations. Coefficients in **bold type** are significant at the 5% level.

[46] Since the corresponding independent variables are measured in standard deviations from their means, large changes in these variables are needed to have a noticeable impact on the dependent variable in question. For example, a one standard deviation increase in subsidies will produce 10 percent more TFP change over the period 2003-2007. For comparison: In 2007, for example, the 1523 large commercial farms for which subsidy information is available received an average of BYR 1,612 million in a range of BYR 0 - 30,474 million, with a standard deviation of BYR 1,640 million, and with 67 percent of farms receiving less than BYR 1,640 million.

Figure 25: Scatter plots of TFP change and its components against the volume of subsidies received between 2003 and 2007



Source: Authors' calculations with Belarusian farm database.

D. Principles and instruments of modern agricultural policy

Summary: *Agriculture has been subject to high levels of government protection and support in many countries. Food security and the perceived need to protect farmers' incomes against falling real agricultural prices are the traditional explanations for this intervention. However, as evidence has accumulated that agricultural protection and support is costly, inefficient and often counterproductive, the willingness to reform domestic agricultural policies has grown. As a result, many countries, and especially OECD countries that have traditionally provided agriculture with the highest levels of protection and support, have begun to reform their agricultural policies, moving away from traditional amber box protection and support measures in favor of green box measures that enhance agricultural productivity and competitiveness. Characteristics of such reform processes include: (i) some lowering of overall support levels; (ii) reduced use of price support measures such as tariffs, input subsidies and output payments and reduced use of especially trade distorting measures such as export subsidies in agriculture; (iii) the 'decoupling' of agricultural support, i.e. removing the link between support and production volumes and hence reducing distortions to production decisions, also encouraging an increased awareness of and response to market requirements by farmers including food safety and quality concerns; (iv) increased use of instruments for risk management and enhanced income stability in response to high and increasing volatility on agricultural markets; (v) increased use of more targeted support payments that are increasingly conditional on a farmer's compliance with environmental or animal welfare restrictions; and (vi) the provision of adjustment assistance. Developments in the EU: Similar to Belarus's objectives for governmental support to the agriculture sector, the European Union has always seen its role in agriculture to help in: (i) ensuring a stable supply of affordable and safe food for its population; (ii) providing a reasonable standard of living for EU farmers, while allowing the agriculture industry to modernize and develop; (iii) ensuring that farming could continue in all regions of the EU. But the Common Agricultural Policy (CAP) of the EU has evolved to provide greater flexibility to farmers to react to market signals, to emphasize concerns for the environment and animal welfare, and to respond to concerns about food safety.*

Agriculture is a unique sector that has been subject to high levels of government intervention in many countries. In the decades after the Second World War, when international trade in most other goods was progressively liberalized in successive rounds of GATT negotiations, agriculture was given a special status that permitted national governments to largely protect it from the disciplines of international competition.

Two main justifications for this special status are often cited. First, food is a necessity and governments have always been concerned about the need to ensure domestic food security. Hence, liberalization, which generally goes hand-in-hand with increased dependence on food imports, was seen as a threat, especially by policy makers who had experienced food shortages and hunger during and immediately after the Second World War.

Second, since the mid-1800s, prices for agricultural products have tended to follow a declining trend relative to prices for industrial goods and services. This reduction in agricultural 'terms of trade' was sometimes interrupted in the short run but quite persistent in the long run. The main cause of this trend has been a combination of above-average productivity growth in agricultural production, and comparatively slow growth in food demand. To compensate for declining real prices, farms have had to grow and adopt more efficient technologies. This structural change in agriculture improves economic efficiency as a

whole, but it can cause hardship for agricultural households that are forced to give up farming and seek employment in other sectors. Hence, many governments have attempted to shield agriculture from the forces of change by protecting domestic production.

In recent decades evidence has accumulated that agricultural protection and support is costly, inefficient and often counter-productive:

- Many governments have observed that their agricultural policies tend to become prohibitively expensive over time as agriculture's terms of trade steadily fall and increasing support is required to compensate.
- It has become increasingly apparent that protection and price support is poorly targeted and provides the biggest benefits to the big and efficient farms that need it least. A case in point is the finding, cited above, that roughly 80% of the support provided by the EU's Common Agricultural Policy was accruing to only 20% of the EU's farmers.
- It has also become apparent that a large share of the transfers generated by many support mechanisms do not end up benefitting farmers but rather accrue to unintended recipients (such as input suppliers) or are entirely lost due to inefficiency, misallocation of resources and the transaction costs of policy implementation. OECD (1996) presented estimates according to which only 20% of the benefits of price support result in higher farm incomes.
- International agricultural trade disputes triggered by domestic agricultural policies (e.g. the impact of agricultural trade dumping caused by the EU's export subsidies; the damage to developing countries caused by US cotton policies) have threatened to spill over into other sectors, with the attendant risk of disproportionate damage to the world trading system as a whole.

As a result, the willingness to reform domestic agricultural policies and subject them to international disciplines has grown. A breakthrough in this regard was attained in the Uruguay Round of GATT negotiations, which led to the establishment of the WTO and the adoption of the Uruguay Round Agreement on Agriculture (URAA). The URAA defined the 'boxes' ('amber', 'green', etc.) that distinguish between different types of agricultural support, and established agricultural policy disciplines (e.g. tariffication of import barriers, limitations on domestic support and the use of export subsidies) that WTO members must observe and implement. To be sure, progress has been slow and halting, as evidenced by the ongoing stalemate in the current Doha Round of WTO negotiations, which is to a large extend due to disputes over agricultural trade issues.

Nevertheless, in many countries, and especially in the OECD countries that have traditionally provided agriculture with the highest levels of protection and support, a reform process is underway. The characteristics of this process include (largely following Moreddu, 2007):

- Some lowering of overall support levels;
- Reduced use of price support measures such as tariffs, input subsidies and output payments, and reduced use of especially trade distorting measures such as export subsidies in agriculture;
- The 'decoupling' of agricultural support, i.e. removing the link between support and production volumes and hence reducing distortions to production decisions, also encouraging an increased awareness of and response to market requirements by farmers including food safety and quality concerns;

- Increased use of instruments for risk management and enhanced income stability in response to high and increasing volatility on agricultural markets; and

- Increased use of more targeted support payments that are increasingly conditional on a farmer's compliance with environmental restrictions (e.g. on fertilizer use or maintaining hedgerows) or ethical/animal rights restrictions (e.g. stocking densities).

Similar to Belarus's objectives for governmental support to the agriculture sector as stated in the SRDP (quoted in chapters above), the **European Union** has always seen its role in agriculture to help in[47]:

- Ensuring a stable supply of affordable and safe food for its population;
- Providing a reasonable standard of living for EU farmers, while allowing the agriculture industry to modernize and develop;
- Ensuring that farming could continue in all regions of the EU.

But the Common Agricultural Policy (CAP) of the EU has evolved to provide greater flexibility to farmers to react to market signals, to emphasize concerns for the environment and animal welfare, and to respond to concerns about food safety. Direct aid continues to have the largest share in CAP expenditures, but its nature has changed considerably towards decoupled support where farmers receive payments irrespective of what they produce as long as the ensure compliance with environmental and animal welfare, standards (cross compliance[48]).

Through the "Agenda 2000" reforms of its CAP, the European Union has adopted a two-pillar structure of its agricultural expenditures (i.e. sector support): (I) Market and income support, covering direct payments to farmers (de-coupled) and market-related subsidies under the common market organizations including public storage, surplus disposal and export subsidies; and (II) Rural development, aiming at encouraging environmental services, providing assistance to difficult farming areas and promoting food quality, higher standards and animal welfare. While income and – to a lesser extent – market support have historically been the main area of CAP expenditures, the focus is now gradually shifting towards rural development. The CAP reforms intended to increase the farmers' market-orientation and to provide incentives for environmentally sensitive farming. EU expenditures for agriculture are capped.

These characteristics of a modern agricultural policy can be summarized as a shift from traditional amber box measures to increased use of green box measures that emphasize enhancing agricultural productivity and competitiveness as well as agriculture's provision of environmental and cultural amenities. The growing share of green box measures in agricultural support in the EU and other WTO members was documented in Table 8 above. This shift from amber to green box measures is sometimes interpreted wrongly as amounting to a reduction in the role of the state in agriculture. It is more accurately to be seen as a reallocation of effort away from costly and inefficient measures towards measures that

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[47] Quoted from: http://ec.europa.eu/agriculture/capexplained/sustain/index_en.htm.

[48] "Cross Compliance means that farmers have to respect a set of standards to avoid reduction of their payments – direct payments and some rural development payments – from the European Union. These standards cover protection of the environment, public, animal and plant health, animal welfare and the maintenance of the land in good agricultural and environmental condition. Cross Compliance has the dual aims of contributing to making farming more sustainable and making the CAP more compatible with the expectations of consumers and taxpayers." (http://ec.europa.eu/agriculture/simplification/crosscom/index_en.htm)

improve the functioning of markets, in particular by providing agriculture with vital public goods and services. There is mounting empirical evidence that shifting government expenditure away from interference on private good markets and towards the provision of public goods and services has significant and highly beneficial effects on economic development and welfare. In a path-breaking study of ten Latin American countries, López (2005, p. 18) presents econometric evidence that *"while government expenditures have a positive and highly significant effect on agriculture per capita income, the structure or composition of such expenditures is quantitatively much more important and also of great statistical significance. […] According to the estimates, a reallocation of just 10% of the subsidy expenditures to supplying public goods instead may cause an increase in per capita agriculture income of about 2.3%."* In another empirical analysis of 87 countries between 1980 and 2004, López and Islam (2008) find that increasing the share of public good spending in government expenditure increases the annual growth rate of per capita GDP by one percentage point.[49]

Research and education are two types of public good that are of great importance for agricultural development and that are not provided in sufficient quantities by markets alone. *Psacharopoulous (1994) and Psacharaopoulos and Patrinos (2002) survey hundreds of studies from around the world that measure returns to education. Although the methods applied and the settings in these studies vary considerably, the results are quite homogeneous and point to an average rate of return of roughly 20%. Alston et al. (2000) survey almost 300 studies that measure rates of re*turn to expenditure on agricultural research and extension (advisory services). The authors rarely find rates of return below 25%, and they report average rates of return to agricultural research of roughly 50% and to extension (advisory services) of almost 80% in developing countries.

Adjustment assistance is another important element of modern agricultural policy, especially when policy reform causes temporary hardship for farmers who have become dependent on traditional forms of protection and support. Adjustment assistance can take two main forms (OECD, 2006). The first of these forms includes measures to assist producers to leave farming and/or to diversify into rural but non-agricultural activities. These measures include early retirement schemes, compensation payments and training for employment in other sectors. The other form of adjustment assistance is aimed at improving the competitiveness of those who remain in farming. Along with education, extension (advisory services) and research (see above), this type of measures includes investments in infrastructure and marketing institutions, and temporary assistance to compensate farmers for income losses due to policy reform.

Another important agricultural policy task is the establishment and maintenance of effective systems for testing and monitoring food safety to protect (objective risk reduction) and reassure (subjective risk reduction) domestic consumers. Food safety systems are also a necessary condition for successful agricultural exports. Domestic producers and consumers expect protection from importable threats such as avian flu and BSE, and potential buyers of Belarusian products in the rest of the world expect documented conformity with international standards. Often, additional national standards will have to be met as well. In some cases (e.g. many large food processors and retailers in the EU), private firms will undertake their own investments in food safety and have their own requirements for suppliers.

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[49] The quantitative extent of these effects obviously also depends on the overall level of support. However, the key conclusion is the direction of the effect: a reallocation of state resources towards the provision of public goods increases agricultural incomes and growth.

Food security is a legitimate concern of every nation and a critical public good that governments should provide. The international food price 'crisis' of 2007-08 heightened concerns about food security and was used by many governments to justify continued and often increased market intervention such as price regulation or export restrictions. However, while food security is an issue of vital importance, many of the arguments that are brought forward in this context are rather questionable. Food security – from an individual household's or country's perspective – is first and foremost a question of purchasing power, and not of gross food supply. Increasing food supply by boosting domestic production will generally be considerably more expensive than providing the poor with targeted income transfers that allow them to convert their needs into effective demand. Artificially depressing domestic food prices provides cheap food for the poor, but it also provides unnecessary benefits to the wealthy and reduces farmers' incentives to produce food, thereby exacerbating the food supply/demand balance in the long run.

Moreover, basing food security on domestic agricultural production often merely shifts import dependence from food products to other imports (those imports that are needed to produce food domestically). For example, modern agriculture is highly dependent on energy that is used to produce fuel, fertilizer and agro-chemicals. Without these energy-intensive inputs, production would fall sharply. Therefore, while increased reliance on domestic food production will reduce a country's dependence on food imports, it will simultaneously increase dependence on energy imports in countries that are net energy importers. This is particularly true for Belarus which is almost entirely dependent on oil and gas imports from Russia[50]. An increased reliance on domestic food production might actually mean greater vulnerability to a food security crisis compared with a situation in which Belarus imports more food but is able to diversify the sources of these imports. After all, Belarus is surrounded on all sides by highly competitive producers of basic foodstuffs (the EU, Russia and Ukraine).

[50] Huelsbergen et al. (2001) provide detailed estimates of energy inputs of crop production in Germany. While their results vary widely by fertilizer treatment and yields, and may not directly applicable to the situation in Belarus, they can nevertheless provide some order of magnitude. Example: wheat. In 2008, Belarus imported 194,918 tons of wheat, equivalent to 59,426 ha of wheat production based on a country-wide average yield of 3.28 t/ha. With estimates from Huelsbergen et al., wheat production on this area would require inputs with an energy equivalent of 1,148,711 GJ, equivalent to 7,832,861 gallons of diesel or 187,719 barrels of crude oil (energy contents equivalents) costing (at a price of 70 US$/barrel) about US$ 13.1 million, compared to the cost of wheat actually imported of US$ 58.4 million.

E. Options for agricultural policy reform in Belarus

The orientation of governmental expenditures and the width and depth of policy reforms – if any – are obviously the sovereign choices of a country, and this Note will not prescribe an "ideal" reform path. Its intention, however, is to quantify some of the impacts of the current policy framework, to outline options for a higher degree of achievement of the government's own objectives, and to estimate (in qualitative terms) their expected effects.

Effectiveness of current policy framework (regulatory and fiscal measures) in achieving governmental objectives for the agricultural sector

The government's overarching objective for the agriculture sector has been established in the SRDP for 2005-2010 as "ensuring food security and improving rural livelihoods" which is envisaged to be achieved through social infrastructure investments in rural areas and an agricultural support system aimed at enhanced efficiency and competitiveness of the sector (comp. para. 47). Following the analyses presented in the previous chapters, Belarus's current agricultural policy regime has the following key characteristics and effects:

- Gross agricultural output and wheat and milk yields have increased considerably in the last decade(s), but labor and capital productivity in agriculture have fallen relative to the rest of the economy.
- Total factor productivity has increased on 69 percent of all large commercial farms between 2003 and 2007, driven by increases in technical (pure) efficiency and technical change. But many Belarusian farms have not evolved in the direction of more efficient size, many farms cannot keep up with the pace of technical change, and a large number (31 percent) of all farms have experienced a net reduction in TFP.
- There is a significant link between the volume of subsidies that a farm received between 2003 and 2007 and its performance in terms of TFP change over the same period, and there is a significant (but negative) effect of the efficiency level a farm had at the start of the observation period (2003), resulting in an increasing efficiency disparity.
- The competitiveness of crop production in Belarus shows large differences between crops, farms, and years. In general, livestock production in Belarus is less competitive than crop production. There is no evidence of 'across the board' improvements in competitiveness in Belarusian agriculture between 2003 and 2007.
- Belarus has "one foot on the gas pedal and one foot on the brake at the same time" (i.e. budgetary expenditures in support of production while production is implicitly taxed through artificially low farm-gate prices). But the considerable differences between financial profitability and economic competitiveness indicate that the net effect of market and price distortions in Belarus is in support of the agriculture sector, taxing the rest of the economy.
- Higher quality requirements in potential new product markets have not yet been systematically reflected in the production technologies and farm management practices.

These effects have significant implications:

- Since the agricultural policy framework primarily employs 'amber box' measures, it creates massive distortions for agricultural production, resulting in considerable losses within the agriculture sector and for the rest of the economy through inefficient resource allocation.

- Agricultural productivity and contribution to growth and rural incomes – at a given governmental expenditure level – is lower than it could be.
- The current policy regime creates disincentives for private investments including FDI which would otherwise also play an important role in knowledge transfer and technical and managerial modernization.
- Belarus has remained almost exclusively dependent on the CIS and especially Russia as a destination for its agricultural exports.
- Distortions to production and trade are likely to become issues in Belarus' WTO negotiations and any future bilateral/multilateral trade negotiations, slowing down Belarus's crucial intensification of economic integration.
- The current agricultural support system causes high cost to the governmental budget (fiscal implications through budgetary expenditures and tax privileges) and administrative inefficiencies (support and implicit taxation at the same time).
- Against the background of the current global economic crisis and the resulting shrinking fiscal space in Belarus, the current nature and level of support – especially since it represents a net transfer to the agriculture sector and creates allocative losses to the economy overall – can only be maintained at the expense of other budget expenditure categories, which might become socio-politically undesirable.
- Where products of subsidized sub-sectors are largely exported, a considerable part of the related governmental expenditures become subsidies to the importing country (to the extent that the additional supply affects the price level in the importing country/region). This is in particular the case for Belarusian dairy production and Russia as importer.

What could be gained from policy reforms in the agriculture sector?

It would seem that through the re-orientation of the agricultural policy framework towards less distortive measures and a related reallocation – and possibly even reduction – of budgetary resources spent on the agriculture sector, governmental objectives in the agricultural sector (productivity and competitiveness) could be achieved to an even higher degree without compromising on other objectives (food security and rural incomes).

In particular,

- With an increased market-orientation of producers, guided by price signals and quality requirements in product markets, Belarusian agriculture would become more competitive, resulting in better access to new markets and increased capacity to maintain its position on domestic markets upon WTO accession (and possibly further trade agreements).
- Private investments, including FDI, would likely increase.
- Trade negotiations would be facilitated.
- Less budgetary expenditures would be needed for agricultural production itself and could be more efficiently used for targeted assistance programs (direct payments to farmers, rural population, "the poor"), or expenditure levels could be reduced altogether.

The following section attempts to outline some alternatives to the current policy framework and to assess their broad implications on key parameters of governmental concern.

Policy reform options (selected elements of a potential policy reform program)

Belarus has undertaken impressive steps towards regulatory improvements in its business environment, but these reforms have been highly selective and seemingly targeted at performance indicators of international recognition. Broader, more comprehensive reforms – especially in the agriculture sector – have not yet been undertaken. From 2007 to 2008, Belarus improved its position from rank 115 to 85 out of 181 economies in the World Bank's overall assessment of the country's business regulations (Doing Business, 2009), which brought Belarus into the group of top-10 reformers in 2009 (reforms between 2007 and 2008). As another example, important steps, which may facilitate a more fundamental land reform, have recently been taken towards the development of a comprehensive land valuation and registry system. However, despite the recent emergence of private ownership over household plots (up to 1 hectare) and long-term leases of land, clear property rights on a more comprehensive basis still do not exist. And given the long legacy of state ownership and the political economy attached to this matter, comprehensive reforms are unlikely to happen soon or fast. At the end of 2007, the government had adopted an Action Plan aimed at improving the country's business and investment climate and at bringing Belarus – within a few years' time – into the top-30 countries of the World Bank's Doing Business (DB) rating. Pursuing such an ambitious objective would likely require the reconsideration of the role of the state in the economy, with implications for the setting of expenditure priorities within a constrained envelope. New constraints imposed by the current global economic crisis, especially through a shrinking fiscal space, are providing an opportunity, and possibly create the necessity[51], to revisit agricultural sector administration and the agricultural growth model with implications for a potential reform of the state support system for this sector. The following section describes some potential elements of such reforms.

The guiding principle for the formulation of policy reform options, based on the observations above, is the reduction of distortions to agricultural incentives through agricultural price liberalization (i.e. market-based pricing of inputs and outputs) and the reduction of state interventions in farm management including production and marketing, and the provision of support to sustainable agricultural growth through the restructuring of budgetary expenditures towards "de-coupled" 'green box' measures. Each of these options (policy elements) would make an important contribution to enhancing agricultural productivity and competitiveness and overall to the better achievement of the government's objectives (food security and rural livelihood support through agricultural sector efficiency and social investments). The following focuses on agricultural measures and does not cover rural development support such as investment support for non-agricultural SMEs which could become an important element in facilitating the structural adjustment in the agricultural sector.

Reduction of distortions to agricultural incentives

Price liberalization for agricultural inputs and outputs: Without fundamental changes in the price regime, productive resources are not guided to their most efficient uses with negative implications for employment generation and agricultural growth and ultimately for the provision of attractive income opportunities as a sustainable basis of rural livelihoods in the long term. Since the net effect of market interventions currently equals a subsidy to agricultural producers, the removal of this preferential treatment would – at first and in the

[51] In 2009, the government already had to decrease state procurement prices for agricultural products (for example, a reduction of the milk price by 10 percent while increasing the base fat content of milk) and to cut expenditures under the marginal agriculture support program of the SRDP (expenditures for the land improvement program, bee keeping, and fishery were reduced in two steps).

short term – reduce the profit margins of agricultural producers. But over time and in combination with the freedom of managers to react to these price signals through adaptations in the orientation of production, intensity, and size of operation (see second measure below), agricultural producers would adjust and reallocate their resources. Nevertheless, these price effects would likely require adjustment assistance (see further below) in order to make them more acceptable to agricultural producers. Depending on whether financial prices for agricultural products are above or below their (border) reference prices, consumers and agro-processors might also experience some price increases, which would make this measure not very popular and might require (temporary) adjustment assistance for the processing industry (see below), supporting productivity and efficiency enhancing investments. The effect on consumers will depend on the share of food in household expenditures. The share of food items in total consumption tends to be higher for rural households and for the poor.

Reduction of state control over farm management: This reform measure would complement the price liberalization effort above, since only with the reduction of state control over farm management, agricultural producers can respond to market signals by adjusting the nature, scope, intensity, and technology of their production and the nature of their business relations for purchases and sales, which will ultimately result in increased efficiency. The key issue here is the market-oriented management of farms and not the specific ownership model. Hence this step would not necessarily require further privatization. (Although privatization might eventually become desirable, but would then need to be undertaken cautiously in order to appropriately reflect the value of the agricultural assets that have been built up and that are of significant value, also to international investors).

Support to sustainable agricultural growth through non-distorting measures

While the measures above increase efficiency and competitiveness through adaptation processes that would be undertaken by farm managers in response to the removal of distorting state support measures, the measures here would provide active state support to the sector through measures that are regarded as little trade distorting at most. The GATT / WTO 'Agreement on Agriculture' (Annex 2) provides a comprehensive list of such measures under its 'green box' (see text box in chapter B), which for Belarus could include the following elements:

Agricultural education, training, and advisory services: Given the legacy of state planning and control in agricultural production, educational measures – especially in the field of market-oriented farm management – would be essential to provide farm managers with the knowledge that would allow them to make the best use of new opportunities created through price liberalization and reduction of state control, i.e. adjusting their operation to market signals. Especially for accessing new, potentially sophisticated markets, Belarusian farmers would benefit from advice on how specific market requirements in terms of type, timing, and quality of products (e.g. "traceability", 'animal welfare', 'good agricultural practices') can be translated into appropriate production technologies and farm management practices. A range of institutional and operational models exist that could be adjusted to the specific situation and needs of Belarusian producers. Most likely, different models would need to be found for large commercial farms and for private farms and household plots. Marketing and soil fertility management would likely be among the most critical topics for advisory services. Farmers would further benefit from market-oriented information systems.

Food safety system modernization: Modern agri-food markets are becoming increasingly sophisticated in their food safety and quality requirements, demanding appropriate control structures in the countries of origin. This is especially true for access to the common market of the European Union. To the extent that exports to the EU are an option for Belarus, the adoption of relevant food safety legislation and establishment of institutional arrangements would become necessary. The degree of harmonization / approximation of domestic legislation to applicable food and feed legislation of the EU, however, would need to be assessed carefully since this would have considerable cost implications. Poland and the Baltic states could provide crucial guidance in this process. Adoption of the Agreements on SPS Measures and the Agreement on TBT are a requirement for WTO accession.

Income support and adjustment assistance through de-coupled payments

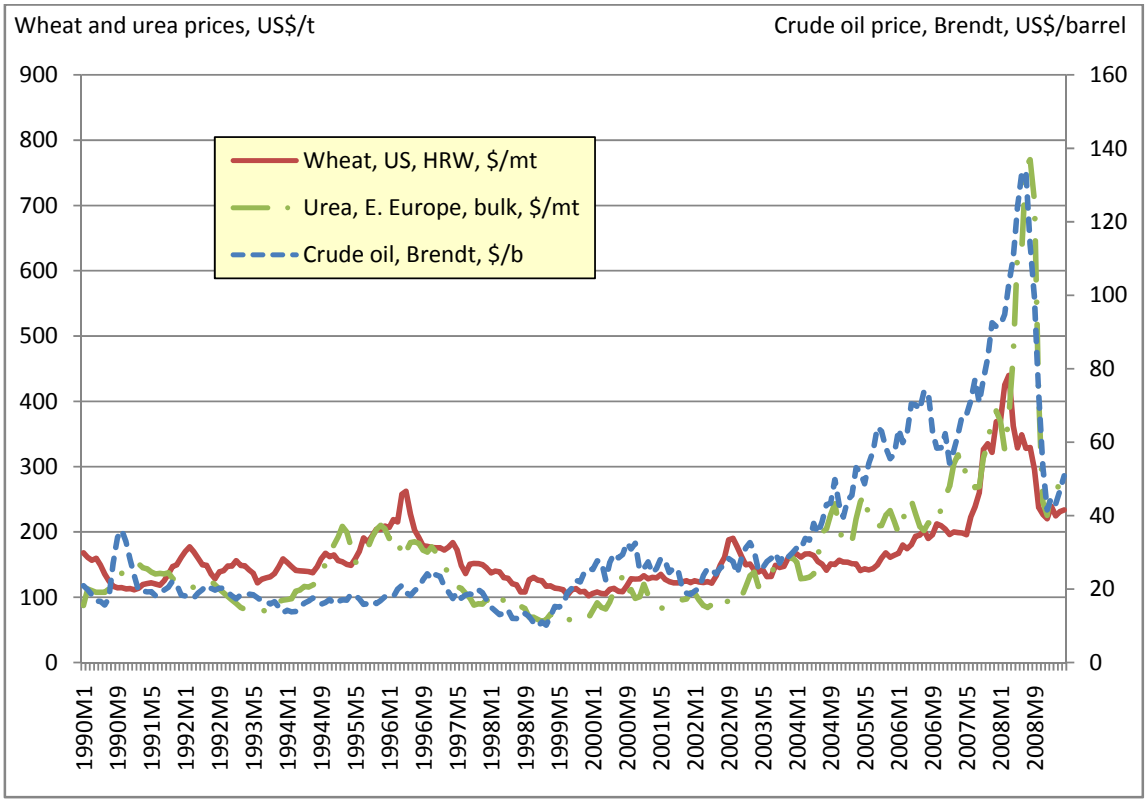
De-coupled payments to agricultural producers: The phasing-out of (a part of) the trade-distorting measures currently in effect would create a burden for agricultural producers that could be reduced or entirely compensated for by introducing direct payments to producers that are de-coupled from their production volumes. Direct payments could also be made in order to support rural incomes in general and/or to pay for environmental or other externalities of agricultural production. If desired, a payment structure could be established that provides full compensation for the losses from the removal of the distorting support system. While such an arrangement would obviously provide less fiscal relief, it would make acceptable to producers those reform measures (i.e. removal of distorting support) which would ultimately lead to higher efficiency and competitiveness of Belarusian farms. The gradual reduction (phasing out) of the de-coupled payments could be an option.

Structural adjustment assistance through producer or resource retirement programs: If the above-described re-orientation of state support towards 'green box' measures is pursued, farms will respond by re-orienting their production systems and management. As a result, some farms may eliminate less profitable lines of production, scale down, or close their business altogether, while other farms would emerge and/or scale up and/or add new production lines. In this restructuring process, driven by market needs and decided and managed by the farmers themselves, some farm workers might lose their employment or would need to retrain to gain the skills needed in new roles and/or for new production processes. In order to avoid hardship and hence to increase the acceptability of a reform program, the state could play an important role in providing assistance through producer retirement programs (the educational measures mentioned above could provide retraining services). Additional assistance, also in view of sudden food price increases as experienced in 2007/2008, could be provided through targeted social protection mechanisms which are well developed in Belarus.

Implications for food security in Belarus

Much of the state support system for agriculture currently in effect in Belarus is motivated by governmental concerns about the country's food security. The food price crisis of 2007/2008 (Figure 26) has fueled such concerns not only in Belarus but world-wide (to varying degrees), partially eroding the general trust in the global food trade system. Numerous countries are therefore revisiting their food security strategies and are reconsidering the option of increased self-sufficiency in foodstuffs and the creation or expansion of public stocks. This is understandable but can create considerable cost to the economy through direct transfers, i.e. budgetary expenditures for such activities, and/or through the diversion of productive resources away from their most efficient use.

Figure 26: Wheat, fertilizer, and oil price development, monthly data, 1990-2009



Source: World Bank (2009b).

In Belarus, a number of specific conditions exist that seem to suggest that the government could create considerable gains for the economy (i.e. society) overall without risking the country's food security by basing its food security strategy on a mix of domestic production and trade (as already the case anyway) and re-orienting its regulatory and fiscal interventions towards measures that provide maximum support for increased efficiency and competitiveness rather than directing production itself.

- Belarus already produces a large amount of its own food and would likely continue to do so even under a less distorting support system. And higher efficiency would lead to production at lower cost.
- Surrounded by agricultural power-houses (EU, Russia, Ukraine) it is difficult to imagine that Belarus could face constraints in access to agricultural products / food as long as an open trade regime and adequate logistical infrastructure are maintained (and none of its neighbors is likely to engage in hostile action to Belarus). And better trade relations due to WTO membership and – potentially – a trade agreement with the EU would mean more diversified, reliable sources of imports.
- Food imports require foreign exchange resources; but so do imports of energy sources needed for agricultural production. Energy supply in Belarus highly depends on imports. Replacing trade in foodstuff by domestic agricultural production effectively means replacing food imports by energy imports. Given that Belarus' energy trade is even less diverse than its agri-food trade, such a substitution arguably even increases the country's foreign dependence.

- Belarus' poverty rate is comparatively low already now. Higher economic growth through a more efficient agricultural sector (if elements of the policy reform options above are implemented) would lead to an even increased purchasing power of the population.

Against this background, the policy re-orientation depicted in the options described above would even have a positive impact on food security in the medium to long term.

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Appendices

Appendix Table 1: Major economic and agricultural indicators for Belarus

	1970	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Population (million)	9.0	9.7	10.2	10.2	10.2	10.2	10.2	10.2	10.1	10.1	10.0	10.0	10.0	9.9	9.9	9.8	9.8	9.8	9.7	9.7
Rural population (mill.)	5.0	4.2	3.4	3.3	3.3	3.3	3.3	3.3	3.2	3.2	3.1	3.0	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6
Nominal GDP (bill. US$)			7.3	2.6	5.3	3.7	4.8	10.5	14.6	14.1	15.3	12.1	10.4	12.4	14.6	17.7	23.1	30.4	36.9	44.5
GDP/capita (nom. US$)			718	252	524	358	475	1,034	1,427	1,394	1,512	1,212	1,043	1,242	1,474	1,810	2,361	3,097	3,809	4,640
Exchange rate (official. US$ aop)						0.3	3.7	11.5	13.2	26.0	46.1	249.3	876.8	1,390	1,791	2,051	2,160	2,154	2,145	2,146
GDP growth (%)			-3.0	-1.9	-9.6	-7.6	-11.7	-10.4	2.8	11.4	8.4	3.4	5.8	4.7	5.0	7.0	11.4	9.4	10.0	8.6
Inflation (% eop)				147.5	1,559	1,997	1,960	244.0	39.3	63.1	181.7	251.2	107.5	46.1	34.8	25.4	14.4	8.0	6.6	12.1
GDP shares (%): Agriculture													11.6	9.7	9.5	8.0	8.3	7.9	7.9	7.5
Industry													26.5	26.1	25.4	26.1	28.0	28.4	28.1	27.1
Construction													6.4	5.9	5.8	6.1	6.5	6.9	8.0	8.5
Transport & communication													11.1	11.5	10.4	9.7	9.6	9.5	9.3	9.3
Trade & catering													10.8	11.1	10.8	10.8	10.2	9.9	10.5	10.8
Other													20.4	23.6	24.9	24.8	23.7	24.0	23.4	23.7
Cereals Total	3.633	4.018	6.783	6.039	7.061	7.315	5.940	5.315	5.482	5.928	4.497	3.414	4.565	4.872	5.711	5.116	6.590	6.089	5.685	7.014
of which: Wheat	0.708	0.302	0.381	0.242	0.330	0.354	0.230	0.439	0.600	0.744	0.787	0.712	0.966	0.867	1.017	0.796	1.121	1.175	1.075	1.397
Rye	1.074	1.515	2.652	1.962	3.063	2.826	1.864	2.143	1.794	1.788	1.384	0.929	1.360	1.294	1.600	1.152	1.397	1.155	1.072	1.305
Oats	0.470	0.493	0.806	0.760	0.723	0.871	0.760	0.638	0.707	0.822	0.501	0.368	0.495	0.530	0.575	0.594	0.765	0.609	0.555	0.580
Barley	1.358	1.693	2.908	3.032	2.934	3.165	3.013	1.965	2.194	2.359	1.623	1.181	1.378	1.700	1.681	1.608	2.031	1.864	1.831	1.911
Triticale	-	-	-	-		0.075	0.065	0.113	0.160	0.185	0.180	0.204	0.311	0.427	0.798	0.890	1.216	1.121	0.978	1.241
Corn	-	-	0.024	0.028	0.003	0.006	0.001	0.003	0.005	0.006	0.006	0.010	0.030	0.031	0.030	0.050	0.039	0.144	0.153	0.541
Sugar beet	1.030	1.122	1.479	1.147	1.120	1.569	1.078	1.172	1.011	1.262	1.428	1.187	1.474	1.682	1.146	1.920	3.088	3.065	3.978	3.626
Pulses Total	0.173	0.090	0.252	0.257	0.169	0.193	0.155	0.187	0.310	0.492	0.334	0.231	0.291	0.281	0.279	0.333	0.426	0.331	0.238	0.202
Sunflower seed					0.004	0.004	0.003	0.006	0.001	0.002	0.002	0.003	0.003	0.0005	0.0003	0.0003	0.0003	0.0001	0.0002	0.0003
Potatoes	13.234	9.333	8.590	8.958	8.984	11.644	8.241	9.504	10.881	6.942	7.574	7.491	8.718	7.768	7.421	8.649	9.902	8.185	8.329	8.744
Vegetables	0.855	0.733	0.749	0.918	0.838	1.048	1.029	1.031	1.204	1.177	1.201	1.302	1.379	1.415	1.507	2.002	2.035	2.007	2.173	2.153
Fruits	0.439	0.414	0.373	0.311	0.480	0.807	0.396	0.383	0.439	0.363	0.202	0.190	0.299	0.315	0.478	0.241	0.358	0.382	0.717	0.420
Meat	0.685	0.857	1.181	1.065	0.950	0.820	0.743	0.657	0.623	0.632	0.673	0.652	0.598	0.627	0.617	0.605	0.629	0.697	0.767	0.815
of which: Beef	0.325	0.411	0.586	0.530	0.495	0.411	0.384	0.316	0.277	0.256	0.271	0.262	0.213	0.231	0.227	0.211	0.224	0.256	0.272	0.274
Pork	0.311	0.350	0.438	0.382	0.323	0.284	0.252	0.263	0.273	0.297	0.320	0.311	0.302	0.303	0.301	0.301	0.299	0.321	0.346	0.372
Poultry	0.035	0.087	0.142	0.141	0.121	0.113	0.097	0.069	0.064	0.069	0.074	0.070	0.076	0.085	0.085	0.087	0.101	0.115	0.145	0.165
Milk	5.264	6.105	7.457	6.812	5.885	5.584	5.510	5.070	4.908	5.133	5.232	4.741	4.490	4.834	4.773	4.683	5.149	5.676	5.895	5.904
Eggs (billion)	1.669	3.035	3.657	3.718	3.502	3.514	3.400	3.373	3.403	3.459	3.481	3.395	3.288	3.144	2.923	2.824	2.950	3.103	3.337	3.228

Source: EBRD (2009); World Bank (1994); National Statistics Committee of the Republic of Belarus (2008a); National Statistics Committee of the Republic of Belarus (2009b); FAO (2009); authors' calculations.

Appendix Table 2: Belarusian agricultural imports – total (thousand tons) and shares from CIS and non-CIS countries (%) by product

	2000	2001	2002	2003	2004	2005	2006	2007
Frozen beef	1.8	1.1	2.0	1.1	2.2	1.6	11.8	0.4
from CIS	*22%*	*19%*	*11%*	*23%*	*3%*	*6%*	*84%*	*60%*
from non-CIS	*78%*	*81%*	*89%*	*77%*	*97%*	*94%*	*16%*	*40%*
Pork	5.1	5.3	7.5	33.8	35.8	30.8	40	7.6
from CIS	*6%*	*1%*	*4%*	*0%*	*0%*	*0%*	*1%*	*1%*
from non-CIS	*94%*	*99%*	*96%*	*100%*	*100%*	*100%*	*99%*	*99%*
Poultry	21.6	14.3	16.2	20.4	15.5	20.2	17.7	12.5
from CIS	*6%*	*4%*	*2%*	*2%*	*3%*	*0%*	*0%*	*3%*
from non-CIS	*94%*	*96%*	*98%*	*98%*	*97%*	*100%*	*100%*	*100%*
Prepared or canned meat products	1.0	2.4	2.8	7.3	8.2	7.7	5.5	4.8
from CIS	*90%*	*95%*	*94%*	*98%*	*98%*	*98%*	*98%*	*97%*
from non-CIS	*10%*	*5%*	*6%*	*2%*	*2%*	*2%*	*2%*	*3%*
Condensed milk and cream	7,268	3,051	1,408	1,759	2,071	1,624	2,247	1,881
from CIS	*96%*	*85%*	*81%*	*75%*	*87%*	*76%*	*81%*	*75%*
from non-CIS	*4%*	*15%*	*19%*	*25%*	*13%*	*24%*	*19%*	*25%*
Eggs (million)	2.0	3.2	1.9	5.5	1.1	0.3	1.1	0.6
from CIS	*84%*	*99%*	*15%*	*43%*	*100%*	*95%*	*99%*	*97%*
from non-CIS	*16%*	*1%*	*85%*	*57%*	*0%*	*5%*	*1%*	*3%*
Sugar	476.6	483.5	592.5	450.6	502.6	444.7	220.5	0.9
from CIS	*7%*	*6%*	*1%*	*0%*	*0%*	*0%*	*1%*	*94%*
from non-CIS	*93%*	*94%*	*99%*	*100%*	*100%*	*100%*	*99%*	*6%*
Sunflower oil	61.3	75.4	75.5	96.1	103.4	96.0	117.3	117.9
from CIS	*98%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
from non-CIS	*2%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Wheat or wheat and rye flour	83.4	19.9	17.1	18.5	68.5	61.3	59.6	45.9
from CIS	*82%*	*97%*	*99%*	*99%*	*100%*	*99%*	*99%*	*100%*
from non-CIS	*18%*	*3%*	*1%*	*1%*	*0%*	*1%*	*1%*	*0%*
Groats	57.5	171.2	182.5	154.1	158.9	150.9	132.7	114.4
from CIS	*60%*	*88%*	*84%*	*82%*	*82%*	*82%*	*77%*	*76%*
from non-CIS	*40%*	*12%*	*16%*	*18%*	*18%*	*18%*	*23%*	*24%*
Wheat and wheat and rye mix	326.0	169.8	152.4	117.8	247.7	2.0	54.8	75.1
from CIS	*77%*	*83%*	*100%*	*100%*	*67%*	*98%*	*86%*	*94%*
from non-CIS	*23%*	*17%*	*0%*	*0%*	*33%*	*2%*	*14%*	*6%*
Barley	2,289	4,797	5,547	5,621	5,754	5,621	5,862	6,026
from CIS	*32%*	*86%*	*84%*	*85%*	*83%*	*79%*	*44%*	*58%*
from non-CIS	*68%*	*14%*	*16%*	*15%*	*17%*	*21%*	*56%*	*42%*
Corn	1.8	1.1	2.0	1.1	2.2	1.6	11.8	0.4
from CIS	*22%*	*19%*	*11%*	*23%*	*3%*	*6%*	*84%*	*60%*
from non-CIS	*78%*	*81%*	*89%*	*77%*	*97%*	*94%*	*16%*	*40%*
Coffee (tons)	5.1	5.3	7.5	33.8	35.8	30.8	40	7.6
from CIS	*6%*	*1%*	*4%*	*0%*	*0%*	*0%*	*1%*	*1%*
from non-CIS	*94%*	*99%*	*96%*	*100%*	*100%*	*100%*	*99%*	*99%*
Tea (tons)	21.6	14.3	16.2	20.4	15.5	20.2	17.7	12.5
from CIS	*6%*	*4%*	*2%*	*2%*	*3%*	*0%*	*0%*	*3%*
from non-CIS	*94%*	*96%*	*98%*	*98%*	*97%*	*100%*	*100%*	*100%*

Source: National Statistics Committee of the Republic of Belarus (2009) *; National Statistics Committee of the Republic of Belarus (2009b);* authors' calculations.

Appendix Table 3: Major objectives of the State Rural Development Program 2005-2010

Main objective	Specific objectives
i) Interventions aimed at development of social infrastructure in rural areas	1. Improving rural people's employment opportunities and incomes 2. Improvement of infrastructure in rural settlements 3. Development of housing construction and improvement of communal infrastructure in rural areas 4. Upgrading of roads and development of transportation services in rural areas 5. Development of education in rural areas 6. Development of health services to rural households 7. Development of cultural and recreation activities in rural areas 8. Development of physical culture, sport and tourism in rural areas 9. Improvement of multiple services network in rural areas 10. Development of trade services to rural households
ii) Measures intended to develop agricultural production in rural areas	1. Improvement of agricultural production specialization 2. Improvement of drained lands' productivity 3. Improvement of soil fertility 4. Development of crop cultivation 5. Livestock sector development 6. Development of individual farms and household subsidiary plots 7. Development of processing industry 8. Foreign trade activities of the agro-industrial sector 9. Improvement of organizational and economic structure of the agro-industrial sector 10. Improvement of government support to the agro-industrial sector 11. Technical upgrading of agricultural production 12. Improvement of personnel training in the agro-industrial sector 13. Improvement of research support to the agro-industrial sector

Source: State Rural Development Program 2005-2010 – English translation.

Appendix Table 4: Calculation of tax concessions in agriculture of Belarus (2007, million BYR)

Taxes and mandatory payments	Taxes and payments WITHOUT concession status			Taxes and payments WITH concession status		Estimate of tax concessions
	Tax base	Tax rate %	Tax due	Tax base	Tax rate %	
Profit tax		24%		3,325*	0%	-3,325*
Property tax	39,814,866	1.0%	398,149	3,339		394,810
V.A.T	6,923,962	18%	576,653	52,299	10%	524,354
Local taxes		<3%		2,286**		-2,286
Payments to the Republican Fund*	6,923,962	3%	207,719	8,991*	0%	198,728
Innovation Fund	3,557,200	0.25%	8893	8,493*	0,25%	0
Unified agricultural tax				113,964	2%	-113,964
Social Protection Fund payments	1,878,027	35%	657,309	563,408	30%	93,901
TOTAL	X	X	1,848,723	X	X	1,092,218

Source: Institute for Systemic Research in Agriculture of the National Academy of Sciences of Belarus (2008-2009). Personal communication.

** Includes payments to the Republican Fund to Support Farmers, Food Producers and Agricultural Science, and payments to the Road Fund.*

*** Most farmers (97%) in Belarus pay the unified agricultural tax. The remaining 3% pay regular taxes, including the profit tax, although, they are still eligible for certain tax concessions. Taxes paid by farmers who have not opted for paying the unified agricultural tax have been subtracted from the estimate of tax concessions.*

**** Fees and taxes paid by farmers only (i.e. not paid by other industries and businesses).*

Appendix Table 5: Tax revenues foregone from agriculture, million BYR

Tax/Payments s	2005	2006	2007	Share in total, % (2007)
Value-added tax	398,449	440,447	524,354	48%
Property tax	272,229	336,964	394,810	36%
Fee to finance local budget funds to support housing investment; Fees to the Republican Fund in support of Agricultural, Food Producers and Agricultural Science; Road Fund; Fee to finance expenditures in maintaining and fixing housing	136,133	163,644	198,728	18%
Fees to the Social Protection Fund	80,849	64,099	93,901	9%
Local taxes and fees*		-1,149	-2,286	0%
Profit tax**	-9,218	-4,915	-3,325	0%
Unified agricultural tax*	-76,940	-91,401	-113,964	-10%
Emergencies tax and fees into the state employment fund***	45,924	56,923	-	
Total	**847,426**	**964,612**	**1,092,218**	**100%**

Source: Institute for Systemic Research in Agriculture of the National Academy of Sciences of Belarus (2008-2009). Personal communication.

** Taxes fees not paid in other sectors/industries except agriculture.*

*** Profit tax paid by 3% of farms that have not switched to the unified agricultural tax.*

**** Tax abolished for all industries effective 2007.*

Appendix Table 6: Private and social cost benefit (PCB, SCB) calculations for a sample farm (US$/hectare)

Product	Perspective	Costs							Revenue	Cost-benefit ratio
		Seed, manure, fertilizer and agro-chemicals	Diesel, gas, gasoline, electricity, and other fuels	Labor	Spare parts and repairs	Services	Credit expenses, depreciation and opportunity cost of capital	Land		
Wheat	Financial	146.9	58.8	67.8	29.3	19.8	63.9	-	444.2	0.87
	Economic	205.6	74.4	67.8	24.9	19.8	109.3	187.7	723.9	0.95
Corn	Financial	340.5	136.5	157.3	67.9	45.9	148.3	-	1,057.0	0.85
	Economic	476.8	172.5	157.3	57.7	45.9	253.5	187.7	877.4	1.54
Barley	Financial	118.4	47.4	54.7	23.6	16.0	51.6	-	367.3	0.85
	Economic	165.8	60.0	54.7	20.1	16.0	88.2	187.7	569.4	1.04
Sugar beet	Financial	377.2	151.2	174.2	75.2	50.8	164.3	-	755.3	1.32
	Economic	528.1	191.1	174.2	63.9	50.8	280.8	187.7	620.1	2.38
Potato	Financial	523.4	209.7	241.7	104.3	70.5	227.9	-	492.1	2.80
	Economic	719.8	265.2	241.7	88.7	70.5	389.6	187.7	758.9	2.59
Rapeseed	Financial	118.2	47.4	54.6	23.6	15.9	51.5	-	329.7	0.94
	Economic	165.5	59.9	54.6	20.0	15.9	88.0	187.7	580.3	1.02

Source: Authors' calculations with Belarusian farm data base. For details and assumptions, see Technical Appendix 2. Information on the conversion of financial into economic prices/costs is presented in Appendix Table 7.

Appendix Table 7: Factors for converting financial to economic costs in SCB analysis*

Category	Item	Wheat	Corn	Barley	Sugar beet	Potato	Rapeseed
Seed, manure, fertilizers and agro-chemicals	Seed	0.95	0.95	0.95	0.95	0.8503	0,95
	Manure, litter, etc.	1	1	1	1	1	1
	Fertilizers	1.95	1.95	1.95	1.95	1.95	1,95
	Agro-chemicals	0.95	0.95	0.95	0.95	0.95	0,95
Diesel, gas, gasoline, electricity and other fuels	Diesel, gasoline	1.25	1.25	1.25	1.25	1.25	1,25
	Electricity	1.925	1.925	1.925	1.925	1.925	1,925
	Gas	3.2	3.2	3.2	3.2	3.2	3,2
	Other fuels	1	1	1	1	1	1
Labor		1	1	1	1	1	1
Spare parts, repairs		0,85	0.85	0.85	0.85	0.85	0.85
Services		1	1	1	1	1	1
Credit expenses, depreciation and capital	Depreciation	1	1	1	1	1	1
	Credit expenses	1	1	1	1	1	1
	Opportunity costs of capital	0.81	0.81	0.81	0.81	0.81	0,81
	Other expenses	1	1	1	1	1	1
Land (in US$/hectare)**		187.7	187.7	187.7	187.7	187.7	187.7
Revenue		1.63	0.83	1.55	0.82	1.54	1.76

* These factors are multiplied with financial prices/costs to determine economic prices/costs. Hence, the factor of 1.63 for wheat revenues indicates that the economic price of wheat is 63% higher than the financial price actually received by farms in Belarus. Land is the only exception to this; see the explanation in the next note.

** The financial cost of land is zero. To calculate the economic cost of land, first the economic profit (revenue at economic prices minus economic costs) without land costs is calculated for each product. The average of the resulting positive profits (i.e. excluding products for which the profit without land considering land costs is negative) is then used as the economic price of land. The value of 187.7 US$/hectare in this table is specific to the sample farm depicted in Appendix Table 6 and varies from farm to farm depending on how profitably they are able to produce the considered crops.

Appendix Table 8: Descriptive statistics for the variables used in the regression analysis of order-m TFP change and its components

Variable	Mean	Standard deviation	Minimum	Maximum
Δ(Pure efficiency)	1.1	0.3	0.4	2.6
Total farm subsidy 2007-2003 (mill. BYR)	4661.1	3550.7	692.0	42010.0
Arable land (ha)	2358.5	1125.2	253.4	10549.0
Animals (animal units)	3115.5	4019.1	287.6	107320.0
Capital/labor ratio (mill. BYR/'000 man-hours)	33.0	23.6	6.7	523.2
Crop costs share, in total farm costs	0.4	0.1	0.2	0.6
Order-m Efficiency score in 2003	1.1	0.6	0.4	7.2
Δ(Scale efficiency)	1.0	0.1	0.9	1.2
Total farm subsidy 2007-2003 (mill. BYR)	4628.6	3332.5	830.0	28724.0
Arable land (ha)	2361.6	1127.5	253.4	10549.0
Animals (animal units)	3111.7	4002.9	287.6	107320.0
Capital/labor ratio (mill. BYR/'000 man-hours)	32.9	23.6	6.7	523.2
Crop costs share, in total farm costs	0.4	0.1	0.2	0.6
Order-m Scale Efficiency score in 2003	1.1	0.1	1	1.8
Δ(Technology)	1.1	0.2	0.7	1.6
Total farm subsidy 2007-2003 (mill. BYR)	4654.2	3253.2	176.0	39282.0
Arable land (ha)	2383.3	1128.5	375.2	10549.0
Animals (animal units)	3107.0	3776.0	287.6	107320.0
Capital/labor ratio (mill. BYR/'000 man-hours)	32.7	24.3	4.8	628.9
Crop costs share, in total farm costs	0.4	0.1	0.2	0.6
Order-m Efficiency score in 2003	1.0	0.4	0.4	5.4
Δ(TFP)	1.2	0.3	0.5	2.7
Total farm subsidy 2007-2003 (mill. BYR)	4778.7	3427.2	176.0	39282.0
Arable land (ha)	2410.6	1147.8	409.0	10549.0
Animals (animal units)	3187.6	3877.7	287.6	107320.0
Capital/labor ratio (mill. BYR/'000 man-hours)	32.9	24.8	4.8	628.9
Crop costs share, in total farm costs	0.4	0.1	0.2	0.6
Order-m Efficiency score in 2003	1.0	0.5	0.3	5.4

Source: Authors' calculations.

Technical Appendix 1: Total factor productivity (TFP) analysis

Overview

The change in TFP for each farm between 2003 and 2007 is calculated based on an order-m frontier estimator concept proposed by Cazals et. al (2002) with a 2 outputs and 12 inputs model, using the detailed farm-level accounting data for commercial farms in Belarus in the years 2003 through 2007. Also, as consistency check, the TFP change was estimated using a conventional DEA model with 2 outputs and only 6 inputs. The analysis, however, is primarily based on the order-m TFP changes, since – compared to the DEA methodology – (i) more information on inputs used (12 inputs) is employed without incurring the 'curse of dimensionality' problem, and (ii) it avoids the problem of finding proper inputs and outputs aggregation tools to reduce the dimension of the model (Daraio and Simar, 2007, Ch.6).

The change in TFP (ΔTFP) is decomposed into the following three components:

i. ***Pure efficiency change (ΔPE)*** measures how far a farm is from the 'best-practice' maximum output level that it could produce given current technology and the level of inputs it uses. This best practice is defined by the most efficient farms in the dataset, i.e. the farms that define the production 'frontier' (see Technical Appendix 1). ΔPE ranges from 0 to infinity; a value less than 1 indicates that the farm has moved away from the best-practice frontier (i.e. become less efficient), while a value greater than 1 indicates that it has moved closer to this frontier. For example, a value of 1.5 indicates that the farm's inefficiency has been reduced by 50%.

ii. ***Scale efficiency change (ΔSE)*** measures whether or not the farm has moved closer to the optimal scale of production. ΔSE also ranges between 0 and infinity, with an interpretation similar to ΔPE: a value less than (greater than) 1 indicates that the distance between the farm's actual scale and its optimal scale has increased (decreased).

iii. ***Technical change (ΔTC)*** measures whether the best-practice frontier has shifted due to the introduction of a new technology such as an improved variety of seed. ΔTC ranges between 0 and infinity as well, and values greater (less) than 1 reflect technological progress (regress). Note that while it may seem difficult to imagine that technological regress can occur, farms can choose or be forced to return to older, less productive technologies, and over time varieties of plants and animals can lose resistance to certain diseases, or weeds, pests and diseases can develop resistance to agri-chemicals or medicines designed to combat them. Hence, a certain amount of research and development (R&D) is required simply to maintain productivity in agriculture, and technical regress can occur in the absence of this maintenance R&D.

The change in TFP (ΔTFP) for each farm is equal to the product of its PE, SE and TC changes, or: $\Delta TFP = \Delta PE * \Delta SE * \Delta TC$.

The links between TFP change and a set of explanatory variables describing the farms, including the subsidies received, were analyzed using ***regression methods***. Specifically, the change in a farm's TFP between 2003 and 2007, and each of the three components of this change discussed above, are regressed on a set of farm characteristics that includes the total volume of subsidies received by the farm between 2003 and 2007, the size of the farm in hectares and head of livestock, its capital/labor ratio, its specialization (measured as the share of crop production costs in total costs) and its efficiency in the initial year 2003. The choice of these independent variables is based on numerous previous studies that have analyzed the link

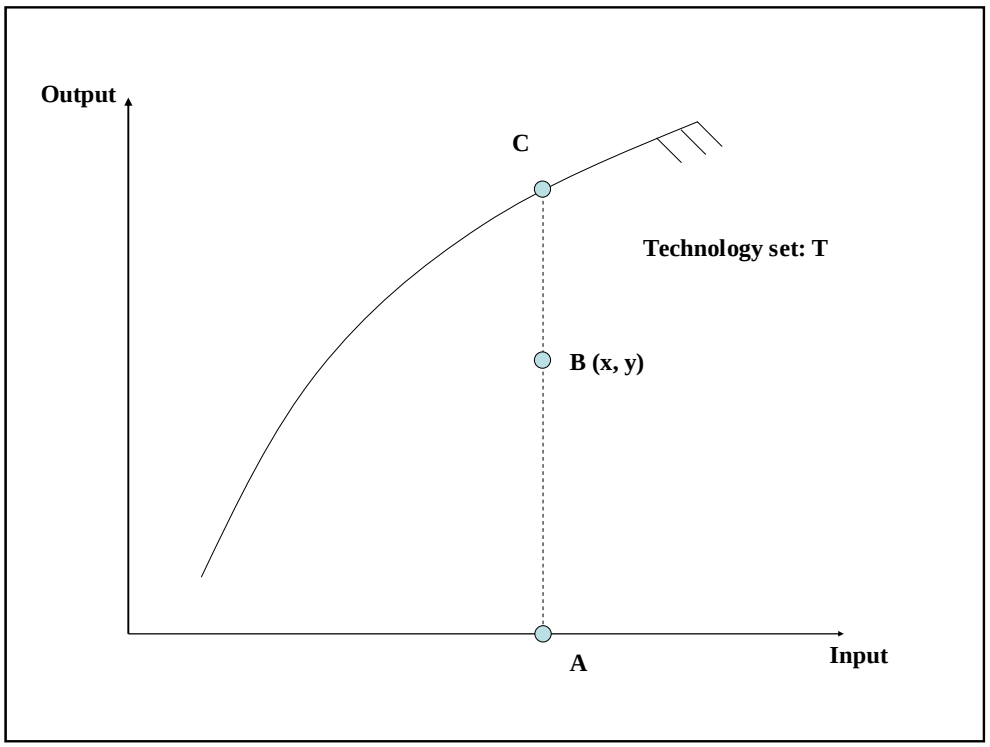
between farm characteristics (such as size, specialization and efficiency) and TFP. Descriptive statistics for the raw data are presented in Appendix Table 8. All independent variables are measured in units of standard deviation from the mean to facilitate the interpretation of the regression coefficients. This means that the estimated coefficients measure the impact of a one standard deviation increase in the explanatory variable in question on TFP change or the corresponding component.

1. Measurement of farm-level individual technical efficiency.

Assume *n* firms operate in the sector at question. Each firm *k* ($k=\overline{1,n}$) uses *N* inputs, $x^k = (x_1^k,...,x_N^k)' \in \Re_+^N$, to produce *M* outputs, $y^k = (y_1^k,...,y_M^k)' \in \Re_+^M$. We assume that all *n* firms have access to the same technology T, defined as $T \equiv \{(x^k, y^k) \ : \ x^k \ can\ produce\ y^k\}$, that satisfies standard regularity axioms of production theory (Färe et al., 1985). Under these assumptions, the output-oriented distance function $D_o^k : \Re_+^N \times \Re_+^M \to \Re_+^1 \cup \{\infty\}$, defined as $D_o^k(x^k, y^k) \equiv \inf\{\theta : (x^k, y^k / \theta) \in T\}$, measures how far each firm k produces from the best-practice frontier $f(x^k)$, the outer bound of the technology set *T* (Shephard, 1970). $TE_o(x^k, y^k) \equiv \max\{\theta : (x^k, \theta y^k) \in T\} = 1/D_o(x^k, y^k)$ then defines a firm's Farrell (1957) output-oriented technical efficiency.

A simple illustration for the case of a technology with one input and one output is illustrated in Appendix Figure 1, in which the Farrell output-oriented technical efficiency (*TE*) for a firm operating at point *B* is computed as *TE = AC/AB*. This measure relates what the firm could produce given the level of inputs it uses (the amount *AC*, in the numerator) to what it actually produces (the amount *AB*, in the denominator).

Appendix Figure 1: The distance function



Source: Authors' presentation.

Whenever $D_o(x^k, y^k) = 1$ (or $TE_o(x^k, y^k) = 1$), firm *k* is technically efficient; *TE > 1* means that the firm is technically inefficient. A firm's *TE* can also be represented in percentages, i.e. $[1/TE_o(x^k, y^k)]*100\%$ and its inefficiency score would then be then $[1-1/TE_o(x^k, y^k)]*100\%$.

2. Estimators used in the study

The best-practice frontier, and hence TE scores, are commonly estimated using the Free Disposal Hull (FDH) method (Deprins et al., 1984) or the Data Envelopment Analysis (DEA) method (Charnes et al., 1978). The DEA frontier is simply a convex hull of the FDH frontier, and it is estimated by solving the following linear optimization problem for each observation or firm in the sample:

$$TE_o(x^j, y^j) \equiv \max_{\substack{z_1,\ldots,z_K \\ \Theta}} \left\{ \Theta : \Theta y^j \le \sum_{k=1}^{K} z_k y_m^k; x^j \ge \sum_{k=1}^{K} z_k x_n^k; \sum_{k=1}^{K} z_k = 1; z_k \ge 0; \right.$$
$$\left. k = \overline{1,K}; m = \overline{1,M}; n = \overline{1,N} \right\}$$

where the z_k are variables that show the intensity with which each firm is used in order to construct the best-practice frontier, $y_{k,m}$ is the m^{th} output of the k^{th} firm and $x_{k,n}$ is the n^{th} input employed by firm *k*.

The main limitations of the FDH and DEA methods are the curse of dimensionality and sensitivity to outliers (Daraio and Simar, 2007). For many applications these problems are potentially acute. As an alternative, partial or so-called robust frontiers can be estimated based on the order-m expected maximum output frontier proposed by Cazals et al (2002). The main idea of this method is to estimate a frontier which does not envelop all the data points, making it is robust to outliers. In the one-output, one-input case, the order-m frontier is defined as $\varphi_m(x) = E\left[\max(Y) \middle| X \le x\right]$. It represents the expected maximum value of the output among a fixed number of *m* farms drawn from the population of farms with at most the level *x* of input use. The parameter *m* can be treated as a trimming parameter. If *m*=100, for example, then $\hat{\varphi}_{m,n}(x_i)$ is the estimated maximum possible output among 100 random farms that use no more than input level x_i. These partial frontier are robust to the extreme points and do not suffer from the curse of dimensionality problem shared by DEA and FDH estimators. The order-m estimator converges at a rate of $n^{-1/2}$, while the DEA and FDH estimators only converge at rates of $n^{-2/(p+q+1)}$ and $n^{-1/(p+q)}$, respectively, where *p* and *q* are the numbers of outputs and inputs, respectively. As *m* increases, the order-m estimator approaches FDH estimator. The advantages of the order-m method are summarized by Daraio and Simar (2007).

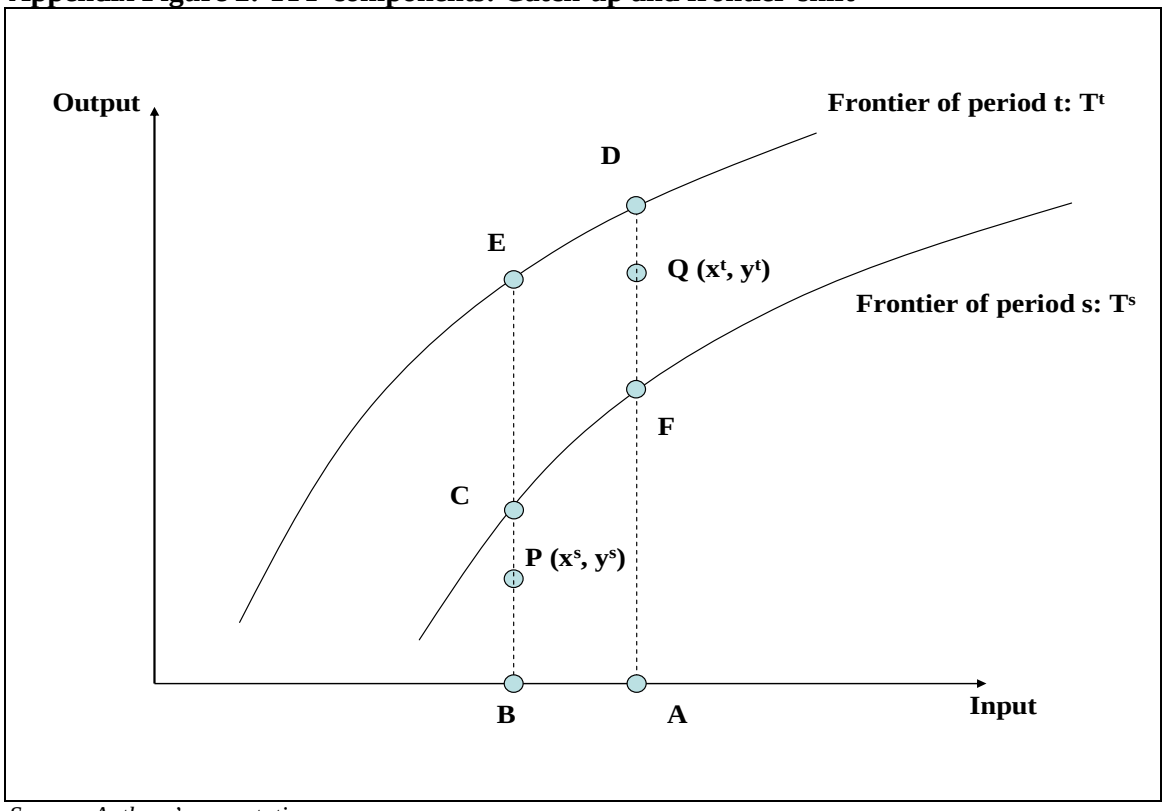
3. Dynamic efficiency

The order-m concept is especially useful in applications that examine dynamic changes in productivity and efficiency. In the case of only one input and one output, productivity can be measured by the ratio of output to input, and changes in productivity can be examined by comparing a firm's output-input ratios at different points in time. However, when a firm produces multiple outputs with multiple inputs, as is generally the case in agriculture, this simple approach can be misleading. Furthermore, in a dynamic setting analysis must account for the fact that the best-practice frontier can shift over time. For example, a firm using a fixed

amount of input may produce more in the course of time but nevertheless become less efficient if the best-practice frontier is shifting out due to technical change faster than the firm's output increases. The Malmquist index is typically used to examine productivity changes in such settings (Färe and Grosskopf, 1996). This index is typically defined as the product of 'catch-up' (efficiency) and 'frontier-shift' (technical changes) terms. Catch-up refers to the degree to which a farm improves or worsens its efficiency, while frontier-shift reflects shifts in the best-practice frontier technology between two time periods.

The catch-up effect from period *s* to *t* is equal to the ratio of the efficiency of (x^t, y^t) with respect to the period *t* frontier to the efficiency of (x^s, y^s) with respect to the period *s* frontier. A simple example for the one-input, one-output case is illustrated in Appendix Figure 2, where the firm in question moves from point $P(x^s, y^s)$ to point $Q(x^t, y^t)$, and the best-practice frontier shifts outward between time *s* and time *t*. The catch-up effect can be computed as *(BC/BP)/(AD/AQ)*. Catch-up > 1 indicates progress in relative efficiency from period *s* to *t*, while catch-up < 1 indicates regress.

Appendix Figure 2: TFP components: Catch-up and frontier-shift



Source: Authors' presentation.

In addition to this catch-up term, however, one must account for the frontier-shift effect in order to fully evaluate a firm's productivity change. In Appendix Figure 2, the reference point for production point *P* (which is *C* on the best-practice frontier in period *s*) shifts out to point *E* on the best-practice frontier in period *t*. Thus, the frontier-shift effect at point *P* equals $\alpha_1 = BE/BC$. This is equivalent to $\alpha_1 = (BE/BP)/(BC/BP)$, which is the ratio of the efficiency of point *P* with respect to the period *s* frontier to the efficiency of this point with respect to the period *t* frontier. Similarly, the frontier-shift at point *Q* is expressed by $\alpha_2 = (AD/AQ)/(AF/AQ)$. The overall frontier-shift effect is defined as the geometric mean of α_1 and α_2. Frontier-shift > 1 indicates progress in a firm's best-practice frontier technology from period *s* to *t*, while frontier-shift < 1 indicates regress in the frontier technology.

The Malmquist index or total factor productivity change (ΔTFP) is computed as the product of the catch-up (efficiency change) and frontier-shift (technical change) components:

$$\Delta\text{TFP} = (\text{catch-up}) \times (\text{frontier-shift})$$

These two components can further be decomposed into additional components (see Simar and Wilson, 1998) that provide additional information about the sources of productivity change. Here, for simplicity, we adopt the decomposition approach of Färe et al. (1997), whereby the catch-up or efficiency change component is further decomposed into measures of 'pure efficiency change' (ΔPE) and 'scale efficiency change' (ΔSE) according to the following formula:

$$TFP_{ts}(x_k^s, y_k^s, x_k^t, y_k^t) = \underbrace{\left(\frac{TE(x_k^s, y_k^s \,|\, T_{VRS}^s)}{TE(x_k^t, y_k^t \,|\, T_{VRS}^t)} \right)}_{=\Delta\text{PE}} \times \underbrace{\left(\frac{TE(x_k^t, y_k^t \,|\, T_{VRS}^t) \,/\, TE(x_k^t, y_k^t \,|\, T_{CRS}^t)}{TE(x_k^s, y_k^s \,|\, T_{VRS}^s) \,/\, TE(x_k^s, y_k^s \,|\, T_{CRS}^s)} \right)}_{=\Delta\text{SE}}$$

$$\times \underbrace{\left(\frac{TE(x_k^t, y_k^t \,|\, T_{CRS}^t)}{TE(x_k^t, y_k^t \,|\, T_{CRS}^s)} \times \frac{TE(x_k^s, y_k^s \,|\, T_{CRS}^t)}{TE(x_k^s, y_k^s \,|\, T_{CRS}^s)} \right)^{1/2}}_{=\Delta\text{TC}}$$

In this equation, ΔTC refers to the frontier-shift (technical change) component. The decomposition of efficiency change into 'pure' and 'scale' components accounts for the fact that a firm can become more efficient both by moving closer to its best-practice frontier and by changing the scale of its production so that it is closer to the optimal 'constant returns to scale' technology. In the presentation above, efficiency has only been discussed in terms of moving vertically closer to a given frontier, but the 'scale' component captures the possibility a firm might also become more efficient by moving horizontally (i.e. by using more or less inputs) to a point at which its scale of operation permits more efficient use of the existing technology.

For each of the resulting three components of ΔTFP (ΔPE, ΔSE and ΔTC), values greater than 1 indicate increased productivity. The Malmquist index is typically estimated by replacing the unknown frontier technology T_j^i $(i = s,t;\ j = VRS,\ CRS)$ by the DEA estimator of this technology. Consequently, the resulting Malmquist index and its decomposition suffer from the same problems (curse of dimensionality, sensitivity to outliers) as the DEA estimator. We therefore employ an order-m Malmquist index to measure productivity change relative to (the conical hull of) the frontier of the expected m-order production set. For details we refer to Wheelock and Wilson (2003).

4. Data and model description

The efficiency and productivity analysis described above is carried out using Belarus-wide farm-level accounting data provided by the State Statistics Committee of Belarus. This dataset is an unbalanced panel of 9232 observations over the period 2003-2007.

Based on the share of crop production costs in total farm production costs, we eliminated highly specialized farms (either crop or livestock) from the dataset. The eliminated farms accounted for less than 5% of the total sample. The share of crop production costs in total farm production costs in the remaining farms was in the range 20-62%.

We defined 2 outputs and 12 inputs (listed in Appendix Table 9).

Appendix Table 9: Data description and summary statistics

Item	Units	2007				2003			
		Mean	Std.dev.	Min.	Max.	Mean	Std. dev.	Min.	Max.
Outputs									
Crop revenues	mill. BYR	563	685	0	10,241	294	455	0	10,108
Livestock revenues	mill. BYR	1,350	1,579	1	21,215	651	956	1	17,829
Inputs									
Arable land	ha	2,634	1,355	118	14,676	2,013	1,064	61	12,396
Hays & pastures	ha	1,733	1,061	1	9,805	1,288	775	0	7,697
Soil quality	points	31	6	16	50	31	6	15	50
Breeding and feeder animals	animal units	1,968	10,500	0	376,500	1,170	1,206	0	13,364
Purchased seeds	mill. BYR	56	65	0	733	27	37	0	660
Fertilizers	mill. BYR	247	180	10	1,822	106	98	1	1,090
Agro-chemicals	mill. BYR	145	154	0	1,594	68	91	0	1,174
Purchased feed	mill. BYR	232	447	0	5619	85	216	0	3,200
Energy	mill. BYR	401	302	32	3601	199	176	4	2,036
Depreciation	mill. BYR	426	397	12	4312	212	211	5	2,730
Other materials	mill BYR	565	917	29	18162	326	517	3	1,2924
Labor	mill BYR	545	420	43	5389	380	369	27	5,147
Number of observations		1,305				1,806			

Source: Authors' calculation using Belarusian farm data base.

Although we have over 1000 observations in each year, the samples are too small for DEA and FDH estimation, given the high dimensionality of application (2 outputs and 12 inputs). A rough comparison of equivalent sample sizes provides an idea of the potential curse of dimensionality in DEA and FDH estimation. Recall that the order-m, DEA, and FDH

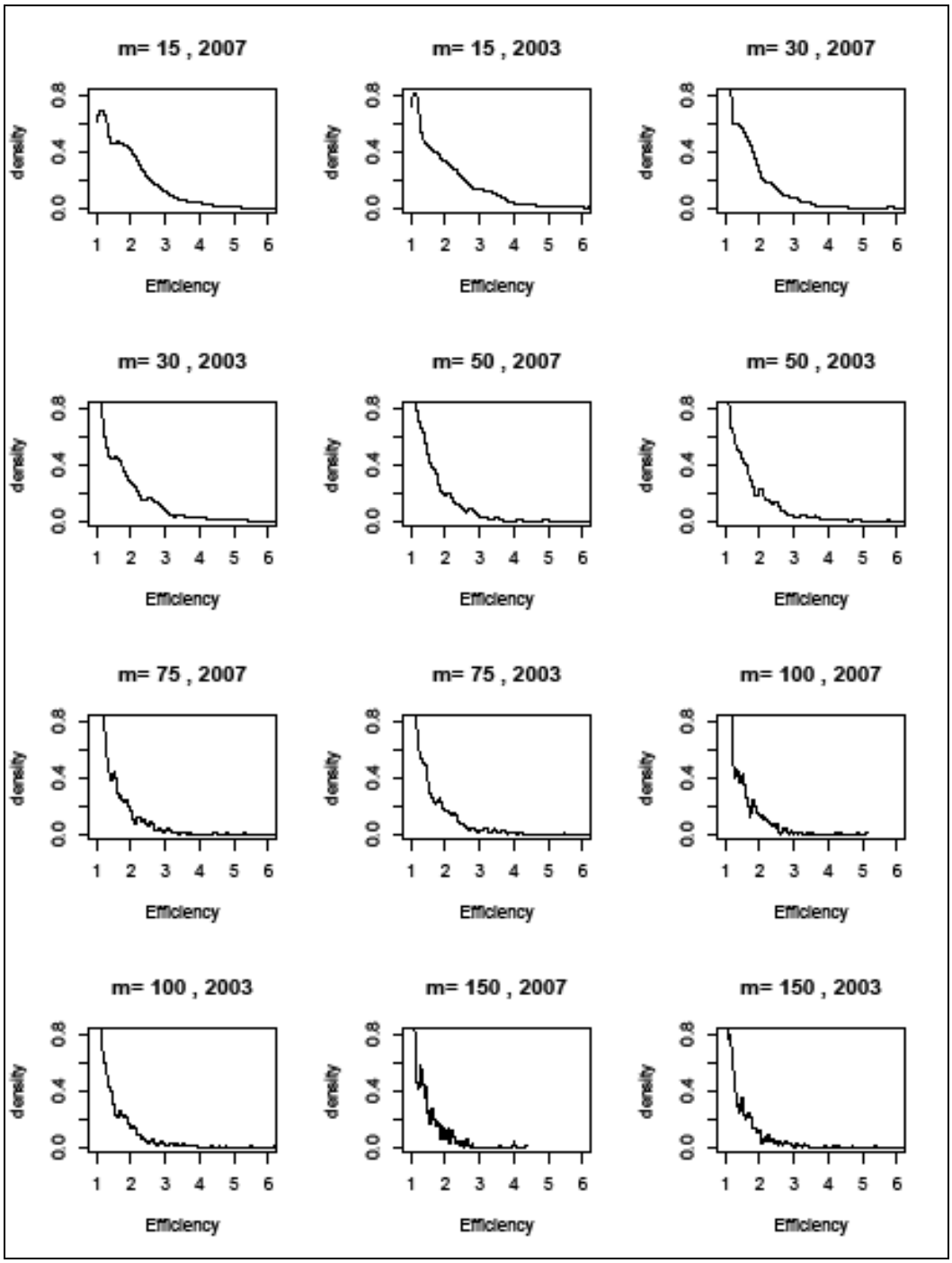
estimators converge at rates of $n^{-1/2}$, $n^{-2/(p+q+1)}$, and $n^{-1/(p+q)}$, respectively, where *p* and *q* are the numbers of outputs and inputs. Hence, the DEA estimator would require $(100^{-1/2})^{-15/2} = 10^{7.5}$ observations to achieve the same convergence in estimation as an order-m estimator with only 100 observations, and the FDH estimator would require $(100^{-1/2})^{-14} = 10^{14}$ observations. Or, with 14 dimensional DEA model, we would have the rate of convergence $1305^{-2/15}$, which roughly equivalent to having $1305^{4/15}$, or 6 observations in a fully parametric model, where the rate of convergence is $n^{-1/2}$.

Using the FEAR package in R (Wilson, 2008), we computed order-m output oriented efficiencies for all farms in each year from 2003 to 2007 (2 outputs by 12 inputs model). Values of *m* ranging from 15 to 300 were tested.

Appendix **Figure 3** presents kernel estimates of the densities of the order-m efficiencies estimates for 2007 and 2003, and for *m*=15, 30, 50, 75, and 150. The estimated order-*m* frontier approaches the FDH frontier as *m* increases (Cazals et al, 2002). Since almost all farms in our case has an FDH efficiency estimate equal to 1 in each year, it is necessarily the case that all farms in each year of our sample lie on or above the contemporaneous estimated order-*m* frontier. So the contemporaneous order-*m* efficiency estimates are equal to or greater than 1 in every case. For the kernel density estimation, we used the reflection method described in Silverman (1986) to avoid the problem of bias in kernel density estimation near boundaries of support. The Gaussian kernel was used, with the bandwidth estimated using the Sheather and Jones (1991) two-stage plug-in procedure. As expected, the densities shift to the left and collapse toward 1 as *m* increases. Based on these results, the order-m TFP analysis was based on order-15 efficiencies.

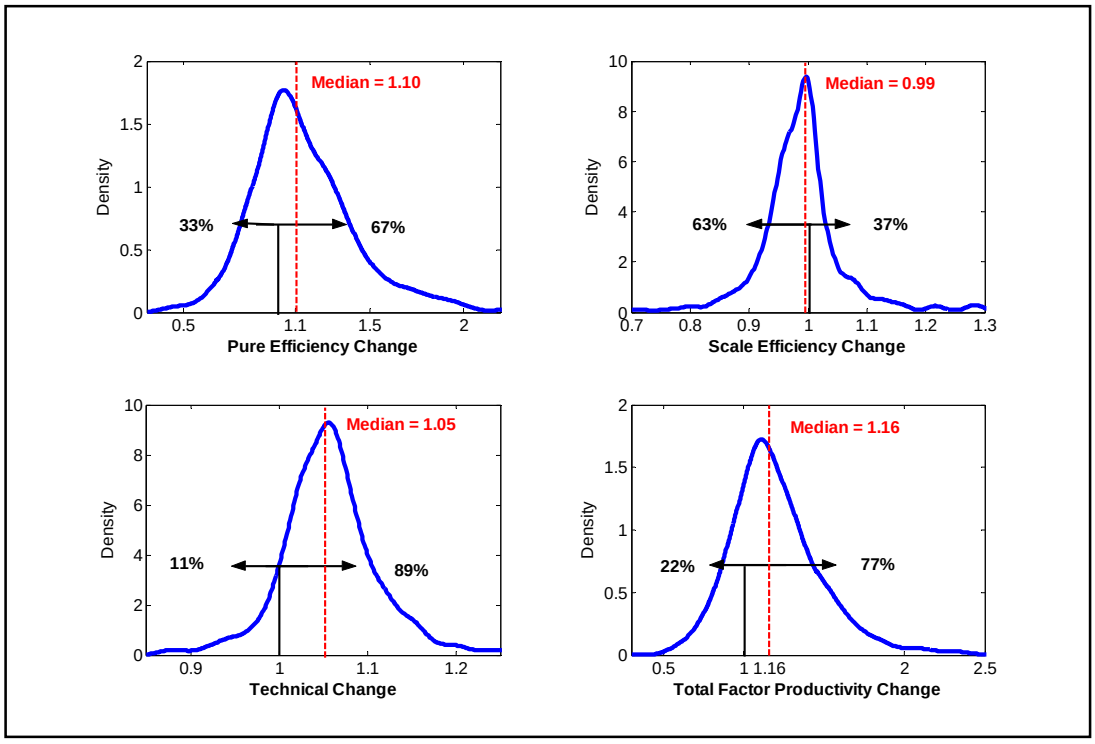
To check the results of our order-m model, we also computed conventional DEA TFP and its components changes. Due to the potential curse of dimensionality discussed above, we reduced the original 14 dimensional model to 8 dimensions. Using the formulas on the rate of convergence above, this would correspond as if we had 24 observations. From the other side, Park et al (2000) recommend at least 1000 observations for 5 dimensional FDH model, which would correspond to 9 dimensional DEA model with 1305 observation to reach that rate of convergence. So 8 dimensions is rather acceptable size for our DEA model given the number of farms we have in the sample. 12 inputs in the original model we combined into 6: i) arable land, in points*ha(= arable land * soil quality); ii) hays and pastures, in ha; iii) purchased inputs, in mill. BYR (= sum of purchased seeds, feed, energy, agrochemicals, fertilizers, and other materials); iv) breeding and feeder animals, in animal units; v) labor, mill. BYR; vi) depreciation, mill. BYR. Before running the DEA model, we applied a semi-automatic outlier's detection methodology proposed by Simar (2003), which is basically an application of the 'order-m frontier' of Cazals et al (2002). Appendix Figure 3 shows that the DEA model qualitatively supports the results of the order-m model.

Appendix Figure 3: Kernel Estimates of Density of Order-m Efficiency



Source: Authors' calculation.

Appendix Figure 4: Changes in total factor productivity and its components for commercial farms in Belarus between 2003 and 2007 (DEA model)



Source: Authors' calculation.

Technical Appendix 2: Analysis of farm competitiveness

Overview

Numerous indicators of competitiveness have been developed and applied. One approach, going back to seminar work by Liesner (1958) and Balassa (1965) is based on the idea that competitiveness will be 'revealed' by a country's actual trade performance compared with other countries, regions or the world. A variety of 'Revealed Comparative Advantage' (RCA) indices have been developed based on this idea. RCA indices are usually justified on the grounds that most policy-induced distortions are on the import side, and that export performance will therefore provide a genuine reflection of competitiveness. To the extent that this is true, the almost complete dependence of Belarusian agricultural exports on the Russian market (Table 3) would appear to reflect a lack of broader international competitiveness. However, given Belarus' particular regime of government-set prices and governmental funding of agricultural production, the basic assumption might not be entirely applicable to Belarus. RCA analysis is therefore not expected to produce many differentiated insights into agricultural competitiveness in Belarus and is therefore not pursued here.

A second approach to measuring competitiveness is causal and attempts to measure factors that influence competitiveness, such as the institutional environment, infrastructure, macroeconomic stability and cost structures. At an aggregated level, this has led to indices such as the 'Growth Competitiveness Indicator' (GCI) developed by Sachs and McArthur, and the 'Business Competitiveness Indicator' (BCI) developed by Porter, both of which can be found in the World Economic Forum's Global Competitiveness Report (e.g. WEF, 2006). These are 'broad brush' measures, however, that reflect a country's competitive environment as a whole. While this environment will certainly influence agriculture as well, such measures will fail to capture many important agriculture-specific factors, such as the prevailing agricultural policy regime.

The Policy Analysis Matrix (PAM) framework developed by Monke and Pearson (1989) is a product of two accounting identities, one that defines profitability as the difference between revenues and costs, and another that measures the effects of divergences (distorting policies and market failures) as the difference between actually observed financial values and economic values that would prevail if the divergences were removed.

If profitability is calculated at financial prices, it provides an indication of the extent to which the production of a specific good or production in a sub-sector overall is profitable from the perspective of the enterprises themselves since this calculation is based on actually observed prices. The ***"Private Cost Benefit ratio" (PCB)***[52] is a simple parameter capturing this financial profitability. It is calculated as the ratio of the sum of tradable and domestic input costs for the production of a particular good, assessed at actually observed (financial) prices divided by the revenue (price) of that good.

[52] The terms "private cost benefits" and "social cost benefits" are commonly used in the literature and hence maintained here when referring to the PCB and SCB as a parameter. However, for the broader concept of private vs. social prices (opportunity cost concept), adjustments to the terminology were made in order to avoid misunderstandings. In Belarus' largely centrally planned economy, prices often serve a "social" function. A "social price" might therefore be perceived as a price set by the government (below market level) for such a social purpose (which would be the exact opposite of the international concept of social pricing, i.e. pricing in the absence of governmental interference). Hence, throughout the entire document, the term "social" is replaced by "economic" when referring to prices for the economy as a whole (opportunity cost concept), and "private" by "financial" when referring to prices actually observed in markets.

The comparison of revenues and costs at economic prices captures to which extent the production of this good or in this sub-sector is desirable from an entire economy's perspective. It takes into account that, for example, subsidized input costs that lower the input price for the producer are actually funded through transfers from other sectors of the economy; that means the economy as a whole pays the financial price plus this transfer. Similarly, if a farm's output prices are artificially reduced by policy measures (such as government-set procurement prices), the farm's financial profits will be depressed while the economy as a whole benefits from the full value of the product (assessed using border reference prices, assuming export). This "economic profitability" is most easily calculated as the ***"Social Cost Benefit ratio" (SCB)***. The SCB is a cost/ revenue ratio calculated as the sum of tradable and domestic input costs for a particular good, assessed at economic prices, divided by this goods economic revenue. Since all costs are calculated on a per unit of output basis, the SCB compares the economic cost of producing a unit of output with the value of that unit for the economy as a whole (i.e, its economic price). The SCB is always greater than 0, and a SCB less than (greater than) 1 indicates that total input costs are less than (greater than) revenue and that production is (is not) competitive.

Since this calculation considers the costs and benefits to the economy as a whole, the SCB is a convenient indicator of competitiveness of that sub-sector[53]. The assessment of competitiveness in agricultural sub-sectors in this Note is based on the SCB. The Note also uses the comparison of PCBs and SCBs for an assessment of the degree of subsidization provided to the respective sub-sector.

If indicators based on the PAM are calculated on the basis of average or 'typical' data for a sector or industry, conclusions become progressively weaker as the heterogeneity of the underlying population grows.[54] Numerous studies that apply empirical efficiency analysis techniques (data envelopment analysis – DEA; stochastic frontier analysis – SFA) to farm level data in CIS countries, however, find significant heterogeneity, with many farms operating at a great distance from the frontier defined by the best-practice farms. The TFP and efficiency analysis of Belarusian agriculture presented in this Note confirms this finding. For this reason, farm-level data is used to calculate SCB distributions for major crop and livestock products in Belarus, analogous to the TFP calculations mentioned above. This procedure, outlined below, makes it possible to determine for each major farm commodity which proportion of total production volume was produced competitively (i.e. with a SCBs less than 1), and which proportion was not produced competitively (i.e. with a SCBs greater than 1).

Sample calculation, illustrating the SCB methodology

(Based on the farm with the modal SCB ratio for wheat.)

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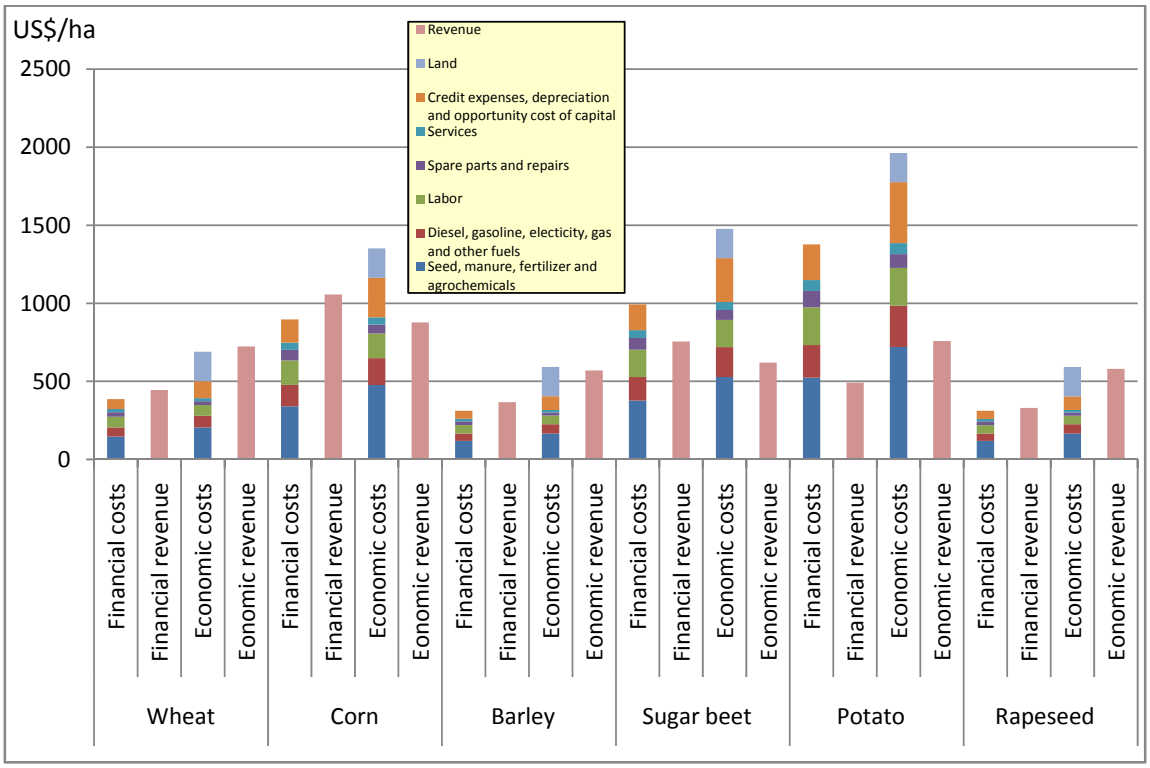
[53] If a sub-sector that produces at the level of costs that it creates to the entire economy and earns revenues assessed at border prices is profitable, then this sub-sector is internationally competitive and it is desirable for an economy (society) to engage in this sub-sector. Conversely, if a sub-sector's export-price-based revenues cannot pay for the actual costs it creates for the economy (society), the sub-sector's production actually subtracts from the value created by the economy and domestic factors employed in this sub-sector would create larger benefits for the economy (society) if transferred to other (sub-)sectors. These considerations do not account for particular social values that a society might attach to the production in a specific sub-sector. But the society should be aware of the economic costs that this decision implies.

[54] A sub-sector would be either competitive or not, ignoring the fact that some farms in a non-competitive sector might actually be competitive.

While each farm is different, this farm can be considered 'typical' in the sense that it is characterized by the most common SCB for wheat. The results are presented in Appendix Figure 5; tables with the underlying data are presented in Appendix Table 6, and information on the conversion of financial into economic prices/costs is presented in Appendix Table 7.

Appendix Figure 5: Private and social cost-benefit (PCB, SCB) calculations for a sample farm



Source: Belarusian farm data base.

The calculations presented in this figure allow a number of interesting conclusions:

- The economic revenue for wheat is larger than the economic cost. That means, the production of wheat on this farm is profitable for the economy (society) as a whole.
- The opposite is true for all other crops (corn, barley, sugar beet, potato and rapeseed).
- Except for sugar beet and potato, all crops have higher financial revenues than financial costs. That means, this farm can produce wheat, corn, barley and rapeseed with (financial) profits, benefiting from transfers from other sectors in the economy, while the economy as a whole will experience losses (except for wheat).
- In the case of sugar beet and potato, this farm runs losses even if financial transfers directed by the state are taken into account (financial and economic profits are negative).
- In the cases of corn and sugar beet, economic revenues are lower than financial revenues, indicating that farm-gate prices are higher than economically valued. The opposite is true for wheat, barley, potato and rapeseed: the value (assessed at farm-gate) to the society of the products generated on this farm is higher than the price received by the farm. That means, the production of these crops is implicitly taxed by prices that are set below the value of the product.
- For all crops, economic costs are higher than financial costs, which means that all crop production on this farm receives governmental support (subsidies).
- For wheat, barley and rapeseed, the subsidies received from the state – reflected in the difference between economic costs and financial costs – compensate for the losses created through the implicit taxation on the product side and create positive financial profits.
- Since the economic value of land is assessed as the average positive per-hectare economic profit before land prices are considered, the economic profit created by wheat production increases the cost for all other crops, implying that the farm should increase wheat production in order to increase the economic benefits. However, crop rotation requirements would not permit an exclusive production of wheat. A rotation involving wheat, barley and rapeseed is common in crop production in Northern European countries such as

Germany, Poland and Belarus, and the sample farm would probably follow this rotation if it were faced by economic prices and costs, with the economic profit in wheat production compensating for the economic losses in barley and rapeseed production to make the crop rotation as a whole economically profitable and, hence, competitive. For the other products (corn, sugar beet and potatoes), production is economically unprofitable even if no land costs are considered.

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1. The Social Cost-Benefit method

The structure of the PAM, used for the calculation of the PCB and SCB ratios, is presented in (Appendix Table 10).

Appendix Table 10: The Policy Analysis Matrix (PAM)

	Revenue	Costs		Profits
		Tradable inputs	Domestic factors	
Accounting in Private (Financial) Prices	$A = P_i^p$	$B = \sum_{j=1}^{k} a_{ij} P_j^p$	$C = \sum_{j=k+1}^{n} a_{ij} V_j^p$	$D = A - B - C$
Accounting in Social (Economic) Prices	$E = P_i^s$	$F = \sum_{j=1}^{k} a_{ij} P_j^s$	$G = \sum_{j=k+1}^{n} a_{ij} V_j^s$	$H = E - F - G$
Effects of Policy and Market Failures	$I = A - E$	$J = B - F$	$K = C - G$	$L = D - H = I - J - K$

Source: Monke and Pearson (1989)

In Appendix Table 10:

the subscript *i* refers to outputs and the subscript *j* to inputs;

a_{ij} for ($j = 1$ to k) are technical coefficients for traded inputs in the production of i;

a_{ij} for ($j = k+1$ to n) are technical coefficients for domestic inputs in the production of i;

P_i^* is the price of output *i*, evaluated financially (* = *p*) or economically (* = *s*);

P_j^* is the price of traded input *j*, evaluated financially (* = *p*) or economically (* = *s*);

V_j^* is the price of domestic input *j*, evaluated financially (* = *p*) or economically (* = *s*);

I measures output transfers;

J measures input transfers;

K measures factor transfers;

D (= *A-B-C*) measures net financial profits;

H (= *E-F-G*) measures net economic profits; and

L measures net transfers.

The SCB equals the ratio of the sum of tradable and domestic input costs to revenue, or (F + G) divided by E in Appendix Table 10. Since all costs are calculated on a per unit of output basis, the SCB compares the economic cost of producing a unit of output (F + G) with the value of that unit (its economic price E). The SCB is always greater than 0, and a SCB less than (greater than) 1 indicates that total input costs are less than (greater than) revenue and that production is (is not) competitive. The SCB method has the advantage of being intuitively clear, reasonably easy to use and well established in applied economics. But it can suffer from several weaknesses. In particular, it is based on the assumption of fixed technical coefficients. Hence, it ignores possible factor substitution and cross price effects that could be expected to result from shifting production away from the observed point of production characterized by financial prices, to the hypothetical point characterized by economic prices. Depending on the strength of these effects, the SCB will be biased.

As discussed in the body of this paper, there is ample evidence that the farms in CIS countries are highly heterogeneous. Calculating average or typical SCB ratios would therefore be of dubious value. For this reason – and following similar analysis for Ukraine (World Bank, 2008) – we use detailed farm level data to calculated SCB distributions for major crop and livestock products in Belarus. For each farm in the dataset employed (see below), SCB ratios are calculated for each of its major crop and livestock products. For each product, an estimate of the resulting univariate density function of SCBs across all relevant farms is calculated using the kernel-based estimate proposed by Rosenblatt (1956).

2. Data and assumptions

The empirical analysis described above is carried out using Belarus-wide farm-level accounting data provided by the State Statistics Committee of Belarus. This dataset is an unbalanced panel of 9232 observations over the period 2003-2007. For each observation in the dataset (representing a farm in one of the five years), information on total input costs for each farm product is available, as is information on the breakdown of input costs for each of the output aggregates 'crop' and 'livestock' products. In order to generate disaggregated input use data for each individual farm product, the share of each individual product in total farm costs is used. In other words, if the data show that wheat accounted for 25% of total input costs in crop production for a specific farm, then 25% of the labor allocated to crop production on that farm is assumed to have been spent on wheat, 25% of the fertilizer, etc. An alternative would be to allocate inputs according to acreage shares, but this would i) probably be less accurate as is known that some more profitable crops (sugar beet, for example) tend to be produced more intensively than others, and ii) not be helpful for acreage-independent livestock products.

Appendix Table 11 provides an overview of the resulting data structure and numbers of observations, and Appendix Table 12 provides information on average input cost shares for crop and livestock production in the sample of farms employed in the SCB analysis. Appendix Table 7 provides an overview of the factors used to convert financial costs into economic costs.

Conversion from financial to economic prices and costs is based on a variety of assumptions and sources of data:

- Factors for converting revenue from the sale of agricultural output from a financial to an economic price basis are calculated using OECD methodology for the Market Price Support estimation in PSE tables (OECD, 2008). Border reference prices (border prices corrected for marketing costs) are compared with farmgate prices to calculate conversion factors that are multiplied with actual reported revenues to estimate hypothetical economic

revenues. The resulting conversion factors are presented in Appendix Table 13, and more detail on their calculation is provided in section 3 of this appendix below. The case of sugar is somewhat more complicated because farmers sell sugar beet while world trade is in raw or white sugar. Technical extraction coefficients are used to convert a border price for white sugar into a sugar beet price, and comparison with the corresponding farm gate price produces the corresponding conversion factor.

- Economic costs for seeds and fodder are based on financial costs corrected for the impact of tariff. Tariffs are taken from official tariff schedules. For all seeds a conversion factor of 0.95 is used in all years (in other words, 5% import tariff is corrected). For fodder, conversions factors of 0.95 are used in all years.
- Conversion factors for fertilizers correct financial costs for several distortions. The purchase of fertilizers by farms is subsidized via direct subsidies and at below the market prices. As Appendix Table 14 shows, farmers received potassium fertilizers at least at 74% discount over 2003-2007. For other fertilizers we assume a 10% downward correction for the import tariff. After accounting for the shares of fertilizers application, calculated using Gusakov et.al (2007, p.293), we come up with weighted discounts.

Appendix Table 11: Data description

	Wheat	Corn	Barley	Rapeseed	Sugar beet	Potato	Beef	Pork	Poultry	Milk
Number of farms producing										
2003	1,108	8	821	585	1,460	949	2,090	944	68	2,084
2004	1,076	11	1,111	604	1,290	1,276	1,854	825	61	1,847
2005	1,302	118	1,575	608	1,168	1,256	1,653	728	50	1,644
2006	1,250	227	1,540	578	1,039	1,174	1,574	679	45	1,566
2007	1,184	803	1,440	477	966	1,312	1,473	614	41	1,467
Inputs used										
Seeds	+	+	+	+	+	+	-	-	-	-
Fertilizers	+	+	+	+	+	+	-	-	-	-
Sanitary and phytosanitary measures	+	+	+	+	+	+	+	+	+	+
Diesel and gasoline	+	+	+	+	+	+	+	+	+	+
Gas	+	+	+	+	+	+	+	+	+	+
Electricity	+	+	+	+	+	+	+	+	+	+
Spare parts, renovation costs	+	+	+	+	+	+	+	+	+	+
Labor	+	+	+	+	+	+	+	+	+	+
Other inputs (manure, litter etc)	+	+	+	+	+	+	+	+	+	+
Land	+	+	+	+	+	+	-	-	-	-
Capital	+	+	+	+	+	+	+	+	+	+
Fodder	-	-	-	-	-	-	+	+	+	+

Source: Belarusian farm database.

- Capital input is measured as the sum of depreciation (i.e. the reduction in the value of assets arising from wear and tear), and the forgone return on financial capital tied up in the value of assets. A conversion factor for capital costs is calculated as the product of a conversion factor for capital assets value and a conversion factor for capital recovery (see Monke and Pearson (1989) for details). The factor for capital assets value is assumed to

equal 0.9 based on information about tariffs applied to agricultural machinery and equipment imports. The forgone return is calculated using the economic capital assets value and the economic interest rate. The economic interest rate (Appendix Table 15) is estimated using macroeconomic data (GDP and factor income shares) based on the assumption that under competitive conditions the ratio of a factor's marginal to average value product should equal its share of total income (Monke and Pearson, 1989).

- Economic valuation of land is estimated as in Monke and Pearson (1989) by comparing economic profits before land costs for as many crops as possible on each farm, and setting farm-specific economic land costs equal to the average of all the positive profits before land costs. According to this method, a crop must compete with other economically profitable crops on the farm in order to enter into the crop rotation. This is unrealistic to the extent that it can lead to rotations that include only one or two competitive crops, whereas in reality the next best one or two (non-competitive) crops with SCBs of over one would also enter into the rotation for agronomic and scheduling/organizational reasons. More sophisticated programming techniques could be used to model on-farm land allocation and pricing, but would produce no major additional insights into competitiveness.
- Financial fuel costs are corrected for two types of distortion to arrive at a economic valuation. The first distortion is due to the fact that Belarus has paid considerably less than world market prices for gas as a result of special arrangements with Russia. Pavel and Yuzefovych (2008) argue that an economically justifiable gas pricing is based on the concept of netback value, i.e. the replacement value of gas at the delivery point based on priced of competing fuels. For Belarus this price can be calculated as the EU market price minus the cost of gas transit from Belarus to the EU. According to this calculation, the price in Belarus in 2007 should have been about 320 US$/tm³ rather than the actual 100 US$/tm³. On this basis, financial-to-economic cost conversion factor for gas use is determined to be 3.2 in 2007. Appendix Table 16 shows calculations for the rest period. The second distortion is the result of supplying diesel and gasoline to agricultural enterprises at about 20% discount. This information is based on various news articles available under www.naviny.by.
- Electricity prices for agriculture are set below the cost recovery cost and significantly lower than in other sectors of economy Appendix Table 17. We assume that these sectors pay the market rates, so the ratio of industry to agriculture electricity prices gives us the conversion factor to adjust the financial electricity costs to the economic level.
- Economic costs are assumed to equal financial costs for labor.
- Finally, economic costs are also assumed to equal financial costs for other inputs such as manure and litter.

Appendix Table 12: Cost shares for inputs in crop and livestock production in Belarus, 2007 (%)

Input	All	Crop	Livestock
Labor	20.5	19.3	21.3
Seeds and grafts	3.4	9.2	-
Fodder	31.1	-	55.9
Other inputs (manure, litter, eggs for incubation etc)	2.1	3.5	1.5
Fertilizers	5.5	15.1	-
Sanitary and phytosanitary measures	3.5	7.0	1.7
Fuel: diesel and gasoline	7.6	14.2	3.7
Electricity	1.3	0.8	1.5
Fuel: gas	0.5	0.6	0.3
Spare parts, renovation	0.5	0.7	0.3
Outside services employed	4.7	6.8	2.9
Other material costs	2.4	3.8	1.5
Depreciation	4.8	1.5	1.0
Other costs	10.1	15.6	6.8
of which credit costs	2.0	2.2	1.6

Source: Authors' calculations.

Appendix Table 13: Financial (farm gate) prices, economic (border) prices, and the calculation of conversion factors for revenues (prices in BYR/ton)

	Wheat	Barley	Corn	Rapeseed	Sugar beet	Potato	Beef	Pork	Poultry	Milk
					2007					
Financial price	312,000	233,000	439,581	412,590	468,750	264,742	2,385,000	3,402,000	3,200,000	506,466
Economic price	558,714	396,891	401,114	798,085	422,933	448,651	2,973,959	3,643,514	2,199,863	637,092
Conversion factor	1.79	1.70	0.91	1.93	0.90	1.69	1.25	1.07	0.69	1.26
					2006					
Financial price	243,000	175,000	321,658	368,930	580,357	264,742	2,065,000	3,175,000	2,798,000	437,899
Economic price	273,761	274,387	229,869	535,595	567,847	448,651	2,790,571	3,061,285	1,685,744	403,749
Conversion factor	1.13	1.57	0.71	1.45	0.98	1.69	1.35	0.96	0.60	0.92
					2005					
Financial price	230,000	166,000	306,341	358,453	543,155	206,604	1,861,000	3,012,000	2,512,000	402,831
Economic price	232,262	282,209	211,426	425,130	317,768	239,378	2,536,918	3,506,420	1,871,583	400,650
Conversion factor	1.01	1.70	0.69	1.19	0.59	1.16	1.36	1.16	0.75	0.99
					2004					
Financial price	225,000	179,000	300,334	337,830	543,155	131,814	1,507,000	2,380,000	1,742,000	369,519
Economic price	252,912	222,007	302,249	423,206	196,213	285,060	2,132,872	2,589,637	1,609,127	325,992
Conversion factor	1.12	1.24	1.01	1.25	0.36	2.16	1.42	1.09	0.92	0.88
					2003					
Financial price	178,000	121,000	238,360	292,480	483,631	174,703	1,119,000	1,768,000	1,536,000	261,949
Economic price	216,970	239,058	233,251	460,038	156,869	260,198	1,447,553	2,110,678	1,552,451	263,338
Conversion factor	1.22	1.98	0.98	1.57	0.32	1.49	1.29	1.19	1.01	1.01

Source: See description in text.

Appendix Table 14: Calculation of conversion factors for fertilizers

Potassium:	2003	2004	2005	2006	2007
farm prices, Br/t	85,763	106,640	107,380	111,055	114,730
'Belaruskaliy' potassium plant sales price: in Br/t	149,400	226,539	321,114	319,799	363,164
in USD/Br	72	105	149	149	169
Exchange rate, USD/Br	2,075	2,164	2,155	2,146	2,149
Discount:					
Potassium, 46.2%	0.74	1.12	1.99	1.88	2.17
Other, 53.8%	-0.10	-0.10	-0.10	-0.10	-0.10
Weighted average discount	0.29	0.47	0.87	0.81	0.95

Source: Authors' calculations using information on potassium plant sales prices from various news articles available at www.naviny.by, and official prices for fertilizers supplied to farms.

Appendix Table 15: The calculation of economic interest rates

	2003	2004	2005	2006	2007
GDP, bln. Bel. rub	36,565	49,992	65,067	79,267	96,165
Labor income, bln. Br (1)	15,979	22,116	29,974	37,834	44,398
Capital income, bln. Br (2)	20,585	27,876	35,093	41,397	51,702
Value of capital stock (4) trln. Br	153	193	235	243	297
Average Rate of Return, % (5) = (2)/((4)*1000)*100%	13.5	14.5	14.9	17.0	17.4
Marginal rate of return, % (6) = (2)/GDP*(5)	7.6	8.1	8.0	8.9	9.4
Marginal rate of return, net of depreciation	4.9	5.2	5.1	5.5	5.9

Source: Authors' calculations.

Appendix Table 16: Calculation of conversion factors for gas costs

	2003	2004	2005	2006	2007
EU price*, USD/tm3	130	135	220	300	320
Import price for Belarus, USD/tm3	36.9	47.68	47.68	47.68	100
CF	3.52	2.83	4.61	6.29	3.20

Source: Authors' calculations with Pavel and Yuzefovych (2008), Giucci and Kirchner (2007), and World Bank (2005).* German gas import price.

Appendix Table 17: Calculation of conversion factors for electricity costs

	2003	2004	2005	2006	1st half 2007	2nd half 2007
Costs, US cents/kWh	2.32	3.21	3.5	4.4	5.86	-
Agriculture, US cents/kWh	2.44	2.66	2.66	2.9	4.32	5.18
Industry, US cents/kWh	4.41	6.02	6.02	6.7	9.21	8.91
CF	1.81	2.26	2.26	2.33	2.13	1.72

Source: Authors' calculations with Tochitskaya (2007).

3. Calculation of conversion factors based on OECD methodology

The calculation of the reference border prices and conversion factors in Appendix Table 13 is performed using OECD (2008) methodology for Market Price Support estimation. All values are expressed in local currency (LC), specifically in rubles (BYR), if not otherwise specified.

Producer prices

- Wheat, corn, potato, and rapeseed: Annual average of farm gate prices (all qualities). Source: Ministry of Agriculture and Food of the Republic of Belarus (MAFRB, 2008); Ministry of Statistical Analysis of the Republic of Belarus (MASRB, 2008).
- Sugar: Annual average of sugar beet prices at farm gate converted to white sugar equivalent by dividing sugar beet price by the sugar extraction ratio from sugar beet. Source: MAFRB (2008); NSC (2008).
- Milk: Annual average farm gate prices of cow milk. Source: MAFRB (2008); NSC (2008).
- Beef and veal: Annual average farm gate prices for all categories of adult bovine animals for slaughter, live weight. Source: MAFRB (2008); NSC (2008).
- Pigmeat: Annual average farm gate prices for all pigs for slaughter, live weight. Source: MAFRB (2008); MSARB (2008).
- Poultry: Annual average farm gate prices of live chickens. Source: MAFRB (2008); MSARB (2008).

Border prices

- Wheat, corn, and barley: Ukrainian export unit values. Source: OECD (2009); State Statistics Committee of Ukraine (SSCU).
- Rapeseed*:* Ukrainian export unit values. Source: SSCU.
- Sugar beet, white sugar*:* EU export price of white sugar, Bourse de Paris (daily prices), fob Europe, calendar year. Source: OECD (2009).
- Milk (reference price)*:* The 'implicit' price of milk at the border is calculated from the unit export values of milk products exported from Belarus. The products considered are butter, cheese, and skimmed milk powder. The values and volumes of these products were converted into milk equivalents. The border price of milk is the weighted average of these unit export values of milk products in milk equivalents. Source: MAFRB (2008) and MSARB (2008).

The reference price of milk at the farm gate is the implicit milk border price net of processing costs. The processing margin is the average of processing margins in Australia, the EU, New Zealand and the US. Source: OECD (2009).

- Beef, pork and poultry meat*:* Belarusian export unit values for frozen beef carcasses, converted into live weight. Source: MAFRB (2008); MSARB (2008).

Handling and processing costs, margins

- Handling costs, processing costs and margins in Belarus are assumed equal those in Ukraine. According to IBRD/World Bank (2008), the costs of exporting and importing products in Belarus have been persistently somewhat higher than in Ukraine. The absolute value of handling and processing costs and margin in a given year for a given product was subtracted (for exported products) from the border price to bring the border price to the farm gate level (OECD, 2009). For imported products, the border price is assumed to equal the farm-gate price. Since information on border-wholesale and farm gate-wholesale margins are not available, it is assumed that these are roughly equal, so that the amount by which the import parity wholesale price lies above the border price equals the amount by which the farm gate price lies below the wholesale price.

Detailed data and the determination of the conversion factors are presented in Appendix Table 18 and Appendix Table 19.

Appendix Table 18: Market price support tables for selected crop products

	Units	2003	2004	2005	2006	2007
WHEAT						
II. Producer price (at farm gate)	LC/t	178,000	225,000	230,000	243,000	312,000
VII. Reference price (at farm gate)	LC/t	216,970	252,912	232,262	273,761	558,714
1. Border reference price (f.o.b. or c.i.f.)	USD/t	89	113	109	128	260
2. Handling and processing costs	LC/t	53,724	59,492	56,404	60,126	67,402
3. Quality adjustment	ratio	1.17	1.03	0.99	1.00	1.00
4. Official exchange rate	LC/USD	2,075	2,164	2,155	2,146	2,149
VIII. Market price differential/Conversion factor	ratio	1.22	1.12	1.01	1.13	1.79
CORN						
II. Producer price (at farm gate)	LC/t	238,360	300,334	306,341	321,658	439,581
VII. Reference price (at farm gate)	LC/t	233,251	302,249	211,426	229,869	401,114
1. Border reference price (f.o.b. or c.i.f.)	USD/t	110	137	96	105	183
2. Handling and processing costs	LC/t	53,724	59,492	56,404	0	0
3. Quality adjustment	ratio	1.02	1.02	1.02	1.02	1.02
4. Official exchange rate	LC/USD	2,075	2,164	2,155	2,146	2,149
VIII. Market price differential / Conversion factor	ratio	0.98	1.01	0.69	0.71	0.91
BARLEY						
II. Producer price (at farm gate)	LC/t	121,000	179,000	166,000	175,000	233,000
VII. Reference price (at farm gate)	LC/t	239,058	222,007	282,209	274,387	396,891
1. Border reference price (f.o.b. or c.i.f.)	USD/t	109	100	127	123.9	179
2. Handling and processing costs	LC/t	44,770	49,305	47,143	50,255	56,336
3. Quality adjustment	ratio	1.06	1.03	1.03	1.03	1.03
4. Official exchange rate	LC/USD	2,075	2,164	2,155	2,146	2,149
VIII. Market price differential / Conversion factor	ratio	1.98	1.24	1.70	1.57	1.70
RAPESEED						
II. Producer price (at farm gate)	LC/t	292,480	337,830	358,453	368,930	412,590
VII. Reference price (at farm gate)	LC/t	460,038	423,206	425,130	535,595	798,085
1. Border reference price (f.o.b. or c.i.f.)	USD/t	254	234	242	297	424.5267135
2. Handling and processing costs	LC/t	66,182	83,533	95,550	101,856	114,181
3. Quality adjustment	ratio	1.00	1.00	1.00	1.00	1.00
4. Official exchange rate	LC/USD	2,075	2,164	2,155	2,146	2,149
VIII. Market price differential / Conversion factor	ratio	1.57	1.25	1.19	1.45	1.93
SUGAR (REFINED EQUIVALENT)						
II. Producer price (at farm gate, refined equivalent)	LC/t	483,631	543,155	543,155	580,357	468,750
1. Sugar beet		65,000	73,000	73,000	78,000	63,000
2. Sugar extraction rate from sugar beet		0.134	0.134	0.134	0.134	0.134
VII. Reference price (at farm gate, refined equivalent)	LC/t	156,869	196,213	317,768	567,847	422,933
1. Border reference price (f.o.b. or c.i.f.)	Euro /t	190	193	234	334	225
2. Handling and processing costs	LC/t	59,564	71,308	83,343	88,844	99,594
3. Reference price at the wholesale level	LC/t	506,571	588,956	710,510	987,490	761,875
4. Wholesale-to farmgate margin	LC/t	349,702	392,743	392,743	419,643	338,942
5. Quality adjustment	ratio	1	1	1	1	1
6. Official exchange rate	LC/Euro	2,353	2,684	2,681	2,692	2,937
VIII. Market price differential / Conversion factor	ratio	0.32	0.36	0.59	0.98	0.9

Source: Authors' calculations with OECD (2008) methodology.

Appendix Table 19: Market price support tables for selected livestock products

	Units	2003	2004	2005	2006	2007
MILK						
II. Producer price (at farm gate)	LC/t	261,949	369,519	402,831	437,899	506,466
VII. Reference price (at farm gate)	LC/t	263,338	325,992	400,650	403,749	637,092
1. Border reference price = New Zealand price of milk	USD/t	164	192	230	236	349.6
2. Processing costs, milk equivalent	LC/t	77,303	88,434	95,509	101,812	114,132
9. Exchange rate	LC/USD	2,075	2,164	2,155	2,146	2,149
VIII. Market price differential / Conversion factor	ratio	1.01	0.88	0.99	0.92	1.26
BEEF AND VEAL						
II. Producer price (at farm gate) (carcass equiv.)	LC/t	1,119,000	1,507,000	1,861,000	2,065,000	2,385,000
VII. Reference price (at farm gate)	LC/t	1,447,553	2,132,872	2,536,918	2,790,571	2,973,959
1. Border reference price (f.o.b. or c.i.f.)	Euro/t	1,337	1,663	2,006	2,203	2,138
2. Handling and processing costs	LC/t	276,407	334,131	434,814	463,512	478,125
3. Quality adjustment	ratio	1	1	1	1	1
4. Official exchange rate	LC/Euro	2,343.62	2,697.49	2,693.91	2686.0626	2936.1208
VIII. Market price differential / Conversion factor	ratio	1.29	1.42	1.36	1.35	1.25
PIGMEAT						
II. Producer price (at farm gate) (carcass equiv.)	LC/t	1,768,000	2,380,000	3,012,000	3,175,000	3,402,000
VII. Reference price (at farm gate)	LC/t	2,110,678	2,589,637	3,506,420	3,061,285	3,643,514
1. Border reference price (f.o.b. or c.i.f.)	Euro/t	1,296	1,378	1,858	1,672	1,805
2. Handling and processing costs	LC/t	319,231	384,250	498,374	531,266	595,550
3. Quality adjustment	ratio	1	1	1	1	1
4. Official exchange rate	LC/Euro	2,344	2,697	2,694	2,686	2,936
VIII. Market price differential / Conversion factor	ratio	1.19	1.09	1.16	0.96	1.07
POULTRY						
II. Producer price (at farm gate) (carcass equiv.)	LC/t	1,536,000	1,742,000	2,512,000	2,798,000	3,200,000
VII. Reference price (at farm gate)	LC/t	1,552,451	1,609,127	1,871,583	1,685,744	2,199,863
1. Border reference price (f.o.b. or c.i.f.)	Euro/t	836	754	878	795	947
2. Border-to-wholesale transportation	LC/t	76,304	89,237	110,703	118,009	132,288
3. Reference price at the wholesale level		2,035,943	2,121,937	2,476,279	2,253,009	2,913,303
4. Wholesale-to farmgate margin		76,304	88,422	109,440	116,663	130,780
5. Quality adjustment	ratio	1	1	1	1	1
6. Official exchange rate	LC/Euro	2,343.62	2,697.49	2,693.91	2686.0626	2936.1208
VIII. Market price differential / Conversion factor	ratio	1.01	0.92	0.75	0.6	0.69

Source: Authors' calculations with OECD (2008) methodology.