The Performance of Agriculture in Transition Economies: Evidence from Poland and Belarus, 1990-2004

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Thesis submitted for assessment with a view to
obtaining the degree of Doctor of History and Civilization
of the European University Institute

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ABSTRACT

This study contributes to the existing literature on the agricultural reforms that took place in Central and Eastern European countries during the transformational period (1990-2004) and on the agricultural development in Europe in general in the long-term (1960-2004).

The thesis explores the history of the agricultural transformations in Poland and Belarus through a detailed analysis of the agricultural production and productivity dynamics, aiming to answer (i) whether the reforms succeeded or failed in terms of agricultural production and agricultural productivity; and (ii) what were the determinants of the agricultural reforms' success or failure.

The research is centered on a comparative analysis of Polish and Belarusian agricultural performance, but it also incorporates the other CEE countries (Czech Republic, Hungary, Slovakia, Russia and Ukraine), as well as the advanced Western European economies.

List of acronyms (abbreviations)

AWU	**Annual Work Unit (**estimated by Eurostat)
CEEC	**Central and Eastern European Countries** – in the context of this PhD research this includes the following seven countries: Poland, Hungary, Czech Republic, Slovakia, Russia, Ukraine and Belarus
FSU	**Former Soviet Union countries –** in the context of this PhD research this includes the following three countries: Russia, Ukraine and Belarus
V4	**Vysiegrad Four countries -** in the context of this PhD research this includes the following four countries: Poland, Hungary, Czech Republic and Slovakia
WB	**World Bank**
OECD	**Organization for Economic Co-operation and Development**
FAO	**Food and Agriculture Organization of the United Nations**
PSE	**Producer Support Estimate** (estimated by OECD)
NRA	**Nominal Rates of Assistance** (estimated by WB)

CONTENTS

CHAPTER 1. General introduction.

This "Introduction Chapter" provides general information about the thesis, and consists of a description of the research background, an explanation of the selection of country cases, a literature overview, data description, methodology and thesis outline sections.

1.1. The research background and scope of the analysis

In 1989, a transformation process was launched to set the centrally-planned agricultural sectors of Central and East European countries onto a path of sustainable economic growth. The key elements of these reforms were privatization, liberalization of markets and prices and the creation of market institutions. Fifteen years later, these tasks were essentially accomplished: privatization (i.e., adoption of privatization laws and the implementation of privatization) was implemented, liberal, free-market economic principles were introduced, the old centrally-planned institutional structure was dismantled, and a new institutional framework emerged and started to function. Thus, in a formal "bureaucratic" sense, the transformation process could be considered a success.

But can the transformation process be considered a success in terms of its (reforms') efficiency? This question is important because the ultimate goal of the transformation was to transform the (presumably) inefficient centrally-planned agricultural system into a more efficient, market-oriented one. But has this happened? Have the implemented reforms resulted in substantial efficiency improvements in agricultural performance? Further, what factors drove the success or failure of the reforms? These are the **research questions** I would like to address to in my thesis.

To be more precise, the research questions in this work might be formulated as – **(1) whether the reforms succeeded or failed in terms of two standard measures of economic efficiency: agricultural production and agricultural productivity, or in other words, an assessment of reform outcomes in terms of agricultural production and agricultural productivity;** and **(2) what were the determinants of the agricultural reforms' success or failure?**

These two standard **measures of the economic performance** (production and productivity) were chosen due to their dual (Socialist, "centrally-planned" and liberal, "free-market") nature and relevance. Output (agricultural production) is usually considered to be relevant to the centrally-planned economy measurement of agricultural performance because according to conventional wisdom, the main objective of agricultural policies in pre-transition

CEE countries was to produce as much output as possible in order to achieve self-sufficiency vis-a-vis agricultural products.

Agricultural productivity is considered to be relevant to the free-market economy measurement of agricultural performance because it refers not only to the simple increase in quantity of agricultural output per unit of selected input, but also refers to the efficiency with which agricultural producers use the available resources in order to produce a given quantity of output, which is relevant to the main "cost-minimization" ("profit-maximization") target of a free-market economy. Moreover, some scholars even suggest that output is a misleading indicator of reform success/failure "because the decline of the agricultural output (in most transition economies) has been a necessary consequence of the market liberalization" (*Lifert & Swinnen, 2002, p.12).* [1]

Therefore, the use of both "Socialist" and "free-market" measures of success provides the possibility to assess the reform outcomes from two points of view – from the "centrally-planned economy" standpoint by using the output indicator as a measure of reform success or failure, and from the "free-market economy" vantage point by using the productivity indicator as a measure of reform outcomes.

Regarding **transformational periodization,** we note that although the "program of political and economic reforms" (so-called "perestroika and glasnost" policy) was launched by Michail Gorbachev in March 1985 (*Barry, 2001, p.1202*) the majority of the political science scholars studing the CEEC post-communist transformations (*e.g., Aslund, 2012; Bohle and Greskovits, 2012; Roland, 2000; Stark and Bruszt, 1998)* as well as those studing the agricultural transformations in CEEC *(Anderson and Swinnen, 2008; Lerman et al., 2004; Spoor and Visser, 2001)* typically take the very end of the 1980s (and the beginning of the 1990s) as a starting point of transformation period due to the visible evidence of economic consequences of "perestroika," as well as to the introduction at this point of the first market reforms. Also, logistical considerations of the availability of economic data in international organizations' databases (starting from the beginning of the 1990s [2]) are probably taken into consideration when determining the starting date of the transformation period. Considering

[1] *Lifert & Swinnen (2002, p. 28) and Macours & Swinnen (1999)* argue that the absence of decline in GAO "more likely reflects the failure of reform, rather than the reform success". To support this idea, they refer to the case of the transition economies with the lowest declines in the agricultural output (Uzbekistan, Turkmenistan and Belarus), which according to the World Bank grading system of agricultural reforms progress were considered as least reformist. This controversy will be discussed in more details further, within the Section 2.2. and Section 2.3. (CEEC chapter) of this PhD thesis.

[2] For example, until the end of the '80s the only widely available statistical data pertained to the USSR as a whole, but not to each separate republic.

all the above arguments, then, the beginning of the 1990s was taken as the starting point of the transformation period for the purpose of this thesis.

1.2. The selection of the countries' case studies (the geographical scope of the research)

The geographical scope of this research is mainly focused on two countries – Poland and Belarus- the former, from the so-called Eastern Bloc countries in the CEEC region and the latter, from the FSU.

The choice of these countries was determined by the following reasons: (i) a considerable similarity in performance level between the countries, (ii) differences in the transformational reforms agendas between the countries and (iii) geographical proximity.

(i) In the CEEC countries, the results of the agricultural transformation were not as brilliant as it was expected at the beginning of the reforms' process. This is especially true in light of the successful history of the East Asian transformational economies (China, Vietnam and so on).

The choice of Poland and Belarus as country cases for the research was determined by their relatively good performance (in terms of agricultural output and productivity) compared to the other CEE countries. Poland achieved the best results among the V4 countries (Poland, Czech Republic, Slovakia and Hungary), and Belarus was top-ranking among the FSU countries (Belarus, Russia and Ukraine) as well as among some V4 countries. Thus, an analysis of the processes of the agricultural transformation in the selected countries might shed light on why some transformational countries (especially in the CEEC region) are more successful than others in terms of agricultural performance, and might provide useful insights into the determinants and driving forces of the successful performance.

(ii) The two countries chosen for the research differ substantially in terms of their reforms agenda – Poland followed a fast-paced "Big-Bang" approach, while Belarus adopted a path of gradual reform. Hence, an analysis of the agricultural transformations in these two countries would provide the possibility of evaluating of the extent to which the reform agenda impacted on agricultural performance, as well as single out the current reforms' outcomes (1990-2004) from the long-term trends of agricultural development (1961-2004).

(iii) The geographical proximity of these neighboring countries minimizes, as far as possible, the impact of agro-climatic differences on agricultural performance.

The comparative analysis of these two countries is also placed into the context of a broader regional and time-span perspective. The processes of agricultural transformation in

Poland and Belarus are compared with similar processes that took place in the other CEE countries –Czech Republic, Slovakia, Hungary, Russia and Ukraine **(Chapter 2**) and selected developed Western countries - Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, and the UK (**Chapter 5**).

Therefore, while Poland and Belarus are usually considered to be the main outliers in the CEEC region[3], placed into a broader regional context and wider time-span, they could be considered in fact the most representative cases, because they could provide the explanations not only for the Polish and Belarusian short-term transformation results, but also provide some useful insights into the bigger (in terms of the geographical scope and time-span) research puzzle.

1.3. General literature overview

A brief overview of the agricultural transformation literature enables us to distinguish the following shortcomings of the existing scholarship on the dissertation topic.

While Belarus agricultural performance is a complete "terra incognita" in the English-speaking scientific community, the numerous country-relevant studies for Poland (e.g., *Zawalinska, 2004; Czyzewski, 2004*) are too specific and lack a comparative approach. (A detailed analysis of the Polish country-relevant studies will be provided in Chapter 3)

In their turn, complex cross-country studies (e.g., *Macours and Swinnen, 2000a; Lerman, 2000; Csaki et.al, 1999)* are too general because of their research scope: some studies cover more than 28 countries (*Kim and An, 2007)* and include not only the CEEC region, but also East and Central Asia (e.g., *Macours and Swinnen, 2000a; Lerman, 2000*).

Other shortcomings of the existing scholarship on the dissertation topic include: use of the micro-data from the surveus (*e.g., Petric, 2002; Csaki and Lerman, 2001*); focuse on the selected groups of agricultural producers (e.*g, Gardner and Lerman, 2006; Lerman and Schreinemachers, 2002; Munroe, 2001; Brada and King, 1993*); particular product (crop or livestock) orientation (*e.g., Tonini, 2007; Kuipers, 2013; Guba, 2000; Budzynski and Krasowicz, 2008; Krasowicz and Kus, 2006);* specific variable selection (*e.g., Latruffe et.al., 2004; Gorton and Davidova, 2008; Dries and Swinnen, 2002; Swinnen et.al., 2005; Petrick and Kloss, 2012; Swinnen and Vranken, 2010).*

[3] Poland due to the fastest reforms' pace among CEEC and existence of the private property for the agricultural land during the socialism, Belarus due to the slowest reforms' pace among the CEEC. The detailed description of the Polish –Belarusian controversy for the GDP dynamic vv. index of economic freedom (reforms progress) is provided by *Chubrik (2003)*

All the above-mentioned limitations constrain the generalizability of the results. In contrast, in this thesis, the data (aggregated on macro-level) sidestep the pitfalls of both over-specification and over-generalization.

1.4. Data

This section discusses the issue of the reliability of the agricultural data, and provides a general description of the data sources and types of variables used for the purposes of the research.

The problem of **quality and reliability of the agricultural** data "has been topical for many years and the debate is still ongoing" (*Tonini, 2007, p.18)*. Collecting, proceeding and estimating agricultural data is not an easy task even for normal, "non-transition" economies, because it "requires well-organized statistical offices with substantial resources and considerable good faith" (*Federico, 2005, p.20*). However the resources could "simply be not available" and "good faith may also be in short supply" *(Federico, 2005, p.21*). For example, "farmers may have an interest in not providing accurate information" because (i) they would like "to conceal some of their products for fear of the taxman," as well as the "policies of compulsory delivery, as occurred in many LDCs in 1960-70s," or (ii) farmers would have an "opposite incentive to over-report the output" due to the "massive adoption of price subsidies in many OECD countries since 1930s" (*Federico, 2005, p.21*).

Besides the above-mentioned problems, which are common for all types of economies (non-transitional, transitional, developed, least-developed and so forth), there is also a set of specific "transitional statistic data" problems. These problems quite often are termed "politically-induced" statistical deviations in data measurement, and they are mainly related to the "manipulation" of figures "for political purposes" (*Federico, 2005, p.21*). These politically induced deviations are usually related to both the output and inputs sides.

Regarding the output debate, there is agreement on the existence of an agricultural production decline at the beginning of the transformation. However, the scale and magnitude of the decline have been called into question. Alongside the purely technical difficulties associated with output measurement in a fast-growing private sector during transition, *Liefert and Swinnen (2002*) put forth that official statistical data overstated the magnitude of output decline due to over-reporting in the Socialist era. According to these researchers, at that time the main goal was to produce as much agricultural output as possible: to reach the "Plan" goals in light of food security concerns. Consequently, agricultural producers over-reported their output in order to look better with respect to agricultural production. *Winnecki (2002,*

p.44) defined two types of such over-reporting: (1) "write-ins" ("*pripisk*i" in Russian), that is, "reporting higher output than one actually produced," and (2) "manipulations with output structure registered as output growth but actually were only [reflected] increases in prices" . In other words, the "write-ins" overstated the output while measuring it in "physical items" (kilograms, tons, litres, and so on) and price manipulations overstated the output, while measuring it in terms of prices. **Regarding the inputs** issue, it is widely believed that in the Socialist period, "the inputs were often applied wastefully" and "the quantities of inputs used were often exaggerated by the agricultural producers" (*Tonini, 2007, p. 146*). The lack of the proper incentives due to the soft budget constraints could be considered as the main reason for the inputs wastage, while the exaggeration of the quantities of the used inputs could refer to the specificity of the centrally-planning system, where the centrally-planned inputs allocation (supply) was based on the quantity of the inputs used previously (in the preceding year, or the average sum of the previous years inputs' consumption). Hence, farm managers were not interested in reporting the decrease of the inputs use (which might have happened for any reasons), because in doing so, the inputs' supply to their farm could be reduced as a result.

However, these arguments (both for output and input over-reporting) neglect the point that the scale of over-reporting (especially in regard to "write-ins") in a very thoroughly controlled Socialist economy could not have been sufficiently high to affect the "output-inputs" mis-measurement at the macro-economy level in a very significant way.

In the transition period, the incentives were supposed to be changed in the opposite direction for both output reporting and input use. Regarding the former, it is assumed that producers under-reported their output to avoid taxes and to "strength[en] their arguments for more state support" (*Lifert & Swinnen, 2002, p.4*) . The latter argument could be especially applicable to Poland, with its predominantly family-run, privately owned and small-scale agriculture, while in less-reformed Belarus, the "old command incentives to overstate output indicators still persist[ed]" (*Wandel et.al., 2001, p.146)* . Inputs, in turn, began to be applied in more productive ways. The issue of the exclusion of small, private enterprises from the reporting system also played its own role in the data bias.[4]

Finalizing the issue of the transformation data quality and reliability, it is possible to conclude that until now, no rigorous studies have investigated this problem. Therefore scholars, experts and politicians, keeping in mind that "imperfect data are better than no data"

[4] For example, "for Poland, the dairy output and dairy cattle stock in subsistence farming were deducted from national aggregate dairy output and dairy cattle stock, so that only data for the commercial dairy sector were considered" for national data (*Tonini, 2007, p.149)*

(*Federico, 2005, p.21*) still use the existing official data just notifying about it "inadequateness", without the specification of the scale and extent of the possible deviations in the agricultural data.

The main variables used for the purpose of this thesis are the following: variables aggregated on the country-relevant macro-level: (i) "GAO"- Gross Agricultural Output; (ii) "land" - total agricultural or arable land for each country; (iii) "labor" – number of people working in the agricultural sector of each country or rural population; (iv) "machinery" - agricultural machinery (tractors in use) for each country; (v) "fertilizers" - fertilizer consumption for each country; (vi) "livestock" - simple average of the cow, pig, ship, horse and poultry inventories.[5]

However, while the above-mentioned quantitative indicators have been a "very handy proxy," they are not good markers of qualitative improvements, especially for labor, as well as for other inputs (*Federico, 2005, p.59*). Therefore indicators such as working hours, Average Working Units (AWU) and labor salary, mechanical draft force resources (in thousands of draft units) for tractors and land quality and land-use intensity were also used in the subsequent chapters of this study.

The data for the research were mainly gleaned from **two types of sources** – the international organization databases (for the comparative CEEC analysis in Chapter 2) and the national (Poland and Belarus) statistical databases for the detailed Poland and Belarus country-level analysis in Chapters 3 and 4. Chapter 5 and Chapter 6 consider the both types of sources.

The international statistical data sources included the FAO (Food and Agriculture Organization), the OECD (Organization for Economic Co-operation and Development), the WIIW (Vienna Institute for International Economic Studies) and the WB (World Bank).

These datasets are usually derived from official national statistics, but collected data are processed and evaluated according to a unified methodology and similar standards, which makes them comparable across countries and allows them to be used for cross-country analysis (bearing in mind the above-noted issue of the quality and reliability of agricultural output-input data for CEEC transition economies).

The Polish national statistical data sources were the Central Statistical Office of Poland (GUS) and the Ministry of Agriculture and Rural Developments (MRiRW). Some specific data were also taken from agriculturally oriented agencies like the Agency for Restructuring

[5] More detailed descriptions of the data used for the empirical analysis will be provided in the subsequent chapters

and Modernization of Agriculture and the Agricultural Property Agency. These data sources are commonly used by the Polish and international academic community and are generally considered reliable.

The data for the Belarusian-specific analysis (Chapter 4) were mainly taken from the State Statistical Committee (SSC) of the Republic of Belarus through the official statistical bulletins published by the central and regional branches of the SSC. Some data were obtained from *Sakovich (2008c*), a comprehensive compilation of Belarusian agricultural data collected from the State Statistical Committee, Belarus Ministry of Agriculture and archival sources.

Generally, all Belarusian data may be considered consistent and reliable (with the exception of the some data inconsistency for the early transitional period 1990-1995), because no extensive debate exists in Belarusian academic literature regarding the reliability of agricultural data, which are collected and published by the State Statistical Committee.

Belarusian "alternative" and independent public economists do consistently make claims in popular press interviews about state authorities' attempts to paint a relatively rosy picture for politically populist reasons, especially with such sensitive indicators as output, prices, inflation and exchange rates (*Dorohov, 2006; Leonid Zlotnikov objasnil…., 2014; V 2009 godu…,2009)*. Thus far, however, these claims have not been supported by any rigorous research that is relevant to the agricultural sector or to the Belarusian economy as a whole.

However some concerns about agricultural data consistency and quality were raised by Western scholars, which include (i) the estimation of the amount of the state support of the agricultural sector; (ii) the actual labor force use and costs; and (iii) the market costs and transparency of the input transfers, agricultural and social services provided by large corporate farms (former "kolhoz" ad "sovhoz") to subsidiary households and farmers (*Freinkman et al., 2005; Cramon-Taubadel et al., 2009).* The latter issue is very often raised by "domestic" Belarusian proponents of large-scale corporate (actually, still state-run) agricultural farms, when it comes to the assessment of households' plots and private farmers' productivity, profitability and competiveness.

The inconsistent, puzzling, and sometimes even actual absence of data on the real value (amount) of state support to the agricultural sector is probably one of the most important obstacles for those studying Belarusian agriculture. Belarus is the only country in the CEEC region for which PSE and NRA indexes have not been calculated. This might be explained in two (possible) ways: (i) a not fully "transparent policy" (*Freinkman et al., 2005, p. 204)*; and

(ii) methodological problems. The variety of the channels of state support, [6] its' levels - national, regional, sub-regional and types - government expenditures, fiscal support, "debt rescheduling, credit write-offs, lower than average industry tariffs for electricity and heat" (*Babicki et al., 2003, p.5*) makes it difficult and sometimes even impossible to calculate accurately the amount of state support that is given to agriculture, not even taking into account the hyper-inflation and sharp jump in the currency exchange rates at the beginning of the transformation period. All these affect the accuracy, as well as cross-country and time-span comparability of these calculations. Some attempts at state-support calculations were made by WB teams in their Belarus-specific country reports; however, their calculations were mainly done on the farm-level [7] and did not cover the entire period in question (but only 2003-2007 period at the most).

The issues of market costs and transparency of input transfers, agricultural and social services provided by large corporate farms to subsidiary households and farmers and actual labor force use and costs are mainly raised in the light of the impressive performance of private agriculture (especially household plots). Western scholars (*Cramon-Taubadel et al., 2009; Freinkman et al., 2005*) argue that the productivity, profitability and competitiveness of household plots and private farmers would be downsized significantly if all the input transfers (ex. fertilizers and machinery use), social services (medical care, schooling and so forth) and undeclared family labor use[8] were to be transparent, clearly calculated and properly (market) priced. While a frequent topic of discussion, these issues still lack even the most basic research, leaving us in the dark with regard to the size and scale of the problem. Finally, the general "disclaimer" regarding the quality and reliability of agricultural output-input data for CEEC transition economies (explained previously) could also be applied to the Belarusian data.

1.5. Methodology outline

Within the framework of the thesis, the success or failure of the reforms will be assessed in terms of agricultural production and agricultural productivity. For each of these standard measures of economic efficiency, a separate set of methodological instruments will be applied.

[6] Around 24-30 according to *Babicki et al. (2003*)

[7] Which includes the sample of more than 1500 large former soviet-type enterprises, but not all of them, and totally exclude the farmers and subsidiary household plots from the estimation. (*Cramon-Taubadel et al. , 2009*)

[8] For example people who permanently live and work in the cities very often come to villages to help their close relatives on weekend basis and sometimes even take their vacation days during the "rush agricultural periods" like harvesting and etc.

For the purposes of the agricultural **production (output) analysis,** the Cobb-Douglas specification of the production function will be used. Although it has well–known limitations, this specification of the production function allows the use of the estimated results for productivity (TFP) calculation. The obtained results can then be compared with other studies, thus overcoming the problem of limited number of observations.

For the purposes of the agricultural **productivity analysis,** the partial productivity and TFP (Total Factors Productivity) calculations will be applied. The partial productivity indexes will be calculated as agricultural output per factor unit (land, labor, machinery, livestock and fertilizers). This analysis, despite its common use, has been heavily criticized by economists for its potential to lead to misleading results (*Zawalinska, 2004*). For example, in some circumstances, an increase of partial productivity indicators could be caused by the simple inputs substitution or the fact that input fall even faster than output, rather than by productivity improvements. To avoid this problem, the TFP will be estimated.

1.6. Contribution to the field of the study

This study contributes to the existing literature on agricultural reforms in CEE countries during the short-term transformational period (1990-2004), and on agricultural development in the European region in general in the long-term (1960-2004). **The research novelty is three-fold: choice of country cases, analyzed time-frame, and research conclusions.**

This is the first study to offer a comparative and systematic analysis of the rarely contrasted (due to different starting conditions and reform progress development) **country-case studies of Poland and Belarus**. The results of this research indicate that these two countries are not reforms outliers (as they are frequently considered in the transformational literature), but rather represent typical examples of long-term developmental trends.

Also, for the first time, **Belarusian agricultural development**, which previously was either neglected in the transformational literature (with the exception of a few WB reports[9] and Working Papers[10]) or was part of comparative multi-country studies[11] - become one of **the main objects of the research**. In this way, the construction of a more complex and comprehensive transformational history puzzle is made possible, and the somewhat ignored Belarusian transformational historiography is incorporated into the transformational history discourse.

[9] For example -*Csaki et.al., 1994; Csaki et al., 2000; Freinkman et al., 2005; Cramon-Taubadel et al., 2009.*
[10] For example - *Babicki et al., 2003 and Babocki et al., 2004.*
[11] For example - *Drager, 2000; Dzun and Tereszczuk, 2009; Swinnen and Rozelle, 2006.*

This research is the first in agricultural transformation literature to **compare CEE countries' agricultural development with that of advanced Western European countries**. Previous studies either limited their scope to the intra-CEEC comparisons (*e.g., Csaki and Kray, 2005; Childress, 2002; Deininger, 2002; and Lerman, 2000)* or contrasted CEE countries with other transformational countries from East Asia (China, Vietnam - *e.g., Macours and Swinnen, 2002; Rozelle and Swinnen, 2004; Swinnen and Rozelle, 2006)*. This allows us to overcome the shortcomings of the previous studies that solely took into account transformational countries, and to incorporate CEE agricultural transformation history into the wider context of European agricultural history.

Although the research is mainly focused on the first fourteen years of the transformation (1990-2004), it also comprises **a long-term comparative analysis (1960-2004),** comparing the agricultural development of CEE countries and developed Western countries in the prolonged forty-four year period. This approach allows us to put agricultural transformation studies, which are usually limited to a short-term period of no more than 20-24 years, into a long-term perspective, and to move beyond "transformational specificity".

Thus, this study aims to fill a significant gap in the transformational literature, which is mainly concerned with establishing the interdependence of the reforms' progress (reforms' profundity) and the reforms' outcomes (production and productivity dynamics), putting somewhat aside the importance of capital endowment.[12] In contrast, this study explores the interdependence of capital endowment and agricultural reforms outcomes, and provides empirical evidence of the **significant impact of capital endowment on the outcomes of the reforms**.

1.7. Thesis outline

The thesis consists of six chapters. **Chapter 1** is an introductory chapter, which explains the research background and provides a literature overview, data and methodology description and general thesis outline.

Chapter 2 provides a general overview of CEEC agricultural performance during the transformation period, with a focus on Polish and Belarusian agricultural performance compared to other CEE countries (Czech Republic, Slovakia, Hungary, Russia and Ukraine). It starts with an outline of the CEE countries agricultural transformation history (Section 1) –

[12] i.e. machinery, fertilizers and livestock

that concludes that Poland and Belarus are situated at opposite ends of the reformation continuum: Poland is the fastest reformer and Belarus is the slowest reformer among the studied seven countries. Next, in Sections 2 and 3, an agricultural production and productivity evaluation is provided (using the results of the pooled regression for seven CEEC countries). The conclusion is that Poland is the best performer among the Vysiegrad-4 countries (herein after "V4") and Belarus is the best performer among the Former Soviet Union (hereinafter –"FSU countries") as well as among some V4 countries.

Chapter 3 and Chapter 4 evaluate Polish and Belarusian agricultural performance. **The "Poland Chapter" (Chapter 3)** offers an analysis of Polish agricultural performance during the fifteen years of transformation vis-a-vis a "success or failure of reforms" assessment in terms of agricultural production and productivity. It starts with an overview of Polish agricultural history in Section 1, evaluating the Polish transformation as fast-paced, well-developed and practically accomplished by 2004. After that, the Polish agricultural production and productivity analysis is provided in Sections 2 and 3. The results of this analysis allow us to consider the transformational results for Poland a "success" in terms of both agricultural production and productivity performance.

The "Belarus chapter" (Chapter 4) is dedicated to an analysis of Belarus agricultural performance during the transformational period. The Chapter starts with an evaluation of the country's transformation history (Section 1), assessing the Belarusian transformation as slow-paced and underdeveloped. Then, in Sections 2 and 3, an analysis of the Belarusian-specific features of agricultural production and productivity (based on the results of the Belarusian-specific pooled regression) is provided, stating that the transformation results for Belarus could be considered a "success" in terms of agricultural production and productivity performance.

Chapter 5 is devoted to a comparative analysis of Polish and Belarusian agricultural performance, and addresses the question of how two countries with such different transformational agendas (Poland following the "Big-Bang" approach and Belarus with its slow-paced reforms) achieved similarly successful transformational results in terms of agricultural production and productivity. The answer is provided within the framework of the hypothesis that "the capital endowment has a more decisive impact on the reforms' success (or failure) than the reforms' profundity" and is supported by the empirical evidence. The observed differences in the speed and magnitude of the production and productivity dynamics

are explained by the differences in the "institutions" in a broadly defined sense, [13] or to be more specific, by the transition economies discourse, the differences in the reforms' paths and initial conditions (*Swinnen, 2006*).

Finally, **Chapter 6** provides the conclusion for t thesis findings.

[13] "institutions" –i.e. "a set of formal or informal rules to determine the initial ownership of the goods and factors (property rights) and to regulate the exchanges (contracts, markets, and other forms of distribution" (*Federico,2005, p.117)*

CHAPTER 2. CEEC agricultural performance during the transformation period.

This chapter provides a general overview of CEEC agricultural performance during the transformation period, with a focus on Polish and Belarusian agricultural performance compared to other CEE countries. It analyzes the seven CEE countries' (Poland, Czech Republic, Slovakia, Hungary, Belarus, Russia and Ukraine) agricultural performance during fifteen years of transformation in regard to the "success or failure of reforms" assessment in terms of agricultural production and productivity. It starts with an outline of the CEE countries' agricultural transformation history (Section 2.1). Next, agricultural production (output) dynamics will be analyzed in Section 2.2. Then, in Section 2.3 agricultural productivity improvements will be evaluated in terms of partial productivity indexes. After that, in the Section 2.4, a panel regression for the seven countries in question will be estimated in order to assess the impact of the changes in inputs use on GAO dynamic and to calculate the TFP indexes. Finally, the concluding remarks (in the Conclusion) will briefly outline the main findings of the produced research.

2.1. CEEC agricultural transformation history overview.

This section is dedicated to a brief overview of the selected Central and Eastern European countries' agricultural transformation history (see the map of the CEEC region – **Figure 2.1**.). The section starts with a description of the basic elements ("cornerstones") of the transformation process; next, a general overview of the evolution and outcomes of the transformation process within the framework of the established "basic elements" will be provided; and finally, concluding remarks outline the main findings of this section.

The transition of ex-Socialist agriculture from a centrally-planned to market-oriented system is a complex, multidimensional process that consists of several inter-dependent elements. Summarizing the findings of the main, agriculture-relevant transformation studies,[14] it is possible to distinguish the following "basic elements" of the transformation process, which constitute the so-called "taxonomy of reforms": (1) land reform; (2) liberalization of the outputs and inputs markets (incl. agricultural price and trade polices liberalization, "the demonopolisation and privatization of trade and food processing", and the creation of the rural banking system); (3) the establishment of the new institutional structure relevant to the market economy (*Csaba and Nucifora, 2006, p. 2*).

[14] To name a few: *Csaki et al., 1998-2005; Federico, 2005; Lerman et al., 2004; Swinnen and Rozelle, 2006.*

Figure 2.1. Map of the CEE countries[15]

	Arable land	Rural Population
Belarus	**6 232**	**3 268**
Czech R.	**3 301**	**2 622**
Hungary	**4 806**	**3 602**
Poland	**14 210**	**14 817**
Russia	**127 500**	**39 570**
Slovakia	**1 557**	**2 331**
Ukraine	**33 286**	**16 903**
Germany	*11 835*	*22 212*
Italy	*8 283*	*18 843*
UK	*5 936*	*12 690*
USA	*181 839*	*60 980*

[15] Map of Eastern Europe (2014). Available at: http://goeasteurope.about.com/od/introtoeasteuropetravel/ig/Maps-of-Eastern-Europe/Map-of-Eastern-Europe.htm / (Accessed: May 10, 2014). Data for the land and rural population are from FAO database. Available at www.fao.org (Accessed: May 10, 2014)

The next paragraphs of this section will provide a brief overview of the process and outcomes of the agricultural transformation in the seven countries in question within the framework of the above-mentioned "basic elements" of the transformation process. A more detailed evaluation of the Polish and Belarusian transformational history will be provided in Chapter 3 (for Poland) and Chapter 4 (for Belarus).

Due to its political, economic and social significance, **land reform** was the most important (and highly prioritized) element of the reform agenda in all seven countries in question. While the land ownership structure might be considered homogeneous in all seven studied countries during the Socialist period,[16] the scope, methods and pace of the transformational land reforms differed significantly among the countries.

The process of land reform (land privatization) may be conceptualized along three dimensions according to *Deininger (2002, p.992*): "(i) the recognition of private property rights; (ii) the mechanism for the privatization of the land and its allocation to producers; (iii) the transferability of the land rights". An analysis of the land reform (privatization) process in the seven countries in question highlights a huge heterogeneity with respect to the three above-stated dimensions. (see **Table 2.1**)

All V4 countries in question"allow the full private ownership for the all types of land*"* *(Deininger, 2002, p.992),* but adopted different privatization strategies. The Czech and Slovak republics generally chose "to privatize land by restitution [of] it to the former owners in the form of physical plots" *(Deininger, 2002, p.992*). Hungary adopted a "mixed strategy": the "land was restituted to the former owners, but a portion if it was also distributed free in the interest of social equity" *(Deininger, 2002, p.992).* According to the national laws of the V4 countries, foreign physical or legal persons were not allowed to acquire ownership of agricultural land. Even after the EU accession, foreigners generally were unable "to purchase agricultural land for a transitional period", which was seven years for the Czech Republic, Slovakia, Hungary and twelve years for Poland *(Swinnen and Vranken, 2008, p.i).* However, "there are generally no restrictions on renting agricultural land by foreigners," and the definition of the term "foreigners" in the legal restrictions provided some (restricted) loopholes for land acquisition *(Swinnen and Vranken, 2008,p.i).*

[16] except for Poland, where private small-scale family-rum farms constituted the 77% of the total land holdings *Deininger (2002)*

Table 2.1. Land reform process[17]

	Potential private ownership	Privatization strategy (method)	Transferability
Poland	all land	sale of state land	buy-and-sell, leasing
Czech R.	all land	Restitution	buy-and-sell, leasing
Slovakia	all land	Restitution	buy-and-sell, leasing
Hungary	all land	Restitution and distribution	buy-and-sell, leasing
Russia	all land	Distribution	buy-and-sell dubious, leasing
Ukraine	all land	Distribution	buy-and-sell dubious, leasing
Belarus	household plots only	None	buy-and-sell dubious, use rights non-transferable

Regarding the countries of the FSU, all three countries in question chose land distribution as the method of privatization, but only Russia and Ukraine recognized (mainly formally) private property for all land. In contrast, in Belarus private property rights were recognized for household plots only.

However, not only the scope and the mechanisms of land reform show the profound difference between the V4 and FSU countries. The outcomes of land reform (privatization) differ significantly between these two groups of countries as well. While the privatization of land is practically accomplished in most V4 countries, the land reform progress in FSU countries seems rather dubious, especially while considering not only the adopted (but most often not implemented) land reform legislation, but the share of privately owned land, which is up to 80% on average in CEE countries (except for Hungary) and less than 30% on average in FSU countries. (see **Table 2.2)**

Table 2.2. Land privatization progress[18]

Private land (%)	Poland	Czech R.	Slovakia	Hungary	Belarus	Russia	Ukraine
in 1990	72	5	5	6	7	2	7
in 2000	77	80	99	54	17	13	26
in 2003-04	78	81	99	60	16	18	32
in 2009-10	81	90	99	60	12	31	43

[17] *Source:* Adapted from *Deininger (2002, p.993)*

[18] Data for 1990 and 2000 are from *Deininger (2002*). Data for 2003-2004 are from national Ministries of Agriculture. *Data for* years 2009-2010: for *Russia* are from - *Agriculture, hunting and forestry in Russia (2011, p.72)*; for *Hungary are* from *Hungarian Agricultural Statistics Yearbook (various years)*; *for Belarus* are from *Belarusian Agricultural Statistics Yearbook (2012, p.64*); *for Ukraine* are from *Ukrainian Statistical Yearbook of Agriculture (2012, p.80*); *for Slovakia and Czech Republic are* from national Ministries of Agriculture; *for Poland* are *from Agricultural Statistics Yearbook of Poland (various years)*.

Thus, the analysis of the land reform process in the seven countries in question allows to come to the following conclusions regarding its methods, scope and progress: (i) land restitution in the V4 and land distribution in the FSU were the main privatization methods;[19] (ii) formally, the scope of the land privatization (potential private ownership) included the private ownership to all land in V4 and some FSU (Russia and Ukraine), but actually in FSU "little more than the name of enterprise has changed" *(Deininger, 2002, p.993);* (iii) the land reform progress is uneven between these two groups of countries – V4 countries had mainly accomplished land privatization, while in FSU the process could be considered as still ongoing (or even stalled to some extent), (iv) the land reform progress differs substantially between Poland and Belarus. Among V4 countries, Poland is the country with the highest share of privatized land[20] and also is one of the most reform-advanced countries. Belarus is the least reformed country among the European FSU countries.

A detailed explanation of the slow progress of land reform in Belarus will be provided in Chapter 4, but in short, the slow progress of land reform are typically considered to be related to: (i) lack of governmental know-how regarding implementation of economic reform (ii) an absence of financial resources to support the institutional restructuring; (iii) lack of interest in land-privatization among the main actors involved in this process (central government, local officials, directors and chief executives of the large state farms and (surprisingly) the peasants themselves.

The liberalization of the outputs and inputs markets followed particular paths and had specific features in each of the seven studied countries due to the different initial conditions, chosen transformation policy and so on. However, besides the specific differences, some common evolutionary trends in the processes of the market liberalization within the period in question (1990-2004) can be identified. *Anderson and Swinnen (2008)* did the most comprehensive analysis, which is as well the one most relevant to this work**.** They identified the following two periods during the process of market liberalization: the transition period (1989-2000) and the pre-EU accession period (2000-2004), referring mainly to the Central Eastern European countries (V4 and other mainly non-FSU countries)

According to these researchers, the ***transition period*** was characterized by three main phases: (1) the liberalization phase, (2) "the fire-brigade policy-making phase" and (3) the "policy- consolidation phase", although they mentioned that, "in reality, there was no clear

[19] with some exceptions

[20] Although it is mainly because Poland was the only socialist country with the predominantly private small-scale and family-run agriculture

separation among the phases and not all countries moved from one phase to the next at the same time" *(Anderson and Swinnen, 2008, p. 57*)**.**

The "liberalization phase" (1988-1992), for these researchers was marked by trade and price liberalization and a reduction of subsidies to producers and consumers, which resulted in a soaring of consumer prices, a decline in real incomes and a fall in domestic demand.

During the second phase *("the fire-brigade policy making***"** in "the early to mid-1990s" *(Anderson and Swinnen, 2008, p. 58*) CEEC governments responded to the pressures of the social conflict (caused by plummeting incomes and soaring prices) by "introducing or re-introducing price and trade interventions in order to protect consumers and producers against the negative … effects" *(Anderson and Swinnen, 2008, p.58)*

During the **"***policy consolidation phase"* of the transition period (from the mid-1990s to 2000), governments had "attempted to formulate more comprehensive agricultural policies for long-term intervention in agriculture. Most of the policy regimes passed through the various degrees of re-instumentalization to address domestic policy objectives, comply with international agreements, or, later, bring agricultural policies more in line with the policies of the EU. Some governments introduced policy instruments that already resembled the CAP prior to the MacSharry reforms" *(Anderson and Swinnen, 2008, p.59)*

The pre-EU accession period (2000-2004) for Poland, Czech Republic, Slovakia and Hungary could be considered, in Anderson and Swinnen's view, to be the onset of the EU policy convergence, narrowing "the gap in product quality and prices" between the CEEC and Western Europe and the rapid growth of the trade integration and foreign investment *(Anderson and Swinnen, 2008, p.60).*

If one would were to apply this periodization framework to the FSU countries in question, it would be possible to conclude that FSU countries went through the *"liberalization phase"* and entered the *"fire-brigade policy making phase"* at the same time as the V4 countries. However, after that the progressive onward movement through the following phases was slowed down substantially, and FSU countries got stuck in either the *"fire-brigade policy-making phase" or the* **"***policy-consolidation phase"* due to the FSU governments' inexperience, agricultural policy inconsistence (or even absence of the long-term agricultural policy) and no perspective for the EU accession (and consequently no access to the EU pre-accession funds).

Although Poland and Belarus followed the above-described tendencies in general, there were some country-relevant specificities of these processes, which will be discussed later in Chapters 3 and 4.

Finalizing the analysis of the process of the liberalization of the outputs and inputs market, it is possible to conclude that although each country followed its own particular market liberalization approach, agricultural policy in all seven countries in question followed the same path: at the beginning of the transformation process in 1989, agricultural policy was oriented to build up the liberal agricultural economy with low support and protectionist levels (*Agricultural Situation and Prospects in CEEC, 1998)*, but during the transformation period this free-market agricultural policy gradually transformed into a more protectionist and better regulated one.

The establishment of a new **institutional structure** relevant to the market economy was a very complex and politically difficult task, which in general required (i) diminishing the role of government influence in the agricultural sector; (ii) the development and implementation of a new legal framework and (iii) a modification of the "education-research-extension" system.

The change of the governmental role in agriculture mainly meant the replacement of its typical command-economy functions as the "establishment of mandatory targets for production and/or delivery of goods and central distribution of investments and inputs" *(Csaki, 2002, p.16)* to functions more appropriate to a market economy such as the establishment of "the ground rules and facilitate[ing] the conditions for smooth and prosperous operation of markets and independent business organizations" *(Csaki, 2002, p.16)***.** This task was supposed to be implemented by the modification of the former "command economy" Ministries of Agriculture, a dismantling of the former units related to central-planning and direct intervention missions and the establishing of new "market-oriented" agencies and funds.

An analysis of the process and outcomes of the diminishing of the government's role in the agricultural sector shows that in V4 countries, this process was accelerated from the very beginning of the 1990s and was almost accomplished by the turn of the century (it was also stimulated by the envisaged EU accession). The structures of the former Ministries of Agriculture were reorganized and new institutions (agencies, funds, payment units) responsible for the implementation and administration of particular goals of agricultural polic**y**[21] were established and began to operate. However, in the FSU countries in question, the government and government-related institutions still performed the same functions as during the Socialist period, especially in Belarus and Ukraine. In Russia, some minor changes were implemented; the Ministry of Agriculture was reorganized and parts of its

[21] like channeling the preferential credits to agriculture, agricultural product intervention purchases and prices regulation, administration of the former state land (state farms)

responsibilities were transferred to the few newly created Federal Agencies in charge of rural development and agricultural markets.

The development and implementation of the ***new legal framework*** also differed among the V4 and FSU countries. A glance at the chronology and typology of the adopted and implemented legislation reveals that in the V4 countries, this process underwent the following three phases: (i) adoption and implementation of the legislation essential for the transition from a centrally-planned to market-oriented economy (roughly 1988 -1995) (ii) adoption and implementation of legislation crucial for the operation of the newly established market-oriented agricultural system (roughly 1996-1999) and (iii) the harmonization of national agricultural legislation with EU norms and standards (1999-2004). Such an evolution of agricultural legislation (and further EU and CAP accession after 2004) allows us to assess the process of the development and implementation of the new legal framework for the V4 countries in question, as it was mostly accomplished during the fifteen years of transformation.

However, in the FSU countries, the process of development and implementation of the new legal framework was interrupted somewhere between the first and second above-described V4 phases. As a result, the agricultural legislation (even fifteen years after the beginning of the transformation in the 1990s) still retained the main features of the former command economy.

Regarding the process and outcomes of the ***reform (modification) of the "education-research-extension" system,*** the seven countries in question could roughly be divided into three groups, according to a World Bank assessment report *(Csaki and Zuschlag, 2004*). The first group is comprised of the countries that already completed education and research system reorganization (or nearly completed, as for year 2004), and created a western-type extension system (e.g., Hungary and Czech Republic), where only some minor improvements needed to be introduced. The second group is made up of the countries in which, despite the reform efforts, the educational, research and extension systems were still (as for year 2004) not fully relevant to market economy conditions and required further improvements (e.g., Poland and the Czech Republic). The third group is comprised of all FSU countries in question (Belarus, Russia and Ukraine) in which the adjustment of the agricultural education and research systems was very slow, had suffered from insufficient financing and in which a Western type of extension system had not been established yet.

Finalizing the issue of the analysis of the institutional reforms, it is possible to conclude that profound differences exist between the V4 and FSU countries in terms of

the speed, scope and outcomes of this process, with practically accomplished institutional reforms in V4 countries and a very modestly transformed institutional system in FSU countries.

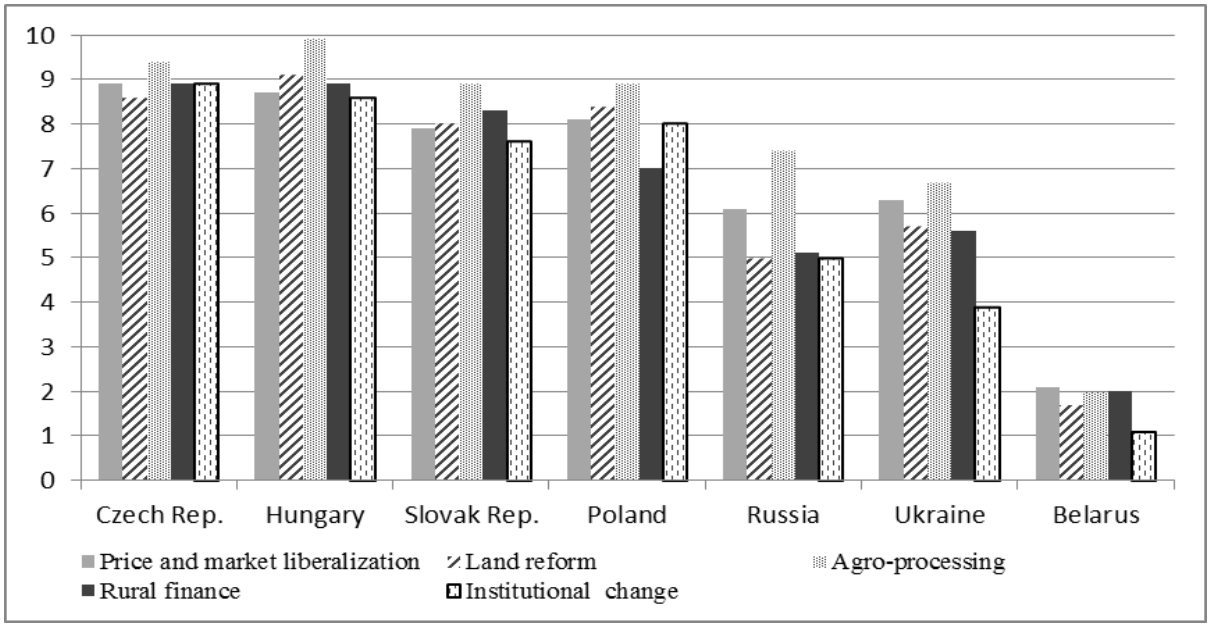
The results of the above-provided analysis of the progress of the three main components of the transformation process (land reform, market liberalization and institutional changes) are supported by a numerical assessment of the reform progress provided by the Agricultural Reform Index of the World Bank. This "Agricultural Reform Index" is a composite index that measures the progress of the following five transformational reforms: (i) land reform, (ii) "liberalization of agricultural markets" (price and market liberalization), (iii) "establishment of an institutional framework for marker agriculture", (iv) "privatization and demonopolization of agricultural services" (agro-processing), and (v) "development of rural finance" (*Lerman, 2007b, p.2)***.** This Index has "a scale from 1 to 10, where 1 corresponds to a command economy and 10 to an economy with completed market reforms" *(Lerman, 2007b, p.3)***.**

The most important limitation of this Agricultural Reforms Index, from our point of view, is its short time-span (only the years 1997-2005), which does not cover the beginning of the transformation period (1990-1996), when the most radical and important changes happened. Therefore, it revealed no significant dynamic changes (which took place in 1990-1996), but provided a clear-cut picture of the final outcomes of the agricultural reforms and cross-country differences in it.

Other, more general limitations of this index include the "subjectivity of expert opinion", statistical unreliability, limited cross-country comparability, vagueness of score attribution and so forth are well-described by *Wandel et al. (2011)***.** Therefore, although the Index does not provide much insight into the dynamics of the reform processes during the whole period in question, it could be used as a good benchmark for an assessment of the final results of the agricultural reforms by the end of 2005 year.

The analysis of the Agricultural Reform Index during the 1997-2005 period confirms the "uneven reform progress" *(Csaki and Zuschlag, 2004, p.20)* between the V4 and FSU countries, previously established in this section. (**Figure 2.2**. provides the results summary, while the detailed annual dynamic is found in **Appendix 2.1)**

Figure 2.2. Status of agricultural reform [22]



As for years 1997-2003, the V4 countries were the "fast reformers," with a total score of reforms (Agricultural Reform Index) ranging from 9.0 for Hungary and 8.1 for Poland and Slovakia, with the FSU countries lagging far behind with a score of 5.7 for Russia, 5.6 for Ukraine and even 1.8 for Belarus. Starting from 2004, the V4 countries that joined the EU were no longer considered in this ranking, because according to the authors of the report, the V4 countries accession to EU had automatically assumed the completion of the market reforms in these countries. The total score for Russia, Ukraine and Belarus remained practically unchanged for the subsequent 2004-2005 years.[23]

Therefore, finalizing the issue of the reform processes and its outcomes in the seven countries in question, it is possible to come to following conclusions: (i) despite the specific reform path of each country, in V4 countries (Poland, Hungary, the Czech Republic, the Slovak Republic) the transition of ex-Socialist agriculture from a centrally planned to market-oriented system was practically accomplished by 2004, while in the FSU countries only "moderate progress" *(Csaki et.al., 2004, p.viii)* was achieved by some countries (Russia, Ukraine) and practically no progress was observed in Belarus; (ii) Poland and Belarus differ significantly in terms of the reform progress; Poland is among the best reformers in the CEEC region, while Belarus is the least-reformed country, not only among the V4, but also among the FSU countries.

[22] Based on *Csaki et al. (2006), Csaki and Zuschlag (2004*) and *Csaki and Nash (1998)* data

[23] The Agricultural Reform Index was only calculated for 1997-2005. Any evaluations have not been published since 2006.

2.2. CEEC agricultural production during the transformation period.

This section analyzes the Gross Agricultural Output (GAO) production in the CEE countries. It is organized in the following way: it starts with the rationale for using agricultural output as an indicator of the "success or failure" of the reforms; next, a detailed GAO dynamics analysis is provided; then, an overview of the reasons for the decline and slow recovery of the GAO provided in contemporary literature is presented; after that, a detailed analysis of the impact of price liberalization and subsidization policies as the most commonly referred reasons for the initial GAO decline is offered; and finally, the concluding remarks end the section.

Before starting the analysis of the agricultural output dynamic, I shall provide my rationale for using agricultural production (output) dynamics as the measure of the success of the reforms.

One of the primary goals of agricultural reform (as proclaimed by the politicians of the CEE countries) was the solving of the problem of food shortages *(Childress, 2002)* or deficits of some food products. It was expected that after the implementation of the market reforms, the liberalized agriculture would be able to produce more output, thereby solving the food-shortage problem.

The theoretical background for this approach (although highly criticized by *Aslund (2012) and Diamond (1999)* is provided by *Przeworski (1991),* who argued that "democracy had to justify itself by material achievements" (*Przeworski, 1991, p.32),* and assumed "that people opted for democracy for the sake of economic welfare, not for political reasons" according to Aslund *(2012, p.48).*

Hence, at the risk of oversimplification, the main goal of the agricultural reforms in the CEEC region as proclaimed by local politicians and included in every reform agenda was not reform for the sake of reform, but rather, reform toward an increase agricultural output, in order to solve the food deficit/food shortage problem.

However, the implementation of market reforms in the CEE countries has not yet brought the expected fast and straightforward agricultural recovery. On the contrary, agricultural production initially experienced a steep decline, which was obvious when compared to the agricultural production increase (during the same period of time) in the developed countries.

This situation surprised many observers, because after the successful completion of agricultural reforms in the East Asia region (China, Vietnam, Laos, and Myanmar) it was expected that the CEE and FSU countries' transformation would bring immediate growth and

recovery in agriculture (*Brooks and Nash, 2002).* The difference in the agricultural production dynamics between the East Asian and CEE (FSU) countries was remarkable. During first decade of its transformation, the Gross Agricultural Output (GAO) rapidly increased in East Asian countries, but in all Eastern European and FSU countries it fell steeply (**see Appendix 2.2.).**

However the speed of the GAO recovery (i.e., length of time between the beginning of the transformation and reaching the nadir of the GAO decline) differs susbstantially among the Eastern European and FSU countries. First, the GAO decline was halted in the Balkan countries (Albania, Romania, and Slovenia) - two to three years after the transformation began. Then, it was halted in most Eastern European countries (Poland, Hungary, and Czech Republic) and in some FSU-Central Asian countries (Kyrgyzstan, Turkmenistan, and Uzbekistan) - five to six years into the transformation. And finally, almost ten years into the transformation, the most prolonged and profound GAO decline was halted in Russia, Ukraine, Kazakhstan, Estonia, Latvia and Lithuania (*Rozelle and Swinnen, 2004).*

A country-relevant GAO dynamic analysis (**Table 2.3 and Appendix 2.3.)** clearly shows that every country from the CEEC region experienced an initial decline in gross agricultural production during the transformation period (the scale of which differs from country to country), which was then followed by an increase.

The Polish GAO decline can be considered small and fairly stable over the studied period. The Czech Republic's and Slovakia's GAO continued its downward slide till the turn of the century. Hungary's GAO dropped at the beginning of the transformation period, and then began to recover. The GAO in Belarus, Russia and Ukraine had a steep downward trend till the end of 1990s, and then started to show signs of recovery (see **Appendix 2.3.).**

The results of the GAO dynamic analysis allow us to come to the following conclusions with respect to the magnitude, speed, reform policy and regional differences of GAO declines. The magnitude of GAO decline varies substantially, from the 83.7% average GAO in Poland to 62.9% in Slovakia, and there is no substantial sub-regional difference in the average annual decline level between V4 and FSU countries: the maximum GAO average for Poland is 83.7% and 80.1% for Belarus, the minimum GAO average for Slovakia is 62.9% and 65.9% for Ukraine.

The period during which countries reached the minimum level of GAO very clearly reflects the type of the reform policy implemented during the transformation. Countries such as Poland and Hungary that chose a "Big Bang" reform approach reached their bottom line faster than other countries and started to recover faster. Their GAO decrease was the lowest in

the CEEC region. All the FSU and some V4 countries (Czech Republic and Slovakia) that opted for a more gradual reform path reached their minimum GAO level almost a full decade after the transition , and the magnitude of their GAO decline was more profound, than in the "fast-paced" reforming countries.

Table 2.3. CEE countries' GAO and GDP dynamics[24]

	Hungary		**Poland**		**Chech R.**		**Slovakia**		**Belarus**		**Russia**		**Ukraine**	
	GAO	***GDP***	***GAO***	***GDP***	***GAO***	***GDP***	***GAO***	***GDP***	***GAO***	***GDP***	***GAO***	***GDP***	***GAO***	***GDP***
1990	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1991	100.4	88	92.5	93	91.1	88	90.9	85	94.5	99	89.9	95	85.8	92
1992	78.9	85	80.8	95	80.1	88	71.2	80	90.3	89	87.7	81	79.4	83
1993	71.1	85	90.8	99	78.3	88	65.4	77	94.4	83	83.3	74	79.8	71
1994	74	87	75.6	104	67.8	91	62.4	81	79.5	73	73.2	65	67.8	55
1995	72.2	89	81.9	111	69.8	96	59.6	86	77	65	68.4	62	66.1	48
1996	77.8	89	84.6	118	70.7	101	61.8	92	79.6	67	66.1	60	59.4	43
1997	79	92	80	127	67.9	100	62	96	73.1	75	67.1	61	59.6	42
1998	79.1	95	86.5	133	68.6	99	58.7	101	72.7	81	56.2	58	52.3	41
1999	76.3	98	81	139	68.8	101	55.5	101	67.5	84	56.7	61	49.5	41
2000	73.4	103	80.7	145	66.1	105	48	102	71	89	60.5	67	54	43
2001	83.9	106	81.5	147	68	109	51.5	106	71.9	93	64.6	71	57.6	47
2002	75.2	111	79	149	64.6	111	52.7	110	72.6	98	66.4	74	59.3	50
2003	72	115	77.6	155	58.3	115	48.9	116	73.9	104	64.9	79	54.2	55
2004	88.3	121	82.5	163	69.9	121	54.3	121	83.6	116	67.4	85	63.3	61
GAO min	**71.1**		**75.6**		**58.3**		**48**		**67.5**		**56.2**		**49.5**	
GAO avg.	**80.1**		**83.7**		**72.7**		**62.9**		**80.1**		**71.5**		**65.9**	
2006	*76.3*	*131*	*77*	*179*	*59.4*	*138*	*49.4*	*140*	*88*	*140*	*69.3*	*98*	*63.1*	*67*
2008	*82.2*	*132*	*81.7*	*201*	*65*	*150*	*53.5*	*164*	*98.7*	*168*	*74.9*	*112*	*72.6*	*74*
2010	*65*	*125*	*79.6*	*213*	*58.4*	*147*	*43.4*	*162*	*99.1*	*181*	*64*	*108*	*67.5*	*66*

The comparison of GAO and GDP dynamics during the period in question shows that GAO decline to some extent correlates with GDP decline. This interdependence was studied by *Lerman (2000)* and will be discussed in the next paragraphs, among the other explanations of GAO dynamic changes.

Despite the clear differences in GAO dynamic, none of the studied countries, has not reached the pre-transition level of production neither by the end of the period in question

[24] The GAO data for data for Hungary, Poland, Belarus, Russia and Ukraine are from *Fuglie (2012).* The GAO data for Czech Republic and Slovakia for 1993-2010 are from FAO. The GAO data for Czech Republic and Slovakia for 1990-1993 are from National Statistical Datasets. Available at: http://faostat.fao.org and http://www.ers.usda.gov/data-products/international-agricultural-productivity/documentation-and-methods.aspx (Accesses: December 20, 2013). For GDP (GDP in constant LCU) data are from WB database. Available at: http://databank.worldbank.org/data/views/reports/tableview.aspx (Accessed: May 2, 2014).

(year 2004), nor by the year 2010. Moreover, Czech Republic and Slovakia started to encounter the second phase of GAO decline after the 2004.

Finalizing the assessment of the agricultural production (output) dynamic in the selected CEE countries in "absolute terms" (GAO dynamic measured in the comparable index numbers), it is possible to conclude that Poland, Hungary and Belarus performed better than the other countries in question - all of these countries have the lowest level of GAO decline and all show strong evidence of GAO recovery.

Many reasons have been advanced to explain the collapse of output during the initial period of transformation and its slow recovery afterwards. These explanations can be divided roughly into the following groups: (i) mainly descriptive statements (demand-supply issues, multidimensional explanations, input-output prices ratio, inputs use decline, overall economy slowdown) and (ii) empirically supported explanations (econometric models that measured the impact of selected political and economic reforms on agricultural output). The next paragraphs of this section will provide a brief overview of these explanations, and after that, a more detailed analysis of the most common explanations of output decline (e.g., price liberalization, changes in subsidization policy and decline in inputs use) will be provided.

Demand-supply related classification of the reasons for general GDP decline is provided by *Roberts (1995, p.4).* As to "demand-side" explanations, she assessed the "restrictive macroeconomic policies" discussed by *Berg and Sachs (1992*), the disruption of CMEA trade explored by *Crane (1993*) and a reduction of aggregate demand and a shift in the composition of the demand analysed by *Charemza (1993) and Gomulka (1991*). The "supply-side" explanations include the destruction of economic institutions and marketing mechanisms provided by *Kornai (1994)* and *Williamson (1993)*, an increase in input prices and a lack of credit resources for purchasing necessary inputs explained by *Calvo and Corricelli (1992).*

A set of multidimensional explanations specifically for CEEC agriculture is elaborated by *Szelenyi (1998)* and *Cian and Pokrivcak (2007). Szelenyi (1998)* presented four causes for the initial collapse of agricultural production in post-Communist countries: (1) a problem-ridden economy inherited from Communism; (2) the shrinking of international and domestic markets; (3) a doctrinaire application of the neo-liberal ideology of the new political class; and (4) a prevalence of "agrarian technocracy" interests which caused rapid privatization. *Cian and Pokrivcak (2007)* proposed the (1) disruption of the socialist exchange system; (2) price and trade liberalization; (3) subsidy cuts; (4) shift of the ownership rights from the state to private individuals; (5) the reduction of the farm size due to re-structuring; and (6) the

reduction of the inputs' use (fertilizers, labor, tractors, land) as possible reasons for the agricultural decline.

The interdependence and extent of the influence of the all above-mentioned factors on the initial agricultural production decline by using an "output-input prices ratio" explanation is investigated in *Ratinger et al. (2006)* study. The authors imply that trade liberalization after transition coincided with low world agricultural prices and contributed to a worsening of agricultural terms of trade. The prices of agricultural output grew more slowly than input prices after liberalization. For example, *Dicke and Misala (1993*) asserted that in 1990, in Poland, prices paid to farmers increased on average only 4 times, while prices for agricultural inputs increased 8 times. In the early years of transition, price liberalization allowed agricultural input prices to rise to world market levels, with the presence of monopolies in the input industries serving to exaggerate this rise in prices. At the same time, agricultural output prices did not rise so quickly. This was partially the result of the falling demand for food during the transition, and partially because the pre-transition subsidies were withdrawn.

The reduction of the use of inputs as the reason for the initial agricultural production decline was studied by *Ciaian and Pokrivcak (2007).* They specified that variable inputs (e.g., fertiliser and labour) declined more than fixed inputs (e.g., tractors and land). They argued that this was caused by the fact that variable inputs are easier to adjust (move), while fixed inputs are more specific to agriculture and are immobile in the short-run. *Dicke and Misala (1993*) agreed that some of the above-mentioned factors can cause agricultural decline, such as a fall in demand for agricultural products, a decrease in the prices of agricultural products and a reduction in agricultural inputs purchases.

The interdependence of GAO and overall output decline is investigated by *Lerman (2000)***,** basing this idea on the assumption of the existence of a positive relationship between GDP growth and GAO growth. The results of his "CEE vs. FSU" comparison in regard to GDP and GAO growth during 1992-1997 show that the CEE countries that had a positive GDP growth also experienced the lowest GAO decline, while the FSU countries with negative GDP growth had a 5-times higher decline in GAO than CEE countries.

The pooled regression estimated for the seven countries in question for 1990-2004 also supports the hypothesis of the dependence of GDP on GAO (see **Table 2.3.1.** for the summary of the regression results and **Appendix 2.3.1.** for regression results in EView format).

Table 2.3.1. Regression results for GAO vs. GDP dependence model.

Dependent variable: GAO							
Model: GAO =GDP (GDP was estimated as the cross-section specific coefficient)							
	GDP Belarus	**GDP Czech R.**	**GDP Hungary**	**GDP Poland**	**GDP Russia**	**GDP Slovakia**	**GDP Ukraine**
coef.	0.97	0.92	0.95	0.91	0.99	0.90	1.03
t value	98.47	87.47	121.26	81.60	145.95	58.27	115.99
Linear estimation after one-step weighting matrix							
No. of countr.	7		***R^2***	0.92			
No. of observ.	15		***Adj. R^2***	0.92			
Durbin-Watson st.	1.6						

An empirical model of the impact of selected political and economic reforms on CEEC agricultural output was elaborated by *Macours and Swinnen (2000a).*[25] They argued that the initial decline in agricultural output was mainly the result of the market liberalization policies (reduction of subsidies, price and trade liberalization). According to their research, price liberalization and subsidy cuts contributed to almost 50% of output decline. The severe drought and transition uncertainty (each of them) explained around 10% of the output decline. The impact of farm restructuring, privatizations and associated disruptions varied among the CEE countries because they depended on initial conditions and the choice of reform policies.

Although an analysis of the existing scholarship provides plenty of explanations regarding the reasons for GAO decline, the main (and the most commonly referred to) reasons are usually considered the following: (i) the price liberalization, (ii) changes in subsidization policy and (iii) changes in inputs use.

The next paragraphs of this section will provide a detailed theoretical analysis of the influence of price liberalization and changes in subsidization policy on GAO dynamics during the period in question, while the empirical testing of the impact of the changes in inputs use on GAO dynamic will be done in the separate (last) section of this CEEC chapter.

The centrally-planned price regulation was one of the key features of the socialist economies *(Rozelle and Swinnen, 2004*). The market role of the prices was limited and relegated to the position of providing accounting information that could be used for monitoring and control of enterprises by the central authorities. The liberalization of

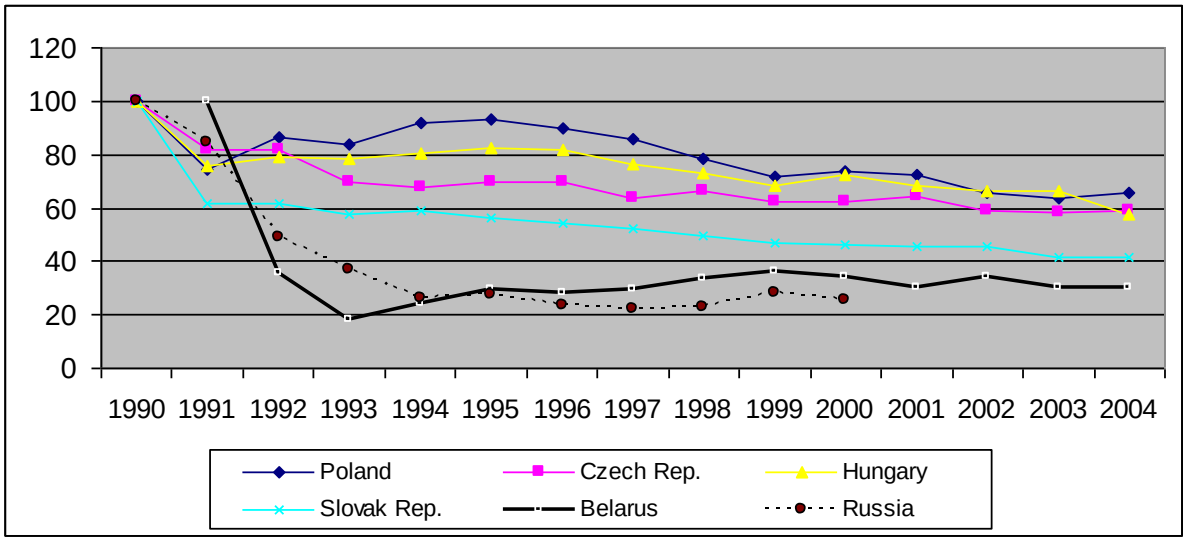
[25] The study covers the output of the five main crops (wheat, corn, barley, sugar and oilseeds in eight CEE countries (Albania, Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia) during 1989-1995.

agricultural prices had started at the beginning of the 1990s in all seven countries in question, although its scope and starting dates differ throughout the region. For example, in Poland the majority of agricultural prices were set free while in Belarus the government kept control over the prices for so-called "socially significant" food and agricultural products. The price liberalization in Russia officially started in 1992, while in Poland it started in 1990.

All the market (price) liberalization programs in the CEE countries were implemented with the expectation that liberalization would allow the previously distorted agricultural prices to align and, thus would lead to an increase in economic efficiency.

However, at the beginning of transformation period, liberalization negatively affected both input and output prices. The financial situation of the former state-owned enterprises in the downstream and upstream sectors (i.e., the food and chemical industries) worsened because of liberalization (due to the subsidies removal, hyperinflation, interest rates increase and so forth). Therefore, following the market (prices) liberalization agenda and sometimes using their monopolistic position in the market, the upstream-sector enterprises[26] increased the inputs' prices, and in some cases even limited the inputs' production, while the downstream-sector enterprises[27] restricted purchases from agricultural producers and attempted to lower the prices offered to farmers by using its monopolistic position in the markets. All this led to a significant terms of trade deterioration at the beginning of the transformation, which took place in every studied country and was especially drastic in the FSU. (The detailed data are in **Appendix 2.4.** and the summary is in **Figure 2.3)**

Figure 2.3. Terms of trade deterioration in CEEC (1990-2004)



[26] The term "upstream sector" refers to the input (fertilizers, machinery and etc.) supply enterprises.
[27] The term "downstream sector" refers to the food processing industry.

Moreover, this declining trend for terms of trade continued until the end of the 2000s. (except for Belarus) with no significant signs of recovery, contrary to the slow GAO recovery, which started from the mid-1990s. This fact could be explained by an analysis of the changes in the subsidy policies in CEE countries that took place during the transformation period.

During the Communist era, CEEC agriculture was supported by the state through different types of subsidies for agricultural producers, inputs' producers, food processing industry and consumers (by keeping food prices artificially low). At the beginning of the transformation, agricultural support for all these groups was reduced substantially, which caused a significant decrease of GAO. However, starting from the mid-1990s, due to the increasing pressure of the so-called "agricultural lobby" and in response to social pressure, the majority of CEEC governments re-introduced price and trade support, and state interventions in agriculture. The main difference between the seven CEE countries in question is that in the V4 countries, this re-introduced system of support was a newly constructed one based on the principles used by advanced Western-European economies, together with the introduction of "hard-budget" constraints, while in the FSU countries, this re-introduced system of support was a revitalized former Socialist central-planning system (with just small modifications), which coexisted with "soft-budget" constraints for agricultural producers.

In any case, despite the differences in the institutional basis of the agricultural support system, the re-introduction of the system of agricultural support in the mid-1990s substantially mitigated the negative effects of the terms of trade deterioration (price liberalization). The impact of this re-introduction continued from the mid-1990s until the end of 2000s, and thus substantially influenced the GAO recovery during this period.

A more detailed country-relevant analysis of the impact of the agricultural support policy on GAO dynamics (provided in next paragraphs) yielded some interesting and controversial results. This analysis has been done for the CEE countries in question (except Belarus[28]) using WB data for NRA,[29] OECD data for PSE [30, 31] (see **Appendix 2.5**).and data from **Table 2.3** for Gross Agricultural Output.

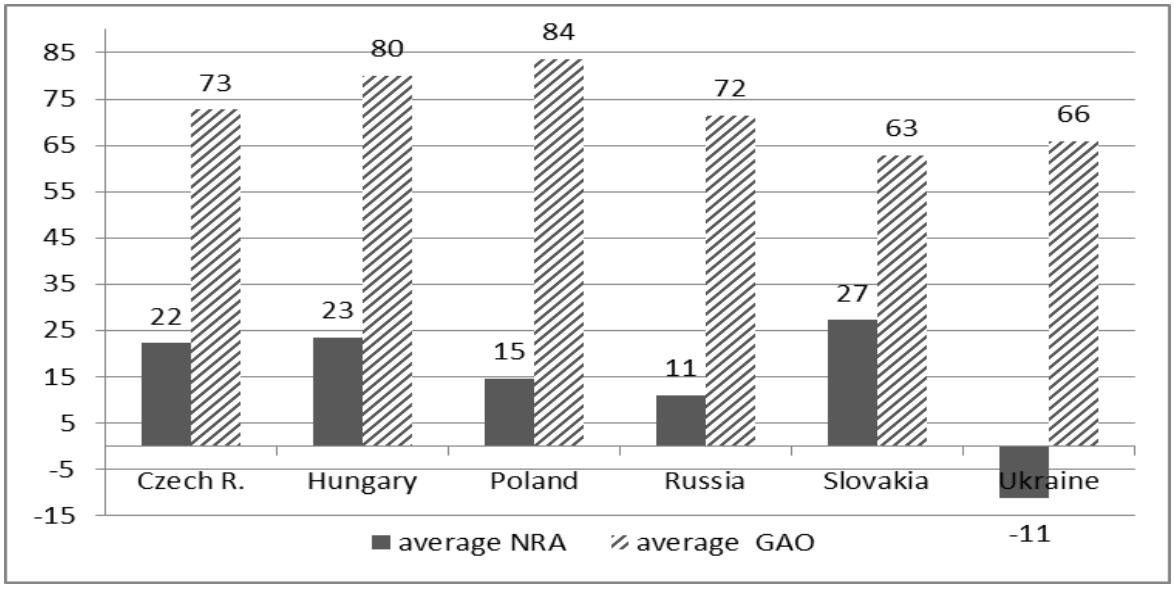
[28] because of the absence of PSE and NRA estimations for Belarus

[29] The NRA is the weighted average of the nominal rate of assistance at the product level, where the industry's value share of the each product is used as a weight *(Anderson, 2010).*

[30] PSE are the most commonly used measures of support to agriculture, which originally were called "producer subsidy equivalents", but in 1999 , the Agricultural Directorate of OECD, which annually calculated PSEs, changed it's use of the phrase to "producer support estimates" (*Liefert and Swinnen, 2002)*

The comparative analysis of the NRA and GAO dynamics (**see Figure 2.4**.) surprisingly shows that the V4 countries (except Poland) have an NRA rate that is double that of the FSU countries with practically the same level of GAO. These results indicate that the agricultural sectors of the V4 countries (Czech Republic, Hungary and Slovakia) were heavily dependent on the subsidies, which definitely could not be considered a reflection of reform success.

Figure 2.4. Average NRA and GAO for 1990 -2004 [32]



An analysis of agricultural subsidization using PSE data was done due to the possibility of comparison of the pre-transition period (1986-1989) and transition period data. To be more specific, this analysis was done using the data for PSE from the pre-transition period (1986-1989), selected years from the final phase of the transition (2000-2003) and the average GAO for 1990-2004.

This analysis allowed us to distinguish the following three groups of countries. In the first group were countries that experienced a decline in "percentage PSE" and some increase in the "share of the standard PSE commodities", (e.g., Czech Republic, Hungary and Slovakia). The second group was comprised of countries that experienced a "soft decline" both in percentage PSE and in the share of standard PSE commodities, (e.g., Poland). The

[31] The Producer Support Estimate (PSE) is estimated as "the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm-gate level, arising from policy measures that support agriculture, regardless of their nature, objectives or impacts on farm production or income". Percentage PSE (%PSE) is estimated as the "PSE as a share of gross farm receipts (including support)" (*OECD's Producer Support Estimate, 2010, p.17)*

[32] WB database. Available at: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPROGRAMS/EXTTRADERESEARCH/0,,contentMDK:21812190~pagePK:64168182~piPK:64168060~theSitePK:544849,00.html (Accessed: July 25, 2011)

third group was made up of countries with a very sharp and drastic decline both in percentage PSE and in the share of standard PSE commodities (e.g.,Russia and Ukraine) (see **Table 2.4.)**

Table 2.4. PSE and GAO dynamic[33]

	average for 1986-1989	**average for 2000-2003**	**average GAO for 1990-2004**
Czech Republic			72.7
Share of standard PSE commodities	67.8	73.2	
Percentage PSE	55.25	23	
Hungary			80.1
Share of standard PSE commodities	73.2	75.3	
Percentage PSE	35.5	26	
Poland			83.7
Share of standard PSE commodities	79.5	56.8	
Percentage PSE	20.8	13.2	
Russia			71.5
Share of standard PSE commodities	73.5	8.8	
Percentage PSE	80.5	12.5	
Slovakia			62.9
Share of standard PSE commodities	66	75.3	
Percentage PSE	49.3	21	
Ukraine			65.9
Share of standard PSE commodities	73.6	-4.8	
Percentage PSE	77.3	0.3	

The analysis of the GAO dynamics in connection with the above-noted results concerning agricultural support dynamics have yielded some predictable as well as some confusing and contradictory conclusions. The "predictable result" is the suggestion that in the pre-reform period, CEEC agriculture was heavily subsidized, and the reduction in the level of subsidies could explaine some part of the GAO decline.

The "confusing and contradictory" part of the story is that the countries from the first group (Czech Republic, Hungary and Slovakia) with the small decline in percentage PSE and increase of the share of standard PSE commodities achieved practically the same level of GAO as the countries from the third group (Russia and Ukraine), which had experienced a drastic decline in both percentage PSE and share of standard PSE commodities. These findings point to the idea that (1) agricultural sectors of the Czech Republic, Hungary and Slovakia even after the transformation reforms are still heavily dependent on agricultural support measures, something that cannot be considered a reform success; (2) in terms of the "comparative GAO dynamics",[34] Russia and Ukraine outperform the Czech Republic,

[33] PSE data are from OECD databse. Available at: www.oecd.org (Accessed: July 27, 2011)
[34] GAO dynamic vs. PSE dynamic

Hungary and Slovakia; (3) the agricultural sectors of Russia and Ukraine are the least dependent on agricultural support measures among the CEE countries, which to some extent could be considered as a reform success.

Only the "comparative" (GAO vs. PSE) dynamic analysis for Poland yielded a more-or-less "conventional picture". Having practically the same high share of commodities covered by PSE as Russia and Ukraine in the pre-transition period, Poland, during the transition period smoothly reduced both "the share of PSE commodities" and "percentage PSE", which resulted in only a mild GAO decline. Such reduction of both "the share of PSE commodities" and "percentage PSE" followed by a minimal decline of GAO, allows us to conclude that Polish agriculture had really became less dependent on subsidies and found its optimal reform path, which could be considered a reform success.

Finalizing the analysis of the agricultural output dynamic in the selected CEE countries, the following conclusions could be made:

(1) The assessment of the reforms results in "absolute terms" (GAO dynamics measured in comparable index numbers) shows that Poland, Hungary and Belarus performed better than other countries in question.

(2) Price liberalization and changes in subsidization policy had a significant impact on GAO dynamics. Price liberalization triggered substantial terms of trade deterioration, which continued during the whole period in question and was considered to be one of the reasons for GAO decline at the beginning of the transformation period (1990-1994, approximately). However, the negative impact of imbalanced and not thoughtfully developed price liberalization was mitigated by the re-introduction of a system of agricultural support (subsidization) starting from the mid-1990s, which continued during 1994-2004 period and influenced substantially the GAO recovery starting from the mid-1990s in V4 countries and from the 2000s in FSU countries.

(3) The assessment of the reforms results in "comparative terms"[35] (comparing the GAO dynamics vs. NRA-PSE dynamics and measuring in this way the dependence of the agricultural sector on subsidization) shows that the outcome of the market reforms could be considered a success for Poland (increase of GAO without a strong dependence on subsidies), a partial success for Russia and Ukraine and a failure for the Czech Republic, Hungary and Slovakia.

[35] comparing the GAO dynamic vv. NRA-PSE dynamic and measuring in this way the dependence of the agricultural sector on the subsidization

2.3. CEEC agricultural productivity during the transformation period.

This section is assesses whether the reforms succeeded or failed with respect to agricultural productivity. From the discussion in the Introduction Chapter and previous Section 2.2., it seems that agricultural production (output) improvements cannot be considered the sole measure of reform success, and moreover, that agricultural productivity is an even more appropriate indicator of reform success. [36]

With respect to this idea, I will try to answer the question "Could an increase in agricultural productivity be considered a reform success?" In order to do this, I plan to calculate and analyze partial productivity indicators for the selected inputs (land, labor, machinery and fertilizers) in order to determine whether there was an increase in partial productivity, and if so, for what kind of inputs it this had been true.

This section is organized as follows: it starts with an explanation of how the partial productivity indexes were estimated; next, the partial productivity dynamics of the above inputs will be analyzed; and finally, concluding remarks will be made about the appropriateness of considering calculated productivity indexes as indicators of reform success (or failiure), providing the background for TFP dynamic calculations.

Table 1, Table 2, Table 3, Table 4 and Table 5 (***in Appendix 2.6*)** provide the results of partial productivity analyses for land, labour, machinery and fertilizers inputs for V4 and FSU countries for 1990-2010. The results in ***Appendix 2.6.*** are presented in index numbers, which allows a cross-country and cross-inputs comparison. Every Table in ***Appendix 2.6.*** shows (1) the dynamic of the selected input productivity for each country; (2) the average speed of productivity change for each country during the transformation period (AVG 1990-2004); (3) average value of productivity for every year for the two sub-regions V4 (AVG V4) and FSU (AVG FSU); and (4) average value of productivity for every year for all seven countries (AVG all). **Table 2.5.** in the text summarizes the results of the partial productivity analysis only for selected years, just to show the very general tendencies.

The data for the partial productivity calculation were taken from *Fuglie (2012)* for all the countries (except for the Czech Republic and Slovakia). These data are considered to be of very good quality, because *Fuglie (2012)* did not simply collect the data, but made crucial qualitative adjustments for the variables (especially for the capital ones). For example, the "Tractors' data" are aggregated in the "40-CV tractor equivalents" (CV=metric horsepower), aggregating the number of 2-wheel tractors, 4-wheel tractors, and combine-harvesters, the

[36] According to *Liefert and Swinnenn (2004*) and Macours *and* Swinnen (1999) opinion.

Fertilizer data are the aggregated "N-fertilizer equivalents" and so on. However, the *Fuglie (2012)* data consider the Czech Republic and Slovakia as one unified country for the whole period in question (1990-2004), so all the data for the Czech Republic and Slovakia are taken from the FAO database[37], which does not do sufficient qualitative adjustments.

Table 2.5. Partial productivity in CEEC (selected years)

		Hungary	Poland	Czech R	Slovakia	Belarus	Russia	Ukraine
Land productivity	1990	**100**	**100**			**100**	**100**	**100**
	1993	75	92	**100**	**100**	95	85	80
	1995	76	83	89	91	76	71	67
	2000	80	84	84	74	71	64	56
	2004	98	95	90	105	91	73	66
Labor productitvity	1990	**100**	**100**			**100**	**100**	**100**
	1993	72	103	**100**	**100**	98	80	81
	1995	74	102	95	95	90	68	62
	2000	86	141	105	88	112	70	54
	2004	127	158	126	110	178	99	79
Machinery productivity	1990	**100**	**100**			**100**	**100**	**100**
	1993	40	93	**100**	**100**	88	93	72
	1995	41	73	87	101	78	90	65
	2000	33	73	73	96	112	113	78
	2004	39	71	84	116	174	176	80
Fertilizer productivity	1990	**100**	**100**			**100**	**100**	**100**
	1993	124	94	**100**	**100**	228	287	284
	1995	105	73	79	82	415	537	366
	2000	95	72	78	60	279	534	560
	2002	90	72	68	62	357	576	524

Partial productivity of land is calculated as the ratio of GAO to the total agricultural land.[38]

Partial productivity of the labour is calculated (i) as the ratio of the GAO to the number of agricultural workers and (ii) as the ratio of the GAO to the working hours. For the calculation of GAO per worker productivity for all countries (except for the Czech Republic and Slovakia) the GAO and the number of the economically active adults in agriculture were

[37] FAO/Production/Production indices/Agriculture (PIN)+ (Total)/Gross Production Index Number (2004-2006 = 100). Available at: http://faostat.fao.org/site/612/DesktopDefault.aspx?PageID=612#ancor (Accessed: January 10, 2014)

[38] *Fuglie (2012)* calculated the GAO as FAO gross agricultural output as the sum of the value of production of 189 crop and livestock commodities, valued at constant, global-average prices from 2004-2006 and measured in international 2005 $.

taken from *Fuglie (2012).* For the Czech Republic and Slovakia, the data for agricultural population[39] and GAO were taken from the FAO database.

Although the number of workers could be a "very handy proxy", it is not considered to be the best indicator for qualitative improvements *(Federico, 2005, p. 59).* Thus, the Annual Working Unit (AWU) was taken as a proxy of the working hours for the calculation of GAO per working hours productivity from the Eurostat database.[40] However, the analysis was done only for the V4 countries for 1995-2010 period, because of limited data availability.

Partial productivity of the machinery is calculated as the ratio of the GAO to the amount of farm machinery measured in items. For all countries (except for the Czech Republic and Slovakia) the machinery data were calculated as the total stock of farm machinery in "40-CV tractor equivalents" (CV=metric horsepower), aggregating the number of 2-wheel tractors, 4-wheel tractors, and combine-harvesters. For weights, she assumed 2-wheel tractors average 12 CV, 4-wheel tractors 40 CV, and combine-harvesters 20 CV. All data were taken from the FAO database except 2-wheel tractors, which she compiled herself from the national sources. The data for the Czech Republic and Slovakia were the number of agricultural tractors in use (without any aggregation).

Partial productivity of fertilizer is calculated as the ratio of the GAO to fertilizer consumption. For all countries (except for the Czech Republic and Slovakia) the fertilizer data were calculated as the metric tons of N, P2O5, K2O of fertilizer consumption measured in "N-fertilizer equivalents," where tons of fertilizer types were aggregated using weights based on their relative prices. Fertilizers and their respective weights in the aggregation are N (1.000), P2O5 (1.3576), and K2O (0.8532). Weights (relative price per ton of nutrient) were derived from IMF annual fertilizer price data from 1995-2012 using Ukraine Urea, U.S. Gulf Ports Superphosphate, and Canadian Potash. Data on N, P2O5, and K2O fertilizer consumption were from the International Fertilizer Association (IFA) where available, and otherwise from FAO. The data for Czech Republic and Slovakia fertilizers were the consumption of NPK in metric tons.

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[39] FAO/Resources/Population/Annual Time series/Agricultural population (1000)/ Population - Est. & Proj. Avaliable at : http://faostat.fao.org/site/550/DesktopDefault.aspx?PageID=550#ancor (Accessed: January 10, 2014)

[40] AWU (annual work unit), "corresponds to the work performed by one person who is occupied on an agricultural holding on a full-time basis. Full-time means the minimum hours required by the relevant national provisions governing contracts of employment. If the national provisions do not indicate the number of hours, then 1,800 hours are taken to be the minimum annual working hours: equivalent to 225 working days of eight hours each". Eurostat database Available at: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Annual_work_unit_(AWU) http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do;jsessionid=9ea7d07d30d65dc56f91cd7341bcafae9ad1763c353e.e34MbxeSaxaSc40LbNiMbxeNaNyKe0 (Accessed: January 5, 2014)

An analysis of the partial productivity indicators for the land, labour, machinery and fertilizer inputs allows us to come to the following conclusions.

Land reform was the main issue on the transformation agenda of all transition-economy countries. Although each country followed its country-specific land reform path, practically all land-reform agendas were concentrated on change of land ownership rights, rather than on changes in total agricultural land use. As such, **land productivity** can be considered the most stable, coherent and also the least declined partial productivity indicator, because the steady decline of land productivity was experienced by every CEE country. During the studied period (1990-2004), land productivity steadily declined in all 7 countries by almost 20% below its pre-transition level, and sub-regional comparison (FSU vs. V4) shows no significant differences in the magnitude of decline. This tendency continued for the next 5 years (with the exception of Belarus) (see **Table 1 in Appendix 2.6**)

A more important indicator of reform effectiveness –**labour productivity**- was more affected by the reforms and shows a more profound magnitude of change (see **Table 2** in **Appendix 2.6.).** In general, the labour productivity decreased on average by 4% during the studied period (1990-2004) in all 7 CEE countries in question. However, the cross-country and sub-regional comparison (V4 vs. FSU) shows a significant difference in labour productivity trends. In the V4 countries (except Hungary), labour productivity steadily increased or remained more or less the same as in the pre-transition period, while in the FSU countries (except Belarus) it steadily declined by 20% on average in Russia and by almost 30% in Ukraine. These differences in labour productivity dynamics could be explained by the differences in the respective reforms' approaches toward agricultural labour between the V4 and FSU countries – the former implemented labor-shrinking approaches, while the latter promoted "labor-preserving" approaches. Therefore, in V4 countries, agricultural labour constantly and significantly decreased, while in the FSU (except Belarus) there were 5-6 year-long periods when the agricultural labor index was the same or even higher than in the pre-transition period.

The analysis of the long-term trends (1990-2010) reveals signs of convergence among the studied countries. In the next 5 years (2005-2010) labour productivity in all seven CEE countries started to show a clear upward tendency, and by the end of 2010 it increased by 46% on average in FSU countries and by almost 30% on average in V4 countries.

A long-term increase of labour productivity is also observed while taking into consideration the quantity of working hours as the base for labour productivity calculations (see **Table 3** in **Appendix 2.6).** The analysis of the labour productivity measured in Annual

Work Units (AWU) for 1995-2010 shows an even clearer tendency for labour productivity increase during the long-term period than in the GAO per-number-of-workers calculations.[41]

Such a convergence of labour productivity trends in the long-time period for both types of calculations (number of workers and number of working hours) could probably be explained by the prevalence of long-term factors that trigger a decrease of agricultural employment (like the ageing of the rural population and the constant increase of better income opportunities in urban areas compared to rural areas[42]) over the "labour-preserving" policy approaches.

Machinery productivity, like labour productivity, shows clear sub-regional differences between the V4 and FSU countries in the studied period (1990-2004), but unlike labour productivity, no convergence in the later period (2005-2010) was observed (see **Table 4** in **Appendix 2.6**). In V4 countries (except Slovakia) machinery productivity decreased, while in FSU countries (except Belarus) it increased during 1990-2004. This divergence dynamic can mainly be attributed to the differences in machinery stock growth rates, which significantly increased in V4 and substantially decreased in FSU countries. Usually, this difference is explained by the higher levels of subsidization and better investment capacity of the (mainly privately-owned) agricultural sectors of the V4 countries.

The changes in **fertilizer productivity** were the most impressive among all the analyzed inputs (see **Table 5** in **Appendix 2.6**). A sub-regional comparison shows the profound difference between the two sets of countries – while all FSU countries experienced a significant fertilizer productivity increase, Hungary was the only country in the V4 sub-region with positive fertilizer productivity growth from 1990-2004. The cross-country differences in fertilizer productivity during 1990-2004 were also remarkable - the most impressive records among the FSU countries are that of Ukraine and Russia, where fertilizer productivity increased more than four times compared to the pre-transition level. Compared to them, the record of Belarus, where fertilizer productivity nearly tripled, looks relatively modest. The observed differences in fertilizer productivity between the countries and sub-regions continued later on, between 2005-2010.

The overall analysis of the partial productivity dynamics of land, labour, machinery and fertilizer for the seven countries in question shows that some partial productivity indexes had increased, while other decreased. However the increase of some

[41] The analysis was done only for the V4 countries for 1995-2010 because of limited data availability.
[42] With the exception of the initial period of transformation, when agriculture absorbed unemployed labour from the other sectors of the economy and allowed the creation of so-called "food security stocks" (or "safety net") for the poorest part of the population.

partial productivity indicators cannot be straightforwardly considered as a reform success due to the following reasons:

(1) The increase could simply be caused by the fact that inputs fell even faster than GAO, but not because of improvements in inputs' use.

(2) Because the partial productivity calculations do not reflect the fact that in reality agricultural production is dependent on the interaction of the several production factors (inputs).

(3) Because the simple partial productivity measures may point to misleading results for countries that are characterized by asymmetric changes in inputs, like those in the CEEC and FSU (*Roselle & Swinnen, 2004)***.**

Therefore, to evaluate whether the growth of some partial productivity indexes could be considered a success or failure of the reform, we must analyze the increase of these particular partial productivity indicators not as separate indicators, but in their complex interdependence with each other, which implies a Total Factor Productivity (TFP) estimation.

The Total Factor Productivity is the "aggregate measure that captures the growth in productivity of all inputs used in production" (*Liefert and Swinnen, 2002, p.23*). If the TFP index rose during the transformation period, the increase of partial productivity could be considered a reform success, because it was caused by improvements in inputs use. If the TFP indexe fell during the transformation period, the increase of partial productivity could not be considered a reform success, because it was caused by the fact that inputs fell even faster than the GAO, and also because of the inputs substitution.

The estimation of the Total Factor Productivity will be done in the next section, together with a concluding assessment regarding the success or failure of reforms in terms of agricultural productivity.

Section 2.4. Empirical assessment of the agricultural production and productivity dynamics.

This section provides the rationale for the final conclusions regarding the assessment of reform outcomes in terms of agricultural output and productivity.

For this purpose, the section provides an analysis of the impact of the changes in inputs use on the GAO dynamic (referring to Section 2.2) and a calculation of the TFP (referring to Section 2.3) by an estimation of the panel regression for the seven countries in question. The section starts with a description of the methodology and data; next, the regression results are provided and discussed; then, the TFP indexes are calculated and explanations about its dynamic are provided; and finally, concluding remarks are made.

In order to analyze how the selected inputs' (land, labor and capital) adjustments had affected (if affected at all) agricultural output dynamics, several panel regressions were estimated using the Cobb-Douglas specification of the production function. The estimations were "based on the assumption that the common meta-production function" exists and could be used for cross-country analysis (*Macours and Swinnen, 2000a, p.182)***.**

The econometric model for the estimations is:

$\ln(\mathbf{gao})=\alpha_0+\beta_1\ln(\mathbf{land_{it}})+\beta_2\ln(\mathbf{labor_{it}})+\beta_3\ln(\mathbf{capital_{it}})+\beta_4\ln(\mathbf{TREND}_{it})+\varepsilon$

where the dependent variable is the GAO, and the independent variables are the inputs - land, labor and capital. The method used for this estimation is the pooled EGLS -cross-section SUR (see **Appendix 2.7** for EVIEW results). For some of the estimations, the TRACTORS, FERTILIZERS and LIVESTOCK variables were used instead of the CAPITAL variable.

The data used for the estimation are the annual observations for seven selected CEE countries: Belarus **(BY),** Czech Republic **(CZ),** Hungary **(HU),** Poland **(PL),** Russia **(RU),** Slovakia **(SK**) and Ukraine **(UKR).** The description of all variables collected for the estimation of the pooled regression is provided in ***Table 2.6.*** All the data are taken from the FAOSTAT database, except for the "LAB_POP" variable, which was calculated using the World Bank WDI data.[43] All variables (except TREND variable) are transformed from index numbers (1990 =100%) to log-linear form using the [=+ln …] Excell program function.

According to the model, several panel regressions were estimated using all the possible combinations of inputs' variables. Further, the accounting statistics, which explain the contribution of each input to output change, was calculated for every country in question.

[43] FAO database. Available at: www.fao.org (Accessed: September 12, 2011) and WB database: available at: http://data.worldbank.org/data-catalog/world-development-indicators (Accessed: May 8, 2014)

Table 2.6. Description of Variables

Variable	Description
gao_	FAO series - Gross PIN (base 1999-2001)- Agriculture (PIN) + (Total)
land_	Arable land
lab_ag	FAO series - Agricultural population (1000) "Population - Est. & Proj. 2008"
lab_ag_ec	FAO series - Total economically active population in Agr (1000) "Population - Est. & Proj. 2008"
lab_pop_	WB (WDI) data Series - Rural population
trac_	FAO series - Agricultural tractors- In Use (No)
fert_	FAO series- Total Fertilizers + (Total)- Consumption (tons)
livest_	Calculated as average stocks for chicken, pigs and cattle from FAO series
cap_net	FAO series -Net Capital Stock (constant 2005 prices) (USD million)

The detailed list of the regressions which shows a more-or-less acceptable results and "accounting" statistics is provided in the **Appendix 2.7. and Appendix 2.8.** As the "acceptable results", the regressions with the following results were considered: (i) coefficients for LAND, LABOUR and CAPITAL (or TRACTORS, FERTILIZERS and LIVESTOCK) are less than 1 and have a positive sign; (ii) "Prob." is less than <0,2 for all the variables; (iii) the "Wald Test" probability more than 1; (iv) the "Durbin-Watson stat." is around 2. A brief summary of these results is in the **Table 2.7.**

All these regressions have a good explanatory power (R-squared vary from 0.7 to 0.9) and Durbin-Watson stat. is around 2 in the majority of the models, which is satisfactory enough. All coefficients (except C) have a positive sign, which implies a normal production function behaviour when the increase of the use of each input (land, labour, capital) leads to the increase in output (GAO).

A more detailed country-relevant analysis of the contribution of each input to the GAO dynamics is provided in **the Appendix 2.8.,** which presents the accounting statistics for each regression. **The results of this detailed analysis show that in the majority of cases, changes in capital use had the most decisive impact on the GAO dynamics. Changes in land and labor had a less important impact on GAO.**

In order to evaluate whether the increase in some partial productivity indexes for the CEE countries could be considered a success of the reforms, the Total Factor Productivity (TFP) indexes were estimated using the results of the regression (see the conclusion for Section 2.3).

Table 2.7. Summary of the CEE countries regression estimations

Dependent variable: GAO (Gross Agricultural Output)								
	Model 1		**Model 2**		**Model 3**		**Model 4**	
	gao=land+ lab_ag_ec+ cap(-1)		*gao=land+lab_ag+ trac(-1)+fert(-1)+livest(-1)*		*gao=land+lab_pop+ trac+fert(-1)+livest(-1)*		*gao=land+lab_pop+ trac(-1) +fert(-1) +livest(-1)*	
	coef.	*t* value	coef.	*t* value	coef.	*t* value	coef.	*t* value
C	-1.63****	-1.57	-2.41****	-1.58	-3.93****	-1.58	-3.05*****	-1.31
land	0.27***	1.67	0.33**	2.30	0.52*	2.78	0.36*	2.51
labor	0.38*	2.52	0.46****	1.62	0.60*****	1.36	0.56*****	1.37
capital	0.64*	5.46						
trac.			0.21*	4.64	0.18*	2.86	0.20*	4.50
fertiliz.			0.11*	5.85	0.10*	4.52	0.11*	5.52
livest.			0.34*	9.10	0.40*	8.82	0.39*	10.61
TFP BY	0.04*	5.90	0.04*	3.66	0.03*	3.78	0.03*	4.27
TFP CZ	0.02*	4.89	0.01*	2.52	0.008	2.20	0.006**	2.15
TFP HU	0.01*	2.60	0.01****	1.45	~~*0.004*~~	~~*0.76*~~	~~*0.001*~~	~~*0.18*~~
TFP PL	0.01*	2.83	0.01****	1.61	~~*0.003*~~	~~*0.95*~~	~~*0.001*~~	~~*0.44*~~
TFP RU	0.02*	4.07	0.04*	4.53	0.03*	4.03	0.03*	5.34
TFP SK	0.02*	5.18	0.02*	2.94	0.01*	2.58	0.009*	2.95
TFP UKR	0.02*	3.48	0.03*	3.68	0.02*	3.68	0.02*	4.45
Linear estimation after one-step weighting matrix (cross-section SUR)								
No. of countries	*7*		*7*		*7*		*7*	
No. of observ.	*77*		*70*		*70*		*70*	
R^2	*0.71*		*0.9*		*0.86*		*0.9*	
Adj. R^2	*0.67*		*0.88*		*0.84*		*0.88*	
Durbin-Watson st.	*1.26*		*1.97*		*2.09*		*1.97*	
Wald Test	*0.10*		*0.10*		*0.10*		*0.2*	
** indicate significance at the 1% level (prob. <0.01); ** indicate significance at the 5% level (0.01<prob. <0.05); *** indicate significance at the 10% level (0,05<prob. <0,10); **** indicate significance at the 15% level (0.10<prob. <0.15); ***** indicate significance at the 20% level (0.15<prob. <0.20);* ~~*1.11*~~ *- insignificant variable (more than 20% significance)*								

A brief overview of the already-existing TFP estimations (see **Appendix 2.9**.) shows a mixed picture of TFP dynamics for the countries in question, which could reasonably be explained by difficulties in the computation, "especially in terms of data requirements" *(Liefert and Swinnen, 2002, p.24)*, mixed time-periods, country-scopes and methodologies applied to TFP estimations. However, despite the observed difference in TFP values, it is possible to generalize that for most of the countries and time-periods the TFP index shows a sustainably increasing tendency.

The results of the TFP calculation based on the regression (Model 1) estimated in this section (see **Table 2.8.)** have also supported this conclusion. The TFP results of the Model 1 regression were chosen as the sample, because only in this Model all the coefficients for all the TFP variables are significant at 1% level, while the coefficients for some TFP variables from Models 2–4 show less good results.

Table 2.8. Total Factor Productivity (TFP) growth rates

	estimated coefficient	**TFP growth**	
		annual TFP growth 1990-2004	cumulative TFP[44]
TFP Belarus	0.044	4.4	0.9
TFP Czech Rep.	0.021	2.1	0.4
TFP Hungary	0.018	1.8	0.3
TFP Poland	0.013	1.3	0.2
TFP Russia	0.025	2.5	0.4
TFP Slovakia	0.026	2.6	0.5
TFP Ukraine	0.023	2.3	0.4

All coefficients of the TREND variable are found significant and have a positive sign, which indicates a TFP growth in every country in question. However, the rate of TFP growth highlights the substantial differences among the countries under study.

During the studied period, Belarus attained the highest TFP growth rates (4.4% annual growth rate and 0.9% for all the 15 years of the transformation), followed by Slovakia (2.6% and 0.5%), Russia (2.5% and 0.4%), Ukraine (2.3% and 0.4%) Czech Republic (2.1% and 0.4%), Hungary (1.8% and 0.3%), and finally Poland (1.3% and 0.2%).

Although a detailed analysis of the TFP growth in Belarus will be provided in the subsequent Belarus chapter, the following reasons could be adduced for this remarkable TFP growth:

[44] Cumulative TFP (or 15-year period TFP growth) was calculated as {((=+exp(estimated coefficient*15))-1}

(i) a more rational use of previously over-used inputs;

(ii) initially lower (than in the FSU and V4 countries) level of Belarusian agricultural development;

(iii) changes in institutions – that is, an increase in the share of household plots in total agricultural production.

Regarding TFP dynamics for the whole sample of the seven studied countries, the most reasonable explanation of the TFP differences among them probably relates to the "small-scale vs. large-scale agriculture" aspect, because the results of the TFP calculations to some extent correlate with the share of large-scale enterprises in the agricultural sector in the countries in question.

For example, in Belarus, large-scale state-owned farms (former Socialist "kolhoz" and "sovhoz") are still the main agricultural producers due to the slow progress of land reform. The same describes the situation in Russia. In the Czech Republic, Slovakia and Hungary large-scale enterprises (while mainly privately owned) are still dominant in the agricultural sector, even after the successful implementation of land reform. While in Poland, the country with the lowest TFP growth rate, the domination of small-scale farms is considered the main obstacle to productivity growth by the majority of local, native agricultural economists and politicians (an opinion that is not always in line with the views of Western economists)

Hence, according to the estimated TFP results and finalizing the issue of the assessment of reform outcome in terms of agricultural productivity, it is possible to conclude that the transformational reform results could be considered a reform success, due to the increase in TFP in every country in question.

2.5. Chapter Conclusion

The analysis of the transformational reforms' progress and agricultural performance of the seven Central and Eastern European Countries (CEEC) for fifteen years leads to the following conclusions:

1. Although each CEE country followed its own specific reform path, in general, the **agricultural reform process** could be considered practically accomplished in the V4 countries, while in the FSU only moderate progress was reached by some countries (Russia, Ukraine), and practically no reform progress was achieved in Belarus. Poland and Belarus differ significantly in terms of reform progress: Poland is among the best reformers in the CEEC region, while Belarus is the least reformed country, not only among the V4, but also among the FSU countries.

2.2. In terms of agricultural production (output), Poland, Hungary and Belarus performed better than other countries in question: all them had low levels of GAO decline during the initial period of transformation, which was then followed by a sustainable recovery. **Therefore, it is possible to conclude that for these countries, the results of the transformation in terms of agricultural production could be considered a success.** As the main determinants of the changes in GAO dynamics, changes in capital use and in prices and subsidization (state support) policies should be considered.

3. In **terms of agricultural productivity**, the transformational reform outcome could be considered a reform success in all countries in question, due to the increase in TFP and despite the fall in the some partial productivity indexes.

CHAPTER 3. Polish agricultural performance during the transformation period.

This chapter is dedicated to an analysis of Polish agricultural performance during the fifteen years of transformation in regard to the "success or failure of reforms" assessment in terms of agricultural production and productivity.[45] It starts with an overview of Polish transformational history (Section 1). After that, the Polish agricultural production dynamic will be analyzed (Section 2). Then, in Section 3, agricultural productivity improvements will be assessed both in terms of partial productivity indexes and the TFP dynamic. And finally, the concluding remarks (in Conclusion) will briefly outline the main findings of the research.

3.1 Poland agricultural transformation history overview.

This section offers a brief evaluation of the Poland agricultural profile and an overview of Polish agricultural transformation history. The section starts with an overview of the country's natural agricultural endowment; next, an analysis of the history of the agricultural transformation, including the history of land reform, market liberalization and institutional transformation will be provided; and finally, this section will end with concluding remarks.

Poland is a country located in the center of Europe, with a **total area** of 312,700 m2 and a population of 38.2 million. It holds the 9th position in Europe and 69th in the world, as regards area, and the 8th position in Europe, and the 30th in the world, as regards population *(Agriculture and food economy in Poland, 2004).*

Prior to 1998, **Poland** had a "two-tier" administrative division. Its territory was organized **in 49 *voivodships*** and 2483 *gminas* (communes), which were the basic units of territorial division *(Agriculture and food economy in Poland, 2004).*

Since 1998, (according to the July 1998 administrative reform) Poland has had a three-tier administrative division, which is made up of **16 voivodships** (provinces), 314 "poviats" (regions) and 2478 "gminas" (communes) *(Agriculture and food economy in Poland, 2004).* Unfortunately, the pre-1998 "voivodships" (regional) borders do not correspond exactly with the post-1998 borders, which makes a coherent regional analysis for 1990-2004 period quite tricky. Scholars studying these overlapping periods (before and after the 1998 administrative reforms) either treat these times periods separately (1990-1998 and 1999-and onward) or try to aggregate the pre- and post-1998 "voivodships" into large macro-regions, which anyway raises issues about the plausibility of such aggregation and the accuracy of such research results.

[45] The study in this Chapter 3 benefited from the research mission at the Natolin European Center supported by the Paderewski Grant

Polish agriculture has significant potential, although the **soil-climatic conditions** are unfavorable, as compared to most European countries. In 2004, there were 16.3 million ha of utilized agricultural land, which constitutes 52.2% of the total area of the country.

Considering the area of utilized agricultural land, Poland takes a leading position in the EU (just after France and Spain, with land area similar to Germany); however, the quality of soil is low. According to the geodesic register at the end of 2004, the utilized agricultural area (UAA) in Poland was 19,148 00 ha, which ranks the country as third in the UE, following France (almost 28 million ha) and Spain (more than 25 million ha).

A highly variable and unstable **climate** can also be considered a land productivity constraint, because due to unfavorable weather conditions, production of a plant with a high heat requirement (wheat, sugar beet, fruit trees and vegetables grown in open fields) is restricted to only a few areas in Poland (*Gorz and Kurek, 1998*). So-called average agrarian value (which take into account all sets of natural conditions - soil quality, agro-climatic conditions, water regime and topography) is estimated at 1.0 for Poland, ranging between 0.692 for Nowy Sacz vioviodship to 1.29 for Krakow viovodship (*Mertens, 2001).*[46]

The quality of agricultural land "is rather poor as evidenced by a relatively "low soil quality index of 0.82 on average" (*Agriculture and food economy in Poland, 2004, p. 9).* The soils in Poland are mainly of medium and poor quality – podzol soils (55%) and brown earths (20%) dominate in Poland, with limited marshland, muds, limestone soils, and chernozems and black earths. According to qualitative evaluation, very good and good soils (classes I-III) amount to 25.6% of the land cover. Medium soils (class IV) account for 39.8%, while poor and very poor soils are found over 34% of the country *(Gorz and Kurek, 1998).*[47] Lower-quality soils, accompanied by poor climatic conditions (worse than in West European countries) resulted in the fact that "Polish agriculture occupies (in terms of agricultural area valorization) one of the last places in Europe" (*Agriculture and food economy in Poland, 2004, p. 9).*

In terms of regional division, the very good soils (classes I-II) are mainly concentrated in the southern parts of Poland, while good, medium and poor quality soils are dispersed more or less homogenously throughout the whole territory (see map in **Appendix 3.1**). The high concentration of very good soils and the high population density in the southern regions of

[46]According to the former *"voivodships"* division.

[47] This farmland classification contains six quality classes each for arable land and grassland, beginning with class I (the best soils). These classes correspond to coefficients from 0.15 for class VI to 1.75 for class I, which are used to create aggregate quality indices for farms and larger geographic units. The average index value for Poland is 0.79 (*Mertens, 2001).*

Poland, compared to the smaller population density and the poorer land quality in the north-western and western regions (see map in the **Appendix 3.1**) **creates the basis of the so-called "north-west" vs. "south" division,** with the dominant concentration of small-scale, private farms in the "south," and large-scale (former state) farms in the "north-west".

Polish agricultural structure may be characterized by three main features. **First**, only 20% of agricultural land was owned by the state and needed to be privatized during the transformation, because approximately 80% of agricultural land was not collectivized in the Socialist period *(Agricultural situation in the candidate countries, 2002)*. State land was mainly concentrated in the northern and north-western parts of the Poland (*detailed maps of state and private land share changes are provided later, in the land reform progress analysis*). Such a division of state vs. private land (large vs. small scale enterprises) could be explained by rural population density (more dense in the south and south-east), land fertility (the lands in northern Poland are less fertile) and historically-inherited production structures (western lands, which formerly belonged to Germany before 1945, had predominately large Prussian farms) (see again **Appendix 3.1** for land quality and population density maps).

Second, significant regional differentiation of farming structure. In the northern and western parts of the Poland, tha large-scale agricultural enterprises predominate, while the other regions (mainly in the south and south-east) are characterized by small-scale farming. The transformational reforms did not significantly alter the average size (around 7.2 ha) of individual farms. (*Detailed maps of regional farm-size changes are provided later, in the land reform progress analysis.)*

Third, the coexistence of market-oriented and peasant (non-market) farming (*Zawalinska, 2004*). Peasant farming, according to *Zawalinska (2004, pp.137-138)* [48] is characterized "by (i) family ownership, (ii) reliance on family labor, (iii) priority of own consumption, (iv) maximizing income per head of family member, not profit, (v) assuring continuation of tradition of family farming, (vi) small-scale production".

The Poland "transformation agenda" for agricultural reforms consisted mainly of the same basic elements as in other V4 countries, namely (1) land reform; (2) liberalization of outputs and inputs markets; and (3) the establishment of a new institutional structure relevant to a market economy. In the next paragraphs, an analysis of the Poland transformation history within the framework of the above-elements will be provided.

[48] Based on *Wos (2000) and Davidova et al. (2002)*

A very specific feature of Polish pre-transition agriculture, which differentiates it significantly from other V4 countries, was the prevalence of small (usually family-run) private farms, but the so-called socialized sector also existed, in the form of state and cooperative farms. In 1990, the relative sizes of private and socialized sectors were as below:

Table 3.1 . Share of private and socialized sectors in Polish agriculture in 1990 (%)[49]

	land	labor	total production	market production	fertilizers purchases	tractors
Private farms	76	80	77	73	64	86
Socialized farms	24	20	23	27	36	14

There were 2.1 million **private farms** with a national average size of 6.3 hectares of farmed land: an average of less than 4 hectares in southern Poland, about 6 hectares in central Poland and more than 8 hectares in northern Poland. More than half of these farms had less than 5 hectares and covered 23% of the agricultural land. Only 6% of private farms had more than 15 hectares and cultivated 20% of the agricultural land ***(Table 3.2).***

Table 3.2. Size of private farms, state farms and cooperatives in 1985-1992[50]

	Private farms			State farms				Cooperatives		
	1986	**1990**	**1992**	**1985**	**1989**	**1990**	**1992**	**1985**	**1990**	**1992**
Number of farms	2260	2138	2144	1258	959	1112	1752	2340	2240	2186
Average farm size	6	6.3	6.3	2666	3490	2924	1786	297	311	310

The majority of **state farms**, which occupied 20% of the total agricultural area, were concentrated in the northern and western parts of Poland (see map from **Appendix 3.2.**). Around 50% of state farms had more than 1,000 hectares of land. However, many of them were divided into smaller production units (100-400 hectares), often located far from central administrative headquarters. These farms mainly specialized in grain and selected livestock production, and also offered such services as grain storage, food processing and machinery repairing facilities (*Agricultural Situation and Prospects in the CEEC, 1995).*

Cooperative farms were on average around the 310 ha, but this category of farms was a mix of the large-scale and small-scale farms, so this 310 ha average in not a very informative characteristic. Approximately half of the cooperative farms were organized on the

[49] Data from *OECD (1995)*
[50] Idem

land allotted to them by the state (*Agricultural Situation and Prospects in the CEEC, 1995).* About 90% of its members were former agricultural workers with no land of their own. Only 10% of the land of these cooperatives was the former legal property of cooperative members, who had been compelled, in the past, to give it up for the cooperative use.

The other half of the cooperative farms was constituted by specialized cooperatives. They were affiliated individual farmers, who remained private owners of their land and cultivated it individually, producing only a minority of products collectively. About the half of total receipts of these farms came from processing, services and non-agricultural activities, but on average, about one-third of their receipts came from livestock production. **Table 3.3.** provides basic data on the cooperatives' share in the agricultural production in the pre-transition period.

Table 3.3. Polish agricultural cooperatives (as of 31.12.1988) [51]

Cooperatives' type	# of cooperatives	# of the members	# of employees	Significance
Supply and marketing	1,912	3,531,500	434,570	59% of marketing of agric. products
Dairy	323	1,199,400	112,793	95% of milk processed
Horticultural market	140	372,600	55,519	50% of fruit and vegetable
Agric. product. cooperatives	2,086	177,000	2,700	2,8% of arable land
Savings and credit	1,663	2,566,100	31,290	18,5% of population's savings
Agricultural circles	2,006	113,200	154,447	Important share in mechanization services
Total	**8,130**	**7,959,800**	**791,319**	

Therefore, the large share of private-owned land during communist period and small size of agricultural holdings should be considered as the most distinctive "Poland-specific" pre-transition characteristic. However, despite the domination of the private sector in Polish agriculture, its efficiency was generally lower than in the state sector. The quantitative and qualitative analyses done by *(Dicke and Misala, 1993)* shows that private farms were effective only in labor intensive harvesting (sugar-beet, fodder-root crops and hay), but were inefficient in livestock and grain production because of a lack of machinery, and unfavorable access to credit markets.

[51] Data from *OECD (1995, p.268*), based on *Kowalak (1993)*

Thus, when the general privatization process was initiated, private property had already prevailed in the agricultural land ownership structure. Importantly, however, that 80% of Polish agricultural land was under private ownership before the transformation does not imply that 80% of Polish agriculture was privately managed, for two main reasons. *First*, in the pre-transition (Socialist) period, Polish agriculture was controlled by the state through strict price regulation, because the majority of agricultural procurement and retail prices were fixed by the government, rather than by free-market forces. Prices were mainly set on the basis of production costs plus a fixed rate of planned profit. The "cheap food" and "income parity" [52] policy (starting in the 1970s) approaches were also taken into consideration while determining agricultural prices (*Wilkin, 1997)*

Second, the food processing industry (which purchases agricultural production both from the state and private farms) was also monopolized by the state-owned enterprises in the majority of sectors. The results of the OECD research *(OECD, 1995*), which are provided in the next paragraph, fully support these theses.

In the **grain sector**, the government fixed a price at which local, state-controlled cooperatives bought all grains offered by farmers based on orders from the central milling industry (PZZ) and feed processors. The production of **rapeseed** was mainly concentrated in state and cooperatives farms, and was processed by 8 major state-owned crushing plants. The rapeseed production was dried and cleaned in the warehouses of the central milling industry (PZZ) and the state farms. They bought rapeseed on the basis of contract agreements with farmers, at a procurement price defined by the government. **In the sugar sector**, 78 state-owned sugar factories had a monopoly on sugar production and domestic sales. The state had a monopoly for processing and for the foreign trade of **potatoes,** where the state procurement price was fixed for the proceeded and exported production. Over 95% of all **milk** produced for market purposes by private, cooperative and state farms was purchased by state-controlled dairy cooperatives at the procurement price fixed by the state. These cooperatives supplied the retail trade and delivered dairy products to foreign trade companies for export. The government fixed the procurement and retail prices for the live **animal and meat** markets. The monopoly on the market of **poultry products** had all enterprises associated in the state company "Poldrob". They purchased at a procurement price 95% of the sales of live poultry and 70% of eggs traded. The slaughter houses, having their own small network of suppliers,

[52] Income parity policy – (i.e. "farmers should receive a similar level of income as workers in the industrial sector") became one of the goals of the Polish agricultural policy from the late 1970th. The goal have been "achieved mainly through the agricultural price support policy" and "in the 1970s and 1980s an income based entirely on agricultural employment reached 80-100 percent of the income outside of agriculture" (*Wilkin, 1997)*

were also integrated in the "Poldrob" company. A free market existed only for **fruit and vegetable** production, which was not covered by the state price fixing system.

Taking into consideration that private farmer's production decisions (both in "capitalist" and "socialist" economies) depend mainly on the possibility of selling the produced output on the offered prices, Polish agriculture should be considered to be partially "privately –owned" (because of large share of private land), but mainly "state-controlled".

The year 1989 should be considered the starting point of Polish land reform (privatization), because it was at this time that the "Solidarity" government formulated the Reprivatization (restitution) Law, which raised heated debate. The "discussants" can roughly be divided into the two parties.

One party denied the idea of property restitution, while the other party (supported also to a great extent by the Office of President of Poland) demanded that all private property seized under Communist rule was to be returned to the original owners or to their rightful heirs.[53] The latter view was presented and mainly shared by those who advocated the notion of eliminating past wrongs. Quite naturally, among them numbered former owners and their families. They prepared their own claims. According to Ministry of Privatization reports, about 50 thousand claims for restitution of real estate, and more than 500 claims for re-privatization of businesses were submitted by the end of 1991 *(Dicke and Misala, 1993*). After extensive discussion, it was decided that, "any demand for Polish smallholders to give up their allotments in favor of the former owners would be politically and socially untenable" (especially bearing in mind that the majority of the possible claims would be made in favor of the citizens of foreign countries), and the Polish government focused mainly on privatizing the 20% of state farms' land by sale *(Csaki and Lerman, 2000, p.9).*

Therefore, land reform was constituted by (i) the process of cooperative farm restructuring, and (ii) the process of state farm privatization.

The process of **cooperative restructuring** was initiated in January 1990 with the adoption of the Law on Cooperatives, which governed the changes in the organization and operation of the cooperative movement (*Dicke and Misala, 1993*). The main objectives of the Law were "to liquidate all the cooperative unions, to restore full democratic independence through obligatory new elections in all the primary cooperatives, to make possible the

[53] Majority of which were the German, Czech or Former Soviet Union counties citizens as of year 1990, because if to oversimplify the issue, the state land was mainly the land, which until 1945 belonged to the former German territory (western and north-western part of socialist after WW II Poland), former Czech territory until 1939 (south and southwest of after WW II Poland) and former Russian Empire territory (eastern part of WW II Poland).

splitting of the existing cooperatives into two or more new cooperatives", and to change the legal nature and competence of the Supreme Cooperative Council (*Agricultural Situation and Prospects in the CEEC, 1998, p.54*). This Council became a voluntary association of primary cooperatives and the legal representative of the cooperative movement in Poland and abroad.

The first step in cooperative restructuring was accomplished with the dissolution of cooperative unions and the liquidation of their assets. The question of cooperative ownership was taken up in the Revalorization Act of 30 August 1991. Under this law, all except the housing cooperatives were authorized to revalue members' shares through transferring not more than half of their reserve funds to their share fund. The above-mentioned laws resulted in the liquidation of a certain number of cooperatives and the division of many of them into smaller units. Only those cooperatives survived that were in good financial standing and were able to undergo the necessary restructuring changes (*Banski, 2007*). Among those "surviving cooperatives," the majority were organized in the pre-World War II period (*Banski, 2010*), and were mainly situated in the central and the south-western regions in *Opolskie, Wielkopolskie and Dolnoslazkie* "voivodships," according to *Banski (2007).*

The production potential of the cooperatives was diminished by one-third in 1997, compared to the pre-transition level in 1988: the number of cooperatives decreased by 20% (from 2063 to 1650), its share in total agricultural land use diminished by 34% and its share in GAO production (in constant prices) decreased by 36.5% (*Wos et al., 1998).* However, those cooperatives which survived during the transformation period are considered to be "improved" and "adjusted to the market economy principles" (*Wos et al., 1998, p.40).* Therefore, according to *Wos et al. (1998, p.40)* "although the share of the cooperative sector in Polish agriculture is small and its expansion is hardly envisaged, but as long as cooperative form of production is more preferable than individual farming for the some agricultural producers, it has a sense of existence".

To facilitate the process of the **privatization of state farms**, a specific law, the Law on Administration of the State Treasury's Agricultural Real Estate, was adopted in October 1991. This law created the Agricultural Property Agency of the State Treasury, and gave to it the "property rights of the state's agricultural real estate and responsibility for the administration, restructuring and privatization" of such property *(Agricultural Situation and Prospects in the CEEC, 1998, p.127*). The process of restructuring and the privatization of state farms consisted of two stages: the taking over of state farms by the Agency, and their subsequent restructuring and privatization. In order to achieve its main task of restructuring and privatization, the Agency managed "the state farms or their assets mainly through the sale of

their assets" in whole or in part, the leasing out "to private legal entities or individuals in exchange for an agreed rent, the transfer of the assets to a shareholding company and the establishment of a management or administration contract" *(Agricultural Situation and Prospects in the CEEC, 1998, p.127*).

An evaluation of the quality and the consequences of the privatization program (both at the level of the whole economy and in the agricultural sector in particular) leads to the conclusion that privatization was driven mainly by political and ideological considerations, rather than efficiency concerns. In 1990, the Polish government declared the introduction of the capitalist market system based on private ownership within two or three years, as the main objective of its preliminary program. In 1991, the Polish Parliament approved the privatization program. The main purposes of the program were (i) the transfer of half the state-owned assets into private hands within three years; and (ii) the formation of an ownership structure similar to that typically found in Western Europe, within five years. Sectoral-relevant efficiency concerns were not taken into consideration.

Regarding agriculture, the privatization program did not consider the specific features of the agricultural sector,[54] which led to quite disappointing results in its privatization, especially (i) in terms of privatization methods, (ii) farm-scale changes and (iii) the transfer of the land-ownership rights.

In terms of privatization methods, it was expected that the former big state farms would be privatized as large agricultural production units, without dividing them into very small plots (the same way that big industrial enterprises were privatized).[55] This would allow to avoid the loss of efficiency in the production of some agricultural commodities, where the state sector was the main producer, the so-called "rational concentration" and "farmerization" approaches (*Slay, 1995*). Unfortunately, this expectation did not come to fruition. The former big state farms were mainly split and sold (or rented) as small pieces of land (mainly to local, small-scale private farmers) or were not sold at all and remained under the supervision of the state Agricultural Property Agency, that is, remained state-owned land (see ***Appendix 3.4.)*** .

In terms of farm-size changes, it was expected that the privatization driven by market incentives would force small, low-efficiency family farms to merge with larger and more

[54] The agricultural sector was treated the same as all other sectors of the economy (like industry, construction etc.)

[55] The majority of industrial enterprises were privatized (sold) as the same unified production units without splitting into small units for the purpose of quick sale (privatization), because any industrial enterprise cannot be splitted into small units without the loss of production efficiency. Some of industrial enterprises cannot be spitted at all because of production cycle specific.

profitable units. Before providing an analysis of the dynamics of farm-size changes, it is worthwhile to briefly look at the debate over the existence of the economy of scale in agriculture. Although the debate on the (non)existence of the economy of scale in agriculture is still an open one (*ex. Gorton et al., 2008; Gardner et al, 2001),* with regard to Polish agriculture, a substantial share of Western agricultural economists are proponents of the idea that large farms are not more efficient than small-scale farms (ex. *van Zyl et al., 1996*), while local Polish agricultural economists support the notion that small-scale agriculture constitutes a serious impediment to Polish agricultural production and productivity growth (ex. *Zawalinska, 2004; Czyzewski et al*., 2002). Both proponents and opponents of the (non)existence of the economy of scale in the Polish agriculture buttress their arguments with theoretical and empirical evidence.

Returning to the dynamics of farm-size changes, it is possible to state that land privatization did not cause any significant impact on farm size, because the "average farm size increased only from 7.0 ha in 1988 to 7.9 ha in 1996" (*Agricultural Situation and Prospects in the CEEC, 1998, p.9*). The majority of private farmers preferred to buy (or rent) small pieces of land to increase only slightly the average farm size, rather than to risk holding a big agricultural estate, which demands large capital investments and more extensive specific knowledge and skills for its management (compared to typical, small "peasant-type" average Polish farm). Therefore, changes in the average size of private farms' were not as impressive as has been expected, and Polish agriculture is still predominated by small-scale family farms. *(see **Table 3.4).***

Table 3.4. Dynamic of private farm size in 1980- 2005 [56]

	FARM SIZE							
	1-2 ha	**2-5 ha**	**5-10 ha**	**10-15 ha**	**15-20 ha**	**20-50 ha**	**<50ha**	**Total**
1980	18.7	37	30	10	4.3	0	0	**100**
1990	17.7	35.1	29.8	11.3	6.1	0	0	**100**
2000	23.8	32.7	23.8	9.8	4.5	4.7	0.7	**100**
2005	25.1	33	21.8	9.4	4.3	5.5	0.9	**100**

The analysis of the farm-size changes also reveals "the increasing duality" of the Polish agricultural system, where only the number of very small, semi-subsistence farms (1-2 ha) and the market-oriented big farms (>20ha) increased, while the number of medium-size farms

[56] Table from *Urban et al (2006, p.191*), *based on the " data of Paszkowski S. from AR Poznan and Jozwiak W. from IERiGZ"*

(2-20 ha) constantly decreased during the period in question (*Agricultural situation in the candidate countries, 2002, p.9).*

No significant changes had occurred in terms of the regional dispersion of small-scale vs. large scale farms during the period in question – small-scale farms are still predominant in the southern regions, while large-scale farms are mainly situated in the western and north-western regions *(*see map from **Appendix 3.3.)**

An interesting process has also been observed in terms of the transfer of land ownership rights. It was expected that the former state land would be privatized fast. However, the share of state-owned land did not change significantly during the transformation period. This was so because the majority of private, small-scale farmers preferred to lease land, rather than to own it, because of the "lack of finance[ing] on the part of buyers", while "leasing… requires less money and is quick to execute" (*van Zyl et al., 1996, p.18*). The analysis of the disposition of state land taken over by the Agricultural Property Agency (APA) shows that the amount of state land which is leased is on average 20 times higher than sold land (see **Appendix 3.4.**). Therefore, although the share of the state-owned land did not change significantly and remained around 20%, the share of state-used land declined twice (**Table 3.5.**).

Table 3.5. Changes in land use and land ownership rights [57]

	owned land			**used land**		
	1990	**1995**	**1999**	**1990**	**1995**	**1999**
Private sector	76	77	79	80	90	92
Public sector	24	23	21	20	10	8
Total	**100**	**100**	**100**	**100**	**100**	**100**

In terms of the regional distribution of state land, no significant changes had taken place. The state land (land in APA disposal) still predominated in the western and north-western regions in 2004, just as it did in 1990 (see map in **Appendix 3.5.** for 2004, and compare with **Appendix 3.2.** for 1990**).** The main reason for this is that the main demand for the land is observed in the southern regions, where the land supply is scarce (even considering the availability of former state land in APA disposal), while in the western and north-western regions the demand for land is lower and the land supply is higher (due to the high share of former state farms) than in the southern regions.

Therefore, even after a decade of reform, although some progress in land reform had been achieved, state land remains state-owned (though mainly privately run), small-

[57] Data for 1990 and 1995 are from *Agricultural Statistics Yearbook for Poland (1998*); for 1999 from *Agricultural Statistics Yearbook for Poland (2001*)

scale farming is still dominant and the regional disparity in terms of the state land vs. private land and small-scale vs. large-scale farming has persisted.

The process and main phases of the **liberalization of the outputs and inputs markets** in Poland did not significantly differ from the "common" CEEC liberalization history, previously analyzed in the CEEC chapter. *Ratinger et.al (2006*) distinguished practically the same phases of liberalization for Poland as *Anderson and Swinnen (2008*) did for the CEEC.

These researchers recognized the 1989-mid-1991 period as the period of "shock therapy" and market liberalization (the "liberalization phase" according to *Anderson and Swinnen (2008*), when the introduction of the "Balcerowicz Plan" (with the withdrawal of practically all support to agriculture) started. However this policy resulted in the "bankruptcy of most of the state farms and a sharp deterioration on the finance conditions of private farms" (*Ratinger et.al, 2006, p.18).*

Therefore, the next liberalization period (between 1991 and 1994), was considered to be the period in which a "new system of the agricultural support" (*Ratinger et.al, 2006, p.18)* was established, or according to *Anderson and Swinnen (2008*), as the period of price and income support, which they termed the "fire-brigade policy-making period".

That was also the period when three new market-oriented institutions for support and control of the agricultural policy were established: the Agency for Restructuring and Modernizing Agriculture (ARMA), the Agency for Rural Market (ARM) and the Agency for Agricultural Property of the State (AAPS).

The next, third period (1994-1999) was identified as the "broadening of the scope of the agricultural policy" (*Ratinger et.al, 2006, p.19*) and building of the "framework for preparing Polish agriculture for adjustment to CAP" (*Ratinger et.al, 2006, p.19*.) period. During this time, the "Strategy for Poland" (which included issues that pertained to rural areas in general, and not only about agriculture) and "Foundations of socio-economic policy for rural areas, agriculture and food economy until 2000" was adopted, which constituted a kind of base for the Polish accession to the EU, according to *Ratinger et.al (2006).*

Therefore, finalizing the analysis of the history of **liberalization of the outputs and inputs markets** in Poland, it is possible to conclude that "Polish history" did not significantly differ from common CEEC history in this respect.

An integral part of agricultural transformation in Poland (as in the other CEE countries) was the deconstruction of the Socialist state central management system and **the building of a new agricultural institutional framework.** These in turn resulted in significant modifications in the political and administrative institutional structure, mainly in the

transformation (or elimination) of the former ex-Socialist political and administrative institutions (e.g., Sejm, Parliament, and Central Planned Office) and the establishment of new ones (e.g., Agricultural agencies, foundations, agriculture-oriented political parties and unions).

During the Socialist period, agricultural legislation was prepared by the Ministry of Agriculture, then submitted to the Government (which together with the Central Planning Office previously formulated the main agricultural policy objectives) and was finally forwarded to Sejm for formal adoption.

Transformational reforms caused the following institutional changes in the Polish agricultural policy decision-making and implementation processes. **Sejm,** which became a part of Polish **Parliament** in 1991, after the **Senat** elections became (not formally) the main governmental body responsible for the adoption of general and agriculture related policy legislation. The role of the **Central Planning Office**, which was responsible for agricultural policy formulation during the Socialist era (as a part of the Polish general national economy plan), was reduced to the monitoring of the economic and trade indicators, because of the abolishment of the central planning system. Finally, the Central Planning Office was liquidated in 1997, within the framework of administrative reform.

From 1991, many tasks pertaining to agricultural policy implementation, which during the Socialist period were the responsibility of the Ministry of Agriculture, were transferred to the newly established agencies - **the Agency for the Restructuring and Modernization of Agriculture (ARMA), the Agency for Rural Market (ARM) and the Agency for Agricultural Property of the State (AAPS).**

The Agency for the Restructuring and Modernization of Agriculture (ARMA) was established by the Act of 29 December 1993. Its goal has been "to support structural changes in agriculture and in rural areas". It has been working as a "paying" authority, mainly "channeling the preferential credits to the agro-food sector" (*OECD, 1995, p.103)*

The Agency for Rural Market (ARM) was established by the Act of 7 June 1990, and has been in charge of intervention measures in the Polish market. Its main goal has been "stabilizing farm products markets and protecting farm incomes" (*OECD, 1995, p.102).* The agency implements intervention policy through purchases, stocks, sells, imports and exports of the agricultural products according to market situation, and it is also responsible for maintaining the state's reserves of the food and agricultural products (*OECD, 1995).*

The Agency for the Agricultural Property of the State (AAPS) (or the Agricultural Property Agency[58] (APA)) was established by the Act of 19 October 1991, with the main goal of taking over and administrating (restructuring and privatization) of the former state-owned assets in the agriculture (agricultural state farms and its land). The Agency manages this task mainly through the selling, leasing and transferring of former state agricultural assets, and by establishing management or administration contracts *(OECD, 1995).* (*A detailed description of the Agency work and its results was provided earlier in this section, while discussing the privatization methods of the state farms*).

During the transformation period, some of the tasks of agricultural policy implementation (particularly in the field of adjusting the agricultural sector to a market economy and the improvement of rural infrastructures) were transferred to newly established foundations (**Foundation of Assistance Programmes for Agriculture**, **European Fund for Development of Polish Rural Areas, Foundation Supporting Rural Areas, Foundation for Development of the Polish Agriculture**, and etc). These foundations mainly offer support for specific investment programmes, training or consulting services. Some of these foundations are financed from domestic resources, and others comprise both domestic and foreign resources (*Karaczun, 2000).*

Since the 1990s, the agriculturally oriented **political parties (**Polish Peasant Party, Peasant Alliance, Polish Peasant Party Solidarity) **and agricultural labor unions (**the Independent Self-governing Labour Union "Solidarnosc" of Individual Farmers, Agricultural Labour Union "Samoobrona", the National Union of Farmers associated in Agricultural Organizations) have started to play an important role in setting the directions of agricultural policy. They take initiative on changing or adjusting existing agricultural policy or associated trade measures as a part of the numerous Parliamentary Commissions' work.

Therefore, it is possible to conclude that the transformation process led to a strengthening of the role of some institutions (Sejm), a reduction of the importance of others (the Central Planned Office) and also resulted in the creation of several new institutions (the Agency for Restructuring and Modernization of Agriculture, the Agricultural Market Agency, the Agricultural Property Agency and different foundations). Overall, the transformation process led to a decentralization of the agricultural policy decision-making process (by increasing the role of Parliament and political parties' activities), and it also led to the

[58] In 2003, the Agency for the Agricultural Property of the State (AAPS) was transformed into Agricultural Property Agency (APA) according to the Law on formation of the agricultural system from 11.04.2003 (*Ustawa z dnia 11.04.2003 r. o kształtowaniu ustroju rolnego - art. 18 ust. 2 (Dz. U. Nr 64, poz. 592*)

diversification of channels of agricultural policy implementation (by establishment of several agricultural agencies and foundations).

Finalizing this general description of the Polish agricultural profile and the evolution of its agricultural transformation history, it is possible to distinguish the following main features: Poland's soil-climatic conditions are unfavorable to agricultural production, compared to most EU countries; the contribution of agriculture to the total GDP significantly decreased during the transformation period; agricultural production[59] and farm structure is highly regional–specific; the Polish agricultural transformation process does not significantly differ from the "CEEC history" in terms of market liberalization and institutional building, but it differs in terms of land reform, due to specific pre-transition land ownership structure; the speed and comprehensiveness of the agricultural reform process allows us to consider the Polish agricultural reform as a kind of "Big-bang" reform, which was mostly accomplished by 2004.

[59] The specialization in production of the particular agricultural product (cereals, potatoes, pigs, cattle etc.)

3.2. Agricultural production in Poland during the transformation period.

This section offers a detailed analysis of the GAO dynamics in Poland from 1990-2004. The section is organized as follows: it starts with an analysis of the long- and short-term trends of GAO production; then, the dynamic of the crops and livestock production with its regional diversification is described; after that, the organizational structure of the agricultural production in terms of the ownership and farm size characteristics is evaluated; next, the overview of the possible reasons for the initial agricultural production decline is provided; and last, concluding remarks finalize the Section.

The **long-term trend** of agricultural production shows a cyclic dynamic, and allows us to distinguish the following phases in its dynamic: (see **Appendix 3.6**)

-stable increase (1961-1975)

-sharp decline (1975-1980)

-sharp increase (1980-1986)

-stabilization (1986-1990)

-steep decline (1990-1994)

-stabilization with the slight increase dynamic (1994-2010)

Comparing the pre-transformation and post-transformation dynamics of the GAO in general, it is possible to state that before 1990, the GAO showed a increasing tendency (except for the 1975-1980 period), reaching its culmination point between 1986-1990 (130% level compared to base year 1961), next, after 1990 the GAO experienced a steep decline (1990-1994), followed by a slow increase that stabilized at the 110% level compared to 1961, however never reaching the pre-transition peak of the 1975-1980 period.

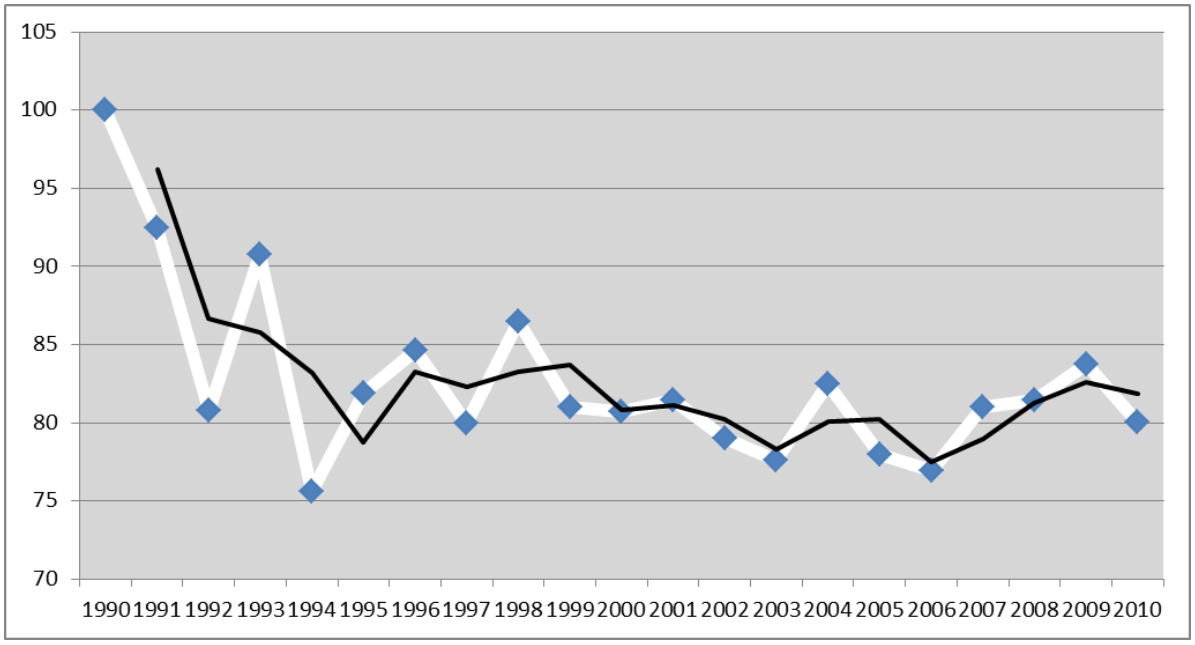
Although the long-term GAO dynamics had ups and downs, the share of agriculture in the GDP was constantly on the decrease: the share of agriculture in the Gross output declined from 16.4% in 1980 to 10.5% in 1990 and then to 2.9% in 2004. [60]

A long-term analysis of the GAO structure (crop and livestock production) shows that from 1961-2004 livestock production prevailed, but its share was constantly declining, and starting from 2004 livestock and crop production shares had stabilized around 50% each (see **Appendix 3.7**).

A "short-term" analysis of the agricultural production in Poland during the transformation period (1990 – 2004) shows that Poland experienced a steep decline in production from 1990 -1994, and after that started a slow recovery.

[60] *Agricultural Statistics Yearbook for Poland. (1986-1990)*

Figure 3.1. GAO dynamic in Poland in 1990-2004[61]



The following are usually considered among the main reasons for this initial GAO decline (which was, however, the smallest among all CEE countries in question): price distortions (terms of trade deterioration), state support withdrawal and a radical re-orientation of agricultural foreign trade. A detailed analysis of these factors will be provided later in this section, after the regional and structural GAO analysis.

The **most important agricultural products** in Poland are cereals (18%), vegetables (7.4%), potatoes (6.9%), fruits (6.3%), milk (13.6%), pork (18.7%) and eggs and poultry together (8.8 %) in respective shares of the value of agricultural output in the years 1998 and 1999 (*Agricultural situation in the candidate countries, 2002*). **The detailed results of the "commodity by commodity"** analysis of the agricultural production dynamics in Poland are presented in **Appendix 3.8.,** where the production of each commodity in the transition period (1990-2004) is compared to its pre-transition level (1983-1989). The results of this analysis allow us to state that after an initial decline, the production of some commodities increased compared to the pre-transition level (maize, oil seeds, wheat, chicken meat, pig meat), but for the majority of agricultural products either decreased compared to the pre-transition level or experienced cyclical changes. Regarding the dynamics of the main agricultural products, the production of all the main crop products (potatoes, vegetables, fruits and cereals (except wheat) decreased. The production of livestock products shows signs of

[61] The white line on the ***Graph 3.1.*** depicts the Polish GAO, and the black line depicts the linear trend. Data are from *FAO database* (Gross Production Value (constant 2004-2006 1000 I$) (1000 Int. $) – *Agriculture (PIN)-Total*. **Available at:** *www.fao.org* (Accessed: December 3, 2013)

increase - the production of pork and poultry increased, and egg production, after an initial decline started to recover. A serious decline in cattle meat production is attributed to the liquidation of former state farms, which specialized in cow breeding *(Banski, 2007; Zurek, 2004*), the outbreak of "Mad Cow Disease" (*Zurek, 2004)* and an increase in demand for chicken meat (product substitution).

In terms of the **regional differentiation of the GAO**, crop production is mainly concentrated in the northern and central parts of Poland (*Banski, 2007*), but the highest yields are achieved in the western regions. According to *Zurek (2004, p.14*) these yields should be attributed "not to the land quality, but to the level of agricultural production". This domination of the western regions in terms of crop yields and crop production did not change during the period in question (1990-2004) as we can see from the maps in **Appendices 3.9.- 3.11.,** where the regional specification of the production of basic cereals, wheat and potatoes is provided.

Livestock (meat) production is mainly concentrated in the central parts of Poland, where the "voivodships" with the highest share in total production and production per-1ha are situated. Milk production is dispersed more homogenously across the country, with the exception of some "voivvodship"- outliers. This production structure did not change significantly during the period in question (see **maps in Appendices 3.12. - 3.13.**)

Considering the general agricultural performance in terms of marketed output-per-hectare of farmland, regional disparities generally increased during the transformation period. *Mertens (2001*) found that the 'performance ratio" of the five best and five poorest voievodships for 1985-1989 vs. 1996-1998 years increased to 50% (from 2,9:1 in 1985-89 to 4:1 in 1996-98).

The **organizational structure of the** GAO production did not change significantly during the entire 14-year period, from 1990 to 2004. Private farms are dominant in the GAO production, and its share in crop and livestock production increased on average by 10% during the period in question (see **Table 3.6).**

Table 3.6. Share of private farms in agricultural production (current prices) [62]

	1990	**1995**	**2000**	**2004**
% share of private farms in total GAO	77	89	90	89
% share of private farms in crop production	78	90	89	89
% share of private farms in livestock production	77	88	91	90

[62] *Agricultural statistics yearbook for Poland (2001, p.115) and Agricultural statistics yearbook for Poland (2005, p.247).*

The interdependence of the scale of agricultural production and farm size also did not change significantly from 1990 to 2004. Commercial agricultural production is mainly concentrated in medium and large farms, while small farms produce mainly for their own consumption. In 1996, around 90% of farms of more than 15ha produced mainly for market purposes, while around 70% of small-scale farms (1ha-4ha) reported production for mainly private consumption (see **Table 3.7).**

Table 3.7. Farm size and purpose of agricultural production in 1996 [63]

land size	# of farms (ths.)	**Purpose of agricultural production** (%share)					
		any agric. production	solely for own needs	mainly for own needs	mainly for market	other	**Total**
1-2 ha	460.7	5.5	24.9	44.5	7.4	17.7	**100**
2-3 ha	280.8	3.2	16.2	52	16.5	12.1	**100**
3-4 ha	211.9	2	10.8	50	29.3	7.9	**100**
4-5 ha	173.2	1.4	7.3	42.6	43.4	5.2	**100**
5-7 ha	260.1	1	4.6	30.6	60.7	3	**100**
7-10 ha	259.6	0.7	2.7	16.4	78.5	1.6	**100**
10-15 ha	216.7	0.5	1.9	7.5	89	1	**100**
15-20 ha	89.2	0.5	1.4	4	93.3	0.8	**100**
20-50 ha	75	0.6	1.5	2.2	94.9	0.8	**100**
50-100 ha	5.5	1.4	2.3	1.1	93.8	1.5	**100**
>100 ha	2.9	1.9	4.1	1.1	90.5	2.3	**100**
Total	**2053.7**	**2.3**	**10.9**	**33.1**	**45.9**	**7.7**	**100**

The analysis of agricultural market output according to farm size in 1996 also shows that farms with more than 7ha size have a main share in market production (see **Table 3.8**).

Table 3.8. Share of different farms in market output in 1996 [64]

farm size (ha)	**1-2**	**2-3**	**3-4**	**4-5**	**5-7**	**7-10**	**10-15**	**15-20**	**20-50**	**>50**	**Total**
% share in market output	4.3	3.6	4.0	4.3	9.4	14.8	19.7	12.1	16.9	10.9	**100**

At the beginning of the transformation, the Polish agricultural sector was widely recognized among scholars and politicians as one of the "best-prepared" for the introduction

[63] Table from Borowicz *et.al (2001, p.121).*
[64] *Agricultural statistics yearbook for Poland (1998, pp.224-225)* and *Agricultural statistics yearbook for Poland (2005, p.247)*

of free-market principles of transformational reforms due to its mainly private nature.[65] Hence, the initial agricultural output decline (although the smallest among analyzed CEE countries) was received with huge disappointment, and several explanations emerged to explain this "phenomenon". These included inherited initial conditions, choice of reform policy, low technical efficiency and land fragmentation. The most commonly mentioned reasons for this initial decline were price distortions, subsidy policy changes and agricultural foreign trade re-adjustment.

Price distortions and subsidy policy changes were analyzed as possible reasons for the initial decline and then slow increase of agricultural production by *Dicke & Misala (1993), Karp & Stefanou (1992), Davidova et al. (2006), Rabinowicz (2003), Zawalińska (2003), Ciaian & Pokrivcak (2007), Rozelle & Swinnen (2004).* [66] The liberalization of agricultural prices and significant reduction of agricultural subsidization in Poland, which started in January 1990 (with the implementation of the Balcerowicz Economic Program), freed-up most agricultural and food prices. It was expected that liberalization would permit agricultural prices to align, thus leading to an increase in economic efficiency. However, the significant terms of trade deterioration induced by price liberalization and subsidy cuts caused a rapid decline of agricultural output. The terms of trade deterioration continued its decline until the 2000s, but starting from the mid-1990s, its negative impact was mitigated by the re-introduction of agricultural subsidization (which, however, constitutes the lowest level of support among the CEE countries in question) (see **Appendix 3.14.** with graphs). Therefore, starting from the mid-1990s, agricultural output, supported by the re-introduction of agricultural subsidization, started to increase gradually.

The impact of **agricultural foreign trade re-adjustment was analyzed by** *Smith (1994), Moutons (1998), Swinnen (2002), Holzmann & Zukowska-Gagelmann (1998), and Czyzewski et al. (2001).* This impact can be split into two main factors: (i) an inflow of cheap agricultural import from Western countries and (ii) a decline of agricultural export from Poland.

The favorable conditions for Western imports at the beginning of the transformation were created by the very low import tariffs that caused a significant increase in agricultural imports (see **Appendix 3.15**.). The scale of agricultural imports and its impact was so

[65] Polish case is unique among CEEC, because its agricultural sector was never fully collectivized after World War II. Private land and "private" labor force has accounted for 76% and 80% share of the total land and total labor force in 1990 (*OECD, 1995)*

[66] *Dicke & Misala (1993), Davidova et al. (2006), Rabinowicz (2003), Zawalińska (2003*) studies refer directly to the Polish agriculture, while *Karp & Stefanou (1992), Ciaian & Pokrivcak (2007), Rozelle & Swinnen (2004)* include Poland as a part of the more general CEEC analysis.

substantial, that the situation with the meat imports from Germany was perceived as a "dumping" and in 1991 cattle and hog imports to Poland were "personally approved by the Minister of Agriculture" (*Karp and Stefanou, 1991, p.15)*. This inflow of cheap agricultural commodities from the West lowered the output prices for national producers and diminished the incentives for production.

The decline of agricultural export was caused by the CMEA (Council for Mutual Economic Assistance) dissolution, because the agricultural products previously directed to CMEA countries (especially to the former FSU and East Germany) on non-market rules (based on imposed division of labor and recourses among CMEA countries) appeared uncompetitive on the recently opened Western markets or went under the Western markets imports' limitation.[67] Thus, agricultural producers had no incentive to produce agricultural commodities that had no chance of being sold, which caused the decline in production of the selected "uncompetitive" commodities. The above-mentioned impact of the export de-composition on output decline was discussed by *Karp & Stefanou (1993), Wziatek-Kubiak (2000) and Bezemer (2003).*

Hence, the results of the Poland-specific agricultural production analysis provided in this section allow us to come to state that the reform results in Poland in terms of output [68] could be considered a success, because despite an initial decline (which was the lowest among the studied CEE countries), agricultural output shows signs of recovery and stable increase.

[67] According to *Karp and Stefanou (1991, p.15)* "the export of meat products declined sharply at the beginning of 1991" in Poland "when the EC reduced the 1990 quota by half".

[68] It means in "absolute terms" referring only to production dynamic, with no comparison to subsidies level.

3.3. Agricultural productivity in Poland during the transformation period.

With reference to Section 2.3 in Chapter 2, where the outcome of the Polish reforms in terms of productivity is already considered a success, this section will provide a detailed evaluation of the country's specific features of productivity dynamics during the transformation period.

This section is organized as follows: it starts with a specification of the partial productivity estimations; then, the dynamic of the partial productivity of land, labor, machinery and fertilizer is analyzed; next, an overview of the selected TFP estimations for Poland is provided; and finally, concluding remarks regarding the success or failure of the reform in terms of agricultural productivity are provided.

For the purpose of the partial productivity analysis, land, labor, machinery and fertilizer productivity indexes for 1990-2010 period were estimated. **Land productivity** was estimated as the ratio of GAO[69] to total agricultural land. The **labor productivity** estimation has two specifications: (i) the ratio of the GAO to the number of agricultural workers (economically active population in agriculture) and (ii) the ratio of GAO per working hours, where the Annual Working Unit (AWU) was taken as a proxy of the working hours.[70] **Machinery productivity** was calculated as the ratio of the GAO to the amount of the agricultural machinery in use (the total stock of farm machinery in "40-CV tractor equivalents" (CV=metric horsepower)). **Fertilizer productivity** was calculated as the ratio of the GAO to the fertilizers consumption (the metric tons of N, P2O5, K2O of fertilizer consumption measured in "N-fertilizer equivalents," where tons of fertilizer types were aggregated using weights based on their relative prices). All the data (except for AWU) was taken from *Fuglie (2012*) datasets, the quality and reliability of which were discussed previously in ***Section 2.3.***

In general, the overall analysis of the Polish agricultural productivity ***(Table 3.9. and* Appendix *3.16.)*** shows that Poland followed the general trend of the CEE countries – partial productivity of inputs that fell faster than the GAO decrease to a smaller degree than the

[69] The GAO was calculated as the FAO gross agricultural output where the sum of the value of production of 189 crop and livestock commodities was valued at constant, global-average prices from 2004-2006 and measured in international 2005$.

[70] The analysis was done only for 1995-2010 period because of the limited data availability. AWU (annual work unit), "corresponds to the work performed by one person who is occupied on an agricultural holding on a full-time basis. Full-time means the minimum hours required by the relevant national provisions governing contracts of employment. If the national provisions do not indicate the number of hours, then 1,800 hours are taken to be the minimum annual working hours: equivalent to 225 working days of eight hours each". Eurostat database Available at:
http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Annual_work_unit_(AWU)
http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do;jsessionid=9ea7d07d30d65dc56f91cd7341bcafae9ad1763c353e.e34MbxeSaxaSc40LbNiMbxeNaNyKe0 (Accessed: January 5, 2014)

partial productivity of the inputs which fell slower than the GAO.[71] As a specific Polish feature, it is possible to consider the relevant stability of the productivity dynamic, compared to other CEE countries - partial productivity indicators did not change by more than 20%.

Table 3.9. Agricultural productivity dynamic in Poland [72].

	1990	1992	1994	1995	1998	2000	2002	2004	AVG 1990-2004	2005	2007	2010
Changes in												
GAO	100	81	76	82	87	81	79	83	84	78	81	80
land	100	99	99	98	96	96	89	87	95	84	86	87
Labor *(ec.active pop.)*	100	92	84	80	65	57	52	52	72	52	53	48
Labor (*rural population)*		100	100	100	99.8	99.4	99.0	99.4	100	99.7	100.2	101.0
Labor *(AWU)*					85	74	67	68	78	68	68	62
machinery	100	99	111	112	111	111	116	117	109	123	132	133
fertilizers	100	89	107	112	114	111	110	120	108	135	152	138
Changes in												
Land productivity	100	81	77	83	90	84	89	95	88	93	94	92
Labor productivity *(per worker)*	100	88	90	102	132	141	152	158	121	149	154	167
Labor productivity *(per AWU)*					121	129	139	144	125	135	140	151
Machinery productivity	100	81	68	73	78	73	68	71	77	63	61	60
Fertilizers productivity	100	91	71	73	76	72	72	69	80	58	53	58

The next paragraphs of this section will provide a detailed analysis of the partial productivity indicators in order to evaluate and explain the specific productivity dynamic features in Poland during the transformation period.

Land productivity in Poland steadily declined during the period in question (1990-2004) and continued this tendency for the next five years. The dynamic of land productivity

[71] In case of some other CEEC - partial productivity of inputs that fell faster than the GAO had increased, while the partial productivity of inputs that fell slower than the GAO had decreased.

[72] All the data for the Table 3.8 are taken from **Appendix 3.16** except for Labor (rural population), which are from *FAO database. Available at: www.fao.org (Accessed: March 3, 2014)*

was dependent on the changes in arable land use, which were to some extent influenced by the land reform changes.

Because of the predominance of small-scale, private farms, the main land-reform (privatization) efforts were focused on land that belonged to large-scale state farms. The land-reform induced decrease in arable land was mainly related to part of this former state farmland being taken out of cultivation.

This happened because nearly one-third of the former state lands belong to the poorest-quality classes (V and VI), and it would have been economically irrational to continue farming on these marginal soils. However, the issue of the rationality of the use of these marginal lands seems rather controversial if one looks further than the simple calculation of a costs/benefits ratio. On the one hand, naturally, the above-mentioned benefits/costs ratio will be negative on these marginal soils, and these lands surely can not be justifiably exploited in terms of the "classical" market economy, where the main task is cost minimization. On the other hand, *Gorz and Kurek (1998*) argue that most of this uncultivated land is situated in areas of high unemployment caused by lay-offs of former state farm workers, who have received unemployment benefits, which cost almost twice as much money as was previously paid in budget allocations to the state farms. Therefore, in terms of social costs, the economic rationale of getting out of cultivation of these marginal lands can be considered debatable.

However, this reform-induced decrease in arable land area was successfully balanced by an increase in land intensivity, measured in terms of machinery-and-fertilizers-use ratio per arable land, which after a slight initial decline in 1990-1993 started to increase steadily and continued this tendency up to 2010, reaching more than a 150% increase compared to the pre-transition period. ***(Table 3.10).***

Table 3.10. Land use intensivity (in relative values)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1999**	**2000**	**2002**	**2004**	**AVG**	**2005**	**2007**	**2010**
machinery	100	100	100	99	112	114	116	116	130	134	115	146	153	153
fertilizers	100	71	90	98	108	114	116	116	124	138	114	161	177	159

For the purpose of this research, **labor productivity** was calculated both in a quantitative (GAO per economically active in agriculture population) and qualitative (GAO per AWU) way. Both these partial productivity indexes increased during the transformation period and had continued its growth, reaching almost a 150% increase compared to the pre-transition level.

The increase of the partial productivity of labor (measured in GAO per economically active population ratio) was caused by the high speed of the outflow of the labor force from the agricultural sector, which was caused mainly by a decrease in working opportunities in rural areas after the land reform (due to the liquidation of the former state agricultural enterprises) and an increase of it in urban areas. This tendency became especially evident after 1995, because until then, agriculture in Poland had played a "shock absorption role" and functioned as a "food safety net" during the turbulent initial years of the "Big-Bang" transformation. The natural outflow of rural people to urban areas due to better income opportunities and quality of life, which was observed starting from 1946 (*Banski, 2006*) also played a role.

However, it is noteworthy that although the economically active population in agriculture diminished substantially during the period in question (by about 50% of the 1990s level) the rural population in general remained practically the same (see **Table 3.8.** "Labor (rural population)" line) This could be explained by the (i) rural population ageing (increase of the share of senior people in the agricultural population) and (ii) increase of the share of agricultural population that works outside the agricultural sector, while living in rural areas.

The labor productivity increase measured in (GAO per AWU ratio) was also influenced by the high speed of the outflow of the labor force from agriculture, because the average number of working hours per one person did not change during the transformation period, although it fluctuated from maximum 37.1 hours per week in 1994 to 33.2 hours per week in 1998 (see **Table 3.11.**and **Appendix 3.17**).

Table 3.11. Average number of hours worked per one person[73]

	1994	**1996**	**1998**	**2000**	**2002**	**2005**
Total ***(****all types of employment****)***	37.1	35.8	33.2	36	34.4	35.1
Employees	42.2	42.7	41.2	40.1	40.7	39.7
Employers and own-account workers	39.4	37.9	34.4	38.4	36.3	37.9
Contributing family workers	27.6	28	26.5	28	27.8	26.3

Considering that the average salary in the agricultural sector in Poland (see **Appendix 3.18**) steadily increased from 1995-2004, both in terms of its nominal value (measured in Polish national currency (zloty) and US$) and power purchasing parity (the average salary in 2004 was 339% higher than in 1995, while the price index for consumer goods and services

[73] Average number of hours worked per one person in the reference week in the main job by employment status and selected sections in the 4th quarter of the year. Data from: Y*earbooks of Agricultural Statistics for Poland (various years) (Section: working conditions)*

increased by only 104% compared to 1995), the results of the transformational reforms in terms of labor productivity could be considered a success.

M**achinery productivity** shows a stable downward trend from the very beginning of the transformation due to the stable increase in machinery use, which was coincident with a stable decline in GAO production. Although overall machinery use in Poland (measured in terms of machinery capacity in horsepower) steadily increased during the period in question (1990-2004) and continued its growth during the next years, this happened mainly due to the positive changes in the narrow stratum of highly adaptable and advanced Polish agricultural producers, while in the less-advanced agricultural enterprises, the increase in machinery use was hampered by technological and institutional constraints. As the most important of them, *Ciepelewska and Mucha-Leszko (1999)* mentioned the following: (i) low educational level and inefficient system of training and extension services contracted the absorption of the technological advances; (ii) technologically unfavorable agrarian structure - farming tractors could not be reasonably used on farms under 10ha, which comprised 90% of Polish farm area; (iii) over half of Polish tractors were 10 or more years old (see **Table 3.12.**) and were not compatible with the more advanced equipment, and this situation did not change significantly during the next decade.

Table 3.12. Amortization of fixed assets (*buildings, machinery, means of transportation***) in % (***current bookkeeping prices***)** [74]

	1993	**1994**	**1995**	**1996**	**1997**	**2000**	**2001**	**2002**	**2003**
Private sector	54.7	56.2	58.9	56.9	63.4	63.4	69.7	40.2	71.3
-cooperatives	*40.6*	*42.3*	*48.7*	*49.9*	*51*	*n.d.*	*n.d.*	*n.d.*	*n.d.*
Public sector	43.7	44.4	46.6	47.5	49.7	49.7	56.5	58.6	59.8

Tractor density (tractors-per-ha ratio) shows a significant regional difference – the highest tractor-per-ha ratio is in the southern regions of Poland, while the lowest is in the northern and north-east regions. However tractor capacity (measured in horsepower) is higher in the northern regions and lower in the southern regions (*Banski, 2007*). This could be related to the two following factors: (i) small-scale family farming, dominant in the southern regions, does not require extremely high-capacity tractors, while in the northern and north-east regions, with predominantly large-scale farming, the use of high-capacity tractors is more reasonable and economically justifiable; (ii) the possession of a tractor has a prestigious meaning for the majority of farmers and a lot of tractors were bought on the basis of (low)

[74] Data from *Agricultural Statistics Yearbook for Poland (1998, p.168) and Agricultural Statistics Yearbook for Poland (2005, p.233)*

price rather than on the basis of technical characteristics when the state-owned, large-scale farm have been renewed its machinery park and got rid of the old, low-capacity and outdated agricultural machinery (*Banski, 2007).* On average, the tractors of medium capacity were prevalent in 2002 in Poland (tractors from 25KW to 60 KW), while only 1 out of 100 farms had tractors of more than 100KW capacity (*Banski, 2007).*

The **fertilizer productivity** after the initial strong increase shows a clear downward trend, which continued during the whole period of observation (1990-2010). The initial strong increase in fertilizer productivity should mainly be attributed to a sharp decrease in fertilizer consumption because of a significant increase in inputs' prices and terms of trade deterioration at the beginning of the transformation. Due to the "shock" price liberalization, the retail prices of inputs, measured in agricultural products, increased twice during the first years of the transformation (**Appendix *3.19*.).**

Besides the overall changes in fertilizer consumption, induced by the transformation processes, the fertilizer consumption gap (regional differentiation in fertilizer use) became more extended than in the pre-transition period. According to *Mertens (2001),* during the first half of the 1980s, the difference between "viovodships" with the highest and lowest fertilizer consumption levels was 2.5:1, in 1996 it became 3.6:1 and in 1998 it reached the 5.5:1 level – which means that the fertilizer consumption gap had increased twice, during the first decade of the transformation. However, the author does not provide detailed information regarding the geographical positions of the regions with the highest (and lowest) fertilizer consumption levels, and whether their fertilizer consumption levels correlate with the small-scale vs. large-scale production regional division.

The general analysis of the partial productivity dynamic of all the inputs in question (land, labor, machinery and fertilizers) produced a mixed picture and did not lead to straightforward assumptions regarding the results of the reforms in terms of productivity. In order to make a final conclusion, the TFP dynamic must be taken into consideration.

Unfortunately, the estimation of a plausible (only Poland-relevant) panel regression is constrained by insufficient (not consistent) data and changes in administrative division during the period in question. The data inconsistency problem is related to a lack of consistent and homogenous GAO data for the whole period in question, because the only GAO data available for the whole 1990-2004 period for each region are the "procurement of agricultural products", which are "the quantity and value of agricultural products purchased by economic entities conducting procurement of agricultural products directly from producers, compiled on the basis of half-year reports presented by this entities" *(Agricultural Statistics Yearbook for*

Poland, 2004, p.312). This procurement value does not cover all the GAO produced in Poland, but only 70%-80% of it, and therefore should not be considered as a representative dependent variable *(Agricultural Statistics Yearbook for Poland, 2004).* The regional division problem means that in 1998 the Polish administrative division was reformed (49 "viovodships" were merged into 16 "voivodships") and the boundaries of the previous 49 "voivodships" do not correspond exactly with the newly emerged 16 "voivodships". Thus, the TFP estimations from the studies when Poland was the part of the multi-countries' panel regression will be used for an assessment of the reforms' results in terms of agricultural productivity.

The analysis of these studies (see **Table 3.13) shows** that although during the some short periods of time within the whole 1990-2004 period (*1989-1992 in Swinnen and Vranken (2010)* study, 1989-1995 in *Rozelle and Swinnen (2004)* study and 2001-2005 in *Fuglie (2012) study)* the TFP in the long-term run for the whole period in question could be considered as a having the stable increasing tendency.

Table 3.13. Average annual TFP growth (*based on overview from Appendix 2.9)* [75]

Swinnen and Vranken (2010) (dep. variable -GAO)	**1989-2001**	1989-1992	1992-1995	1995-1998	1998-2001
	0.8	-1.7	0.5	3.3	0.9
Rozelle and Swinnen (2004) (dep. variable -crops)	**1989-1995**	1989-1992	1992-1995		
	-0.4	-5.1	4.3		
Fuglie (2012) (dep. variable -GAO)	**1991-2010**	1991-2000	2001-2005	2001-2010	
	0.008	0.011	-0.003	0.0017	
CEEC Chapter regression (Appendix 2.7) (dep. variable -GAO)	**1990-2004**				
	0.4				

Such an increase of TFP could be attributed to the fact that the technological, agricultural and managerial improvements in inputs' use had a more decisive impact than the fall in some inputs use. This leads to the conclusion that the transformational reforms (in terms of productivity) could be considered a success in Poland.

[75] This overview does not include the numerous panel regressions whose estimation was based on Polish farm survey data due to its micro-coverage (not the whole of Polish agriculture, but only selected -though very representatively- farms) and time-span limits (mainly selected years, but not the whole period in question).

3.4. Conclusion

The analysis of the Polish agricultural performance during the fifteen years of transformation allows to come to the following conclusions:

1. The analysis of the speed and the comprehensiveness **of agricultural reforms** points to Poland as an "advanced reformer", and the reform process itself could be considered as accomplished in terms of market liberalization, institutional building and land ownership structure as for year 2004.

2. In terms of **agricultural production and productivity,** the transformational reforms results in Poland could also be considered a success.

CHAPTER 4. Belarusian agricultural performance during the transformation period.

This chapter evaluates Belarusian agricultural performance during the fifteen years of transformation in regard to the "success or failure of reforms" assessment in terms of agricultural production and productivity. The chapter consists of three sections. Section 4.1. is dedicated to a description of Belarus agricultural history, and is divided into four sub-sections. Section 4.2 provides an analysis of Belarusian agricultural production dynamics. After that, in Section 4.3, agricultural productivity will be discussed. Next, in Section 4.4., the panel regression for the seven Belarusian regions is estimated in order to analyze the impact of the changes in inputs use on the GAO dynamic, and to calculate the TFP indexes. Finally, the concluding remarks in Section 4.5 will outline the main findings of the research.

4.1. Overview of Belarusian agricultural transformation history.

This section consists of the four following sub-sections: Sub-Section 4.1.1 provides an overview of the Belarus agricultural profile, and a description of the land reform progress; Sub-Section 4.1.2 provides a detailed evaluation of the reasons for the slow land reform progress with a special emphasis on the reluctance of Belarusian peasants to become a private farmers; Sub-Section 4.1.3 evaluates price- and state-support policies; and Sub-Section 4.1.4 provides concluding remarks regarding the appropriateness of the gradual reform approach chosen by the Belarusian government.

4.1.1. Overview of land-reform progress in Belarus, 1990-2004

This sub-section briefly reviews the agricultural reform process in Belarus during the transformation period. The sub-section is organized as follows: it starts with an overview of the Belarus natural agricultural endowment; then, the role of the agricultural sector in the Belarus economy will be analyzed; after that, an outline of the process and results of the land reform will be provided; and finally, the concluding remarks will cap off this sub-section.

The Belarus Republic encompasses 207,595 square kilometers. It has 10.3 million inhabitants (80% of whom are Belarusians, with the rest mainly Russians and Ukrainians). The majority of the population speaks fluent Russian *(Csaki et al., 1994*).

Administratively, Belarus is divided into six regions ("*oblast"*) with a quite homogeneous agricultural structure in terms of the dispersion of agricultural land and agricultural labor among them (see map in **Appendix 4.1)**

Agricultural land constitutes around 45% of the total territory of Belarus: 65% of it is given over to annual crops, 19% is pasture and 2% are orchards (*Csaki et al., 1994*).

In general, the Belarus natural environment is usually considered only of average quality for agriculture (*Csaki et al., 1994*)**.** Further, the Chernobyl explosion has had enduring effects on Belarus agricultural resource endowment – "about 261 thousands hectares of agricultural land were taken out of cultivation and some restrictions on agricultural cultivation were introduced on about 1,5 million ha, about 16% of productive farmland" *(Csaki et al., 1994, p. 6).* [76]

The role of the agricultural sector in the Belarusian economy did not change substantially during the transformation period, although the share of agriculture in the national economy did decline steadily at that time.

Belarus had been considered one of the most industrialized countries in the USSR – the Belarusian share in USSR production was about 8%, while the Belarus population accounted for 3% of the total USSR population (*Csaki et al., 1994*).

Despite the mainly "industrial orientation" of the Belarus economy, agriculture played a significant supplementary role (income earnings, substantial employment, export revenues and so forth), although the country had the status of a net importer of food and agriculture products in the USSR *(Csaki et al., 1994).* In 1992, the agricultural sector constituted 24% of the Belarus NMP[77] (18% of GDP) and employed about 20.7% of the labor force *(Csaki et al., 1994).*

During the transformation period, the role of agriculture continued its natural downsizing tendency **(*Table 4.1*).** While in 1990, agriculture employed 18% of the total labour force and produced 20% of the GDP, in 1998 its share in the total labor force and GDP production declined to 16% and 14%, and in 2004 to 11% and 9% respectively.

Table 4.1. Agriculture's share in the economy [78]

	1990	**1992**	**1994**	**1996**	**1998**	**2004**
Share in GDP	20	22	18	16	14	9
Share in assets	20	23	17	15	16	--
Share in investment	28	18	9	8	7	--
Share in employment	18	20	19	17	16	11

[76] Although the Chernobyl reactor is located in Ukraine, 75% of the Cherernobyl radioactive fallout landed in Belarus due to the weather conditions (the direction of the prevalent winds) and the Chernobyl proximity to the Belarus border (*Csaki et al., 1994)*

[77] NMP – Net Material Product was the main macroeconomic indicator used by the USSR and other centrally-planned economies. GDP calculations are only available from 1992. (*Csaki et al.,1994)*

[78] *Csaki et al. (1994)* and *Belarusian Agricultural Statistics Yearbook (various years)*

According to the "agrarian index" calculated by *Lerman (2007a),* Belarus (together with Russia and Ukraine) was considered to be the least agrarian among the FSU countries, which reflects the correction of the national economic structure and general urbanization trends[79] **(*Table 4.2.*).** According to the WB report, such tendencies could be considered to be positive, because they "illustrate[s] the relatively mature nature of the economy" (*Cramon-Taubadel et al., 2009, p.6).*

Table 4.2. FSU countries agrarian index[80]

	Azerbaijan	Armenia	**Belarus**	Georgia	Kazakhstan	Kyrgyzstan	Moldova	**Russia**	Tajikistan	Turkmen.	Uzbekistan	**Ukraine**
Agrarian index	33.2	34.8	**15.9**	40.8	28	49.9	39.2	**14**	55.1	38.3	45.4	**22.7**

The most distinctive characteristic of the Belarusian agricultural transformation, which significantly distinguishes Belarus from the other CEEC and FSU countries, is the slow speed of its transformational reform. For most transitional countries, the transformation agenda mainly included land reform, reduction of state (government) subsidies and price (agricultural market) liberalization. However, in Belarus, after fifteen years of transformation, the role of private agriculture is still marginal, and significant state support together with strict price regulation still play an important role in the agricultural sector. This will be discussed in the next paragraphs.

In terms of **land tenure**, during the Soviet period, Belarus agriculture (as in all FSU countries) consisted of a "socialized sector" (centrally controlled, large-scale state farms) and a "private sector" - subsidiary household plots.

The "socialized sector" consisted of two types of farms – "sovkhoz" (state farms) and "kolkhoz" (collective farms). "Kolkhozes" were the "collective farms in which output and assets were jointly owned by the members", while the "sovkhozes" were "the state farms in which output and all assets, including land, were owned by the state" *(Bondar and Lilje, 2002, p.4).* Both types of "socialized farms" were organized on the same principles as the industrial enterprises, where its members became its workers and received assigned tasks to

[79] This "agrarian index" is expressed in percentages and is calculated as the arithmetic average of three components: share of rural population (in percent of total population), share of agricultural employment (in percent of total employment), and share of agricultural Gross Value Added in the country GDP (*Lerman, 2007a, p.5)*

[80] *Source: Lerman (2007a, p.5)*

be done from the farm managers (*Rozelle and Swinnen, 2004*). The state also made investments, set production goals (according to the regional and national centrally elaborated production plans), "purchased inputs through planning channels, and remitted profits up through the ministerial system" *(Rozelle and Swinnen, 2004, p.421*).

The "kolkhozes" and "sovkhozes" were large-scale and well-mechanized enterprises**.** According to *Csaki et all. (2000, p. xix),* "Soviet type" farms "were large in terms of all three production factors – land, labor and capital", compared to the "farms in the market economies, which tend to be large either in terms of capital or labor, but not both". The scope of its operations very often comprised both upstream and downstream activities, such as agro-processing (dairy, meat, sugar processing) and the provision of inputs (machinery repair, construction services, agrochemical supplies); only a small share of farms was narrowly specialized *(Csaki et all., 1994).* The "socialized" sector was also responsible for providing a comprehensive range of social and municipal services in rural areas, like kindergartens, schools, medical and social care, housing, clubs, sport facilities and so on.

Private agriculture consisted of subsidiary household plots (from 0.1 to 0.5 ha), which were cultivated by the members of "kolkhozes" and "sovkhozes" who lived in rural areas, and so-called "garden plots", cultivated by urban residents (*Csaki et al., 1994*). During the 1980s, household plots (around 1.4 million families, according to *Csaki et al., 1994*) occupied 7% of total agricultural land and produced around the 25% of total agricultural output ***(Table 4.3.)***

Table 4.3. "Socialized" and "private" agriculture in Belarus (%)[81]

	1980	1985	1989	1990
Total agricultural land use	**100**	**100**	**100**	**100**
-household plots	7	7	8	8
-state farms	93	93	92	92
Total agricultural production	**100**	**100**	**100**	**100**
-household plots	34	30	25	25
-state farms	67	70	75	75

The process of land reform in Belarus was initiated between 1989-1990 by the Communist Party and Soviet Supreme Council as a vital part of the entire process of transformation of the Socialist command economy to a market economy (*Sakovitch, 2008a and Sakovitch, 2008b).* More specifically to land issues, the whole process of land reform in Belarus from 1990-2004 could roughly be divided into two parts: **(1) changes in land tenure (land property rights)** that affected the "private sector" - subsidiary household plots and newly emerged individual private farms, and (**2) changes in the legal and**

[81] *Belarusian Agricultural Statistics Yearbook (1990)*

organizational status of "socialized sector" farms ("kolhozes" and "sovhozes"), which is often referred to as "**farm restructuring"** in the international (Western) transformation literature *(Csaki et.al., 2000; Csaki and Kray, 2005).* These two land reform streams will be analyzed in the next paragraphs.

Regarding **land tenure issues**, there were two main waves of land legislation reforms, the first of which took place at the beginning of the transformation in the 1990s , and the second of which took place in 1996. The first wave started in 1990 with the adoption of a set of legislative acts that allowed for the creation of private farms, increased the permitted limit of land size for household plots and recognized private property for land in household possession.[82]

The creation of private farms run by private individuals that would be able to make "production and marketing decisions independent[ly]" *(Csaki et al., 2000, p.15*) of the state was allowed by the new Land Code adopted in December 11, 1990. Although farm size was limited to 50 ha per farm, and the farmland was only used privately but owned by the state,[83] this new legislation broke the previous state monopoly on commercial, large-scale agricultural production.

Household plot size increased from 0.5 ha to 1 ha by a Resolution of the Supreme Soviet of the Belarus Soviet Socialist Republic, adopted in December 11, 1990. This aspect of Belarusian land reform is considered by some experts to be its most crucial, even more important than the redistribution of Soviet collective farmland to private farmers (*UNDP, 2006).* This point will be discussed in greater detaill later in this section.

The 1993 Law on Land Ownership officially recognized household plots as private property.

In Belarusian historiography, this period of land reform was referred to as the period of "imposed farmerization" *(Sakovitch, 2008a, pp. 21-22),* which was characterized by the following features: (i) dismantling of the state system of the large-scale agricultural production based on the "kolhoz"-es and "sovhoz"-es; (ii) forced farmerization of the Belarusian villages; (iii) re-orientation of the all Belarusian enterprises to the market methods of the work" *(Sakovitch, 2008b)***.**

During the second wave of land legislation reform, initiated in 1999 by the adoption of the new Land Code, individual private farmers were allowed to have up to 100 ha in a lifetime

[82] In total, there were more than 15 land-reform relevant legislative acts adopted during the first wave of land reform. I chose only three to discuss on the basis of their importance.

[83] The land for private farms was allocated only in lifetime inherited possession with no transfer rights. This land could not be sold, sub-leased, exchanged, and divided into the sub-plots.

inherited possession, and any amount of land to lease. The limit of the household plot permitted to be in private possession remained the same (1 ha), but individuals were allowed to lease additionally up to 2 ha, so the previously established (in 1990) one-hectare limit of household land size increased to 3 hectares**.** Although official recognition of private property pertaining to land in household plots had taken place in 1993, only a small part of the household plots became officially privately owned, some more in lifetime inherited possessions, and the major part of land cultivated in household plots remained in state-use rights (*Csaki et al., 2000).* The WB survey made among the people without land titling documents (662 respondents) in 1999, revealed the following reasons for this situation: (i) passive approach of the local authorities (do not inform the people about their rights on the land) ; (ii) land is not officially valued and titled; (iii) lack of money to pay for the titling procedure and document; (iv) sometimes land documents are kept by the corporate farm management; (v) other reasons (*Csaki et al., 2000).* Considering the very small share of officially owned private land, the land market in Belarus is poorly developed and the main household land transactions are the leasing of land from corporate farms (*Csaki et al., 2000).*

Although land reform caused significant legislative change (the break-up of the state monopoly on commercial agricultural production, the introduction of private property on household plots and an increase in their size) the real economic outcomes were far from expected. Reallocation of land from the "socialized" sector ("kolhozy" and "sovhozy") to the "private" sector (household plots and individual farmers) was marginal. The share of privately used land of the total agricultural land did not exceed 17% during the period in question (***Table 4.4*.).** Moreover, the main redistribution of state land occurred not in the farmers' land sector, but in the household plots' sector. The peak of land re-distribution to household plots happened in 1992-1993, after the government permission of the two-times increase of allowed household plot size, from 0.5 ha to 1ha. During this period, the share of household plots' land increased more than twice, and then stabilized at around a 15% share.

The share of private farmers' land was still marginal, and did not exceed 2% even after fifteen years of transformation (see **Table 4.4.)**

This land tenure structure (with the prevalence of corporate farm land over private farms and household plots) remained the same in every Belarus region for the whole period in question (see **Appendix 4.2)**

Table 4.4. Agricultural land tenure (1990-2004) [84]

	1990	1991	1992	1993	1994	1995	1997	1999	2000	2001	2002	2003	2004
Corporate farms	94	87	84	84	84	84	84	84	84	84	83	83	84
Private farms	0	0	0	1	1	1	1	1	1	1	1	2	2
Household plots	6	13	15	15	16	16	16	15	15	16	16	15	15
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Belarus and international scholars maintain that this fact reflects a failure in the development of the farmers' sector, although the explanations of this failure differ. International (mainly Western) scholars suggest that the underdeveloped status of the land reform (weak and underdeveloped legislation and lack of consistent policy for large, post-Soviet farms restructuring and privatization) *(Csaki and Kray, 2005; Csaki and Nash, 1998)* and the lack of (or insufficient) support of the Belarusian government for farmers' sector development (*Csaki et al., 2000)* are the key reasons for this failure. Conversely, Belarusian scholars (*e.g. Kazakevich,2006; Kornilov,2006; Shpak,2007; Korbut,2009*), officials (*Andrievich, 2007; Belagroprombank, 2011*) and some farmers (*Sinevich, 2012*) argue that Belarusian government provided a sufficient legislative basis and fair enough supportive measures for farmers' development (especially at the beginning of the transformation period (1991-1994), when it was almost officially declared that farmers would create "the third and most effective sector of the agricultural production, in addition to the state-farms' and subsidiary household plots' sectors" (*Belagroprombank, 2011).* Therefore, it is probably possible to consider the "the risk-averse behavior and the reluctance of the rural population (farm workers, peasants) in starting up the individual farming" (*Prognoz, 1999, p.75*) as the reason for the failure of individual farming. (These suggestions will be analyzed more thoughtfully in the next sub-section of this chapter).

After the surge of individual farming from 1990-1996, the initial enthusiasm subsided substantially, and beginning in 1997, the number of individual farms started to shrink (***Table 4.5.).*** Also, the normalization of the food supply and the end of the food shortages (which diminished the role of individual farming as a food security net) played a role in the diminishing interest in individual farming.

[84] *Belarusian Agricultural Statistics Yearbook (various years)*

Table 4.5. Average size and number of private individual farms[85]

	Number of organised farms	Number of liquidated farms	Average size per farm (ha)
1990	17	0	21.2
1991	84	8	25.4
1992	757	160	20.6
1993	2,372	137	19.2
1994	2,730	283	20.4
1995	2,954	342	20.6
1996	3,030	328	20.6
1997	2,977	451	20.7
1998	2,668	264	22.7
1999	2,641	234	25.4
2000	2,651	344	28.9
2001	2,525	357	32.8
2002	2,397	219	38.9
2003	2,399	257	54.2
2004	2,493	373	72.1
2005	2,318	251	73.9
2006	2,204	203	67.4

Summing up the outcomes of the land reform process in terms of land tenure (land ownership rights), it is possible to conclude that the main developments took place only in the private sector (individual private farms and household plots). The "socialized" state sector (large-scale "post-Soviet" farms) remained practically unaffected by land tenure reforms, because all the land of the former soviet "kolhoozes" and "sovhozes" remained as state property even after fifteen years of transformation, and only minor (mainly cosmetic) restructuring changes in the legal status of these farms had been achieved, which will be discussed later in the next paragraphs.

In terms of large-scale, "post-Soviet" **farm restructuring,** it is possible to set forth the following three stages. The first stage (1990-1998) is recognized by both Belarus and Western scholars as having been "mainly of declarative character" (*Miasnikovitch, 2007, p.314)* in restructuring and "formal change of title" (*Miasnikovitch, 2007, p.314)* with "little change in organizational type" (*Csaki et al., 2000, p.19)*. During this period, only 95 former "kolhozes" and "sovhozes" were reorganized into new legal entities (these, however, still remained under state control with some minor changes in organizational structure), which constituted less than 4% of the total post-Soviet big farms[86] (***Table 4.6.)***.

[85] Data from *Sakovitch (2008c, p. 153)*

[86] Although the World Bank study recognized three periods in farm restructuring between 1990-1998 (*Csaki et al., 2000)*, the small scale of the observed change and insignificant number of restructured farms permits to consider and research this time period as a coherent one.

The second stage (1999-2003) was the most intensive, while involving mainly a formal reorganization of post-Soviet farms. It started in 1999 with the adoption of the new Land Code, which did not categorize the "kolhoz" and "sovhoz" as legally recognized forms of business organizations (enterprises). However, the actual reorganization started in 2000, after the adoption of the Presidential Decree, which stipulated that the "kolhozes" should be reorganized into agricultural production cooperatives, and that "sovhozes" should be reorganized into state unitary enterprises (*Presidential Decree #22, 2000*).

As a result, during the following three years, almost all "kolhozes" and "sochozes" were reorganized into new legal entities – large-scale, corporate farms (see ***Table 4.6.***). However, the effects of this restructuring were marginal, because the reorganized farms remained under state control. Only "the transfer of responsibility for the provision and maintenance of the social infrastructure from agricultural enterprises to local authorities" can be considered a vital and positive change during this period (*Freinkman et al., 2005, p.183*).

Table 4.6. Corporate farm restructuring [87]

	1.Collective farms (kolhoz)	**2.State farms (sovhoz)**	**3.Inter-farm associations**	**4.Reorganised farms (total)**	*among them*				**TOTAL number of farms**	Average size of the farm
					unitary enterprises	*agricultural production cooperatives*	*joint-stock companies*	*Other*		
1985	1,715	917	44						2,676	
1990	1,641	866	45						2,552	3,449
1991	1,779	733	43						2,555	
1992	1,834	659	39	28					2,560	
1993	1,824	658	30	39					2,551	3,060
1994	1,806	649	29	69					2,553	
1995	1,803	643	28	69					2,543	
1996	1,802	632	26	63					2,523	
1997	1,774	624	18	84					2,500	3,018
1998	1,760	621	17	91					2,489	
1999	1,730	617	17	95					2,459	
2000	1,690	612	17	95					2,414	3,824
2001	1,670	87		663	578	29	32	24	2,420	3,674
2002	1,519	37		787	603	70	39	75	2,343	3,725
2003	37	13		2,161	591	1,169	107	294	2,211	3,884
2004	18	8		1,914	522	1,018	132	242	1,940	

[87] Data from *Csaki et al. (2000) and Sakovitch (2008c)*

During the third stage (2003-2004) of the post-Soviet farm reorganization, the legal basis of the liquidation of the unprofitable (loss-making) farms was formed.[88] The set of legislative documents,[89] which allowed the actual legal liquidation of the unprofitable farms by its reorganization, sale, merge and leasing, was adopted between 2003-2004. As a result, "511 loss-making enterprises were merged with other entities", "48 enterprises had been sold to private investors and 27 enterprises had also been leased to private farmers" at the end of the 2004 (*Freinkman et al., 2005, p.183)* , which also caused a visible decrease in the total number of large-scale corporate farms (*see* ***Table 4.6*****)**

Nonetheless, the above-described, big "post-Soviet" farm transformations did not cause any significant change in either farm management or in farm size. These large corporate farms remain under state control, because the state holds a majority share in the farms' assets (*Cramon-Taubadel et al., 2009*), imposes production plans, sets procurement quotas and provides financial support. Average farm size did not decrease during the period in question, but became even larger, while it had shrunken in other FSU countries. (***Table 4.7)***. This fact is usually attributed to the "little deep restructuring" (*Cramon-Taubadel et al., 2009, p.16)* and "little leeway for farms to change size in an attempt to improve efficiency and profitability" (*Cramon-Taubadel et al., 2009, p.17),* however with the notification that although there is no "optimal farm size in Belarus or elsewhere" (*Cramon-Taubadel et al., 2009, p.17)*, the proper restructuring "would most likely lead on average to smaller farm structures in Belarus" (*Cramon-Taubadel et al., 2009, p.17).*

Table 4.7. Average size and number of corporate farms in Belarus [90]

	1990	**1993**	**1997**	**2000**	**2001**	**2002**	**2003**	**2007**
Number of corporate farms	2,552	2,551	2,500	2,414	2,400	2,338	2,230	1,617
Average size of corporate farm (ha)	3,449	3,060	3,018	3,824	3,674	3,725	3,884	3,985

There is a two-fold explanation of the slow progress of farm restructuring. While Western scholars consider the general unwillingness of state authorities to land reform as the

[88] Before this, farms with zero-profitability and even with long-lasting records of loss-making were not allowed to be liquidated and were heavily supported by the state.

[89] The following Laws and Presidential Decrees were adopted: *Zakon RB «O reorganizacii ubytochnyh sel'skohozjajstvennyh organizacij» (9.06.2003); Ukaz Prezidenta RB № 138 «O nekotoryh merah po finansovomu ozdorovleniju sel'skohozjajstvennyh organizacij i privlechenii investicij v sel'skohozjajstvennoe proizvodstvo» (09.03.2004); Ukaz Prezidenta RB № 280 «O porjadke i uslovijah prodazhi juridicheskim licam predprijatij kak imushhestvennyh kompleksov ubytochnyh sel'skohozjajstvennyh organizacij» (14.06.2004)* (*Sakovitch, 2008d, p.148)*

[90] *Belarusian Agricultural Statistics Yearbook (various years)*

main reason for the slow restructuring, Belarus scholars and state officials identify the primary problem in the lack of interest in farm reorganization by all involved "actors"– the central government, local (regional) authorities, farm directorate and farm workers (peasants) themselves. A detailed analysis of this situation will be provided in the next sub-section of this chapter, dedicated specifically to this issue.

Finalizing the land reform issue, it is possible to conclude that during the fifteen years of transformation nothing of real significance changed in terms of land property rights and farm structure. The main agricultural production entities engaged in agricultural production were still the large-scale corporate farms (former "kolhozes" and "sovhozes"), private subsidiary household plots and the newly emerged private individual farms. The former "kolhozes" and "sovhozes" underwent some formal changes and were transformed into large-scale corporate farms. They still occupy the major part of agricultural land, and operate as they did in Soviet times.[91] The household plots and individual farms, although usually considered "private" entities, remain closely linked to the structure of the corporate "mother" farm, on which they depend heavily (especially the household plots) for inputs and support services[92] and still occupy a comparably small share of agricultural land in Belarus.

In general, international scholars assess the land reform progress as slow and inadequate (*Csaki and Kray, 2005; Freinkman, 2005*). From the point of view of Belarusian scholars, however, the introduction of legislation that allowed the creation of individual (not state-owned) farms, that recognized private land in household plot possession and that broke the previous socialist state monopoly on commercial, large-scale agricultural production was a significant "step forward" when taking into account the seventy-years legacy of state-controlled agriculture based exclusively on a state-owned land tenure structure *(e.g., Shingel', 2005).*

[91] Workers at the corporate farms do the work assigned by farm managers, both workers and managers are salary-paid and state pension-covered employees, the production targets are (mainly) set by the state authorities, with accordance to the state annual production plan.

[92] All rural households use the production resources of corporate farms (although to different extents) without a full-costs compensation (*Babicki, 2003, p 4).*

4.1.2. Belarus land reform constraints, or why Belarus peasants do not want to be the private farmers.

This sub-section describes a specific set of reasons for the slow progress of land reform, that is, the reluctance to reforms of the all "actors" involved in this process – state authorities (central government and local authorities), farm directorate and farm workers (peasants) itself. The sub-section is organized in a following way: it starts with a brief analysis of the state authorities' position regarding the reformation process; then, the reasons of the large corporate farms directorate (former "kolkhoz"-es and "sovchoz"-es) reluctance to reformation are provided; and finally, a detailed analysis of the reasons behind the Belarusian peasants unwillingness to be independent private farmers is provided and supported by the empirical evidence.

The poor progress of individual private farming development and generally slow progress of land reform in Belarus can be explained by a set of strongly interrelated political, economic and social factors.

As mentioned in the previous sub-section, Western scholars consider a general unwillingness of the state authorities (central government and local authorities) to land reform as the main retarding force in the restructuring (*Csaki et al., 2000; Csaki and Nash, 1998; Csaki and Kray, 2005*), while Belarusian scholars and state officials maintain that the primary problem has been a lack of interest in large, corporate farm reorganization (land privatization) by all involved "players" *(Prognoz, 1999).*

Western and (some) Belarusian scholars concur that the central government and local authorities were reluctant to participate in land reform *(Csaki and Zuschlag,2004; Prognoz, 1999; Sakovitch, 2008e).* As the basic and the most obvious explanation for this unwillingness, a concern for the diminishing of the sphere of their command-administrative influence is suggested. Also the so-called "catastrophic results" of the initial period of reform (especially in terms of food supply) could be the reason for state authorities' reluctance to participate in radical reformation. A more thoughtful analysis of this opinion is provided in the next paragraphs, with a detailed description of the initial period of reform (1990-1995), its poor results and an explanation as to why it led to a reluctance of state authorities to forge ahead with radical reformation.

Actually, Belarus was among the first countries to start the land reform process in the post-Soviet area. The different pieces of legislation that broke the state monopoly on commercial, large-scale agricultural production also allowed for the creation of individual (not state-owned) farms, and recognized the private status of land in household plots were

passed in 1990-1991 (while in Russia and Ukraine this process started a few years later). From 1990-1991, it was almost officially declared that independent farmers will create "the third and the most effective sector of the agricultural production, in addition to the state-farms' and subsidiary household plots' sectors" *(Belagroprombank, 2011)***.**

Therefore, in 1990-1994, the process of the large farm ("kolhozes" and "sovhozes") dismantling, forced "farmerization" and reorganization of input supply channels along free-market principles had begun. However, all the above-mentioned led to catastrophic results (instead of the agricultural prosperity promised by the reform proponents) and was considered a failure in 1995-1996, because although numerous private farms emerged, they still played a marginal role in agricultural production, while the production of large, state farms plummeted, leading to a serious disruption in food supply for the majority of the Belarus population.

To be more precise, the disruption in the food supply led to severe food shortages (the so-called period of the "empty shelves in the food stores") and the introduction of food stamps. According to the food stamps system, each person in Belarus was able to buy a limited quantity of food and other consumer products during a one-month period. The range of food products that were covered by the food stamps system was substantial and included the majority of Belarusian staple products: all cereal products (buckwheat, manna-croup, oatmeal, pasta products, peeled barley, rice, pearl-barley and so on), oil, row meat and processed meat products, fish products, salt, sugar, tea and so forth.. Although this system guaranteed adequate food for all, the 2-7 hour queues in food shops and substantial delays in salary payments (from 1-7 months) made the whole process extraordinarily time-consuming and effortful.

Although "grey markets" for the deficit food and other consumer products existed during this period, the incredibly high prices for the products which were sold on it and the extremely low salaries (or sometimes payment-in-kind or a 1-7 month salary payment delay) made it practically impossible to satisfy food demand for the majority of the Belarusian population. In this situation, the household plots of rural residents and garden plots of urban residents became a survival food safety net, together with the food stamps system provided by the Belarusian government. The main reasons for these severe food shortages were: (i) an abrupt GAO decline; (ii) the strong dependence of the food supply on other USSR republics, because in the pre-transition period Belarus was a net food importer *(Csaki et al., 1994);* (iii) the serious disruptions in the food processing plant work, which led to a situation in which already-produced harvests were not processed and manufactured for retail consumption.

In 1996, this critical situation had officially been termed by the Belarus government as "a crisis that could lead to difficulties in food supply for the population" (*Resolution, 1996),* and starting from this moment the process of radical land reform (as well as the majority of the other reforms) was put on hold. Since then, only minor, mainly formal changes were introduced into the farm structure and land tenure system.[93] The main emphasis was put on the preservation and development of large-scale, "post-Soviet" farms (although slightly reformed), as a response to the failure of the initial stage of market reformation in Belarus, which resulted in a "crisis situation" in Belarus agriculture, especially in terms of food supply security. The slogan "Farmers will not feed the country" was widely used by the proponents of the large-scale, "post-Soviet" farms during the discussions about the possible ways of furthering agricultural developments.

Therefore, regarding Western and Belarusian scholars' opinions about the general unwillingness of state authorities to participate in the reforms, as the main reason for the slow land reform (privatization) process, it is possible to conclude that this "unwillingness" of state authorities mainly refers to the second period of transformation (starting from 1995-1996), because at the beginning of the transformation Belarus state authorities "expressed a commitment to transforming agriculture…by encouraging the development of a market-based, predominantly privately-owned, and largely owner-managed agricultural production system" (*Csaki et al., 1994*, p.i) and were among the first in the FSU area to start the considerably radical reformation**.** But the extremely poor results of the initial period of reforms (1990-1994) raised concerns about the path of radical reform, and after 1995-1996 a gradual reformation approach (accompanied by slow land reform progress) was considered to be the proper path.

As the main reasons for the poor results of the initial period of reform it is possible to consider (i) the little understanding of economic reform implementation in general and of agricultural reform implementation in particular by the newly formed Belarus government, and (ii) the lack of the consistent consultancy support from the IMF, WB, OECD, FAO and other international organizations, compared to the intensive consultancy support provided by these international organizations for the V4 countries.

As the most common (and well-explained) reasons regarding the farm directorate unwillingness to reform the following are considered: (i) the the fear of farm directorate of

[93] Maybe with the exception of the increase of the limits of the land allowed to be held in lifetime inherited possession from 50 ha to 100ha, and any amount of land in lease for farmers and additional 2ha of leased land to household plots (*Belarus Land Code, 1999)*

the loss of fertile agricultural land due to its transfer to the newly emerged private farmes (*e.g. Belagroprombank, 2011*); (ii) the "understanding of how conflict and difficult this task is" (*e.g. Prognoz, 1999, pp. 79-80*).

Nevertheless, the most important and surprising part of the "general unwillingness to reform" puzzle is the indubitable reluctance of the rural population (farm workers) to start independent private farming (i.e., produce agricultural output for mainly commercial purposes on commercial scale). The vast majority of the rural population prefers to combine the salaried work on large, corporate farms with work on small, household plots for subsistence agricultural production.

This notion of a general unwillingness to introduce private property on land and engage in independent farming is also supported by some (limited) empirical evidence provided by survey results from the beginning and middle of the transformation period.

For example, according to a survey conducted by the Sociological Institute of the Belarus National Academy (hereinafter "Belarus survey"), in 1992 around 40% of survey respondents were in favor of preserving state property on land, 27% supported the idea of transferring land into lifetime possessions with a right of inheritance, and only 27.8% were proponents of the introduction of private property on land. Most interestingly, in 1993 only 14.6% of the surveyed rural residents supported the idea of private property on land. In the next year (1994) this share became even smaller – only 12.8 % of the surveyed rural residents. Also, the share of people who wished to begin independent farming diminished during the survey period in question: in 1992 -7.5% of respondents claimed an intention to start independent farming, while in 1994 this share diminished to only 2% of respondents.[94]

This attitude would not change significantly during the next years. According to the results of a survey conducted by the World Bank in 1999 [95] (hereinafter in this section "WB survey") only 20% of farm workers were in favor of allowing buy-and-sell transactions of land. Moreover, only 6% of respondents stated their intention to start private farming, while 90% of respondents reported no intention to start private farming (*Csaki et al., 2000*)**.**

In 2000, according to officially reported data, there were 44 officially registered refusals of agricultural enterprises restructuring, with officially formulated statements for this such as the "uncertainty in the rightness" of the privatization/reformation and "the willingness to

[94] The survey results were taken from the Sakovitch PhD resume *(1998, pp.11-12*), which provided no information regarding the scope of the survey (number of people, regional, professional and other stratifications). Access to the full PhD thesis text was denied.

[95] The survey included the 855 respondents (among them 744 farm employees, 30 private farmers and 81 farm managers) randomly and proportionally dispersed among the all six Belarus regions *(Csaki et al.,2000)*

preserve state property" as the main reasons for the refusal of the enterprises' reformation (*Miasnikovitch, 2007, p.314).*

Many explanations were offered to the question "why Belarusian peasants are not interested in farm restructuring and starting to independently private farm". The most common ones are:

-long historical legacy of state–run agricultural production, which resulted in an erosion of individual farming habits due to the natural generation change *(Sakovitch, 1998);*

- high start-up costs (*Prognoz, 1999*) and problems with credit access;

-lack of proper institutions and agricultural support services (*Csaki and Zuschlag, 2004*);

-poor quality of the land redistributed to individual farmers (*Dzun and Tereszczuk, 2009*) and reluctance of the big state farms directorate to give land to individual farmers *(Belagroprombank, 2011);*

- insufficient technical (machinery) equipment (*Dzun and Tereszczuk, 2009*) and its maladjustment to small-scale individual farming (*Belagroprombank, 2011).*

Taking into consideration the range of explanations, and generalizing the debate on this issue, the following conclusions could be made:

(1) International (mainly Western) scholars (*e.g. Csaki and Nash, 1998; Csaki et al., 2000; Csaki and Kray, 2005*) suggest that a lack of proper institutions (underdeveloped legislation, poor access to land, financial capital and inputs, insufficient support from the Belarus government for farmers' sector development) are the key reasons for the unwillingness to engage in private farming.

(2) Belarusian scholars, officials and some farmers (*e.g. Kornilov, 2006; Shpak, 2007; Korbut ,2009; Andrievich, 2007; Belagroprombank, 2011*; *Sinevich, 2012*) argue that the Belarus government provided a sufficient legislative basis and fair enough supportive measures for farmers' development, but the risk-averse behavior and a reluctance on the part of the rural population (farm workers, peasants) to start individual farming are the reasons for the failure of individual farming (*Prognoz, 1999*). Some Belarusian scholars also mention human capital quality issues and the legacy of state-run agricultural production as possible reasons for the unwillingness to start private farming *(Lihachev, 2001; Sakovich, 1999).*

(3) None of these explanations are supported by strong empirical evidence.

At the risk of oversimplification, it is possible to conclude that the majority of international scholars and especially Western politicians argue that Belarusian peasants did want to engage in independent farming, but could not do so because of the obstacles laid by

the government, while the Belarusian scholars, officials and some farmers contend that risk-averse behavior and reluctance are the main reasons for the unwillingness to start individual farming, while not denying institutional and legislative problems.

In the next paragraphs, I will analyze the above-mentioned main constraints (institutional capacity[96], human capital quality, risk-averse behavior, and general reluctance) in order to attempt to answer the question whether Belarusian peasants really do not want to have land in private property and start individual farming, or whether they did intend to engage in individual farming but were prevented from doing so by institutional hardships.

In terms of **institutional capacity** relevant to private farming development, international and Belarusian scholars agree that it is not well-designed and does create obstacles for people in individual private farming (*e.g. Csaki and Kray, 2005; Garmel', 2010; Gilevskaja, 2011).* However the language used seems to implicitly suggest the difference regarding the extent of the hardship provided by this underdeveloped institution capacity.The bulk of the international scholars maintain that institutional underdevelopment created practically unbearable hardship, while Belarusian scholars state that although several, and sometimes severe obstacles do exist, they are not insurmountable. For example, over 2000 individual farms have remained and successfully continued its work out of the pool of 6000 individual farms, which were created during 1990-2010 (*Belagroprombank, 2011).* This 33% "survival rate" shows that although the institutional environment for individual farming is not particularly friendly, it is not unbearably hostile and that ways to start and continue individual farming in Belarus exist. Also, this not very high, but substantial-enough 33% "survival rate" raises the question why some individual farmers were able to survive, while others failed. Answers to this question might be found in an analysis of **the human capital quality**, which will be done in the next paragraphs.

It is obvious that not every rural resident (and not every farm worker) is able to become a farmer – relevant education, experience, specific skills and appropriate age are the apparent prerequisites to start individual farming. In terms of educational attainments, and especially their role in the successful survival of the individual farm, the results of the two surveys ("Belarus survey" and "WB survey") are very revealing. According to the "Belarus survey" conducted at the beginning of the transformation in 1993, only 30% of surveyed farmers had a

[96] "institutions" –i.e. "a set of formal or informal rules to determine the initial ownership of the goods and factors (property rights) and to regulate the exchanges (contracts, markets, and other forms of distribution)" *Federico (2005, p.117*)

bachelor degree (and 27% had a technical college degree[97]), while in 1999 (according to the "WB survey"), the share of the people with a bachelor degree among the surveyed farmers almost doubled (60% of respondents had a bachelor degree) and number of people with a technical college degree among the surveyed farmers increased by 10% (36% of respondents) (*Csaki et al., 2000).*

The results of these surveys bring us to the following conclusions: (1) proper education is an important prerequisite for the starting-up of individual farming; (2) keeping in mind the considerably small share of appropriately educated people among the rural residents, the natural pool of candidates for starting-up individual farming is not very extensive; (3) at the beginning of the transformation 1990-1993 (the so-called period of the "imposed farmerization" (*Sakovitch, 2008a, pp. 21-22; Lihachev, 2001, p.24),* an appropriate education was not considered to be the paramount prerequisite for successful conducting of individual farming, but 7-10 years later, after gaining real-life experience of individual farming, its importance became **more evident.**

The survey results are also supported by official Belarusian statistics. As for the year 2005, 31% of the heads of the individual farms held a bachelor degree, 44% held a technical college degree, and only 23% held only a high school diploma – out of the whole pool of 2326 heads of individual farms in Belarus (*Sakovitch, 2008c).*

While proper education was not considered to be an important prerequisite at the beginning of the transformation, and some people were brave enough to start individual farming with insufficient educational attainment, an acquaintance with specific skills and the experience was considered a fundamental precondition from the very beginning of the transformation. The "Belarus survey" in 1993 reveals that the majority of independent farmers at that time were former state farm directors, chef executives, chief specialists (chief agronomists, chief vets, chief accountants and etc.) and the other highly skilled professionals.[98] Nothing changed in the next 7-10 years, according to the "WB survey" of 1999: 60% of respondents come to individual farming from high managerial, chief specialist and highly skilled professional jobs in large, corporate (former state) farms (*Csaki et al., 2000*). Keeping in mind the obviously small ratio of former state farm management to all-

[97] A Bachelor degree in Belarus required 5 years of study at the University, and a technical college degree required two years of study at a specific vocational college. Data for educational background are from *Sakovitch (1998)*

[98] Data for the skills and experience background are from *Sakovitch (1998)*

state farm workers, the natural pool of candidates for start-up individual farming became even smaller than in cases of proper educational attainment (*Csaki et al., 2000)* [99]

Last but not least, prerequisite for a successful start-up of individual farming is age. According to both surveys, the majority of independent farmers were under (or around) the age of 40. According to the "Belarus survey," the average age of the independent farmer was 40 years in 1993 (15% of the respondents were under 30 years old, 45% respondents were under the 40 years old and 29% were 41-50 years old). According to the "WB survey", the average age of the independent farmer in 1999 was 41. Considering the generally increasing tendency of the rural population ageing (which started long before the 1990s) the natural pool of candidates for start-up individual farming seems not very extensive, and is continuously shrinking.

Therefore, an analysis of the main human capital characteristics such as education, specified skills, experience and age leads to the conclusion that although the rural population (and farm workers) constitute a substantial part of the Belarus population (and Belarus labor force), a large part of it was not able or was not sufficiently prepared for starting and successfully managing an individual farm. Hence, the natural pool of candidates for starting up individual farming is quite limited.

The so-called "risk-averse behavior" of the Belarusian rural residents is one of the constraints upon which both international (*Csaki et al., 2000*) and Belarusian scholars *(Prognoz, 1999, p.75; Lihachev, 2001; Sakovich, 1999)* concurred. The range of the suggested reasons for such behavior runs from a passive approach to life (as an inherited part of the Belarusian traditional rural mentality) to the long historical legacy of state-run agricultural production, which eroded individual farming habits. However, a more diligent probing of rural mentalities reveals that the conception of "risk-averse behavior" was mainly based on a concern for the possible loss of social services and benefits provided by large, corporate (former state) farms to farm workers.. Considering the range and scale of these social benefits and services (see **Table 4.2.1.** based on WB survey) this explanation seems very plausible.

The importance of this concern is also supported by the fact that 50% of the spouses of independent farmers (mainly wives) keep their jobs at large, corporate farms as "insurance against the risk in the uncertain business of independent farming", according to the WB survey (*Csaki et al., 2000, p.29).*

[99] A university education (bachelor's degree) and a technical college education are either free of charge or are affordable in price, while the number of opportunities to get managerial skills and experience is scarce (limited to already existed large corporate farms) and is more difficult to obtain.

Hence, an analysis of the main constraints of independent private farming development (institutional capacity, human capital quality and risk-averse behavior) shows that all of them do really exist. However, there is little research (especially quantitative) have been done on the extent of the influence of each constraint on the decision regarding whether to start or not to start the independent farming.

Table 4.2.1. Social benefits and social services provided by large corporate (former state) farms to its employees (% of respondents) [100]

Social benefits	Farm managers (n=81)	Farm employees (n=744)
-wage premium compensations for inflation	79	46
-pension premiums	17	7
-free/subsidised vacation	74	22
-subsidesed food products	49	19
-children allowances to families	44	13
-support for school services	48	19
-stipends to students	26	6
-medical care	21	4
Social services		
-housing construction and repair	58	5
-heating fuel	23	6
-subsidesed utility services	33	5
-use of enterprise housing	53	11
-transportation	86	62
-help with fieldwork on household plots	91	NA
-burial services	89	NA

The only attempt to measure quantitatively the share of each constraint was the WB survey questionnaire. Within the framework of this questionnaire, 439 farm workers were asked whether they had plans to become private farmers. Only 6% indicated that they "have plans to establish an independent private farm" (*Csaki et al., 2000, p.48*). Considering that this 6% expressed only the "intention" but had not undertaken any real action, the actual share of farm workers who would probably start independent farming seems even less than 6%. Around 92% of respondents (403 persons) stated that they had no intention of becoming private farmers. These 403 persons were asked to state their reasons why they "do not plan to become private farmers" *(Csaki et al., 2000, p.48)*. The results of this questionnaire are summarized in **Table 4.2.2.**

[100] *Source: Csaki et al. (2000, p.90)*

Table 4.2.2. Why employees of large corporate farms do not plan to become private farmers (% of respondents) [101]

Institutional constraints	
Non-supportive environment	
uncertain legal situation	4
land related issues (lack of good land for private farms, prohibition to buy and sell)	1
social considerations (negative attitude in the village, reluctance of other family members)	2
Resources' considerations	
insufficient capital	20
difficult to find inputs	6
Human capital quality issues	
Personal considerations	
too old and unhealthy	14
inadequate personal qualifications (not enough economic and legal knowledge)	1
Risk-averse behavior	
Attitudes to risk	
don't want to change my life style	24
don't want to risk uncertainty	20
Income considerations	
better income in farm enterprise	5
don't want to lose social benefits	3
Total	**100**

The results of this questionnaire show that the institutional constraints such as uncertain legal situations, land-related issues and difficulties in inputs' supply are of marginal importance, although insufficient capital (lack of financial resources) plays an important role. The quality of human capital seems to play a role, though not a leading one – the majority of respondents were more concerned about their age and health as the main obstacles for the private farming, rather than educational and experience attainments. This to some extent correlates with empirical evidence pertaining to changes in the educational background of independent farmers. The share of people in individual farming who held a bachelor's degree doubled in a 7-10 year period, which means that the majority of start-up farmers had not taken into account the importance of proper education before they actually started in the private farming business.

These answers leave some room for interpretive speculations, because although the unwillingness "to risk uncertainty" and "to change lifestyle" plays a crucial role in the reluctance to start independent farming (44% share), it is not clear whether it because of the

[101] *Source: Csaki et al. (2000, p.48)*

risk of the loss of the social benefits and services provided by large corporate farms (8% share). It is quite possible that the respondents of this questionnaire did not want to announce openly and straightforwardly how important for them are the social benefits and services provided by the large corporate farm. Considering that the provision of social benefits and services is generally dependent (at least in an implicit way) on the farm directorate good-will, it could have been possible that the survey respondents did not wish to reveal this tool for leverage.

The general conclusion of the team of international scholars that conducted this WB questionnaire is that "the prospects for the growth in private farming appear to be bleak" (*Csaki et al., 2000, p.48*).

Finalizing the analysis of Belarusian peasants' attitudes toward independent farming, it is possible to conclude that although substantial institutional obstacles do exist and hamper the individual private farming development, the poor quality of human capital and risk-averse behavior also play significant roles in the obvious reluctance of Belarusian peasants to engage in individual private farming.

4.1.3. Overview of state support and price policy developments in Belarus in 1990-2004

A detailed analysis of the state support dynamics during the period in question is impeded by a lack of relevant data (see the discussion in the Introduction Chapter). The general impression of both Belarusian and Western scholars about the dynamics of state support is that during the initial period of transformation (1990-1995), state support had been cut abruptly and drastically, and then, after the 1996, started to increase, finally achieving its highest levels during the 2003-2004 period, and continuing this growth onwards (*Miasnikovitch, 2007; Sakovitch, 2008d; Csaki et al., 2000; Freinkman et al., 2005).*

A decrease of state support to agriculture during the initial period of reform (1990-1995) is usually attributed to the "crises situation in Belarus agriculture" *(Sakovitch, 2008a),* which endangered the country's "food sovereignty". Thus, in 1996 the increase of the state support to agriculture was considered to be a possible way out of this "crisis", and in 1996 the largest (non-budget) source of agricultural funding –the National Fund for Support of Agricultural Producers, Food and Agricultural science – was created (*Freinkman et al.,2005*), along with an increase of regular budget spending to agriculture.

Starting from that period, the system of state support (subsidization) began to intensify and expand. In general, the **subsidization** of agriculture in Belarus was provided in different direct and indirect ways, [102] and may be classified into the following groups, according to the World Bank report and Belarusian Institute of Privatization and Management study: (i) state supply of inputs (state purchase and distribution of key inputs and compensation for some inputs purchases by farms, preferential prices for fuel, subsidized leasing for machinery, industry tariffs (lower than normal) for the electricity and heat)); (ii) investment support (budget loans and guarantees for budget loans, direct budget investments, interest rate subsidies, debt write-offs and so on); (iii) preferential tax treatment; (iv) non-monetary transfers from other sectors (*Cramon-Taubadel et al., 2009; Babicki et al., 2003*).

The main sources of state support were (and still are) (i) the national budget (budget state expenditures called "Expenditures for agriculture" at the annual Laws on Budget of Belarus Republic), (ii) the local budgets, (iii) National Fund for Support of Agricultural Producers, Food and Agricultural Science and (iv) the Local Fund for Support of Agricultural Producers, Food and Agricultural science.

[102] According to official sources, around 30 different subsidization schemes are applied for agricultural support (*Babicki et al., 2003*)

The main beneficiaries of state support are the large, corporate farms (as the principal agents of the existing institutional framework), although some direct and indirect support for private, individual farms[103] and subsidiary household plots[104] is also provided.

The above-mentioned increase of state support resulted in the stabilization of agricultural sector performance (in 1996-2000), and was used as a justification for further, more profound increases of state support to agriculture in the subsequent years (2000-2004)

The limited numerical data from the ***Table 4.8*** show the increase of state support share in GAO, per ha and per worker.[105]

Table 4.8. State support to agriculture in Belarus [106]

	1990	1999	2000	2001	2002	2003	2004
Support as a share of GAO (%)	8	26	25	25	24	37.1	33.8
Budget support as a share of GDP			4	3.8	3	4.3	4
Budget support per worker (in constant 2000 US$)			653	771	827	1,425	1,728
Budget support per hectare (in constant 2000 US$)			44	49	49	78	94

A comparative analysis of agricultural support in the FSU, CEEC and EU shows that although the amount of budget support per ha in Belarus has been increasing steadily and was higher than in the selected FSU countries (Russia, Ukraine), it was still smaller than in some CEE countries (Hungary, Czech Republic, Slovakia) and significantly smaller compared to the EU-15 and EU-27 (***Table 4.9)***

Although the budget support per ha in Belarus was smaller than in the CEEC and EU, it comprised the highest share of GDP ***(Table 4.10).*** The effectiveness of state support use, calculated as the ratio of agricultural value added share in GDP per state support share in GDP to agricultural value added share in GDP seems to be the lowest among the studied CEE countries ***(Table 4.10.).*** However, the results of this calculation are highly biased by the fact that a significant amount of agricultural support goes through non-budget channels.

[103] The annually adopted Laws of Belarus budget include a separate line for expenses headed, "State support for private, individual farms"

[104] For example, the state subsidies "leak from the large corporate farms to household plots" because the household plots sometimes officially receive for free (or substantially lower than the market price) some inputs (fuel, fertilizers, feed for animals) from the corporate farms, use for free the machinery and "appropriate for their use some ready-to-be-sold products" from the corporate farms. (*Cramon-Taubadel et al., 2009, pp. 6-7)*

[105] The twice- higher increase of the support per ha and per worker compared to the share in GAO could be attributed to the decline in land and labor during this period.

[106] Data for 'Support as a share of GAO' are from *Sakovitch (2008c, p.143).* All the other data are from *Freinkman et al. (2005, p.197*)

Table 4.9. Support per hectare (in constant 2000 US$)[107]

	2000	2001	2002	2003	2004	2005
Belarus	47	51	51	84	103	127
Russia	11	13	14	16	16	18
Ukraine	11	16	20	21	36	46
Hungary				203		
Czech Republic				159		
Slovak Republic				135		
Poland				37		
EU-15	381	402	421	520	583	585
EU-27	270	287	302	374	472	479
Switzerland	1,369	1,513	1,639	1,982	2,028	2,005
USA	189	193	183	195	219	234
Canada	52	52	60	74	76	91
New Zealand	7	6	7	9	11	14

Table 4.10. Budget support for agriculture and its effectiveness in 2003 (%)[108]

	Belarus	**Russia**	**Ukraine**	**Hungary**	**Czech R.**	**Slovakia**	**Poland**	**EU-12**	**Switzerland**	**USA**	**New Zealand**
Budget support for agriculture (% of GDP)	4,3	0,95	1,65	1,44	0,81	1,03	0,33	0,68	0,95	0,73	0,22
Agriculture, value added (% of GDP)	10,2	6,3	12,1	4,3	2,7	4,5	4,4	1,9	1	1,2	6,2
Agricultural value added per budget support	2,4	6,6	7,3	3	3,3	4,4	13,3	2,8	1,1	1,6	28,2

The relatively high share of budget support to agriculture (measured as a % of GDP) is typically used by Western experts as a ground for the claim that state support for agriculture is provided at the cost of the other sectors of the economy, where it could be more efficiently

[107] Data for Belarus, Russia, Ukraine, EU-15, EU-27, Switzerland, USA, Canada and New Zealand are from *Cramon-Taubadel et al. (2009).* Data for Hungary, Czech Republic, Slovak Republic and Poland are from *Freinkman et al. (2005)*

[108] Data for budget support for agriculture as the share of GDP are from *Freinkman et al. (2005).* Data for the share of the agricultural value added in GDP are from WB database. Available at http://data.worldbank.org/data-catalog/world-development-indicators / (Accessed: May 4, 2014)

used (*Freinkman et al.,2005*). However, these scholars do not identify these presumably more appropriate sectors of the Belarusian economy, not to mention supporting these claims through economically grounded calculations.

Concluding the state support issue, it is possible to make the following generalizations about its dynamics and comparative characteristics: (i) state support in Belarus (measured in absolute terms – total spending in national currency or USD) went through the following three stages: sharp decrease (1990-1995), slight increase and recovery (1996-2000), steep surge (2001-2004); (ii) although the percentage share of state support in GDP is higher in Belarus than in some CEE countries and EU, the level of per-ha support in Belarus is still substantially lower than in the above-mentioned CEEC and EU.

Price policy is considered one of the most important components of the agrarian policy in Belarus (*Babicki et al., 2004).* It was mainly executed through the strict price regulation provided by the Belarus government.

A brief analysis of Belarus price regulation history allows us to determine two main phases in price regulation.

(1) 1990-1995 – price liberalization (or price deregulation) period. However, it is important to mention that this period is considered the "price liberalization period" mainly by Belarusian officials *(e.g., Garkun, 1997)* and some scholars (*Miasnikovitch, 2007; Parshin, 2003; Dadalko, 1997*), but not Western scholars *(Csaki et al., 1994)*.

Actually, in 1990-1994 the following changes took place in the former USSR centralized price determination system: (i) wholesale prices were liberalized; (ii) consumer prices were not supported by budget subsidies (except for milk and bread); (iii) fruit, vegetable, wool, poultry and sheep meat prices were fully liberalized; (iv) prices for all other agricultural and food products (like grain, sugar beet, flax, rapeseed, milk, beef and pork meat), although it had been announced as liberal and free, in reality were regulated by the introduction of procurement prices (quotas) and "recommended" or "indicative" prices *(Csaki et al.,1994, p. iv; Miasnikovitch, 2007, p.309).*

The above-noted changes in a previously totally regulated price system permitted Belarus officials to claim agricultural prices as liberalized *(Csaki et al.,1994*), while their Western counterparts argued that prices "are not free or liberalized in the Western sense, where "price liberalization" generally means that prices are allowed to be formed by competitive forces" (*Csaki et al.,1994, p. iv*).

(2) 1996-2004 – return of the state regulation. Starting from 1996, in conjunction with the "State program of the agricultural reformation" (adopted in August 6, 1996) and The

Resolution of the Supreme Soviet of the Belarus Republic (adopted in May 3, 1996), the Belarusian government started to pay closer attention to price issues, and began to increase its influence in this sphere.[109] This resulted in the adoption in 1999 of the Law "On Price Regulation," which implicitly favored the state regulation of prices, although allowing the co-existence of regulated and free prices. According to a World Bank assessment, this law (and other legislative documents adopted on the basis of this law) had agricultural prices in Belarus "generally set at a level that allows agricultural enterprises to generate "normal" profits" and "performing a social function" (*Cramon-Taubadel et al., 2009, p. 24).*

The extent to which agricultural prices in Belarus were over-regulated (i.e., were kept artificially low) according to Western standards during the 1997-2004 period, compared to other countries in the CEEC region, could be derived from the World Bank annual calculation of the "Price and market liberalization index" [110] ***(Table 4.11.)***, previously discussed in **Chapter 2 (Section 2.1)**

Table. 4.11. Price and market liberalization index for CEE countries [111]

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Czech Rep.	9	9	9	8	9	9	9	-
Hungary	9	9	8	8	9	9	9	-
Slovak Rep.	7	7	7	8	8	9	9	-
Poland	9	8	7	8	8	8	9	-
Russia	7	6	6	6	6	6	6	6
Ukraine	7	6	6	6	7	6	6	6
Belarus	3	2	2	2	2	2	2	3

During the whole transformation period studied in this research (1990-2004), the **prices i**n the Belarus economy were regulated by the state in many ways, such as: (i) establishing fixed prices; (ii) setting prices ceilings; (iii) setting compulsory trade mark-ups; (iv) setting maximum rates of return; (v) determining price-calculation procedures; (vi) establishing procurement quotas on agricultural products; (vii) declaring prices levels and so on. Specific

[109] Both of these documents pay special attention to the agricultural terms of trade deterioration and the crucial necessity of its mitigation.

[110] The analysis is based on the *Csaki and Zuschlag (2004, p.15*) calculations of the "Agricultural Reform Index", (for details see CEEC Chapter Section 2.1) which includes the "price and market liberalization" index as its composite element, where "1-2" index means the "direct state control of prices and markets"; "5-6" means "mainly liberalized markets constrained by the absence of competition and some remaining controls on trade policy"; "7-8" means that all command economic "type interventions are removed, market and trade policies are in compliance with WTO, however, domestic markets are not fully developed"; "9-10" refers to "competitive markets with market conforming trade and agricultural policies", and no more than modest protection.

[111] Data from *Csaki and Zuschlag (2004)*

to food (agricultural) production, the so-called "list of socially important products", the prices of which should be maintained at "reasonable" levels was introduced in 1999. The main aim (and the main result) of these price regulations was the keeping of agricultural output prices artificially low in order to make food products affordable for everyone. This price policy of the Belarusian government was supported by the Belarusian public opinion, which according to Western experts, could be explained by a lack of "clear grasp of the welfare effects of price controls" by the Belarus public, the same "as in many other transition economies" *(Csaki et.al., 2000, p.9).*

At first glance, the price regulation aimed at keeping agricultural output prices artificially low resulted in consequences that were extremely unfavorable for the agricultural producers. First of all, it caused a substantial terms of trade deterioration, with the most abrupt decline in 1990-1994 (see ***Figure 4.1).*** Second, it resulted in a substantial decline in price parity for agricultural products, measured in so-called "natural prices" [112] (see **Table 4.12).** The "natural prices" (or "real prices") measurement is a specific way of measurement that is commonly used for the description of the transition economies, where the substantial rate of inflation (like 1 milliard times for inputs and 381 million times for output in Belarus from 1990 to 2004 see **Appendix 4.3**.) makes the calculation of the commonly used price dynamics useless.

In Belarus, during the period in question, the increase of prices for inputs ranged from up to 3 times (grain/fertilizers(N) or milk/tractors ratio) to up to 50 times (meat/diesel ratio), while in developed Western countries[113] this "natural prices" ratio either remained the same (fertilizers/milk ratio) or increased by an incomparably smaller extent (fertilizers/grain ratio and diesel/ grain, milk, meat ratios) than in Belarus, and for some inputs even decreased (fertilizers/meat ratio) (see **Appendix 4.4- Appendix 4.9.**).

[112] The "natural prices" (or "real prices") measurement is a calculation, when the price (cost) of agricultural input (fertilizer, diesel, tractor) is measured not in monetary (money) units, but in physical quantities of agricultural output (e.g., how many tons of agricultural output (grain, meat, milk measured in tons) should be sold in order to buy one ton of fertilizer (or one ton of diesel, or one tractor).

[113] The choice of countries and inputs/outputs was mainly determined by the data availability in the Eurostat database

Figure 4.1. Agricultural terms of trade deterioration [114]

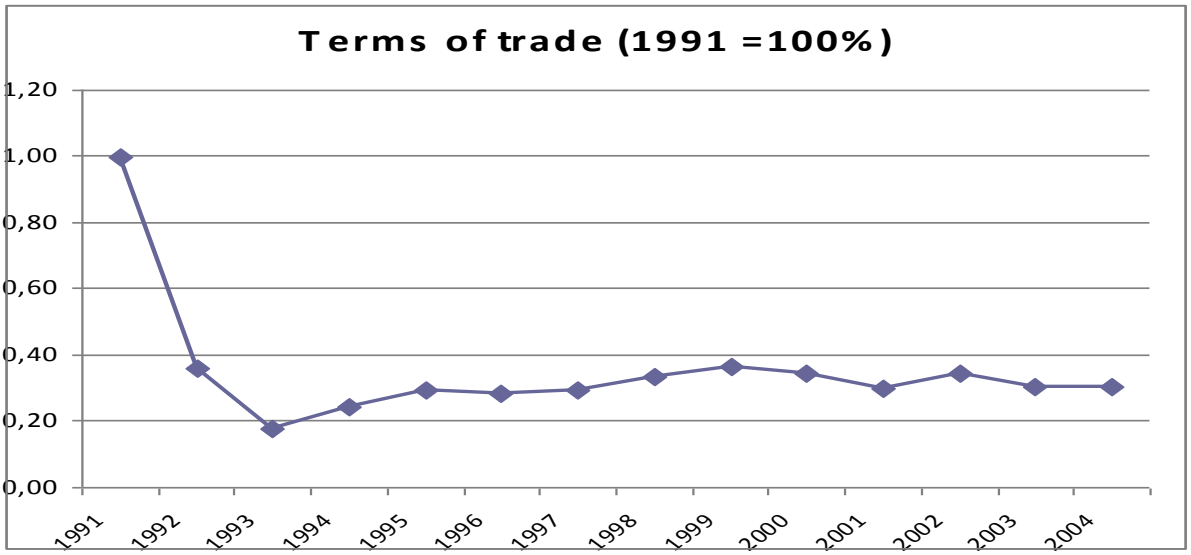


Table 4.12. Retail prices of agricultural inputs and agricultural products in Belarus in 1991and 2004 [115]

	Prices expressed in tons of								
	grain			milk			meat		
For inputs	**1991**	**2004**	**2004/ 1991**	**1991**	**2004**	**2004/ 1991**	**1991**	**2004**	**2004/ 1991**
Tractor MTZ-82	26	114	**4.4**	18	54	**3.0**	2	12	**6.0**
Combine KSK-100A	81	544	**6.7**	56	261	**4.7**	7	59	**8.4**
Fertilisers-K (t)	0.128	1.361	**10.6**	0.089	0.654	**7.3**	0.011	0.148	**13.5**
Fertilisers-N (t)	0.201	0.628	**3.1**	0.14	0.301	**2.2**	0.017	0.07	**4.1**
Fertilisers-P (t)	0.607	2.771	**4.6**	0.422	1.331	**3.2**	0.051	0.302	**5.9**
Petrol (t)	0.343	5.357	**15.6**	0.239	2.573	**10.8**	0.029	0.584	**20.1**
Diesel (t)	0.259	4.758	**18.4**	0.083	2.285	**27.5**	0.01	0.519	**51.9**

However, all the above-discussed negative effects of keeping agricultural output prices artificially low [116] were balanced by significant state support directed at agricultural producers. This policy was called "pushing the gas and brake pedal at the same time".[117] Although the net effect of such a policy was considered to be "a priori unclear", the "overall

[114] Data from *Ceny v Belarusi (2006, pp.182-185)*
[115] Data from *Sakovitch (2008c, p.147)*
[116] The process of keeping agricultural output prices low is considered to be a kind of "implicit taxation" of the agricultural producers *(Cramon-Taubadel et al ,2009, p. 69; Freinkman et al., 2005, p.190)*
[117] Belarus government "steps on the gas" via subsidies and „applies the brakes" via price regulation. (*Babicki et al., 2004, p.9)*

perception of the agricultural producers was that the taxes[118] they pay overweigh the subsidies they receive".[119]

Finalizing the price regulation issue, it is possible to conclude that some attempts toward agricultural prices liberalization were made at the beginning of the transformation period, which however were hampered from 1996. Price limitations were the main instrument of price regulation. This resulted in a terms of trade deterioration, which was mitigated by state support directed at agricultural producers.

[118] The definition of "taxes" here includes direct taxes such as land, labour and profit taxes, and indirect taxes such as procurement quotas and price limitations.
[119] Results of the survey made by the World Bank in 2000 among the managers of the corporate (state) farms and independent private farmers. (*Csaki et al., 2000)*

4.1.4. Conclusion for Section 4.1.

Finalizing the general description of the Belarus agricultural profile and agricultural reforms path, it is possible to outline its main features as follows: The Belarusian natural agricultural environment is only of average quality for agriculture; the role of agriculture in the national economy continued its natural downward trend during the transition period; the major features of the former Socialist (command) economy, like the prevalence of large corporate farms (former state-farms) over the private agriculture, the state support and price regulation were preserved in Belarus, although some attempts at its reformation were made.

The main justification for the slow pace of land reforms and remaining practically intact (or only a little bit modified) the old Soviet system of state subsidies and price regulations is that the "gradual" reformation approach and strict government regulation of agricultural sector allows (i) the achievement of **food sovereignty** (food security) on a country-wide level and (ii) the maintainence of **social stability.**

"Food sovereignty" as defined in the "National program for increasing agribusiness efficiency for the period of 2000-2005", means that the "critical level" of domestic production should cover no less than 80% of the consumption of nine main products – grains, meat, eggs, sugar, vegetable oil, fruits, vegaatables and potatoes - in order to ensure an adequate food supply (the "optimistic level" of domestic production means the domestic demand is fully covered by the domestic production, and agriculture is export-oriented).

The calculations based on this conception (**Table 4.12.1**.) show that although Belarus has achieved the minimally required "critical level" of food sovereignty, the desired "optimistic level" of domestic production is still to be achieved.

This food sovereignty (food security) conception at that time was (and still is) the cornerstone of Belarusian agricultural policy. Numerous Belarusian studies are dedicated to the development of different aspects of this conception (*i.e. Il'ina, 1999; Gusakov and Il'ina, 2004; Il'ina and Batova, 2009*). Further, numerous product-specific studies have emphasized the importance of the increase in production of selected food products; for example, potatoes (*Kazakevich, 1998*), meat (*Enchik, 2004)*, milk (*Pilipuk, 2009; Sziszko, 2009*), grain (*Piskunova, 2009).*

Table 4.12.1. Belarus food sovereignty (food security) indexes [120]

	1990		1995		2000		2005		2010	
	critical level	*optimistic level*	*critical level*	*optimistic level*	*critical level*	*optimistic level*	*critical level*	*optimistic level*	*critical level*	*optimistic level*
Grain	1.2	0.8	0.9	0.6	0.8	0.5	1.1	0.7	1.4	0.9
Potatoes	1.3	0.9	1.5	1.0	1.3	0.9	1.3	0.8	1.4	0.9
Vegetables	0.7	0.4	1.0	0.6	1.4	0.8	2.0	1.2	1.9	1.1
Sugar beets	1.0	0.7	0.8	0.5	1.0	0.7	2.0	1.4	2.5	1.7
Meat	1.8	1.2	1.0	0.7	0.9	0.6	1.0	0.7	1.4	1.0
Milk	1.7	1.0	1.1	0.7	1.0	0.6	1.3	0.8	1.4	0.9
Eggs	1.8	1.3	1.7	1.2	1.6	1.1	1.6	1.1	1.8	1.2

However, this conception is to some extent questioned by *Babicki et al. (2004)*, who maintain that Belarus is food-secure on the country-level (i.e., the level of Belarus GAO production is sufficient), but there are some issues on the household and individual levels (e.g., low income levels that do not allow individuals to buy sufficient amounts of food products). According to *Babicki et al. (2004)*, it would be better to provide "targeted aid to a vulnerable population" rather than apply direct price regulation for the whole economy *(Babicki et al., 2004, p.1)*.

In a nutshell, the notion of food sovereignty suggests that in order to secure enough food products at affordable prices for everyone it is necessary to increase GAO production and introduce agricultural reforms (land reform, price regulation and state support system reforms) very gradually and cautiously. While *Babicki et al. (2004)*, argue that instead of expending financial resources through state support for producing enough affordable food for everyone, it would be better to reduce substantially this spending, allow food prices to rise to a free-market level, and then re-channel the financial resources released from state support for agriculture to provide targeted financial help to low-income people, who would not be able to buy food at the high, "free-market" prices.

The "social stability" concern means that reforms should be provided in a way that avoids unemployment and income decreases in rural areas, and that ensures universal access

[120] The food sovereignty (food security) indexes were calculated as a ratio of actual production to the required level of production (critical or optimistic) according to data from the *Conception (2004)*.

to food through "reasonable" food prices (i.e., even the poorest people should be able to buy sufficient amounts of food products).

Although "food sovereignty" is considered to be a traditional goal of closed command economies in the view of Western economists (*Csaki et.al., 2000*) and "social stability" issues could be solved through the creation of new workplaces outside of agriculture and the establishment of special employment programs and direct assistance for the poor, the Belarus "very cautious" approach to reform seems to have brought good results. The agricultural production decline was not as drastic as in the other FSU countries, the food supply for the population was protected and the disruption of the production system was halted.[121] Would these positive effects became only short-term achievements of the trade-off between the speed of reform and sectoral stability, or has it become the characteristic Belarusian way of systemic transformation, which seems at this moment to be very slow and financially costly (in long-term run), but reasonable and appropriate in terms of social stability? This question remains.

The question remains open as well because, while both radical and gradual reform approaches have their respective proponents and opponents, a detailed and comprehensive cost-benefit analysis for any of these approaches has not been calculated yet. The majority of the "pro" and "contra" arguments are based on the experiences of other countries (sometimes not very relevant to the Belarus case), or are limited to specific agricultural sub-sectors (but the not the whole of Belarusian agriculture), which leaves a lot of room for speculation and constitutes an evident line for the further research.

[121] Actually, these positive effects became the basis for the continuation and reinforcement of the policies founded on the approach of government intervention and "gradualism".

4.2. Agricultural production in Belarus during the transformation period

This section is dedicated to an analysis of the Belarusian GAO dynamics during the transformation period. It is organized in the following way: a brief description of Belarusian output dynamic in pre-transition period opens the section; then, a detailed description and analysis of output decline in Belarus during the transformation is provided, comprising the long- and short- term output dynamic analysis and sectoral (crop-livestock), organizational (private–socialized) and regional output differentiations; after that, several pooled regression models are estimated for analysis of how the changes in selected inputs affected the agricultural output dynamic; and last, the final concluding remarks for the whole "output section" are made.

Belarus agricultural production in the pre-transition period may be characterized by its comparable significance in the total USSR agricultural production,[122] steady growth in both crop and livestock sectors and the prevalence of the livestock sector over the crop sector in the agricultural production structure.

The livestock sector accounted for about 60% share in Belarusian agriculture by the end of the 1980s**.** The mainstay of the livestock sector was dairy production, while beef production had a complementary role. Pork production was also an important livestock sub-sector (due to the food consumption preferences of the Belarusian population), but poultry was the fastest-growing sub-sector, which accounted for about 14% of meat consumption (*Csaki et al., 1994*).

An analysis of the production dynamics shows a continuous growth of livestock production from the 1970's until the beginning of the 1990s ***(Table 4.13.).***

Table 4. 13. Livestock production (1970 =100%)[123]

	1970	**1975**	**1980**	**1985**	**1990**	**1992**
Milk *(1000 ton)*	100	116	116	128	142	112
Meat *(1000 live weight)*	100	126	131	166	176	127
Eggs *(millions)*	100	158	182	201	219	210

Livestock productivity also achieved an impressive increase between 1970 and 1990. During this period, the quantity of milk-per-cow increased 47% , the number of eggs-per-hen increased 25% and beef productivity also increased, indicating efficiency gains (beef

[122] Belarus, with only 1.7% of total FSU land, accounted for 6% of meat, 7% of milk and 4% of eggs in total FSU agricultural production, although it has been a net importer of food and agricultural products (*Csaki et al., 1994)*

[123] Data from *Sakovitch. (2008c)*

production increased more rapidly than cattle numbers due to more rapid weight gains and younger slaughter age) (*Csaki et al., 1994*).

The prevalence of livestock production over crop production may be explained not only by the specificity of the natural resource endowment (which favors livestock over crop production), but also due to the centrally allocated unlimited imports of grain and the high priority of livestock sector development during the Soviet period. This prioritization of livestock sector development was reflected by generous subsidies to both livestock producers and consumers, and by the construction of large-scale livestock farms with high concentrations of animals, and substantial requirements for feed, energy, and transportation *(Csaki et al., 1994*).

Crop production in the pre-transition period played a mainly complementary role, accounting for about 40%-45% of the GAO since 1975. Around 80% of crop land was used for the production of fodder crops and feed grains[124] **(*Table 4.14*).** Although the principal activity of the crop sector was the production of forage and feed for livestock, Belarus has accounted for the 27% of the FSU flax production and 15% of potato production, which shared around 3% and 13% of total crop area accordingly. Other important non-grain crops were sugar beets, vegetables and oilseeds (*Csaki et al., 1994*).

Table 4.14. Belarus crop production patterns [125]

	1970		**1980**		**1990**	
	area	*% of total*	*area*	*% of total*	*area*	*% of total*
Grain crops	2,503.3	41.4	3,139.2	49.8	2,645.2	43.2
Fodder crops	2,223.5	36.8	2,038.3	32.3	2,553.6	41.7
Potatoes	956.3	15.8	786.6	12.5	638.3	10.4
Vegetables	48.6	0.8	53.8	0.9	40.9	0.7
Flax	261.1	4.3	234.3	3.7	149.2	2.4
Sugar beets	48.9	0.8	51.7	0.8	46.2	0.8
Other	3.4	0.1	4.2	0.1	52.8	0.9
Total cropped area	**6,047.1**	**100**	**6,308.1**	**100**	**6,126.2**	**100**

The analysis of the crop production dynamics shows that in the pre-transition period (10 pre-transition years) the production of all major crop products increased ***(Table 4.15).*** The most substantial increase was in grain production - from 4.1 mln. tons in 1980 to a 7.3 mln. tons in 1989. Impressive results were also achieved for sugar beets and flax production with 127.6% and 120.8% average growth, respectively. The increase in potato and vegetable production was modest, but significant enough to be noticeable.

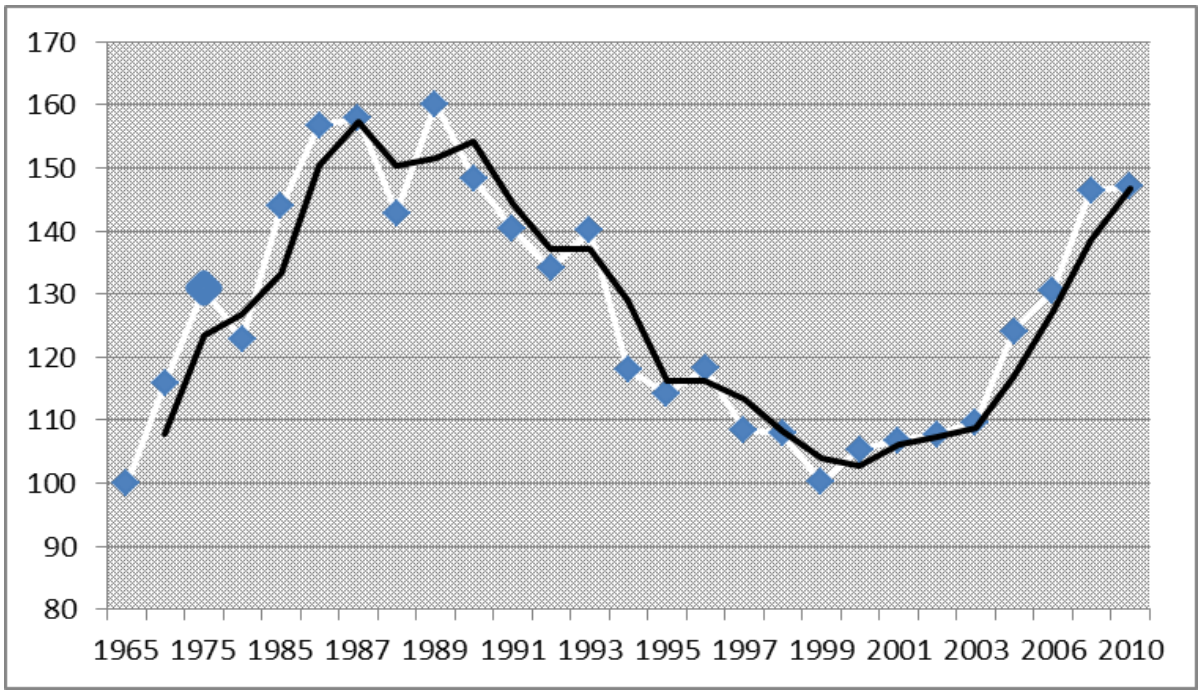
[124] However, these grains were mainly used for the animals' feed, and necessary food grain requirements were met by imports.
[125] *Belarusian Agricultural Statistics Yearbook (various years)*

Table 4.15. Production of the major crops [126]

	1980	1985	1989	average growth rate
Grain	4,108	5,790	7,384	134.2
Potatoes	9,333	10,553	11,097	109.1
Vegetables	733	828	894	110.5
Sugar beets	1,122	1,568	1,810	127.6
Flax	61	85	87	120.8

The evaluation of the **long-term trend (1965 - 2010) of total agricultural production** leads to the distinguishing of the following phases in its dynamics (see ***Figure 4.2.)***: (1) constant growth (aprx. 1965 – 1990); (2) step decline (1990- 1999); (3) steady recovery (1999-2003); (4) rapid growth (2003 -2010). This dynamic could provide the basis for the conclusion that the Soviet agricultural system "worked at full speed" not only until the beginning of the "*Perestrojka*" process in USSR in 1986, but even for a half decade longer (until 1990), showing no evidence of collapse in terms of production volumes.

Figure 4.2. Long-term GAO production dynamics in Belarus (1965-2010) [127]



The "short-term" analysis of the agricultural production in Belarus during the transformation period (1990 – 2004) shows that Belarus experienced a steep decline in production, just as the other FSU countries (Russia and Ukraine) did until the end of the

[126] Idem

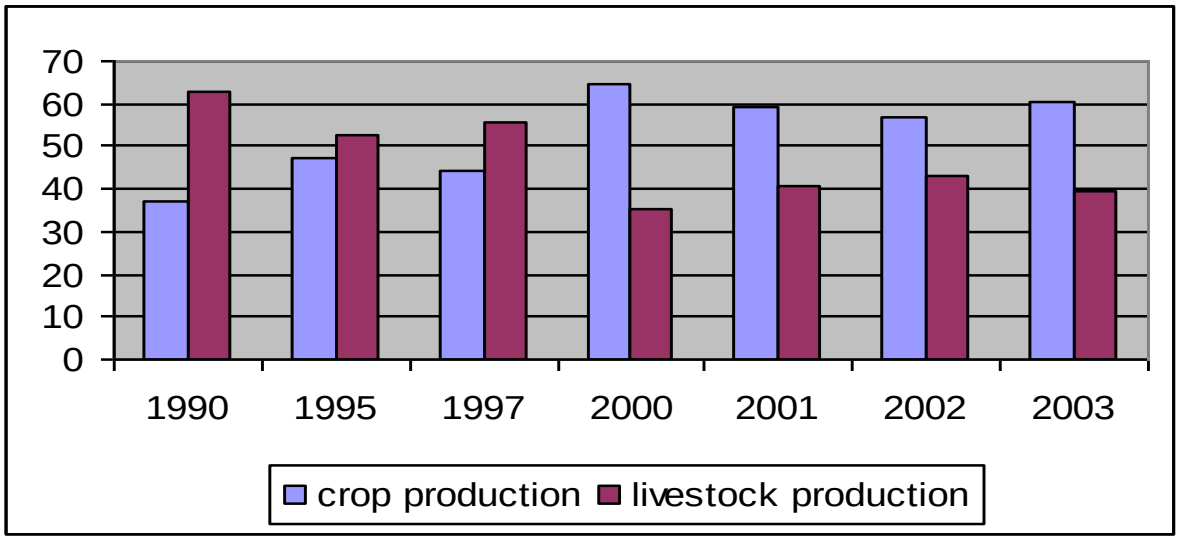
[127] The white line on the Graph 4.1. depicts Belarus GAO, the black line depicts the linear trend. Data from *Fuglie (2012)*

1990s, and then started to show signs of recovery. This initial GAO decline was then followed by a slow recovery that could be attributed to the disruptive consequences of the initial reforms (lack of clear reformation policy resulted in a general deregulation of the economy, state support withdrawal, terms of trade deterioration, which influenced the inputs supply, and so on), which then were mitigated by an increase in state support and the introduction of a more restrictive agricultural policy. A detailed empirical analysis of the impact of land, labor, machinery and fertilizers on GAO dynamics will be provided later, using the regression analysis in the sub-sequent section of this chapter.

The **"sectoral analysis"** of the Belarusian agricultural production during the transformation period shows two significant structural changes: (i) a shift from livestock to crop production and, (ii) an increase in the share of the "individual sector" in overall agricultural production.

During the period in question, Belarusian agriculture transformed from being livestock-based to being crop-oriented ***(Figure 4.3.)***. The share of crops in total agricultural production increased almost twice (from 37% in 1990 up to 60.7% in 2003), while the livestock share contracted from 63% in 1990 to 39.3% in 2003.

Figure 4.3. Share of crops and livestock in agricultural production [128]



The main reasons for this re-specialization were (i) the unfavorable for livestock production shift in prices, and (ii) the dismantling of the former inter-USSR trade connections.

The unfavorable for livestock production shift in prices means that during the transformation period, the sale prices for crops generally increased more than production

[128] Data from *Belarusian Agricultural Statistics Yearbook (2004)*

costs, while the prices of livestock inputs increased beyond the livestock sales prices, which made crop production more profitable than livestock production.

The negative impact of the dismantling of former inter-USSR trade connections on livestock production reflects the fact that during the Socialist period, Belarus was a livestock-oriented republic within the Soviet Union, and cheap animal-feed delivery (mainly from Russia and Kazakhstan) was organized on a centrally-planned basis. After the collapse of the USSR, the trade connections established during the USSR period were disrupted, and livestock production in Belarus consequently became unprofitable and thus declined.

However, this decrease of livestock production did not significantly jeopardize Belarus food security in terms of livestock consumption, because during the Socialist era, a substantial part of livestock products was produced not for internal Belarus consumption, but for delivery to the other USSR republics. For example, in the "late 1980's about 30% of dairy products" produced in Belarus "were delivered to Russia" *(Csaki et al., 1994, p.8)*

"Individual" agricultural production (household plots and private farmers) registered impressive gains during the transformation period, rising twice, from 23.7% share in total agricultural production in 1990 to 39.9% in 2004, while the corporate (state) farm production contracted from 76.3% in 1990 to 60.1% in 2004 (***Table 4.17.)*.**

The increase of the share of the individual sector in agricultural production was mainly the result of the reallocation of land from state farms ("kohoz" and "sovhoz") to household plots**.** Agricultural land used by household plots more than doubled during the short period between 1990 and 1995,[129] while the total agricultural land remained unchanged (around 9 mln. ha).

Private, individual farms[130] started to appear as the result of the realization of the land reform programs. However, after the initial increase, land redistribution stagnated, and the structure of land use has remained unchanged since 1995, with almost 85% share of corporate (state) farms and 15% share of household plots (the private farms still accounted for less than 1% of agricultural land[131]**)**.

[129] Mainly due to the government permission of two-times increase of the allowed size of household plot land from officially allowed in USSR 0.5 ha to 1 ha. This aspect of the Belarus land reform is considered by some experts as the most important aspect of the land reform in Belarus, even more important than the redistribution of the Soviet collective and state farms land to the private farmers (*UNDP, 2006).*

[130] Around 2600 private farms with an average land size of 20 hectares were organized from 1990 to 1994.

[131] In Russia, the share of private farms in agricultural land use was about 6%; in Ukraine, about 8%. *(UNDP, 2006)*

Table 4.17. Individual versus state agricultural production[132]

	1990	1995	2000	2004
land use structure				
corporate farms	93.5	83.5	83.8	83.6
household plots	6.4	15.8	15.3	14.5
private farmers	0	0.7	0.9	1.9
BELARUS TOTAL Land	**100**	**100**	**100**	**100**
GAO production structure				
corporate farms	76.3	51.6	61.2	60.1
household plots	23.5	48.0	38.2	38.8
private farmers	0.2	0.4	0.6	1.1
BELARUS TOTAL GAO	**100**	**100**	**100**	**100**

The analysis of the **regional diversification** of the agricultural output production shows that the share of each region in total agricultural production remained fairly stable during the transformation period **(*Table 4.18*** and the **map in the Appendix 4.10.*)***.

The Minsk region has the highest share in total Belarus agricultural production (23%), and the Mogilev region the lowest (12.5%). While the difference between the regions with the highest and lowest share is more than two times, the difference between the regions from the second (Brest region), third (Grodno region), fourth (Vitebsk region) and fifth (Gomel region) positions in rating is very small and almost insignificant. The share of each region in the total agricultural production is to some extent correlated with the regions' share in the total Belarusian agricultural labor force. The "most agricultural" in terms of the share in agricultural output regions like the Minsk, Grodno and Brest regions also have the highest shares in the total agricultural labor force.

The analysis of the regional agricultural output growth rates resulted in practically the same picture as the analysis of the regions' share in output **(*Table 4.19).*** The "main agricultural producers" (Minsk, Grodno and Brest regions) had the highest output growth rates during the studied period – 74.7%, 78.5% and 70.3% respectively. The only exception was one of the least productive Belarus regions –the Vitebsk region, which while having one of the smallest shares in agricultural production (# 4 according regions' rating) had achieved one of the highest annual output growth rates (#2 in regions' rating).

[132] Data from: *Babicki et al. (2003)* and *Belarusian Agricultural Statistics Yearbook (various years)*

Table 4.18. Regions' share in total Belarus agricultural output (%)[133]

	1990	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	regions rating	regions share in agric. labor[134]
Mogilev region	13.0	12.5	13.1	12.5	12.5	12.7	12.1	11.8	11.5	**6**	13.9
Minsk region	23.1	23.7	22.7	23.6	23.8	24.2	24.4	24.1	23.7	**1**	19.3
Grodno region	16.6	17.7	17.2	18.6	17.2	16.9	17.3	17.4	17.7	**3**	19.9
Gomel region	15.4	14.4	13.6	12.7	13.9	14.7	14.2	14.6	15.3	**5**	13.1
Vitebsk region	13.6	14.6	15.7	14.2	15.0	14.8	14.0	14.9	14.3	**4**	14.4
Brest region	18.3	17.2	17.8	18.5	17.5	16.8	18.0	17.1	17.5	**2**	18.8
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**		

Table 4.19. Regions' agricultural output growth rates (1990=100%)[135]

	1990	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**2003**	**regions rating**
Mogilev region	100	73	72	64	67	68	69	74	**5**
Minsk region	100	74	70	64	76	78	78	83	**3**
Grodno region	100	79	79	74	77	79	78	83	**1**
Gomel region	100	67	63	56	63	63	65	69	**6**
Vitebsk region	100	79	79	69	74	74	75	78	**2**
Brest region	100	70	69	65	68	70	72	77	**4**
Average for Belarus	**100**	**74**	**72**	**65**	**71**	**72**	**73**	**77**	

Finalizing the analysis of the **regional diversification** of agricultural output production during the transformation period, it is possible to come to the **following conclusions:**

(1) There were three regions in Belarus that could be considered to be the "leaders" in terms of agricultural production - Minsk region, Grodno region and Brest region, and three regions that could be considered to be the "laggers" - Gomel region, Vitebsk region and Mogilev region.

2) This (agriculture-relevant) regional differentiation can be considered relatively strong: the ratio of the share in total Belarus agricultural output of the "least agricultural" Mogilev region and the "most agricultural" Minsk region is approximately 1:1.9.

[133] Data from *Regions of Belarus Republic (2004)* and *Regions of Belarus Republic (2005).*
[134] Percentage share of each region in total Belarus agricultural labor force for 2001.
[135] Data from *Belarusian Agricultural Statistics Yearbook (2003) and Belarusian Agricultural Statistics Yearbook (2003)*

3) The best-performing (in terms of agricultural output) regions were in the western part of the Belarus, while the worst-performing were in the eastern part of the country. This East-West agricultural division can mainly be attributed to the better soil and climatic conditions in the western parts of Belarus.[136]

4) During the transformation period, the share of each region in Belarusian agricultural output production remained fairly stable. The regions with the highest shares in total agricultural output also showed the highest output growth rates (with the only exception for the Vitebsk region).

Finalizing the analysis of the agricultural output dynamic during transformation period, in Belarus, it is possible to make the following conclusions:

(1) The dynamics of agricultural production in the Belarus pre-transition period is characterized by a steady output growth and the prevalence of the livestock sector over the crop sector.

(2) During the transformation period, the agricultural output production experienced a steep decline (although the lowest among the studied FSU and some V4 countries), which was then followed by a slow but steady recovery. However, unfavorable changes transformed the livestock-based Belarusian agriculture into one that was crop-oriented.

(3) The regional structure of agricultural output production did not change during the transformation period: the share of each region in total Belarus agricultural production remained stable. Therefore, the results of the detailed region-specific analysis of the agricultural production allow us to conclude that in "absolute terms,"[137] the transformational reforms' outcome could be considered a modest success, due to a slow but steady output recovery.

The possibility of making a more comprehensive output analysis in "comparative terms"[138] is constrained by the absence of Producer Subsidy Equivalent (PSE) estimations for Belarus, and also by the partial and unclear data and estimations of the official Belarus statistics, regarding state support to agriculture.[139]

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[136] However, some researchers attribute it to the fact that western regions of Belarus (Grodno, Brest and some parts of Minsk region) experienced just 40 years of a Soviet-type socialist economy, while the eastern Belarus regions experienced 70 years of it.

[137] referring only to output dynamic (see conclusion of the "CEEC output Section")

[138] comparing the output dynamic to changes in agricultural subsidies (see conclusion of the "CEEC output section")

[139] Only the budget state expenditures under the headings: „Expenditures for agriculture" and „Fund for supporting producers of agricultural products" are the "visible portion of subsidies". "Many other support payments do not show up in the state budget" like: credits and below-market interest rates, write-offs of credits, preferential tax treatment, preferential prices for inputs, non-monetary transfers from other sectors (*Babicki et al., 2003, p.4)*

A detailed empirical analysis of the impact of land, labor, machinery and fertilizers on the GAO dynamics will be done applying the regression analysis in the subsequent Section 4.4. of this chapter.

4.3. Agricultural productivity in Belarus during the transformation period

This section tackles the productivity dynamics in Belarus during the transformation period. It starts with a description of the main characteristics of the productivity dynamic; next, the factors that influenced land, labor, machinery and fertilizer productivity are discussed; after that, the concluding remarks finalize the section.

Overall, Belarusian agricultural productivity dynamics followed the general trend of the CEE and FSU countries, where the partial productivity of the inputs that fell faster than the GAO had increased, while the partial productivity of the inputs that fell slower than the GAO had decreased. ***(Table 4.21***- productivity dynamic summary and **Appendix 4.11** - detailed calculations)

An analysis of overall **land productivity** calculated as a GAO/land ratio[140] shows that land productivity steadily declined until 1999, and after that started to increase slowly, which resulted in an average decrease of land productivity by almost 20% during the period in question (1990-2004). However, the upward tendency continued for the next five years, and starting from 2007, land productivity reached its pre-transition level and continued its growth. The changes in land productivity can mainly be attributed to the different speed of changes for the GAO and land use rather than improvements in land use, because the amount of land under cultivation was stable (even with some minor increases) until 2000, but after that, started to decline steadily, contrary to the GAO, which steady declined up until 1999 and then began to increase gradually.

Although an analysis of overall land productivity yielded expectable results, the analysis of the sectoral (crop-livestock) and organizational (private–socialized) patterns of land productivity provided a more complex picture, and showed surprisingly low achievements of individual (private) farmers, who had been expected to be the "leaders" of the agricultural transformation in Belarus.

[140] GAO is the FAO gross agricultural output, which was calculated as the sum of the value of production of 189 crop and livestock commodities, valued at constant, global-average prices from 2004-2006 and measuring in international 2005$. Land is the total agricultural land.

Table 4.21. Agricultural productivity dynamics in Belarus [141]

	1990	1991	1992	1995	1996	1998	2000	2003	2004	AVG 1990-2004	2006	2010
Change of												
GAO	**100**	95	90	77	80	73	71	74	84	**80**	88	99
land	**100**	100	100	102	102	101	100	92	91	**98**	91	91
labour-1 (*ec.active population in agriculture*)	**100**	95	99	86	77	71	63	50	47	**75**	46	47
labour-2 *(average salary US $)*	**100**		7	27	39	34	31	42	58	**30**		
machinery	**100**	100	118	99	87	73	64	51	48	**81**	46	44
fertilizers	**100**	81	52	19	27	29	25	22	34	**36**	45	60
Change of the productivity of												
land productivity	**100**	95	90	76	78	72	71	81	91	**81**	96	108
labor productiv.-1	**100**	99	91	90	103	103	112	149	178	**111**	192	210
labor productiv.-2	**100**		1,241	283	204	212	228	176	146	**373**		
machinery productivity	**100**	95	77	78	91	99	112	145	174	**105**	190	227
fertilizers productivity	**100**	116	175	415	296	254	279	340	247	**280**	195	165

The analysis of **crop yields (**calculated as the ratio of the selected crops per arable land) in regard to different farms types (**Appendix 4.12 and Appendix 4.13*)*** shows a mixed picture. Corporate farms and household plots had the highest average crop productivity. Corporate farms achieved the highest productivity for vegetables and forage beets (first places in the "productivity rating") and slightly smaller productivity for grains and potatoes (second places in "productivity rating"). Contrarily, household plots had the highest productivity for grains and potatoes (first places in "productivity rating") and a slightly smaller productivity (compared to corporate farms) for vegetables and forage beets. Individual farms had the lowest productivity for all types of studied crops during the transformation period.

The analysis of crop yield dynamics (**Appendix 4.12 and Appendix 4.13**) during the transition period shows that in general, all main crop yields (analyzed in this research) declined in all types of farms. The average annual decline for fodder beets was about 62.6% (maximum decline), for vegetables – 78.5%, for grains – 83.7% and for potatoes – 93.4%. However, the analysis of the crop production dynamics with respect to different types of

[141] Data for calculations are from *Fuglie (2012*). Data for average salary in Belarusian agriculture are from the *Belarusian Agricultural Statistics Yearbook (various years*). Re-calculation from the Belarusian national currency ("rouble") to US $ was done according to the official exchange rates.

farms reveals that corporate farms had the lowest productivity growth rates compared to the individual sector[142] - (third places in "productivity rating" for all the studied crops). Household plots achieved the best productivity growth results for (labor-consuming) vegetables and potatoes production (first places in the rating), while individual farms had the best results for (capital-consuming[143]) grain and forage beets productivity growth.

In general, the analysis of crop productivity during the transformation period shows that crop productivity fell in all types of farms (although to different extents), and there was no clear evidence of a significant advantage of "individualized agriculture" over "socialized" agriculture. Individual farms had the lowest productivity, but the highest productivity growth rates, while corporate farms had the lowest productivity growth rates, but the highest productivity itself. (To oversimplify the issue, the corporate farms had already achieved the highest possible limits of their productivity, and thus had "less room" for increase in growth rates).

While discussing the issue of crop productivity, it is necessary to mention that according to the experts, crop productivity potential in Belarus has not yet been exploited to the full (*Csaki et al., 2000).* For example for grain production, the gap between the yields achieved at scientific research stations (4.5 t/ha) and the yields gained by farms (around 2.5 t/ha) reached almost 50% *(Csaki et al., 1994).* The main constraints of crop productivity growth are usually considered low-quality seeds, insufficient application of fertilizers, herbicides and insecticides, outdated machinery and some special climate features (like moisture stress) *(Csaki et al.,2000).*

The analysis of the land productivity in terms of **livestock production**[144] (**Appendix 4.14. and Appendix 4.15)** shows that it declined for the majority of studied livestock products, with a very slight exception for milk production. The slow speed of livestock production decline can be attributed to the fact 1995 was taken as the base year for the comparison; this was when the main decline in animal herds and livestock production had already taken place.[145] An analysis of livestock growth rates in regard to farm types shows that individual farmers had the highest growth rates for milk production, but the lowest rates for animal production, which can be explained by its milk production orientation. Household

[142] household plots plus individual farms
[143] "Capital" here means the machinery and the agricultural equipment use.
[144] Livestock productivity was calculated as the ration of the selected livestock products per ha of the agricultural land.
[145] The year 1995 was deliberately taken as the base year, because the "year 1990" (which is usually taken for the comparison) could be considered as "bumper year" and thus, the all calculations which could be done, would be extremely biased downwards.

plots had higher growth rates compared to corporate farms in animal production, but lower in egg and milk production.

While an analysis of crop productivity does not produce any clear picture in regard to productivity differentiation according to farm type, the results of the livestock productivity analysis shows the visible over-performance of household plots over corporate farms and individual farmers. Household plots achieved not only the highest productivity for meat, milk and egg production, but also the difference between the household plot productivity and its "corporate and individual farms" rivals was remarkably huge. Household plots' productivity was four times higher for eggs production, three times higher for milk production and almost two times higher for meat production, compared to the productivity achieved by corporate farms. The gap between household plots' and individual farms' productivity was even more remarkable - it was eight time higher for eggs production, seven times higher for milk production and two times higher for meat production. Although the difference between the corporate and individual farms' productivity was not as remarkable as for the household plots vs. "corporate-individual farming", the corporate farms achieved substantially higher productivity (two times higher) for milk and egg production compared to individual farmers, while the difference in meat productivity was only slight. The above results allow us to come to the conclusion that the best livestock productivity (with a huge gap) was achieved by household plots, while the lowest productivity performance is mainly attributable to individual farmers.

Summarizing all the results obtained for land productivity (in terms of the GAO, crop and livestock production-per-land), one may conclude that overall GAO/land productivity, as well as crop and livestock productivity, declined during the period in question (1990-2004). Any significant difference was observed in regard to the "individualized" vs. "socialized" sector for "crop-related" land productivity, while "livestock-related" land productivity shows a significant advantage of household plots over corporate and individual farms. Surprisingly, individual farms had the worst productivity results for crop/land and livestock/land productivity measured in natural volumes (except for the highest growth rates for crop productivity).[146]

[146] Surprisingly, because at the beginning of the transformation, it was expected that the newly emerged individual farms will be able to achieve the best results (compare to the corporate farms and household plots) and become the locomotives of the agricultural sector progressive development.

The **labor productivity** (calculated as GAO per agricultural workers ratio[147]) during the transformation increased on average at an 11% rate, which, however, was mainly caused by the fact that the GAO declined slower than agricultural labor, but not because of the labor adjustment process. The significant decrease in agricultural labor (the economically active adults in agriculture) could be explained by two main factors: (i) rural population ageing and (ii) increasing attractiveness of urban life compared to rural dwelling (better jobs, better salaries, and better living conditions). The latter factor was not effectively hampered by either governmental policy, oriented to the subsidization of agriculture as a kind of a job creation scheme, or by the decline of working opportunities in urban areas, which makes work in agriculture (and settlement in rural areas) more attractive due to the possibility of the creation of "food security stocks".[148]

Although the number of economically active adults in agriculture could be a "very handy proxy" for the labor productivity calculations, it might not be a good marker for qualitative improvements *(Federico, 2005, p.59)*. Therefore, for the purpose of a more thoughtful assessment, labor productivity was also calculated as the GAO per-average-salary ratio.[149] This GAO per-salary-productivity index shows an even more substantial increase than the GAO per-worker-productivity index. However this GAO per-salary index should be interpreted very cautiously, because this average salary index was significantly biased due to (i) the huge inflation rate, which reached the millions' times increase for inputs and milliard times increase for output[150] – **(see Appendix 4.3)**; (ii) the widespread practice and sometimes the prevalence of payment-in-kind (especially in 1990-1996), rather than salary payments in money units.

The machinery productivity measured as the ratio of GAO per total stock of farm machinery in "40-CV tractor equivalents" decreased slightly until 1997, but from 1998 started its recovery and continued its remarkable growth until 2010 - reaching the 227% increase compared to the 1990 level. Considering that the actual number of tractors (measured in items, without considering horsepower capacity) constantly decreased during 1990-2010, this

[147] "Labor workers" is number of the economically active adults in agriculture. Data for GAO and "labor workers" are from *Fuglie (2012)*

[148] In fact, agriculture in Belarus had played its role as the "food security net" during the initial period of transition (when the GAO decline was the most profound and the food shortages in the urban areas were substantial), but after the improvements in the food supply and the general economy revitalization its role as the "security net" diminished substantially.

[149] Calculation of the GAO/working hour is impossibly due to the scarcity of the data regarding the working hours in agriculture.

[150] Even the calculation of the average salary in US dollars in order to mitigate inflation effects does not help a lot due to currency exchange rate biases and the existence of several exchanges rates (official and "black market") during that period of time.

machinery productivity growth could be considered a substantial qualitative improvement and thus, a transformational reform success.

Fertilizer productivity was calculated as the ratio of the GAO per-metric tons of fertilizer consumption (measured in "N-fertilizer equivalents"), where the tons of different kinds of fertilizer were aggregated using weights based on their relative prices. This partial productivity index shows the most impressive growth among all the studied productivity indexes from 1990-2004, which could probably be considered a reform success. The signs of the slow decrease of fertilizer productivity, which started to appear from 2002 could possible reflect the fact that the speed of GAO recovery was slower than the speed of fertilizer-use increase.

An overall analysis of the partial productivity dynamics of land, labor, machinery and fertilizers shows that only land productivity decreased during the period in question, while other partial productivity indexes increased (though to different extents). Such a dynamic could be considered a success of the reform, as well as simply a reflection of the differences in the speed of the decline/increase of GAO and the input in question (i.e. land, labor, machinery and fertilizers). Therefore, to evaluate whether the growth of some partial productivity indexes can be considered a success or failure of reforms, it is necessary calculate the Total Factor Productivity (TFP). The estimation of the Total Factor Productivity will be done in the next Section 4.4., together with a concluding assessment regarding the success or failure of reforms in terms of agricultural productivity.

Section 4.4. Empirical assessment of the agricultural production and productivity dynamics.

This section provides the rationale for the final conclusions regarding the assessment of the reform outcomes in terms of agricultural output and productivity in Belarus.

For this purpose, the section analyzes the impact of the changes in inputs use on GAO dynamics (referring to Section 4.2) and the calculation of the TFP (referring to Section 4.3) by an estimation of the panel regression for the seven Belarusian regions. The section starts with a description of the methodology and data; next, the regression results are provided and discussed; then, the TFP indexes are calculated and explanations about its dynamic are offered; concluding remarks will finalize the section.

In order to analyze how (and if) the selected inputs' (land, labor and capital) adjustments affected agricultural output dynamics, a panel regression was estimated using the Cobb-Douglas specification of the production function.

The econometric model for the estimation is:

$$\ln(\mathbf{GAO_{it}}) = \alpha_0 + \beta_1 \ln(\mathbf{LAND\_TOT_{it}}) + \beta_2 \ln(\mathbf{LAB_{it}}) + \beta_3 \ln(\mathbf{CAP_{it}}) + \varepsilon$$

where **GAO** is the total value of Gross Agricultural Output, aggregated using the constant prices (base year: 1990) for the three types of agricultural producers (corporate farms, household plots, individual farmers), **LAND_TOT** is the agricultural land used by the three types of agricultural producers (corporate farms, household plots, farmers), **LAB** is the number of the working hours, **CAP** is the average of the machinery in use (tractors and combines), fertilizer consumption and livestock inventories (cows, pigs and poultry), and **TREND** is a proxy for TFP.

The data used for the model are the observations for the years 1990-2004.[151] Although the above-presented variables are mainly of a quantitative rather than qualitative character, and also not all of them are available for the whole period in question (the data coverage for 1991-1995 is extremely scarce) - they are the only data available, and the panel regressions results based on them allows us to make plausible conclusions.

The geographical coverage for this pooled regression includes all six Belarusian regions: Mogilev region **(_mog),** Minsk region **(_min),** Grodno region **(_gr),** Gomel region **(_gom),** Vitebsk region **(_vit)** and Brest region **(_br).**

All variables (except **TREND variable**) are transformed from index numbers (1990 =100%) to log-linear form using the [=+ln …] Excell program function.

[151] Data are from *Belarusian Agricultural Statistics Yearbook (various years)*

The detailed results of the pooled regression estimations (coefficients in EView format and growth accounting statistics Tables) are presented in the **Appendix 4.17.** and summarized in **Table 4.22**

Table 4. 22. Belarus pooled regression results

Dependent variable: GAO (Gross Agricultural Output)		
	coef.	***t* value**
Land	0.20*	5.04
Labor	0.29*	11.75
Capital	0.49*	14.73
TFP_Brest	0.01*	6.88
TFP_Gomel	0.01*	5.94
TFP_Grodno	0.02*	8.24
TFP_Minsk	0.01*	6.86
TFP_Mogilev	0.02*	10.36
TFP_Vitebsk	0.03*	11.86
Linear estimation after one-step weighting matrix (cross-section SUR)		
No. of regions	*6*	
No. of observ.	*60*	
R^2	*0.91*	
Adj. R^2	*0.9*	
Durbin-Watson st.	*2.03*	
Wald Test	*0.3*	
** indicate significance at the 1% level (prob. <0.01)*		

Table 4.22. presents the results of the model where the CAP variable is estimated without any time-lag (while in previous CEEC regression in Section 2.4. the **CAP** variable was estimated with a minus one-year lag). This was done because the results for the models in which the **CAP** variable was estimated with time-lags are not as good as when the estimation was done without any time-lag. However, this does not imply a discontinuity in results, because this approach is consistent with the estimation of the Western countries' pooled regression model in the next Chapter 5, where the best results were also obtained for the model without any time-lags.

The regression has a good explanatory power (R-squared is around 1) and the Durbin-Watson stat. is about 2, which is satisfactory enough. The Wald Test result is "0.3". All the coefficients are highly significant ($p<0.01$) and have a positive sign, which implies the normal production function behaviour when the increase of the use of each input (land, labour, capital) leads to an increase in output (GAO). According to the regression results, the capital has the most significant impact on GAO: a 1% increase in capital use raises the GAO by almost 0.5%. The next important input is labor, which causes a 0.3% of GAO increase for

each 1% of land-use increase. The land input has the lowest impact on the GAO dynamics: the 1% increase of labor use would provide only 0.2% of GAO increase.

A more detailed regionally relevant analysis of the contribution of each input to the GAO dynamics is provided in **Table 4.23.** This table summarizes the results of the GAO accounting calculations from **Appendix 4.17**

Table 4.23. Contribution of each input to GAO change as the % of total change

Belarus regions	**Total GAO change**	**Contribution to total change of the**				**∑ GAO**
		land	**labor**	**capital**	**TFP**	
		LAND	*LAB*	*CAP*	*TREND*	
Mogilev	-0.02	0.18	-0.95	1.83	-1.71	**-0.65**
Minsk	-0.01	0.12	-1.19	2.02	-2.13	**-1.18**
Grodno	-0.01	0.13	0.54	1.19	-1.75	0.11
Gomel	-0.03	0.08	0.43	0.92	-0.68	**0.75**
Vitebsk	-0.02	0.21	-1.02	1.58	-1.77	**-0.99**
Brest	-0.02	0.08	0.40	1.72	-1.21	**0.99**

The growth accounting statistics is acceptable (the sum of the percentage contribution to the total GAO change is around "1") for the five Belarusian regions from the model sample.

According to the growth accounting statistics for the regions with acceptable results, the capital variable made the highest contribution to output change among the all inputs, and sometimes made an even higher contribution than the TFP variable.

Thus, it is possible to conclude that the obtained regression results suggest that the changes in capital use had the most decisive impact on the GAO dynamics in Belarus. The changes in land and labor had a less important impact on the GAO. These results are consistent with the findings of the previously estimated Cobb-Douglass production function for the seven CEEC countries (including Belarus) in the CEEC Chapter 2 (Section 2.4.), where the changes in capital use were found to be the most influential factor of the GAO dynamics.

In order to evaluate whether the increase in some partial productivity indexes in Belarus could be considered a success of the reform, the Total Factor Productivity (TFP) should be estimated. The results of the TFP estimations are summarized in the **Table 4.24**

Table 4.24. Total Factor Productivity (TFP) growth rates

	estimated coefficient for TREND variable	TFP growth	
		annual TFP growth	cumulative TFP growth [152]
TFP_Brest	0.019	1.9	0.3
TFP_Gomel	0.018	1.8	0.3
TFP_Grodno	0.022	2.2	0.4
TFP_Minsk	0.020	2.0	0.3
TFP_Mogilev	0.030	3.0	0.6
TFP_Viitebsk	0.031	3.1	0.6

Coefficients of the **TREND** (TFP) variable are found significant and have a positive sign for all six Belarus regions. The annual TFP growth among them vary between 1.8% to 3.1%, which is consistent with the results of the CEE countries' regressions (**Section 2.4**), where the annual TFP growth for Belarus varied from 3.3% to 2.3% depending on the model. **Therefore, considering the positive (and significantly high) TFP growth in Belarus, it is possible to assess as a "success" the transformational reforms' result in terms of productivity.**

The incredibly high rate of the TFP increase in Belarus can be explained by the following reasons:

(i) more rational and economical use of previously (during the Socialist era) over-used inputs, less wastage of inputs;

(ii) initially lower (less favorable) level of Belarusian agricultural development. Among the FSU countries in question (Russia, Belarus and Ukraine), Belarus is usually considered the country with the least favorable conditions for agricultural production (in terms of climate and soil characteristics) and *Federico (2005) and Galonopoulos et al. (2008*) imply that the "backward" countries *(Federico,2005, p.211)* or countries with "lower initial levels of productivity" *(Galonopoulos et al.,2008, p.10*) show higher growth rates, or, to generalize, the "initially poorer regions grow faster than initially more wealthy regions" (*Bivand and Brunstad, 2002, p.i*). *Macours and Swinnen (2000a)* also found that GAO growth was higher for countries with lower levels of pre-reform development and with lower pre-reform distortions;

[152] Cumulative TFP (or 15 years period TFP growth) was calculated as {((=+exp(estimated coefficient*15))-1} in Excell (MS)

(iii) the increase of the share of household plots in total agricultural production (changes in institutions). During the transformation period, the most remarkable institutional changes occurred in the household plots production sector – having only a small share of the agricultural land, the household plots' production reached almost 50% of total GAO for some years (see **Table 4.25**).

Table 4.25. Share of the households' plots in Total GAO and Total agricultural land[153]

	1990	**1995**	**2000**	**2005**
Total GAO	100	100	100	100
household plots GAO	**23.5**	**48.0**	**38.2**	**37.6**
Total agricultural land	100	100	100	100
household plots land	**6.4**	**15.8**	**15.3**	**14.5**

Therefore, according to the estimated TFP results and finalizing the issue of the assessment of the reforms outcome in terms of agricultural productivity, it is possible to state that the transformational reforms' results in Belarus could be considered a reform success, due to a (substantial) increase in TFP.

[153] Data from *Belarusian Agricultural Statistics Yearbook (1994*), *Belarusian Agricultural Statistics Yearbook (2005)* and *Belarusian Agricultural Statistics Yearbook (2007).*

4.5. Conclusion

The analysis of the Belarus agricultural performance during the fifteen years of transformation leads to the following conclusions in regard to the "success or failure of reforms" in terms of the transformational processes, agricultural production and productivity.

1. The main features of the centrally-planned (command) economy were mainly preserved in Belarus, although some attempts were made to reform the former Socialist agricultural system. In general, the transformational reform dynamics could be considered as a process of soft and mild adaptation from the former centrally-planned economy to the free-market environment, which emerged after the dissolution of the USSR.

2. In terms of agricultural production (in "absolute terms"[154]), the transformational reforms' outcome may be considered a modest success, due to slow but steady output recovery. A change in capital use was the most influential factor in the GAO dynamics.

3. In terms of agricultural productivity, the reform outcome in Belarus may be considered a success due to the Total Factor Productivity growth.

[154] referring only to output dynamic (see conclusion of the "CEEC output section")

CHAPTER 5. Polish and Belarusian agricultural performance, from a centrally-planned to market oriented economy: the determinants of reform success.

The analysis of the transformational processes in Polish and Belarusian agricultural systems provided in the previous chapters allows us to make the following comparative conclusions regarding the transformational approaches and results.

In terms of the chosen transformational policies, **Poland and Belarus** chose **different reform approaches and followed divergent reform paths.** Poland chose a liberal-market reform approach and followed the speedy "Big-Bang" transformational path, while Belarus took the so-called "socially-oriented" ("socially-friendly") reform approach and followed a slow and very gradual reform path.

At the risk of oversimplification, it is possible to describe the Polish agricultural transformation as a fast and straight **reformation** of the centrally-planned economy to the market-oriented economy, while the Belarusian agricultural transformation could be marked as the very slow and mild adaptation of the centrally-planned economy to the hostile free-market environment, which rapidly emerged after the dissolution of the USSR.

However (and surprisingly), despite the different transformational policies, the **results of the transformations, measured in terms of agricultural production (output) and productivity could be** generally **considered** a **"success" for the both Poland and Belarus**, although some differences in the dynamics and magnitude of production and productivity changes were observed.

The agricultural production (output) clearly followed the same upward direction (after an initial decline) in Poland and Belarus, which leads to the conclusion that the transformational results a "success" for both countries.[155] The only differences observed pertained to the speed and the magnitude of the production dynamics.

In terms of **agricultural productivity,** the transformational results could also be generally considered a "success" for Poland and Belarus, because both countries experienced a modest TFP increase, despite the fall of the partial productivity of some of the inputs. Both Poland and Belarus followed the same (declining) trend for land and labor partial productivity, but different trends for machinery and fertilizer partial productivity.

In light of the above-noted conclusions, the following questions should be raised:

(1) How did it happen that Poland and Belarus, having so **different transformational approaches** and following so different transformational paths, achieved **similarly successful**

[155] although the agricultural production (output) had not yet reached the pre-transformation level of agricultural production in both Poland and Belarus, as for year 2004.

results in terms of agricultural production and productivity? What were the driving forces behind such a controversial effect?

(2) Which were the determinants and reasons for the **differences in the** dynamics and magnitude of agricultural **production and productivity?**

A possible explanation could be provided by the following hypotheses, which will be verified within the next two sections of this chapter.

Hypothesis 1. "Poland and Belarus achieved similarly **successful results** of the agricultural transformation in terms of production and productivity because both countries **followed the developmental path of advanced Western countries - a shift from land- and labor-intensive agriculture to capital-intensive agriculture".** Or if to reformulate it in the transformational history framework, **"the capital endowment has the more decisive impact on the reforms' success (or failure) than the reforms' profoundness".**

Hypothesis 2. "The **observed differences** in the dynamics and magnitude of production and productivity changes could be explained by the **differences in the "institutions"** in a broadly defined sense,[156] or to be more specific, to the transition economies discourse, the differences in the reform paths and initial conditions (*Swinnen, 2006).*

The next **Section 5.1**. of this chapter provides verification of Hypothesis #1 (explaining the "similarities" of the transformational results), while **Section 5.2.** provides proof for Hypothesis #2 (dealing with the explanation of the "differences").

[156] "institutions" –i.e. "a set of formal or informal rules to determine the initial ownership of the goods and factors (property rights) and to regulate the exchanges (contracts, markets, and other forms of distribution)" (*Federico, 2005, p.117)*

5.1. Explanation of the similarities in agricultural production and productivity dynamics.

This section explains the "similarities" of the transformational results within the framework of the previously formulated hypothesis that "**Poland and Belarus achieved similarly successful results in agricultural transformation in terms of production and productivity, because both countries followed the developmental path of advanced Western countries: a shift from land- and labor-intensive agriculture to capital-intensive agriculture".**

The section is organized as follows: first, it establishes that advanced Western countries experienced a shift from land- and labor-intensive agriculture to capital-intensive agriculture from 1960 to 2004, and that Poland and Belarus also took this path; then, in order to verify whether the increase in capital use had a decisive impact on agricultural production, a pooled regression for the selected advanced Western countries was run; next, a brief explanation of the impact of capital intensivity (and increase in capital use) on productivity (TFP) increase will be provided; and finally, concluding remarks will finalize the section.

An analysis of the **land dynamics** shows that agricultural land decreased in practically all advanced Western countries from 1961 to 2004.[157] Further, **agricultural labor** (measured in terms of agricultural population) decreased in this period. These declining tendencies for the both land and labor began in the 1960s and continued through the 1980s, 1990s and 2000s. The dynamics of land and labor changes in CEE countries (and Poland and Belarus as part of it) followed the path taken by advanced Western countries (see **Appendix 5.2** for land and **Appendix 5.3** for labor).

However, the picture for **tractor and fertilizer** dynamics appears to be more complicated.

At first glance, a simple quantitative analysis of the **tractors in use** in advanced Western countries compared to the CEEC (Poland and Belarus) shows no clear common path. In the advanced Western countries, the number of tractors in use grew until the 1990s, and then started to decline. In Poland, the number of tractors in use constantly increased since the 1960s, while in Belarus it grew until the 1990s and then started to decrease (see **Appendix 5.4**).

However, the picture becomes more interesting when one considers the ratio of **tractors- per-land-use** (see **Appendix 5.5**.). A comparison of advanced Western and CEE

[157] except for arable land in France, Ireland and Netherlands.

countries shows the huge gap between these two sets of countries, and Poland was the only country from the CEEC that was able to overcome it and come close to the average Western "standard" for tractors-per-land-use (as for year 2003). Or in other words, Poland was the only CEE country that was able to achieve the "average Western countries" tractors-per-land ratio.

The same tendency applies for the **fertilizer consumption**. A simple analysis of fertilizer consumption trends shows no clear commonalities between the advanced Western and CEE countries (see **Appendix 5.6**.), while fertilizer-per-land-consumption reveals a substantial gap between these two sets of countries (see **Appendix 5.7**.) Further, Belarus and Poland were the only CEE countries that came close to the average Western "standard" for fertilizer-per-land- consumption (as for year 2002). Or in other words, Belarus and Poland were the only CEE countries that were able to achieve the "average Western countries" fertilizer-per-land ratio.

Thus, a brief descriptive analysis of land, labor and capital changes leads to the following conclusions:

(i) Western countries experienced a shift from land- and labor-intensive agriculture to capital-intensive agriculture from 1961 to 2004; (ii) Both Poland and Belarus followed this path (a shift from land and labor-intensive to capital-intensive agriculture), although with a 10-15 years delay, and were the most successful among the other CEE countries in terms of capital use: Poland was leader among the CEEC for tractors-per-land-use, and Belarus for fertilizer-per-land-consumption.[158]

The next issue in verifying Hypothesis #1 is to evaluate whether the capital intensivity (increase in capital use) could be considered an important factor in the agricultural production (output) increase, or in other words, could the shift from land- and labor-intensive agriculture to capital-intensive agriculture be the reason for the agricultural production increase.

The crucial importance of capital improvements for the agricultural production increase for the CEE countries from 1990 to 2004 has already been empirically established in previous **Chapters 2-4**, where the results of the pooled regression for the seven CEE countries and also the Poland- and Belarus-specific regressions had proven that an increase of

[158] However, the driving forces behind these leaderships are different. Poland was the leader in tractor use due to a constant increase in the number of tractors per land which had started long before the pre-1990s period and proceeded during the transformation period (1990-2004); Belarus was the leader in fertilizers-per-land-consumption due to the pre-1990s excessive fertilizer consumption ,and had actually experienced a decline in fertilizer-per-land-consumption from 1990-2004. Thus, the Belarus leadership was mainly based on the exploitation of its the pre-1990s potential.

capital use was one the most important factors (or at least had a very significant impact) for agricultural production increase.

In order to verify whether the changes in capital use (increase or decrease) had the same importance for the agricultural production dynamics in the advanced Western countries, a pooled regression for the selected 12 advanced Western countries was estimated. This pooled regression was estimated according to the following model:

$$\ln(\mathbf{GGAO_{it}}) = \alpha_0 + \beta_1 \ln(\mathbf{LAND\_AR_{it}}) + \beta_2 \ln(\mathbf{LAB\_RUR_{it}}) + \beta_3 \ln(\mathbf{CAP_{it}}) + \varepsilon$$

where **GGAO** is Gross Production Index Number (2004-2006 = 100), **LAND_AR** is arable land, **LAB_RU**R is rural population, **CAP** is the average of the tractors in use and fertilizers consumption, **TREND** is a proxy for TFP.

The regression sample was comprised of the twelve most advanced Western countries: Denmark **(_DEN**), Finland **(_FIN**), France **(_FRAN),** Germany **(_GER),** Ireland **(_IRL),** Italy **(_ITAL),** Netherlands **(_NETH),** Portugal **(_PORT),** Spain **(_SPA),** Sweden **(_SWD),** Switzerland **(_SWZ),** United Kingdom **(_UK).**

The data used for the model are the observations for the 1990-2004 years period from the FAO database. All variables used for the regression estimations were calculated as the index (percentage) numbers normalized around the year 1990 (1990=100%) and then transformed into a log-linear form using the EXCELL formula [=lg]

The detailed results of the pooled regression estimations (coefficients and growth accounting statistics Tables in EView format) are presented in **Appendix 5.8. and Appendix 5.9.** and summarized in **Table 5.1** and **Table 5.2.**

The regression has good explanatory power (R-squared is around 1) and the Durbin-Watson stat. is about 2, which is satisfactory enough. The Wald Test result is above "0,1". All coefficients (except for Trend for Sweden) are highly significant ($p<0.01$) and have a positive sign, which implies the normal production function behaviour when the increase of the use of each input (land, labour, capital) leads to the increase in output (GAO). According to the regression results, the capital has the most significant impact on GAO in all Western countries in question: a 1% increase in capital use raises the GAO by almost 0,6%. The next important input is labor, which causes the 0.4% of GAO increase for each 1% of labor increase. The land input has the lowest impact on the GAO dynamic: the 1% increase of the land use would provide only the 0.1% of GAO increase.

Table 5.1. Regression results

Variable	Coefficient	t-value
C	~~-0,519~~	-1.146
Land	0,127*	5.833
Labor	0.404*	4.874
Capital	0.580*	24.385
TFP for Denmark	0.033*	32.227
TFP for Finland	0.017*	8.832
TFP for France	0.019*	15.236
TFP for Germany	0.010*	6.683
TFP for Ireland	0.011*	9.769
TFP for Italy	0.006*	7.822
TFP for Netherlands	0.024*	10.310
TFP for Portugal	0.017*	7.851
TFP for Spain	0.010*	4.407
TFP for Sweden	0.003**	2.148
TFP for Switzerland	0.003*	3.541
TFP for UK	0.006*	4.798
Linear estimation after one-step weighting matrix (cross-section SUR)		
No. of regions	*12*	
No. of observ.	*156*	
R^2	*0.9*	
Adj. R^2	*0.97*	
Durbin-Watson st.	*2.16*	
Wald Test	*0.1*	
** indicate significance at the 1% level (prob. <0.01); ** indicate significance at 5% level (0.01<prob. <0.05);* ~~*0.519*~~ *- insignificant variable (more that 20% significance)*		

The more detailed country-relevant analysis of the contribution of each input to the GAO dynamic is provided in **Table 5.2.** This **Table 5.2**. summarizes the results of the GAO accounting calculations from **Appendix 5.8** and presents the "*Column D*" (contribution to output change / % of total change) from the country-relevant Tables from **Appendix 5.8** The growth accounting statistics is acceptable (the sum of the percentage contribution to the total GAO change is around "1") for half of the countries from the model sample.

Table 5.2. Contribution of each input to GAO change as the % of total change

	Total GAO change	land (land_ar)	labor (lab_rur)	capital (cap)	trend (trend)	∑ GAO
Denmark	0.0095	-0.14	0.07	-2.41	3.48	**1.00**
Finland	-0.0004	1.42	11.95	36.12	-44.87	**4.62**
France	0.0059	0.05	-0.71	-1.64	3.37	**1.07**
Germany	0.0003	0.46	5.22	-61.34	36.98	**-18.68**
Ireland	0.0069	0.21	0.18	-0.78	1.62	**1.23**
Italy	0.0019	-0.35	-0.24	-0.72	3.67	**2.37**
Netherlands	-0.0020	-0.24	5.16	8.16	-12.61	**0.46**
Portugal	0.0072	-0.65	-0.54	0.47	2.42	**1.69**
Spain	0.0254	-0.08	0.01	0.47	0.41	**0.82**
Sweden	0.0035	-0.13	-0.24	-1.49	0.91	**-0.96**
Switzerland	-0.0071	-0.02	-0.40	2.05	-0.56	**1.07**
UK	-0.0054	0.26	-0.04	0.94	-1.30	**-0.14**

According to the growth accounting statistics for the countries with acceptable results (Denmark, France, Ireland, Spain, Sweden and Switzerland), the capital variable had the highest contribution to output change among the all inputs, and sometimes had an even higher contribution than the TFP variable (for Spain, Sweden and Switzerland). Thus, although the regression results do not look excellent, they generally provide significant evidence that changes in capital use have an essential impact on the agricultural production dynamics for advanced Western countries.

Therefore, it is possible to conclude that the results of the regressions made for the several set of countries (twelve advanced Western countries, seven CEE countries, and Belarusian region-specific regressions) **verify the hypothesis** that capital intensivity (increase in capital use) could be considered one of the most influential factors in the agricultural production increase, or in other words, **that the shift from land- and labor-intensive agriculture to capital-intensive agriculture could be considered the reason for the agricultural production increase.**

The successful results in terms of agricultural productivity (TFP) for Poland and Belarus could mainly be attributed to improvements in capital use (an increase in capital intensivity), like the agricultural production "success". The following three main types of capital improvements can be identified for both Poland and Belarus for the 1990-2004 period:

1. More rational and sparing use of previously (during Socialist times) overused inputs due to the introduction of hard budget constraints.

2. Capital use (tractors-per-land and fertilizers-per-land ratio) increased, and came close to the level of the advanced Western countries (in the case of Poland) or at least did not decrease substantially and remained close to the level of the advanced Western countries (in the case of Belarus)

3. Adoption of more efficient Western agricultural technologies and use of more productive Western agricultural machines, fertilizers and other inputs, which became possible due to a liberalization of trade relations.

Therefore, finalizing this section's exploration of the "similarities" between the transformational results for Poland and Belarus it is possible to make the following statements:

1. Advanced Western countries experienced a shift from land- and labor-intensive agriculture to capital-intensive agriculture. Poland and Belarus followed this path, and were the most successful in this, compared to the other CEE countries. Increase in capital use (and capital intensivity) was one of the most significant factors in the agricultural production and productivity increase for the advanced Western countries and CEEC. Thus, the hypothesis that *"Poland and Belarus achieved similarly successful results for the agricultural transformation in terms of production and productivity, because both countries followed the developmental path of advanced Western countries (a shift from land- and labor-intensive agriculture to capital-intensive agriculture)"* may be considered to be true.

2. Although both Poland and Belarus achieved the similarly successful results for agricultural production and productivity, despite the differences in the transformational policies, the Polish "advanced" transformation policy seems more sustainable from a long-term perspective than the Belarusian, because it induced a steady increase of capital use (capital intensivity), while the Belarusian "slow and incomplete" transformational policy only allowed capital use (the capital intensivity) not to drop drastically (as in other FSU countries) and remained close to the level of the advanced Western countries.

5.2. Explanation of the differences in the agricultural production and productivity dynamic.

This section is dedicated to an analysis of the "differences" in the transformational results within the framework of the previously formulated hypothesis that "The **observed differences** in the dynamics and magnitude of the production and productivity changes could be explained by the **differences in the "institutions"** in a broadly defined sense, [159] or if to be more specific to the transition economies discourse, the differences in the reforms' paths and initial conditions (*Swinnen, 2006).*

The section is organized in the following way: first, a brief summary of the observed "differences" in agricultural production and productivity is provided; then, the framework within which the analysis will be done is outlined; after that, the set of differences in agricultural production will be analyzed; next, the differences in the agricultural productivity (tractor and fertilizer productivity) will be explained; and finally, concluding remarks will finalize the Section.

The analysis of the Polish and Belarusian agricultural transformation results revealed the following differences in the agricultural production and productivity: **a difference in the speed and the magnitude of the production (output) dynamic, differences in sectoral performance (crop/livestock ratio and share of the individual sector in output production), regional disparities in output production and differences in machinery and fertilizer productivity.**

The analysis of the reasons and driving forces behind these "differences" provided in the subsequent paragraphs will be organized around the explanations of how the "differences in the reforms' paths and initial conditions" (*Swinnen, 2006* conception), *or in other* words "the difference in the (1) ownership of the goods and factors and in (2) the regulation of its' exchange" (*Federico, 2005* conception) caused the observed differences in agricultural production and productivity.

The analysis of the agricultural production dynamics shows that although both countries followed the same path in terms of the agricultural output trend (a sharp decline in agricultural production at the beginning of the transformation period followed by visible signs of production recovery) there are some clear **differences in the speed and magnitude** o**f the production dynamics.** These differences could mainly be attributed to the different reform

[159] "institutions" –i.e. "a set of formal or informal rules to determine the initial ownership of the goods and factors (property rights) and to regulate the exchanges (contracts, markets, and other forms of distribution)" (*Federico, 2005,p.117)*

path followed by each country. Poland, as the country with the "Bing Bang" reform policy approach, reached the "bottom line" of agricultural production earlier than Belarus, and consequently started to recover earlier. Also, the magnitude of the decline was lower in Poland. Belarus, which took a more gradual reform path, reached its "bottom line" five years later than Poland, and its magnitude decline was 13% higher than in Poland. These findings are in line with *Macours and Swinnen (2000a)* findings that fast "Big Bang" reformers reached the bottom line of the decline and recover faster than gradual reformers, which could suggest the idea that "fast reformation" provided better and more efficient "institutions" for the regulation of the exchange of goods and factors, which catalyzed the faster and more profound growth of agricultural production.

The **"sectoral analysis"** of Polish and Belarus agricultural production shows that Belarus experienced more profound changes than Poland during the transformation period in terms of (**i) crop/livestock ratio,** and **(i) individual vs. state agricultural production**.

During the studied period, Belarus transformed from **a livestock-oriented to crop-oriented production,** while the Polish livestock/crop ratio remained practically unchanged (approximately 50% for crop production and 50% for livestock production, according to *Lukas and Mládek (2006)*. That happened because during the Socialist period, Belarus was a livestock-oriented republic within the Soviet Union, where livestock production was mainly concentrated in large-scale, state agricultural farms. Animal feed delivery was organized on a centrally-planned basis and was primarily based on Russian- and Kazakhstan-delivered animal feed. After the collapse of the USSR, the connections established during the USSR period were quite disrupted, and livestock production in Belarus became unprofitable without stable and cheap animal feed delivery from FSU republics, and thus, declined.

In Poland, where the agriculture was organized largely around private, small-scale farms on a mainly self-sufficient basis, the dismantling of the centrally-planned system and the destruction of the inter-state economic relations established during the Socialist era (e.g., CMEA agreements) had no significantly destructive impact.[160] Thus, this "sectoral difference" should mainly be attributed to the different initial conditions, (i.e., length of time under the centrally-planned system and therefore the strength of the interdependence between the socialist countries), which affected the "institutional mechanism" of the "exchange of the factors and goods."

[160] It is necessary to keep in mind that in Poland, the climate and soil conditions are more favorable for agricultural production than in Belarus; hence, Poland is more self-sufficient in terms of agricultural production.

Moreover, **the share of the individual sector** in agricultural production increased substantially in Belarus but remained practically unchanged in Poland, which could also be attributed to the difference in initial conditions. In Poland, with the mainly pre-dominant private agriculture during Socialist times, there was no huge demand for an increase in privately-owned (or privately-run) agricultural land. However in Belarus, with the dominance of large-scale, state-run farms during the Socialist period, the government permission of the two-times increase of the allowed size of the household plot (from 0.5 to 1 ha) caused a significant increase in both privately-owned subsidiary households' land and the share of private agricultural production. Thus, this "sectoral difference" in the share of the "individual sector" should also be attributed to the difference in initial conditions, which caused differences in the "institutional mechanism" of ownership rights.

The analysis of the **regional structure of the agricultural production** shows that the "regional gap" (the difference between the more and less agriculturally developed regions) was more profound in Poland than in Belarus, and during the transformation period, this gap became even wider, which could be attributed mainly to the differences in the countries' reform path, which affected the "institutional" mechanism of the exchange (distribution) of "goods and factors". In Belarus, the main approach of the gradual agricultural (industrial, transportation and any other type of) policy still tended to be somewhat egalitarian in character, or more precisely, the main aim of every policy was to moderate regional disparities and "catch-up" the "lagger"" regions to "leader" regions at (sometimes) any price.[161] While in Poland, with its liberal market-oriented reform approach, the prevailing attitude (also not clearly pronounced) is that "widening regional disparities in Poland are an unavoidable consequence of the process of transformation and economic growth" (*Lobatch, 2003, p.9)*

The analysis of the **capital (machinery and fertilizers) productivity**[162] shows a profound difference between Poland and Belarus, not only in the speed and magnitude of the changes, but also in the directionality of the changes (see **Appendix 5.10 and Appendix 5.11**). In Belarus, machinery productivity at first dropped and then began to increase, while in Poland it had a clear downward trend during the studied period.

The fertilizers productivity, initially, experienced a huge increase and then sharply decreased, reaching its nadir for both Poland and Belarus in 1997. After that, fertilizers

[161] This is not explicitly pronounced in the Belarusian official documents, but could be derived from the formulated in these documents main goals of the development and the methods of its achievement

[162] measured in items (tractors in use and tons of fertilizers consumptions), but not in horsepower for tractors and pure nutrient values for fertilizers

productivity steadily decreased in Poland and steadily increased in Belarus. The magnitude of the fertilizer dynamic change was also remarkable. The average "index of change" for fertilizer productivity was about 99.7% in Poland and 175.9% in Belarus.

This difference in tractor and fertilizer productivity between Poland and Belarus could be explained by the differences in tractor and fertilizer use. Although the tractor and fertilizer dynamic had its "ups and downs" in both Poland and Belarus, the resulting trends for Poland show a stable increase of tractor and fertilizer use, and a steady decrease for Belarus (see **Appendix 5.12**). Such a difference resulted from the differences in the "institutional mechanism" of "exchange of the factors and goods" – the liberal free-market environment in Poland permits the accumulation of more financial resources and has a more efficient mechanism of tractor and fertilizer supply than the under-reformed economy in Belarus.

Finalizing this section's exploration of the "differences" in transformational results for Poland and Belarus in terms of agricultural output and productivity, it is possible to conclude that these differences were caused by the different reform paths and different initial conditions (or in other words, the "differences in institutions"). Hence, the hypothesis formulated at the beginning of this section may be considered verified.

CHAPTER 6. General discussion and conclusion

This chapter provides the final conclusions for all the thesis findings. It includes a synthesis of the research and suggestions for further work.

6.1. Synthesis of the research

This section provides the synthesis of the research results obtained in **Chapters 2-5**. The analysis of the agricultural performance of the V4 countries and three FSU countries (Belarus, Russia and Ukraine) shows that besides the noticeable differences and profound gaps in the agricultural performance of the seven above-noted countries, **Poland and Belarus could be considered to be the "best-performers"** in their regions in terms of agricultural production and productivity.

Despite the different transformational policies ("Big-Bang" reforms for Poland and gradual reform path for Belarus), the **results of the transformations, measured in terms of agricultural production and productivity could be** generally **considered "successful" for both Poland and Belarus**, although some differences in the dynamics and magnitude of the production and productivity changes have been observed.

These **similarly successful** results might be explained by the fact that both countries followed the developmental path of advanced Western countries – a shift from land- and labor- intensive agriculture to capital-intensive agriculture, while **the differences** in the speed and magnitude of the changes may be attributed to the differences in institutions.

6.2. Suggestions for the further research

In this section, the prospects for further research are briefly discussed.

This PhD study has a several limitations regarding its **geographical coverage, time-frame and research methodology.** Hence, much room is left for possible further extension of the given study scope within the "success or failure of reforms" assessment framework.

While the geographical scope of the study is limited only to the two "transitional" countries (Belarus and Poland), it would be possible to extend the **countries' coverage** to other "transitional countries" from Central Europe (Czech Republic, Hungary, Slovakia) and European FSU countres (Russia, Ukraine and Moldova). This broader framework would lead to more precise generalizations, and would enrich the historical puzzle of regional transformations. It would also be interesting to extend the **countries ' coverage** to countries from the Baltic region (Estonia, Latvia, Lithuania), Central Asia region (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan), Transcaucasia region (Armenia, Azerbaijan, Georgia), Balkan region (Albania, Bulgaria, Romania, Slovenia) and East Asia region (China, Vietnam, Laos).[163] This kind of extension of the countries' coverage would expand the understanding of the transformational commonalities and differences (or convergence and divergence) between the Eastern Europe vs. former USSR (or Europe vs. Asia) and therefore would enrich the regional perspective.

Methodologically, this PhD work is limited to **two measures of economic performance** (production and productivity) and **six variables** (Gross Agricultural Output, land, labor, machinery, fertilizers and livestock). Thus, the use of other measures of economic performance (e.g., export-import trade improvements, consumption of agricultural products, agricultural farms' profitability, market services' improvements) and additional variables relevant to the above measures might contribute to solving the puzzle of the "success or failure of the transformation reforms."

[163] This regional classification is from *Rozelle and Swinnen (2004)*

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APPENDIX 2.1. Agricultural reform index 1997-2005[1]

	Price and market liberalisation								
	1997	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***
Czech Rep.	9	9	9	8	9	9	9		
Hungary	9	9	8	8	9	9	9		
Slovak Rep.	7	7	7	8	8	9	9		
Poland	9	8	7	8	8	8	9		
Russia	7	6	6	6	6	6	6	6	6
Ukraine	7	6	6	6	7	6	6	5	6
Belarus	3	2	2	2	2	2	2	3	3
	Land reform								
	1997	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***
Czech Rep.	8	8	8	9	9	9	9		
Hungary	9	9	9	9	9	9	10		
Slovak Rep.	7	8	8	8	8	8	9		
Poland	8	8	8	9	8	9	9		
Russia	5	5	5	5	5	5	5	6	6
Ukraine	5	5	6	6	6	6	6	5	5
Belarus	1	1	2	2	2	2	2	2	2
	Agro-processing								
	1997	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***
Czech Rep.	8	9	9	10	10	10	10		
Hungary	9	10	10	10	10	10	10		
Slovak Rep.	8	8	8	9	9	10	10		
Poland	7	8	9	9	9	10	10		
Russia	7	7	7	7	8	8	8	8	9
Ukraine	7	6	6	7	7	7	7	8	8
Belarus	2	2	2	2	2	2	2	3	4

to be continued on the next page…

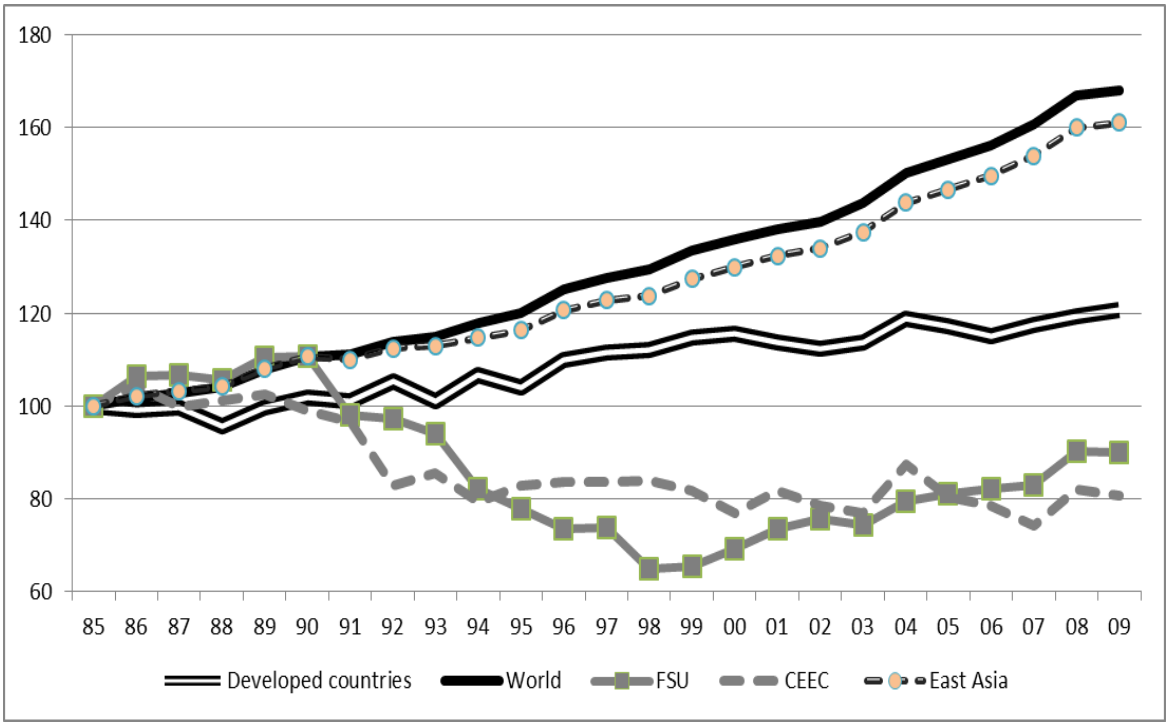
[1] Data for 2004-2005 are from *Csaki et. al. (2006)* Data for 1998-2003 are from *Csaki and Zuschlag (2004*). Data for 1997 are from *Csaki and Nash (1998)*

Continuation of **APPENDIX 2.1.**

	Rural finance								
	1997	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***
Czech Rep.	8	9	9	9	9	9	9		
Hungary	8	9	9	9	9	9	9		
Slovak Rep.	8	8	8	8	8	9	9		
Poland	6	7	7	7	7	7	8		
Russia	6	5	5	5	5	5	5	7	7
Ukraine	5	5	5	6	6	6	6	8	7
Belarus	2	2	2	2	2	2	2	2	2
	Institutional Change								
	1997	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***
Czech Rep.	8	8	8	9	9	10	10		
Hungary	8	8	8	9	9	9	9		
Slovak Rep.	7	7	7	7	8	8	9		
Poland	8	8	8	8	8	8	8		
Russia	5	5	5	5	5	5	5	4	5
Ukraine	3	4	4	4	4	4	4	5	5
Belarus	1	1	1	1	1	1	2	3	4

APPENDIX 2.2. Agricultural production indexes [1]

Figure 1. Agricultural production indexes for the developed, CEE, FSU, and East Asian countries in 1985-2009



Developed countries	*Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain ,Sweden, Switzerland, Taiwan Province of China United Kingdom, United States*
FSU	*Estonia, Latvia, Lithuania, Armenia, Azerbaijan, Georgia, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Belarus, Kazakhstan, Moldova, Russian Federation, Ukraine.*
CEEC	*Albania, Bulgaria, Czechslovakia, Hungary, Poland, Romania, Yugoslavia.*
East Asia	*China, Vietnam, Laos, Myanmar*

[1] Data are from *Fuglie (2012)*

APPENDIX 2.3. GAO Dynamic for CEEC[1]

Figure 1. GAO dynamic for V4 countries

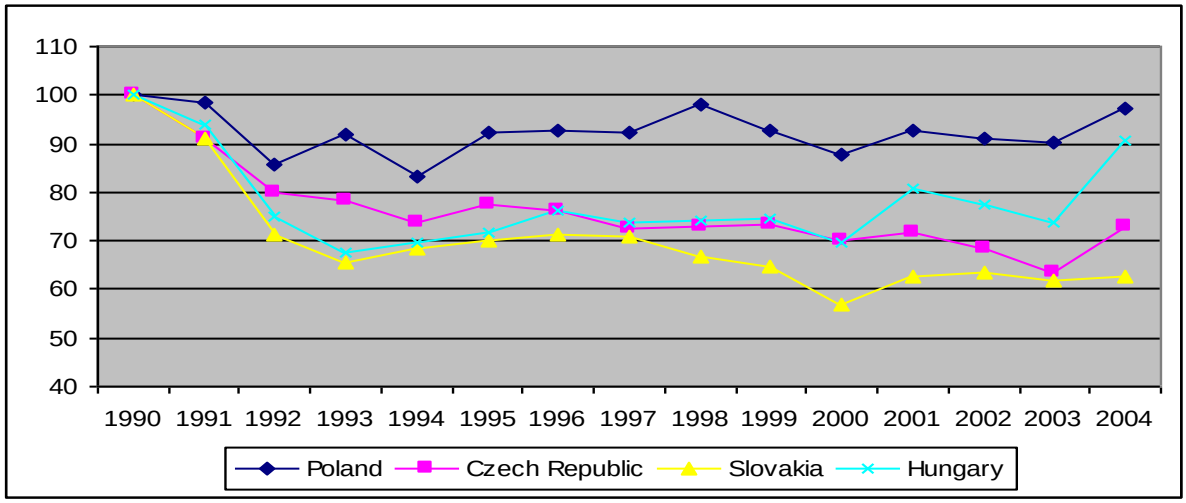
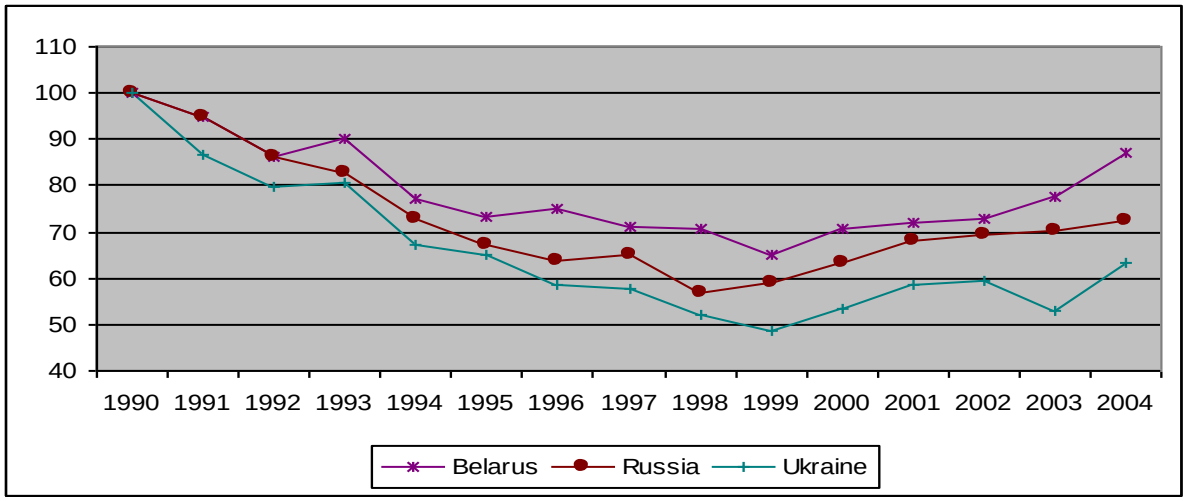


Figure 2. GAO dynamic for CIS countries



[1] The GAO data for Hungary, Poland, Belarus, Russia and Ukraine are from *Fuglie (2012)*. The GAO data for Czech Republic and Slovakia for 1993-2010 are from FAO. The GAO data for Czech Republic and Slovakia for 1990-1993 are from National Statistical Datasets. Available at: http://faostat.fao.org and http://www.ers.usda.gov/data-products/international-agricultural-productivity/documentation-and-methods.aspx (Accesses: December 20, 2013)). For GDP (GDP in constant LCU) data are from WB database. Available at: http://databank.worldbank.org/data/views/reports/tableview.aspx (Accessed: May 2, 2014).

APPENDIX 2.3. 1. Regression results for GAO vs. GDP dependence model.

Dependent Variable: GAO?
Method: Pooled EGLS (Cross-section SUR)
Sample: 1990 2004
Included observations: 15
Cross-sections included: 7
Total pool (balanced) observations: 105
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
_BY--GDP_BY	0.978759	0.009939	98.47417	0.0000
_CZ--GDP_CZ	0.927251	0.010600	87.47831	0.0000
_HU--GDP_HU	0.956083	0.007884	121.2679	0.0000
_PL--GDP_PL	0.918408	0.011254	81.60743	0.0000
_RU--GDP_RU	0.993894	0.006810	145.9535	0.0000
_SK--GDP_SK	0.900914	0.015460	58.27511	0.0000
_UKR--GDP_UKR	1.035406	0.008926	115.9982	0.0000

Weighted Statistics

R-squared	0.926143	Mean dependent var	-4.339778
Adjusted R-squared	0.921621	S.D. dependent var	40.95229
S.E. of regression	1.031686	Sum squared resid	104.3089
Durbin-Watson stat	1.604429		

Unweighted Statistics

R-squared	-0.061968	Mean dependent var	4.285254
Sum squared resid	3.707451	Durbin-Watson stat	0.209666

APPENDIX 2.4. Terms of trade deterioration in CEE countries in 1990-2004 [1]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Poland	100	75	86	84	92	93	90	86	78	72	74	72	65	64	66
Czech Rep.	100	82	82	70	68	70	70	64	66	63	62	64	59	58	59
Hungary	100	76	79	79	80	82	82	77	73	68	72	69	66	66	58
Slovak Rep.	100	62	61	57	59	57	55	52	50	47	46	46	46	42	41
Belarus		100	36	18	24	29	28	29	33	36	34	30	34	30	30
Russia	100	84	49	37	26	27	24	22	23	28	26				

to be continued on the next page…

[1] Data for V4 are from *Lukas and Mládek (2006).* Data for Russia are from *Nash et al. (2002).* Data for Belarus are from *Ceny v Belarusi (2006)*

continuation of **APPENDIX 2.4. Price indices and terms of trade deterioration in CEE countries**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Poland																
Input prices	100	173	240	326	410	512	617	705	772	829	923	983	1,002	1,023	1,111	1,137
Output prices	100	129	207	274	376	478	554	605	606	595	683	709	656	653	728	738
Terms of trade	100	75	86	84	92	93	90	86	78	72	74	72	65	64	66	65
Czech Republic																
Input prices	100	119	128	163	176	184	200	224	220	206	227	240	235	231	247	
Output prices	100	98	105	114	119	128	139	144	146	129	141	154	139	135	146	
Terms of trade	100	82	82	70	68	70	70	64	66	63	62	64	59	58	59	
Hungary																
Input prices	100	133	143	172	203	251	337	393	424	464	539	602	611	648	706	702
Output prices	100	100	113	135	163	206	276	301	310	318	389	412	406	430	407	410
Terms of trade	100	76	79	79	80	82	82	77	73	68	72	69	66	66	58	58
Slovak Republic																
Input prices	100	169	181	222	239	257	282	311	324	337	368	402	398	417	430	433
Output prices	100	104	111	127	141	146	154	162	162	159	170	184	182	174	177	173
Terms of trade	100	62	61	57	59	57	55	52	50	47	46	46	46	42	41	40

to be continued on the next page…

continuation of **APPENDIX 2.4. Price indices and terms of trade deterioration in CEE countries**

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belarus									
Input prices		100	2,405	59,091	1,030,544	5,554,634	8,887,415	16,441,718	25,484,663
Output prices		100	860	10,569	251,235	1,630,513	2,510,990	4,846,210	8,480,868
Terms of trade		***100***	***36***	***18***	***24***	***29***	***28***	***29***	***33***
Russia									
Input prices	100	190	3,078	32,935	138,325	442,641	725,931	856,599	933,693
Output prices	100	160	1,504	12,182	36,547	120,606	172,466	189,713	210,581
Terms of trade	***100***	***84***	***49***	***37***	***26***	***27***	***24***	***22***	***23***

	1999	2000	2001	2002	2003	2004
Belarus						
Input prices	108,819,510	321,017,555	581,041,775	755,354,308	989,514,143	1,266,578,103
Output prices	39,690,461	110,736,386	173,856,127	259,045,629	300,492,929	381,626,020
Terms of trade	***36***	***34***	***30***	***34***	***30***	***30***
Russia						
Input prices	1,503,245	2,224,803				
Output prices	421,163	572,781				
Terms of trade	***28***	***26***				

APPENDIX 2.5. Agricultural subsidization in CEE countries (PSE for CEE and FSU countries) [1]

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Czech Republic																		
Share of standard PSE commodities	71	68	66	66	67	63	65	65	66	67	70	72	72	70	73	77	73	70
Percentage PSE	64	55	50	52	50	47	20	25	16	11	11	6	26	23	17	23	25	27
Hungary																		
Share of standard PSE commodities	71.8	74.1	72.9	73.9	73.2	70.7	74.9	73.3	73.6	71.6	67.2	73,6	71.1	71.4	72.5	78.1	74.8	75.8
Percentage PSE	42	40	33	27	23	11	18	20	22	13	11	11	25	24	22	22	33	27
Poland																		
Share of standard PSE commodities	60	60	99	99	109	68	63	59	60	55	62	64	65	62	55	56	57	59
Percentage PSE	32.1	19	23.5	8.37	-17.7	6.99	9.07	16.7	22.1	16.4	19.1	18.09	27.7	24.12	15.1	14.63	14.3	8.72
Russia																		
Share of standard PSE commodities	76	73	74	71	64	55	-154	-61	-48	-3	9	22	12	-6	0	5	12	18
Percentage PSE	84	81	80	77	71	58	-110	-29	-4	13	18	26	19	-1	5	9	15	21
Slovakia																		
Share of standard PSE commodities	67	66	66	65	71	66	76	78	75	73	72	76	76	75	74	78	77	72
Percentage PSE	58	51	41	47	52	32	22	30	25	12	0	14	32	26	25	16	22	21
Ukraine																		
Share of standard PSE commodities	77.6	75.1	72	69.7	60.8	63.4	-67	1	-10	-47	-10	11	6	-9	-4	4	-8	-11
Percentage PSE	81	79	76	73	64	65	-53	8	6	-37	-5	13	8	0	0	8	-2	-5

to be continued on the next page…

[1] PSE data are from OECD databse. Available at: www.oecd.org (Accessed: July 27, 2011)

continuation of **APPENDIX 2.5. Agricultural subsidization in CEE countries (NRA calculations)** [1]

	nra_cz	nra_hu	nra_pl	nra_ru	nra_sk	nra_ukr
1992	20	16	-2	-45	30	-46
1993	32	28	14	-20	35	1
1994	22	24	18	9	30	-2
1995	7	7	9	24	17	-38
1996	8	7	18	29	7	-13
1997	8	7	18	42	19	13
1998	36	26	34	26	43	9
1999	25	33	27	1	36	-12
2000	16	26	13	3	35	-19
2001	25	23	10	17	20	-3
2002	31	45	8	19	30	-13
2003	35	43	0	14	35	-10
2004	23	19	21	25	17	-13
avg	22.2	23.4	14.5	11.07	27.2	-11.23

[1] Data are from World Bank database. *Available at :* http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPROGRAMS/EXTTRADERESEARCH/0,,contentMDK:21812190~pagePK:64168182~piPK:64168060~theSitePK:544849,00.html *(Accessed: July 25, 2011)*

APPENDIX 2.6. Partial productivity dynamic 1990-2010 [1]

Table 1. Land productivity (growth index 1990=100% , except for Czech Republic and Slovakia)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVG 1990-2004	2005	2006	2007	2008	2009	2010
Hungary	**100**	100	83	75	78	76	81	82	82	79	80	91	82	76	98	84	90	85	73	92	83	73
Poland	**100**	93	81	92	77	83	88	83	90	84	84	88	89	90	95	88	93	90	94	94	97	92
Czech Republic				**100**	87	89	90	87	88	88	84	87	83	75	90	87	83	76	79	84	80	75
Slovakia				**100**	95	91	95	95	90	85	74	85	88	82	105	90	102	95	90	103	92	83
Belarus	**100**	95	90	95	78	76	78	73	72	67	71	76	79	81	91	81	91	96	100	109	109	108
Russia	**100**	90	88	85	75	71	69	70	59	60	64	69	71	70	73	74	73	75	76	81	80	69
Ukraine	**100**	86	80	80	68	67	60	61	54	51	56	60	62	57	66	67	66	66	62	76	72	71
AVG V4	**100**	97	82	92	84	85	88	87	87	84	81	88	85	81	97	87	92	87	84	93	88	81
AVG FSU	**100**	90	86	87	74	71	69	68	62	59	64	68	70	69	77	74	77	79	79	89	87	83
AVG all	**100**	93	84	90	80	79	80	78	76	73	73	79	79	76	88	82	86	83	82	91	88	82

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[1] *Data for Czech Rep. and Slovakia are from* FAO database. FAO/Production/Production indices/Agriculture (PIN)+ (Total)/Gross Production Index Number (2004-2006 = 100). Available at: http://faostat.fao.org/site/612/DesktopDefault.aspx?PageID=612#ancor (Accessed: January 10, 2014). Data for all other countries are from Fuglie (2012)

continuation of **APPENDIX 2.6.**

Table 2. Labour productivity – GAO per agric. workers (growth index 1990=100%, except for Czech Republic and Slovakia)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVG 1990-2004	2005	2006	2007	2008	2009	2010
Hungary	100	101	80	72	75	74	80	86	90	84	86	104	93	95	127	90	123	120	113	155	139	125
Poland	100	97	88	103	90	102	110	110	132	141	141	141	152	149	158	121	149	147	154	152	160	167
Czech R.				100	89	95	99	98	102	106	105	112	109	102	126	104	120	113	120	130	127	122
Slovakia				100	97	95	101	104	102	99	88	97	102	97	110	99	110	105	102	120	109	102
Belarus	100	99	91	98	88	90	103	98	103	101	112	121	134	149	178	111	180	192	200	214	214	210
Russia	100	90	84	80	69	68	69	76	63	65	70	82	87	90	99	80	98	101	111	122	125	113
Ukraine	100	89	80	81	71	62	59	59	52	49	54	69	71	66	79	69	78	86	84	108	110	114
AVG V4	100	99	84	94	88	91	98	100	107	107	105	113	114	111	130	103	125	121	122	139	134	129
AVG FSU	100	93	85	87	76	74	77	78	73	72	79	91	98	101	118	87	118	126	131	148	150	146
AVG all	100	95	85	91	83	84	89	90	92	92	94	104	107	107	125	96	122	123	126	143	141	136

Table 3. Labor productivity - GAO per Annual Work Unit (AWU)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVG 1990-2004	2005	2006	2007	2008	2009	2010
Czech R.									100	109	112	117	112	109	136	113	131	125	125	151	153	151
Slovakia						100	106	111	117	124	114	133	136	141	175	126	183	184	174	202	188	264
Hungary						100	109	116	122	114	117	141	126	129	172	125	167	163	153	206	182	159
Poland							100	100	121	129	129	128	139	136	144	125	135	134	140	141	151	151

to be continued on the next page…

continuation of **APPENDIX 2.6.**

Table 4. Machinery productivity (growth index 1990=100%, except for Czech Republic and Slovakia)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVG 1990-2004	2005	2006	2007	2008	2009	2010
Hungary	100	57	45	40	42	41	44	44	44	42	33	38	34	31	39	45	35	33	28	36	32	28
Poland	100	93	81	93	68	73	77	72	78	73	73	73	68	66	71	77	63	60	61	61	63	60
Czech R.				100	86	87	89	87	89	93	73	77	73	68	84	84	80	75	79			
Slovakia				100	90	101	109	114	110	109	96	105	113	102	116	106	115	102	104	118		
Belarus	100	95	77	88	74	78	91	88	99	100	112	123	134	145	174	105	178	190	204	226	228	227
Russia	100	92	94	93	89	90	95	105	91	100	113	129	143	154	176	111	196	219	240	286	284	245
Ukraine	100	79	72	72	63	65	62	68	65	66	78	65	69	65	80	71	83	84	80	99	94	92
AVG V4	100	75	63	83	71	76	80	79	80	80	69	73	72	67	77	78	73	68	68	72	48	44
AVG FSU	100	89	81	84	75	78	83	87	85	89	101	106	115	121	143	96	152	165	175	204	202	188
AVG all	100	83	74	84	73	76	81	83	82	83	83	87	91	90	106	86	107	109	114	138	140	130

to be continued on the next page…

continuation of **APPENDIX 2.6.**

Table 5. Fertilizers productivity (growth index 1990=100% , except for Czech Republic and Slovakia

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVG 1990 -2004	2005	2006	2007	2008	2009	2010
Hungary	100	161	179	124	122	105	93	103	109	98	95	107	90	84	100	111	101	89	79	138	115	108
Poland	100	130	91	94	71	73	72	65	76	73	72	72	72	63	69	80	58	55	53	59	61	58
Czech R.				100	79	79	80	85	89	100	78	67	68			83						
Slovakia				100	93	82	77	85	72	92	60	65	62			79						
Belarus	100	116	175	228	482	415	296	255	254	335	279	314	357	340	247	280	211	195	183	162	166	165
Russia	100	103	203	287	692	537	507	564	540	547	534	505	576	590	541	455	538	508	445	410	387	336
Ukraine	100	107	160	284	316	366	511	469	461	539	560	565	524	540	573	405	533	381	328	324	327	333
AVG V4	100	146	135	104	91	85	80	84	87	91	76	78	73	74	84	88	80	72	66	99	88	83
AVG FSU	100	109	179	266	497	439	438	429	418	474	458	462	486	490	454	380	427	361	319	299	293	278
AVG all	100	123	161	174	265	237	234	232	229	255	240	242	250	323	306	213	288	246	218	219	211	200

APPENDIX 2.7. CEE countries pooled regression estimation Model 1.

Dependent Variable: GAO?
Method: Pooled EGLS (Cross-section SUR)
Sample (adjusted): 1994 2004
Included observations: 11 after adjustments
Cross-sections included: 7
Total pool (balanced) observations: 77
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.638324	1.045074	-1.567663	0.1217
LAND?	0.273554	0.163604	1.672049	0.0992
LAB_AG_EC?	0.385354	0.152852	2.521088	0.0141
CAP_NET?(-1)	0.643044	0.117840	5.456931	0.0000
_BY--TREND_BY	0.044123	0.007477	5.900802	0.0000
_CZ--TREND_CZ	0.021465	0.004385	4.894946	0.0000
_HU--TREND_HU	0.017893	0.006882	2.599941	0.0115
_PL--TREND_PL	0.013196	0.004665	2.828925	0.0062
_RU--TREND_RU	0.024544	0.006032	4.068773	0.0001
_SK--TREND_SK	0.025796	0.004980	5.180246	0.0000
_UKR--TREND_UKR	0.022870	0.006567	3.482771	0.0009

Weighted Statistics

R-squared	0.716055	Mean dependent var	103.4687
Adjusted R-squared	0.673033	S.D. dependent var	91.78674
S.E. of regression	1.072217	Sum squared resid	75.87683
F-statistic	16.64397	Durbin-Watson stat	1.773572
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.466292	Mean dependent var	4.383828
Sum squared resid	0.364128	Durbin-Watson stat	1.269122

Wald Test:
Pool: POOL01

Test Statistic	Value	df	Probability
t-statistic	1.352417	66	0.1809
F-statistic	1.829031	(1, 66)	0.1809
Chi-square	1.829031	1	0.1762

Null Hypothesis: C(2)+C(3)+C(4)=1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2) + C(3) + C(4)	0.301953	0.223269

Restrictions are linear in coefficients.

to be continued on the next page…

continuation of **APPENDIX 2.7.**

Model 2

Dependent Variable: GAO?
Method: Pooled EGLS (Cross-section SUR)
Sample (adjusted): 1994 2003
Included observations: 10 after adjustments
Cross-sections included: 7
Total pool (balanced) observations: 70
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.415891	1.527950	-1.581132	0.1194
LAND?	0.338196	0.147000	2.300653	0.0251
LAB_AG?	0.466773	0.288567	1.617557	0.1113
TRAC?(-1)	0.214955	0.046353	4.637383	0.0000
FERT?(-1)	0.118083	0.020189	5.848732	0.0000
LIVEST?(-1)	0.347287	0.038173	9.097812	0.0000
_BY--TREND_BY	0.040718	0.011138	3.655937	0.0006
_CZ--TREND_CZ	0.019266	0.007651	2.518004	0.0146
_HU--TREND_HU	0.016469	0.011339	1.452479	0.1519
_PL--TREND_PL	0.013132	0.008176	1.606157	0.1138
_RU--TREND_RU	0.041068	0.009060	4.532700	0.0000
_SK--TREND_SK	0.020215	0.006886	2.935631	0.0048
_UKR--TREND_UKR	0.039769	0.010792	3.684989	0.0005

Weighted Statistics

R-squared	0.905781	Mean dependent var	96.16730
Adjusted R-squared	0.885946	S.D. dependent var	87.11571
S.E. of regression	1.068193	Sum squared resid	65.03901
F-statistic	45.66471	Durbin-Watson stat	1.977659
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.681325	Mean dependent var	4.377228
Sum squared resid	0.197760	Durbin-Watson stat	1.411706

Wald Test:

Test Statistic	Value	df	Probability
t-statistic	1.484144	57	0.1433
F-statistic	2.202684	(1, 57)	0.1433
Chi-square	2.202684	1	0.1378

Null Hypothesis: C(2)+C(3)+C(4)+C(5)+C(6)=1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2) + C(3) + C(4) + C(5) + C(6)	0.485294	0.326986

Restrictions are linear in coefficients.

to be continued on the next page…

continuation of **APPENDIX 2.7.**

Model 3

Dependent Variable: GAO?
Method: Pooled EGLS (Cross-section SUR)
Sample (adjusted): 1994 2003
Included observations: 10 after adjustments
Cross-sections included: 7
Total pool (balanced) observations: 70
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.936959	2.483030	-1.585547	0.1184
LAND?	0.527094	0.189024	2.788502	0.0072
LAB_POP?	0.607175	0.444627	1.365583	0.1774
TRAC?	0.182418	0.063751	2.861426	0.0059
FERT?(-1)	0.102146	0.022569	4.525947	0.0000
LIVEST?(-1)	0.400533	0.045408	8.820678	0.0000
_BY--TREND_BY	0.033986	0.008967	3.789969	0.0004
_CZ--TREND_CZ	0.008516	0.003857	2.207736	0.0313
_HU--TREND_HU	0.004316	0.005649	0.764078	0.4480
_PL--TREND_PL	0.003769	0.003928	0.959595	0.3413
_RU--TREND_RU	0.032596	0.008084	4.032212	0.0002
_SK--TREND_SK	0.012046	0.004652	2.589217	0.0122
_UKR--TREND_UKR	0.029031	0.007874	3.687096	0.0005

Weighted Statistics

R-squared	0.868284	Mean dependent var	72.02343
Adjusted R-squared	0.840555	S.D. dependent var	60.29208
S.E. of regression	1.067951	Sum squared resid	65.00958
F-statistic	31.31254	Durbin-Watson stat	2.098712
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.678466	Mean dependent var	4.377228
Sum squared resid	0.199534	Durbin-Watson stat	1.656515

Wald Test:

Test Statistic	Value	df	Probability
t-statistic	1.526927	57	0.1323
F-statistic	2.331507	(1, 57)	0.1323
Chi-square	2.331507	1	0.1268

Null Hypothesis: C(2)+C(3)+C(4)+C(5)+C(6)=1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2) + C(3) + C(4) + C(5) + C(6)	0.819367	0.536611

Restrictions are linear in coefficients.

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continuation of **APPENDIX 2.7.**

Model 4

Dependent Variable: GAO?
Method: Pooled EGLS (Cross-section SUR)
Sample (adjusted): 1994 2003
Included observations: 10 after adjustments
Cross-sections included: 7
Total pool (balanced) observations: 70
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.055100	2.314941	-1.319732	0.1922
LAND?	0.363098	0.144633	2.510480	0.0149
LAB_POP?	0.564304	0.410543	1.374530	0.1747
TRAC?(-1)	0.202192	0.044888	4.504392	0.0000
FERT?(-1)	0.111073	0.020102	5.525387	0.0000
LIVEST?(-1)	0.390089	0.036759	10.61215	0.0000
_BY--TREND_BY	0.031413	0.007350	4.273669	0.0001
_CZ--TREND_CZ	0.006684	0.003102	2.155157	0.0354
_HU--TREND_HU	***0.000967***	***0.005104***	***0.189511***	0.8504
_PL--TREND_PL	***0.001444***	***0.003211***	***0.449662***	0.6547
_RU--TREND_RU	0.030457	0.005699	5.344228	0.0000
_SK--TREND_SK	0.009686	0.003281	2.952367	0.0046
_UKR--TREND_UKR	0.028149	0.006321	4.453101	0.0000

Weighted Statistics

R-squared	0.902105	Mean dependent var	97.87573
Adjusted R-squared	0.881495	S.D. dependent var	102.2720
S.E. of regression	1.067386	Sum squared resid	64.94079
F-statistic	43.77123	Durbin-Watson stat	1.973938
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.681319	Mean dependent var	4.377228
Sum squared resid	0.197764	Durbin-Watson stat	1.426884

Wald Test:

Test Statistic	Value	df	Probability
t-statistic	1.259329	57	0.2130
F-statistic	1.585909	(1, 57)	0.2130
Chi-square	1.585909	1	0.2079

Null Hypothesis: C(2)+C(3)+C(4)+C(5)+C(6)=1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2) + C(3) + C(4) + C(5) + C(6)	0.630755	0.500866

Restrictions are linear in coefficients.

APPENDIX 2.8. Accounts for GAO change

Accounting statistics for Model 1

	Total GAO change	Contribution to total change of the				∑ GAO
		land	labor	capital	TFP	
					(trend)	
Belarus	-0.01	0.19	1.35	**2.48**	-3.36	**0.66**
Czech Rep.	-0.01	0.08	**1.07**	0.28	-1.96	**-0.54**
Hungary	-0.01	0.171	**1.737**	0.163	-1.97	0.10
Poland	-0.01	0.226	**0.955**	0.071	-1.23	0.02
Russia	-0.02	0.08	0.54	**1.52**	-1.31	**0.84**
Slovak Rep.	-0.02	0.14	0.33	**0.85**	-1.12	0.19
Ukraine	-0.02	0.03	0.69	**1.09**	-0.92	**0.89**
accounting statistics is acceptable for 4 countries (∑ GAO is around 1), in 3 out of it the capital has the most significant contribution						

Accounting statistics for Model 2

	Total GAO change	Contribution to total change of the						∑ GAO	∑ capital
		land	labor	capital			TFP		
		LAND?	*LAB_AG_EC*	TRAC?(-1)	FERT?(-1)	LIVEST?(-1)	*(trend)*		
Belarus	-0.01	0.24	1.57	**1.27**	**0.07**	**1.10**	-3.10	**1.15**	**2.44**
Czech Rep	-0.01	0.10	**1.36**	-0.24	-0.11	1.64	-1.76	**0.98**	1.29
Hungary	-0.01	0.21	**1.87**	-0.90	-0.33	1.40	-1.81	0.44	0.17
Poland	-0.01	0.28	**1.07**	-0.23	-0.21	0.07	-1.22	-0.25	-0.38
Russia	-0.02	0.10	0.74	**0.82**	**0.63**	**1.28**	-2.20	**1.38**	**2.74**
Slovak Rep.	-0.02	0.17	0.54	**0.34**	**-0.10**	**0.34**	-0.88	0.41	**0.58**
Ukraine	-0.02	0.04	0.75	**0.28**	**0.70**	**1.01**	-1.60	**1.16**	**1.98**
accounting statistics is acceptable for 4 countries (∑ GAO is around 1) , in 3 out of it the capital has the most significant contribution									

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continuation of **APPENDIX 2.8.**

Accounting statistics for Model 3

	Total GAO change	Contribution to total change of the						∑ GAO	∑ capital
		land	labor	capital			TFP		
		LAND	LAB_POP	TRAC	FERT?(-1)	LIVEST?(-1)	*trend*		
Belarus	-0.01	0.37	0.74	**1.07**	**0.06**	**1.27**	-2.59	**0.92**	**2.40**
Czech Rep.	-0.01	0.15	-0.19	**-0.17**	**-0.10**	**1.89**	-0.78	**0.80**	**1.62**
Hungary	-0.01	0.33	0.09	**-0.74**	**-0.29**	**1.61**	-0.47	**0.53**	**0.59**
Poland	-0.01	**0.44**	0.04	-0.19	-0.18	0.08	-0.35	-0.17	-0.30
Russia	-0.02	0.16	0.05	**0.71**	**0.55**	**1.48**	-1.74	**1.20**	**2.74**
Slovak Rep.	-0.02	0.26	-0.05	**0.27**	**-0.09**	**0.39**	-0.53	0.26	**0.57**
Ukraine	-0.02	0.06	0.22	**0.21**	**0.60**	**1.16**	-1.17	**1.09**	**1.98**
accounting statistics is acceptable for 5 countries (∑ GAO is around 1) , in 5 out of it, the capital has the most significant contribution									

Accounting statistics for Model 4

	Total GAO change	Contribution to total change of the						∑GAO	∑capital
		land	labor	capital			TFP		
		LAND?	LAB_POP?	TRAC?	FERT?(-1)	LIVEST?(-1)	*trend*		
Belarus	-0.01	0.26	0.68	**1.19**	**0.07**	**1.24**	-2.39	**1.05**	**2.50**
Czech Rep.	-0.01	0.10	-0.18	**-0.23**	**-0.11**	**1.84**	-0.61	**0.82**	**1.51**
Hungary	-0.01	0.23	0.08	**-0.85**	**-0.31**	**1.57**	-0.11	**0.62**	**0.41**
Poland	-0.01	0.30	0.04	**-0.22**	**-0.20**	**0.07**	-0.13	-0.14	**-0.35**
Russia	-0.02	0.11	0.04	**0.77**	**0.59**	**1.44**	-1.63	**1.33**	**2.81**
Slovak Rep.	-0.02	0.18	-0.05	**0.32**	**-0.09**	**0.38**	-0.42	0.32	**0.61**
Ukraine	-0.02	0.04	0.20	**0.26**	**0.66**	**1.13**	-1.14	**1.16**	**2.05**
accounting statistics is acceptable for 5 countries (∑GAO is around 1) , in 5 out of it the capital has the most significant contribution									

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Accounting statistics for Model 1

Model 1	estimated coefficient		contribution to output change	
		change in variable	absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND?	0,273554	-0,009285	0,00	0,19
LAB_AG_EC?	0,385354	-0,04605	-0,02	1,35
CAP_NET?(-1)	0,643044	-0,050566	-0,03	**2,48**
trend_by	0,044123		0,044123	-3,36
total GAO change		**-0,013133**	**-0,013133**	**0,66**

Model 1	estimated coefficient		contribution to output change	
		change in variable	absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND?	0,273554	-0,003093	0,00	0,08
LAB_AG_EC?	0,385354	-0,030344	-0,01	**1,07**
CAP_NET?(-1)	0,643044	-0,004771	0,00	0,28
trend_cz	0,021465		0,021465	-1,96
total GAO change		**-0,010936**	**-0,010936**	**-0,54**

Model 1	estimated coefficient		contribution to output change	
		change in variable	absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND?	0,273554	-0,005674	-0,002	0,17
LAB_AG_EC?	0,385354	-0,040990	-0,016	**1,74**
CAP_NET?(-1)	0,643044	-0,002303	-0,001	0,16
trend_hu	0,017893		0,017893	-1,97
total GAO change		**-0,009094**	**-0,009094**	**0,10**

Model 1	estimated coefficient		contribution to output change	
		change in variable	absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND?	0.273554	-0.008883	0.00	0.23
LAB_AG_EC?	0.385354	-0.026600	-0.01	**0.96**
CAP_NET?(-1)	0.643044	-0.001182	0.00	0.07
trend_pl	0.013196		0.013196	-1.23
total GAO change		**-0.010731**	**-0.010731**	**0.02**

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Model 1	estimated coefficient		contribution to output change	
		change in variable	absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND?	0,273554	-0,005677	0,00	0,08
LAB_AG_EC?	0,385354	-0,026448	-0,01	0,54
CAP_NET?(-1)	0,643044	-0,044232	-0,03	**1,52**
trend_ru	0,024544		0,024544	-1,31
total GAO change		**-0,018708**	**-0,018708**	**0,84**

Model 1	estimated coefficient		contribution to output change	
		change in variable	absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND?	0,273554	-0,011431	0,00	0,14
LAB_AG_EC?	0,385354	-0,019809	-0,01	0,33
CAP_NET?(-1)	0,643044	-0,030319	-0,02	**0,85**
trend_sk	0,025796		0,025796	-1,12
total GAO change		**-0,022932**	**-0,022932**	**0,19**

Model 1	estimated coefficient		contribution to output change	
		change in variable	absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND?	0.273554	-0.002746	0.00	0.03
LAB_AG_EC?	0.385354	-0.044437	-0.02	0.69
CAP_NET?(-1)	0.643044	-0.042093	-0.03	**1.09**
trend_ukr	0.02287		0.02287	-0.92
total GAO change		**-0.024785**	**-0.024785**	**0.89**

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Accounting statistics for Model 2

Model 2	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.338196	-0.009285	0.00	0.24	
LAB_AG?	0.466773	-0.044218	-0.02	1.57	
TRAC?(-1)	0.214955	-0.077574	-0.02	**1.27**	
FERT?(-1)	0.118083	-0.007948	0.00	**0.07**	
LIVEST?(-1)	0.347287	-0.041664	-0.01	**1.10**	**2.44**
trend_by	0.040718		0.040718	-3.10	
total GAO change		**-0.013133**	**-0.013133**	**1.15**	

Model 2	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.338196	-0.003093	0.00	0.10	
LAB_AG?	0.466773	-0.031785	-0.01	**1.36**	
TRAC?(-1)	0.214955	0.012246	0.00	-0.24	
FERT?(-1)	0.118083	0.010459	0.00	-0.11	
LIVEST?(-1)	0.347287	-0.051694	-0.02	1.64	**1.29**
trend_cz	0.019266		0.019266	-1.76	
total GAO change		**-0.010936**	**-0.010936**	**0.98**	

Model 2	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.338196	-0.005674	0.00	0.21	
LAB_AG?	0.466773	-0.036461	-0.02	**1.87**	
TRAC?(-1)	0.214955	0.038028	0.01	-0.90	
FERT?(-1)	0.118083	0.025511	0.00	-0.33	
LIVEST?(-1)	0.347287	-0.036603	-0.01	1.40	**0.17**
trend_hu	0.016469		0.016469	-1.81	
total GAO change		**-0.009094**	**-0.009094**	**0.44**	

Model 2	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.338196	-0.008883	0.00	0.28	
LAB_AG?	0.466773	-0.024642	-0.01	**1.07**	
TRAC?(-1)	0.214955	0.011704	0.00	-0.23	
FERT?(-1)	0.118083	0.019368	0.00	-0.21	
LIVEST?(-1)	0.347287	-0.002054	0.00	0.07	**-0.38**
trend_pl	0.013132		0.013132	-1.22	
total GAO change		**-0.010731**	**-0.010731**	**-0.25**	

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Model 2	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.338196	-0.005677	0.00	0.10	
LAB_AG?	0.466773	-0.029496	-0.01	0.74	
TRAC?(-1)	0.214955	-0.071384	-0.02	**0.82**	
FERT?(-1)	0.118083	-0.100089	-0.01	**0.63**	
LIVEST?(-1)	0.347287	-0.069182	-0.02	**1.28**	**2.74**
trend_ru	0.041068		0.041068	-2.20	
total GAO change		**-0.018708**	**-0.018708**	**1.38**	

Model 2	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.338196	-0.011431	0.00	0.17	
LAB_AG?	0.466773	-0.026772	-0.01	0.54	
TRAC?(-1)	0.214955	-0.036538	-0.01	**0.34**	
FERT?(-1)	0.118083	0.019420	0.00	**-0.10**	
LIVEST?(-1)	0.347287	-0.022357	-0.01	**0.34**	**0.58**
trend_sk	0.020215		0.020215	-0.88	
total GAO change		**-0.022932**	**-0.022932**	**0.41**	

Model 2	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.338196	-0.002746	0.00	0.04	
LAB_AG?	0.466773	-0.039646	-0.02	0.75	
TRAC?(-1)	0.214955	-0.031892	-0.01	**0.28**	
FERT?(-1)	0.118083	-0.146795	-0.02	**0.70**	
LIVEST?(-1)	0.347287	-0.071804	-0.02	**1.01**	**1.98**
trend_ukr	0.039769		0.039769	-1.60	
total GAO change		**-0.024785**	**-0.024785**	**1.16**	

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Accounting statistics for Model 3

Model 3	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.527094	-0.00929	0.00	0.37	
LAB_POP?	0.607175	-0.01594	-0.01	0.74	
TRAC?	0.182418	-0.07678	-0.01	**1.07**	
FERT?(-1)	0.102146	-0.00795	0.00	**0.06**	
LIVEST?(-1)	0.400533	-0.041664	-0.02	**1.27**	**2.40**
trend_by	0.033986		0.033986	-2.59	
total GAO change		**-0.013133**	**-0.013133**	**0.92**	

Model 3	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.527094	-0.003093	0.00	0.15	
LAB_POP?	0.607175	0.003498	0.00	-0.19	
TRAC?	0.182418	0.010240	0.00	**-0.17**	
FERT?(-1)	0.102146	0.010459	0.00	**-0.10**	
LIVEST?(-1)	0.400533	-0.051694	-0.02	**1.89**	**1.62**
trend_cz	0.008516		0.008516	-0.78	
total GAO change		**-0.010936**	**-0.010936**	**0.80**	

Model 3	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.527094	-0.005674	0.00	0.33	
LAB_POP?	0.607175	-0.001369	0.00	0.09	
TRAC?	0.182418	0.036802	0.01	**-0.74**	
FERT?(-1)	0.102146	0.025511	0.00	**-0.29**	
LIVEST?(-1)	0.400533	-0.036603	-0.01	**1.61**	**0.59**
trend_hu	0.004316		0.004316	-0.47	
total GAO change		**-0.009094**	**-0.009094**	**0.53**	

Model 3	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.527094	-0.008883	0.00	0.44	
LAB_POP?	0.607175	-0.000723	0.00	0.04	
TRAC?	0.182418	0.011188	0.00	**-0.19**	
FERT?(-1)	0.102146	0.019368	0.00	**-0.18**	
LIVEST?(-1)	0.400533	-0.002054	0.00	**0.08**	**-0.30**
trend_pl	**0.003769**		0.003769	-0.35	
total GAO change		**-0.010731**	**-0.010731**	**-0.17**	

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Model 3	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.527094	-0.005677	0.00	0.16	
LAB_POP?	0.607175	-0.001466	0.00	0.05	
TRAC?	0.182418	-0.072746	-0.01	**0.71**	
FERT?(-1)	0.102146	-0.100089	-0.01	0.55	
LIVEST?(-1)	0.400533	-0.069182	-0.03	**1.48**	**2.74**
trend_ru	0.032596		0.032596	-1.74	
total GAO change		**-0.018708**	**-0.018708**	**1.20**	

Model 3	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.527094	-0.011431	-0.01	0.26	
LAB_POP?	0.607175	0.001918	0.00	-0.05	
TRAC?	0.182418	-0.033872	-0.01	**0.27**	
FERT?(-1)	0.102146	0.01942	0.00	**-0.09**	
LIVEST?(-1)	0.400533	-0.022357	-0.01	**0.39**	**0.57**
trend_sk	0.012046		0.012046	-0.53	
total GAO change		**-0.022932**	**-0.022932**	**0.26**	

Model 3	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.527094	-0.002746	0.00	0.06	
LAB_POP?	0.607175	-0.008916	-0.01	0.22	
TRAC?	0.182418	-0.029163	-0.01	**0.21**	
FERT?(-1)	0.102146	-0.146795	-0.01	**0.60**	
LIVEST?(-1)	0.400533	-0.071804	-0.03	**1.16**	**1.98**
trend_ukr	0.029031		0.029031	-1.17	
total GAO change		**-0.024785**	**-0.024785**	**1.09**	

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Accounting statistics for Model 4

Model 4	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0,363098	-0,009285	0,00	0,26	
LAB_POP?	0,564304	-0,01594	-0,01	0,68	
TRAC?(-1)	0,202192	-0,077574	-0,02	**1,19**	
FERT?(-1)	0,111073	-0,007948	0,00	**0,07**	
LIVEST?(-1)	0,390089	-0,041664	-0,02	**1,24**	**2,50**
trend_by	0,031413		0,031413	-2,39	
total GAO change		**-0,013133**	**-0,013133**	**1,05**	

Model 4	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0,3631	-0,003093	0,00	0,10	
LAB_POP?	0,5643	0,003498	0,00	-0,18	
TRAC?(-1)	0,20219	0,012246	0,00	**-0,23**	
FERT?(-1)	0,11107	0,010459	0,00	**-0,11**	
LIVEST?(-1)	0,39009	-0,051694	-0,02	**1,84**	**1,51**
trend_cz	0,00668		0,006684	-0,61	
total GAO change		**-0,010936**	**-0,010936**	**0,82**	

Model 4	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***b***	***C (A*B)***	***D***	
LAND?	0,363098	-0,005674	0,00	0,23	
LAB_POP?	0,564304	-0,001369	0,00	0,08	
TRAC?(-1)	0,202192	0,038028	0,01	**-0,85**	
FERT?(-1)	0,111073	0,025511	0,00	**-0,31**	
LIVEST?(-1)	0,390089	-0,036603	-0,01	**1,57**	**0,41**
trend_hu	**0,000967**		0,000967	-0,11	
total GAO change		**-0,009094**	**-0,009094**	**0,62**	

Model 4	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0,363098	-0,008883	0,00	0,30	
LAB_POP?	0,564304	-0,000723	0,00	**0,04**	
TRAC?(-1)	0,202192	0,011704	0,00	-0,22	
FERT?(-1)	0,111073	0,019368	0,00	-0,20	
LIVEST?(-1)	0,390089	-0,002054	0,00	0,07	**-0,35**
trend_pl	**0,001444**		0,001444	-0,13	
total GAO change		**-0,010731**	**-0,010731**	**-0,14**	

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continuation of **APPENDIX 2.8. Country-relevant tables for the GAO changes**

Model 4	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.363098	-0.005677	0.00	0.11	
LAB_POP?	0.564304	-0.001466	0.00	0.04	
TRAC?(-1)	0.202192	-0.071384	-0.01	**0.77**	
FERT?(-1)	0.111073	-0.100089	-0.01	**0.59**	
LIVEST?(-1)	0.390089	-0.069182	-0.03	**1.44**	**2.81**
trend_ru	0.030457		0.030457	-1.63	
total GAO change		**-0.018708**	**-0.018708**	**1.33**	

Model 4	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.363098	-0.011431	0.00	0.18	
LAB_POP?	0.564304	0.001918	0.00	-0.05	
TRAC?(-1)	0.202192	-0.036538	-0.01	**0.32**	
FERT?(-1)	0.111073	0.019420	0.00	**-0.09**	
LIVEST?(-1)	0.390089	-0.022357	-0.01	**0.38**	**0.61**
trend_sk	0.009686		0.009686	-0.42	
total GAO change		**-0.022932**	**-0.022932**	**0.32**	

Model 4	estimated coefficient		contribution to output change		
		change in variable	absolute	% of total change	
	A	***B***	***C (A*B)***	***D***	
LAND?	0.363098	-0.002746	0.00	0.04	
LAB_POP?	0.564304	-0.008916	-0.01	0.20	
TRAC?(-1)	0.202192	-0.031892	-0.01	**0.26**	
FERT?(-1)	0.111073	-0.146795	-0.02	**0.66**	
LIVEST?(-1)	0.390089	-0.071804	-0.03	**1.13**	**2.05**
trend_ukr	0.028149		0.028149	-1.14	
total GAO change		**-0.024785**	**-0.024785**	**1.16**	

APPENDIX 2.9. Average annual TFP growth

Swinnen and Vranken (2010)						
dependant variable		**1989-2001**	1989-1992	1992-1995	1995-1998	1998-2001
GAO *(FAO-PIN)*	Czech Rep.	**1.4**	1.3	2.3	3.9	1.6
	Hungary	**4**	1.9	3.4	5.1	5.6
	Poland	**0.8**	-1.7	0.5	3.3	0.9
	Slovakia	**2.2**	0.1	2.4	4.3	2.1

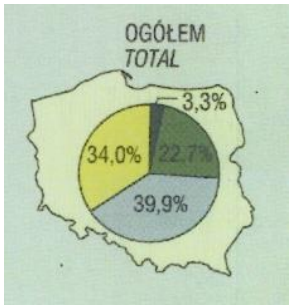
Rozelle and Swinnen (2004) - *for FSU cited from Lerman et al.. (2003) and for V4 cited from Macours and Swinnen (2000)*		
dependant variable		**1992-1997**
GAO	Belarus	0.6
	Russia	1.4
	Ukraine	0.4

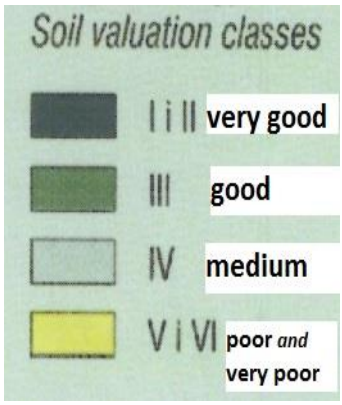
dependant variable		**1989-1995**	1989-1992	1992-1995
crops	Czech Rep.	**2.7**	1.1	4.3
	Hungary	**1.1**	-4.5	6.7
	Poland	**-0.4**	-5.1	4.3
	Slovakia	**1.2**	-0.6	3.1

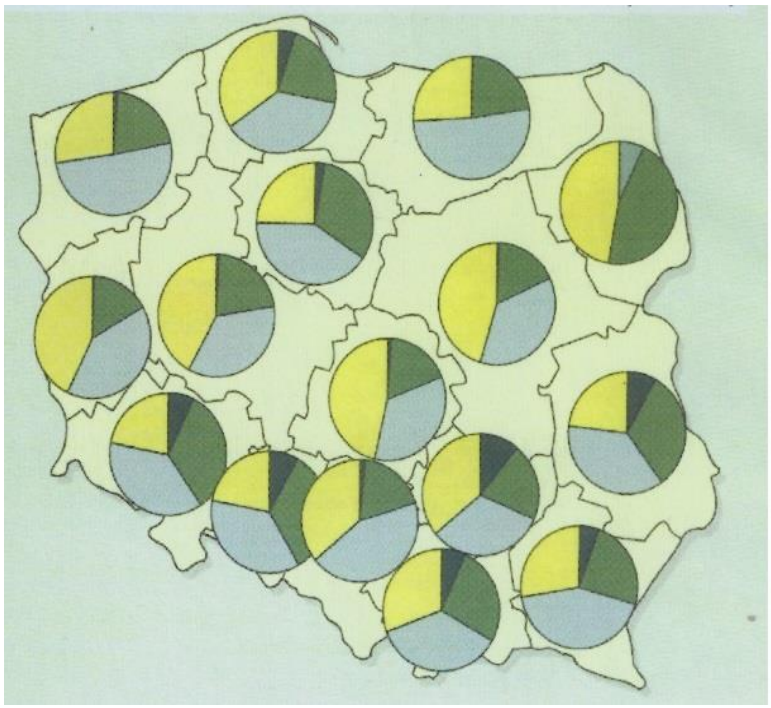
Fuglie and Rada (2012)						
dependant variable		**1991-2010**	1991-2000	2001-2005	2001-2010	
GAO	Belarus	**0.0308**	0.0057	0.0580	0.0389	
	Poland	**0.0080**	0.0110	-0.0030	0.0017	
	Hungary	**0.0096**	0.0023	0.0211	0.0117	
	Russia	**0.0302**	0.0136	0.0547	0.0313	
	Ukraine	**0.0325**	-0.0016	0.0601	0.0498	
	Czechslovakia	**0.0108**	0.0075	0.0135	0.0126	

APPENDIX 3.1 Land quality and population density in Poland [1]

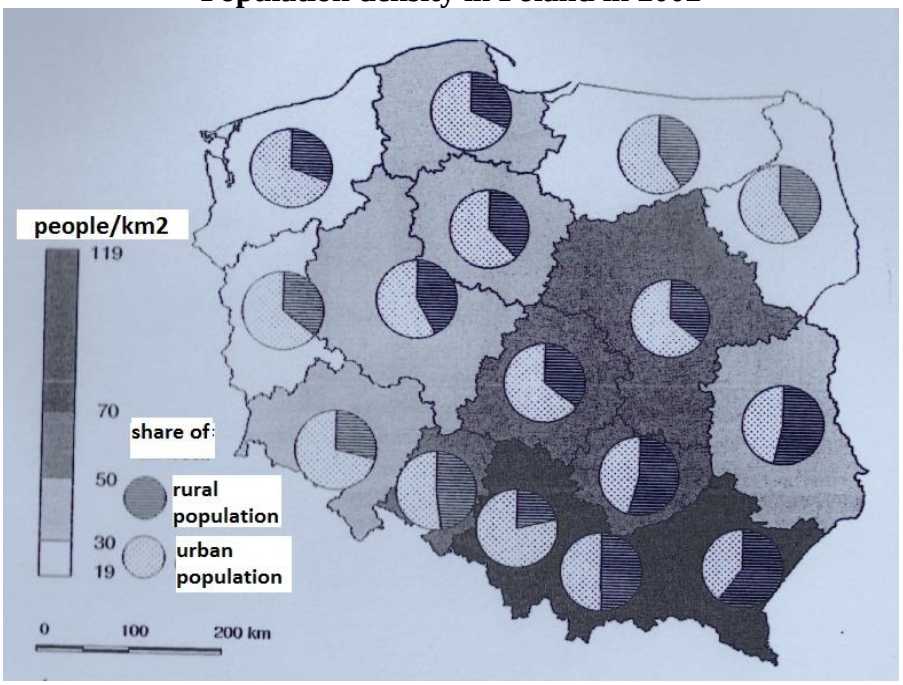
Agricultural land quality in Poland as of 01.01.2000





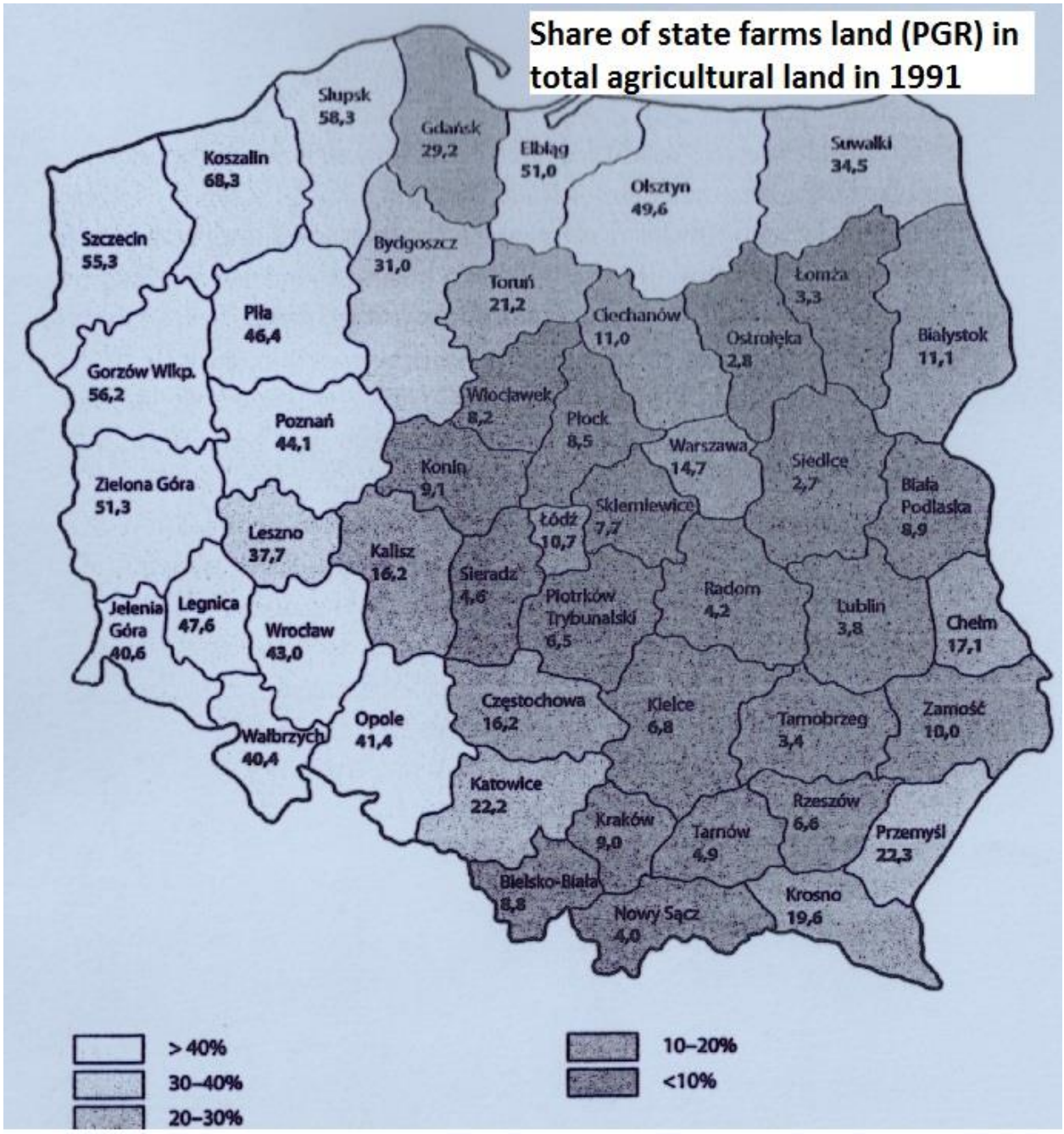


Population density in Poland in 2002



[1] Map of the land quality is from *Agricultural Statistics Yearbook for Poland (2001)*. Map of the population density is from *Banski (2006, p.44)*

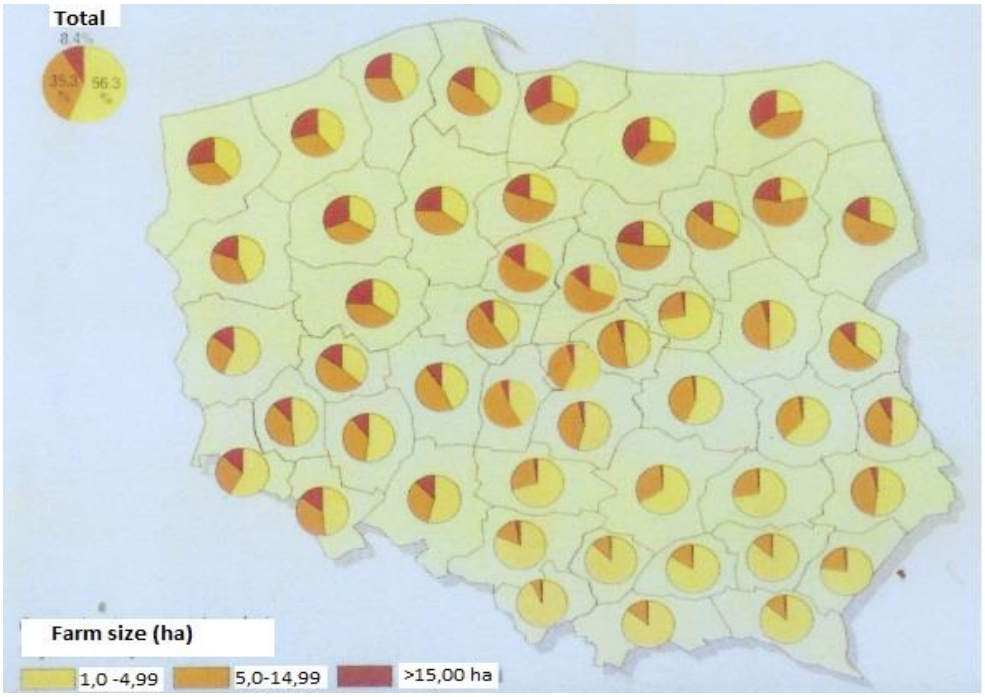
APPENDIX 3.2. Share of the state farms land in 1991 [1]



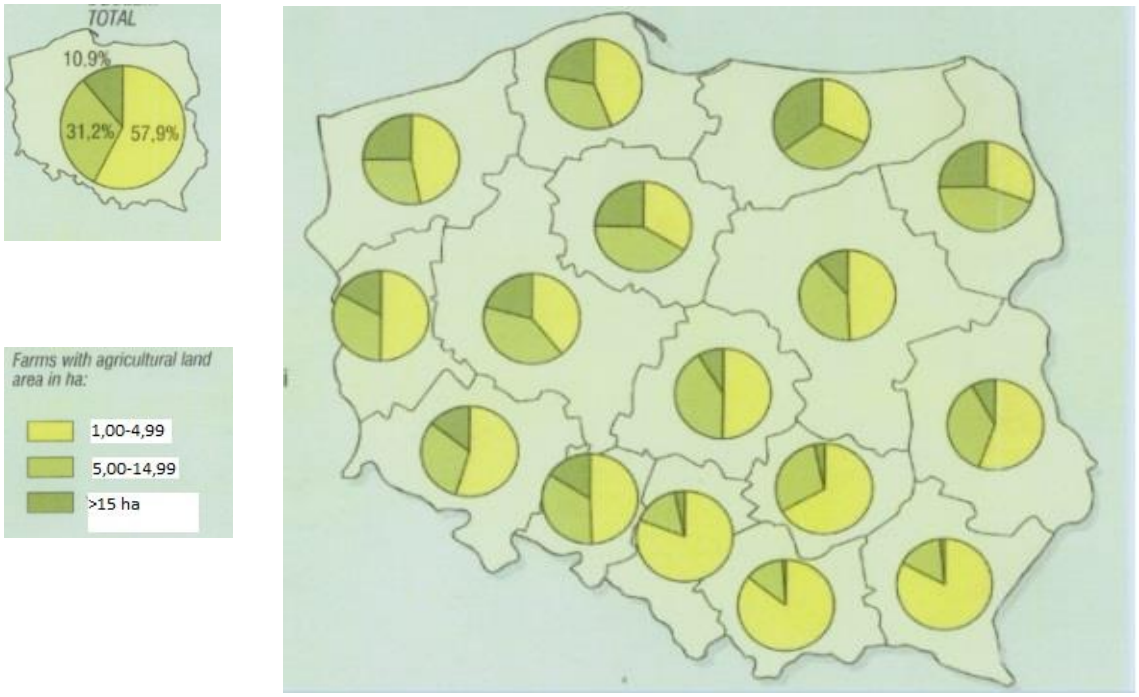
[1] Map is from *Marks-Bielska (2010, p.119)*

APPENDIX 3.3 Differentiation of private farms by land size in 1997 and 2005[1]

Private farms' size in 1997.



Private farms' size in 2005.



[1] Maps are from *Agricultural Statistics Yearbook for Poland (1998) and Agricultural Statistics Yearbook for Poland (2006)*

APPENDIX 3.4. State land incorporation, distribution and availability by Agricultural Property Agency (thous. ha) [1]

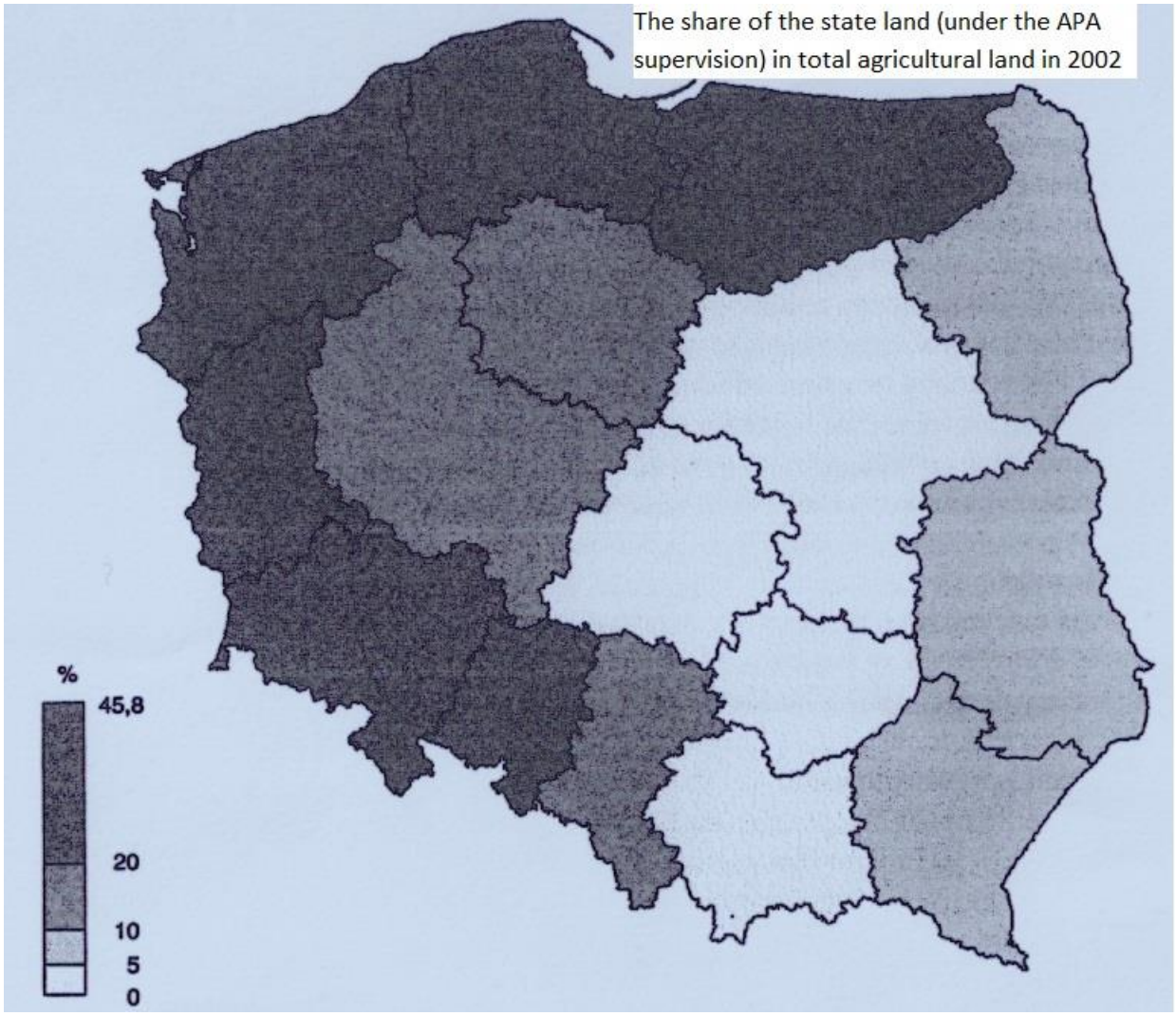
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
(1) Incorporated TOTAL	1,432	1,868	932	182	92	86	57	20	29	6	4	1	3
(2) Distributed (transferred) from APA -TOTAL **(not state-owned land)**	**10**	**59**	**82**	**147**	**227**	**172**	**192**	**155**	**158**	**176**	**182**	**114**	**117**
(2.1) land sold	*9*	*49*	*65*	*115*	*193*	*150*	*147*	*119*	*120*	*147*	*159*	*102*	*105*
(2.2.) land transferred without payment	*1*	*8*	*12*	*30*	*34*	*22*	*38*	*34*	*33*	*24*	*18*	*11*	*11*
(3) Land still in APA fund- TOTAL **(state-owned land)**	**1,422**	**3,231**	**4,081**	**4,116**	**3,981**	**3,895**	**3,757**	**3,622**	**3,492**	**3,323**	**3,146**	**3,032**	**2,917**
*(3.1) land transferred for **management*****or perpetual usufruct*	*0*	*0*	*22*	*41*	*66*	*107*	*122*	*124*	*153*	*151*	*149*	*134*	*124*
*(3.2) land transferred for **administration****	*0*	*93*	*285*	*333*	*268*	*248*	*208*	*135*	*39*	*12*	*5*	*3*	*3*
(3.3) land for lease	*49*	*900*	*1,981*	*2,745*	*2,928*	*2,890*	*2,810*	*2,692*	*2,618*	*2,508*	*2,408*	*2,342*	*2,305*
(3.4) land awaiting utilization	*1,373*	*2,328*	*1,793*	*997*	*719*	*650*	*617*	*617*	*682*	*652*	*584*	*553*	*485*
ratio of land for lease*(#3.3)* per land sold *(#2.1)*	**5**	**18**	**30**	**24**	**15**	**19**	**19**	**23**	**22**	**17**	**15**	**23**	**22**

*** Management** contracts are similar to leasing, but the manager works for the APA (for his own account). Usually, the management contracts are used when there is no possibility of leasing

****Land in administration** means that the operational assets are transferred to the company (which is wholly owned by APA), but the land is leased.

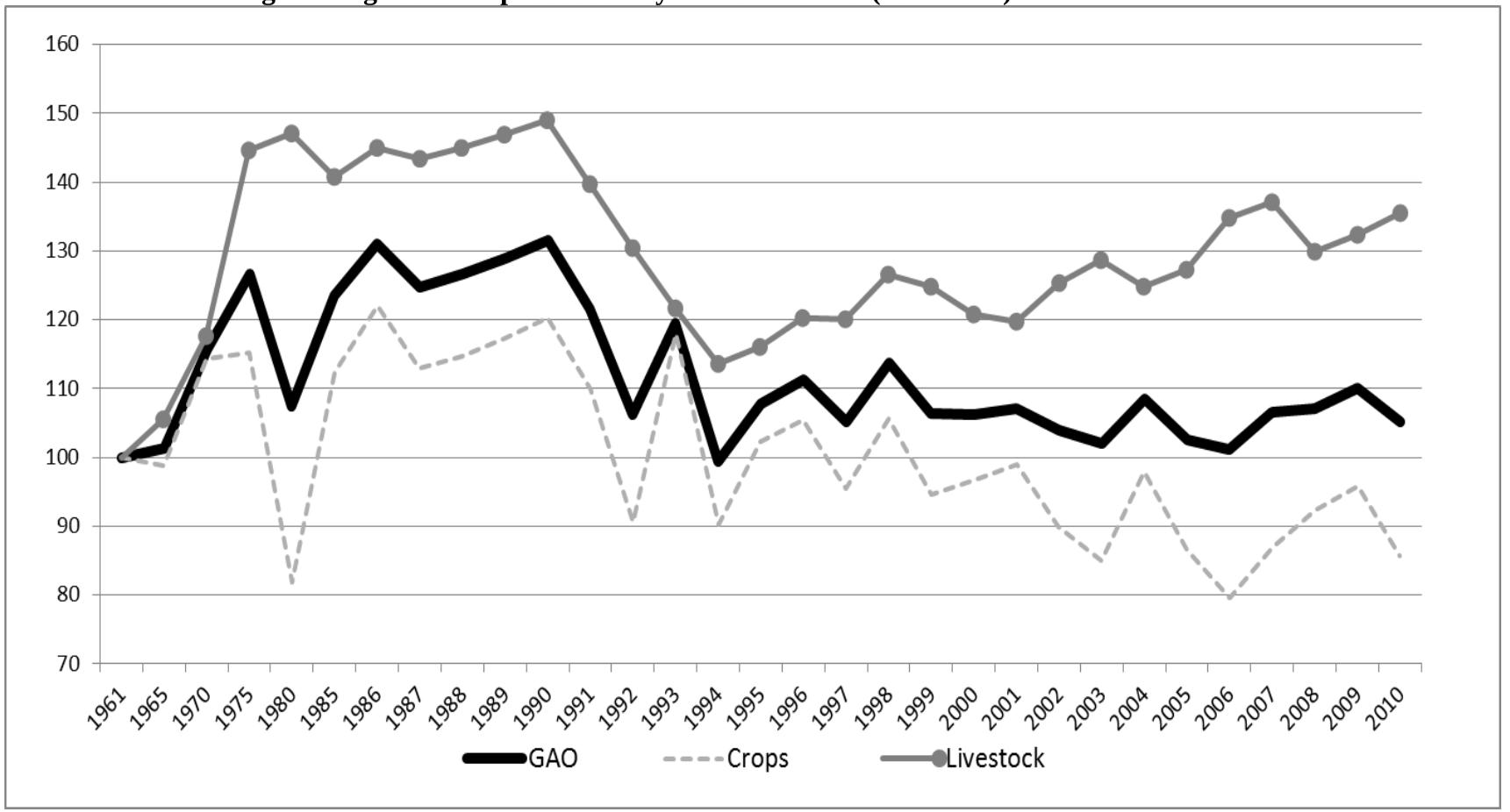
[1] Data are from *Agricultural Statistics Yearbook of Poland (2005, p.71); Agricultural Statistics Yearbook od Poland (2001, p.16).* Explanations regarding the land management and land administration are from *van Zyl et al. (1996)*

APPENDIX 3.5. The share of the state land (under the APA supervision) in total agricultural land in 2002 [1]



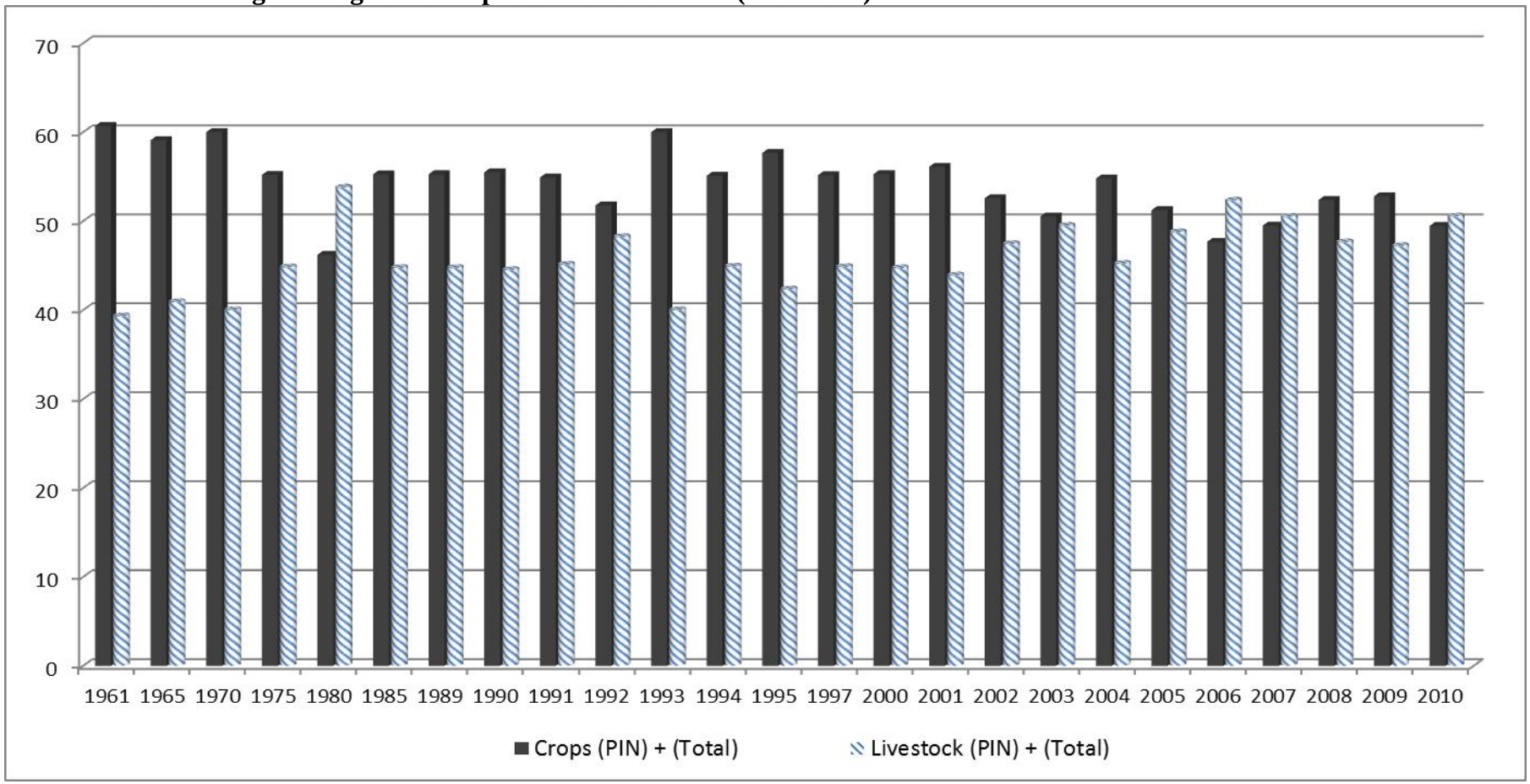
[1] Map is from *Banski (2007, p. 99)*

APPENDIX 3.6. Long-term agricultural production dynamic in Poland (1961-2010) [1]



[1] Data are from *FAO database* (Gross Production Value (constant 2004-2006 1000 I$) (1000 Int. $) – *Agriculture (PIN)-Total*. Available at: www.fao.org (Accessed: December 3, 2013)

APPENDIX 3.7. Long-term agricultural production structure (1961-2010) [1]



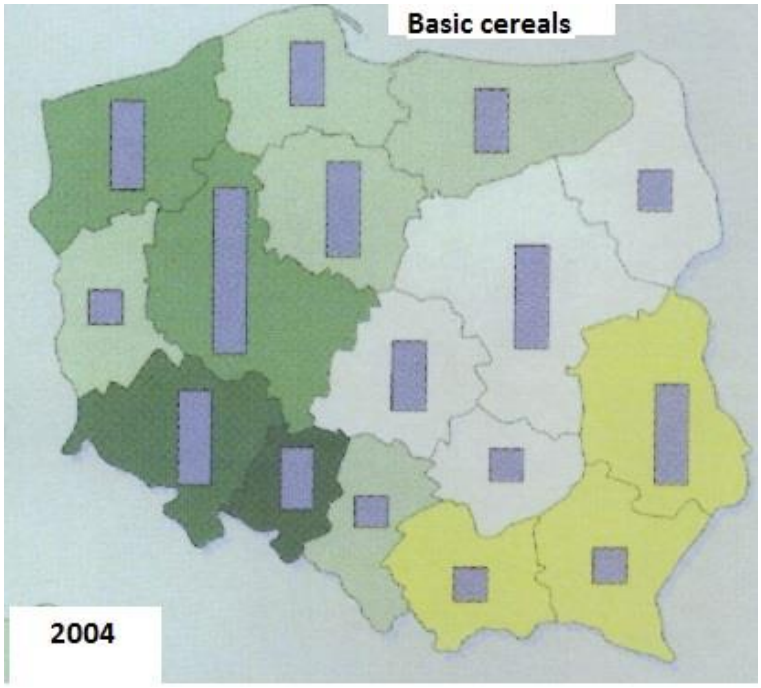
[1] Data are from *FAO database* (Gross Production Value (constant 2004-2006 1000 I$) (1000 Int. $) – *Agriculture (PIN)-Total.* Available at: www.fao.org *(*Accessed: December 3, 2013*)*

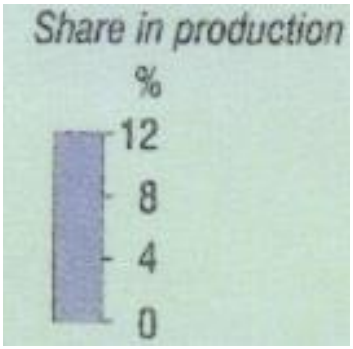
APPENDIX 3.8.Agriculture output dynamic in Poland (selected products)[1]

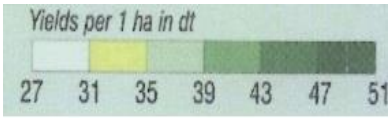
	average 1983-1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	**Total average**
Barley	100	108	109	72	83	69	84	88	99	92	87	71	85	86	72	91	**87**
Fruit Fresh	100	44	29	19	9	4	4	83	58	51	18	22	29	127	109	95	**50**
Maize	100	226	265	161	226	148	186	273	325	388	468	721	1,063	1,532	1,471	1,830	**587**
Oats	100	87	77	51	62	51	62	65	67	60	60	44	54	61	49	59	**63**
Oilseeds, Nes	100	257	136	103	113	198	179	179	151	207	236	118	170	132	141	156	**161**
Potatoes	100	101	80	65	100	64	69	75	58	72	55	67	54	43	38	39	**67**
Pulses, nes	100	143	159	82	88	43	47	51	47	59	76	60	44	54	66	62	**74**
Rye	100	82	80	54	68	72	85	77	72	77	70	54	66	52	43	58	**69**
Sugar beet	100	113	77	75	105	79	90	120	107	102	85	89	77	91	79	86	**92**
Vegetables fresh nes	100	88	89	107	91	81	85	82	78	19	75	83	86	100	55	60	**80**
Wheat	100	129	132	105	117	109	124	122	117	136	129	121	132	133	112	141	**122**
Eggs	100	93	80	75	69	71	77	87	94	89	92	94	99	110	113	114	**91**
Cattle meat	100	104	95	78	69	61	56	60	62	62	55	50	46	40	46	45	**64**
Chicken meat	100	111	116	109	102	129	128	148	177	193	210	219	261	298	249	275	**177**
Pig meat	100	115	120	126	118	104	121	128	117	125	126	119	114	125	135	121	**120**
Sheep meat	100	116	133	91	71	33	23	19	12	5	6	5	5	4	6	7	**40**
Milk	100	91	83	80	77	74	74	77	80	78	75	75	75	75	75	75	**79**

[1] Data are from *FAO database* (Gross Production Value (constant 2004-2006 1000 I$) (1000 Int. $) – *Agriculture (PIN)-Total.* Available at: www.fao.org *(*Accessed: May 15, 2010*)*

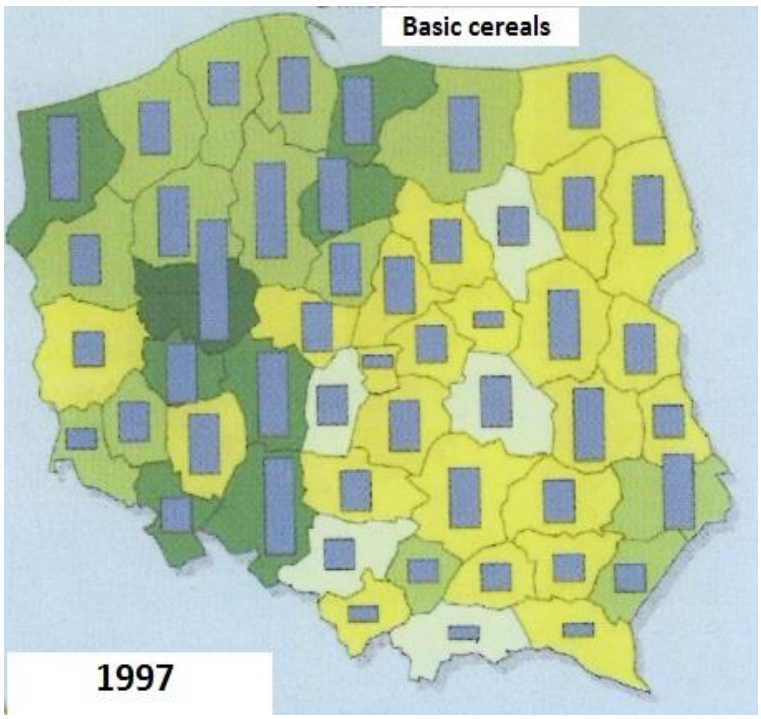
APPENDIX 3.9. Regional division of the basic cereals production in 1997 and 2004[1]





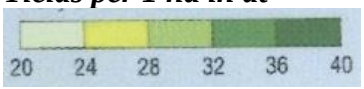


Average yields for basic cereals in 2004-35,5 dt/ha



Share in production

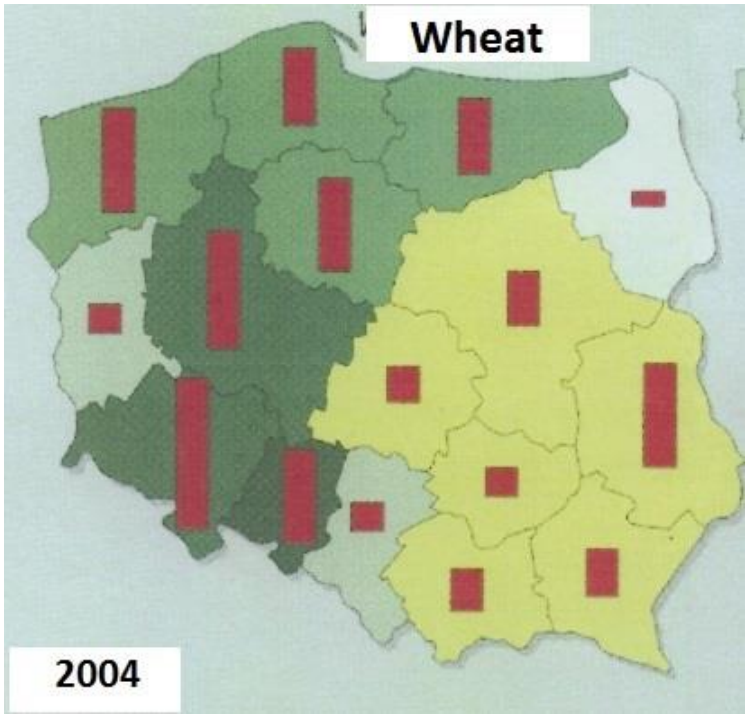
Yields per 1 ha in dt

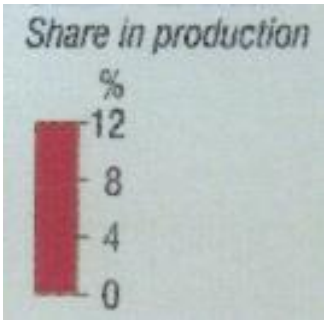


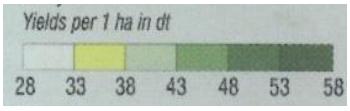
Average yields for basic cereals in 1997 – 28,4dt/ha

[1] Maps are from *Agricultural Statistics Yearbook for Poland (1998) and Agricultural Statistics Yearbook for Poland (2005)*

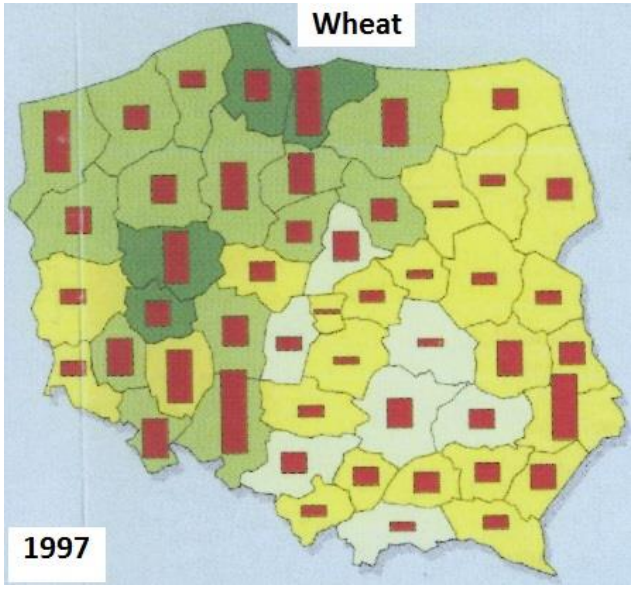
APPENDIX 3.10. Regional division of the wheat production in 1997 and 2004[1]



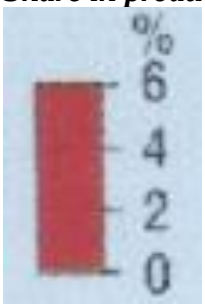




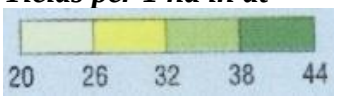
Average wheat yields in 2004- 42,8 dt/ha



Share in production



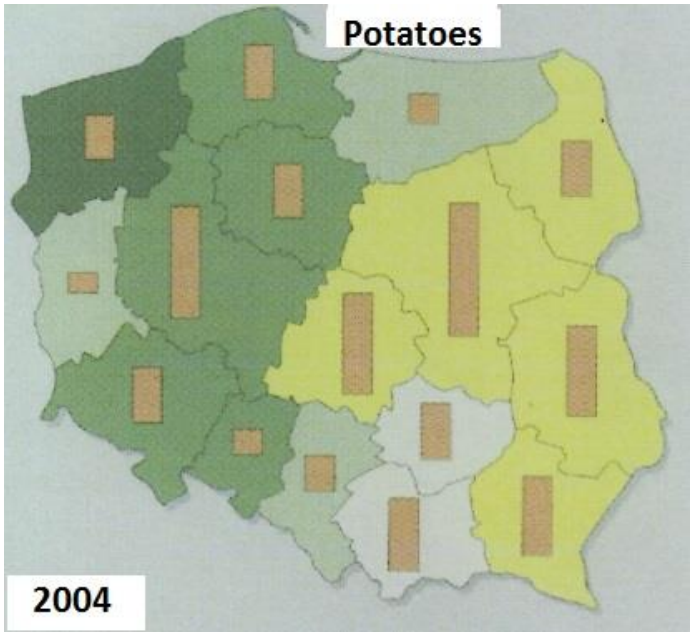
Yields per 1 ha in dt

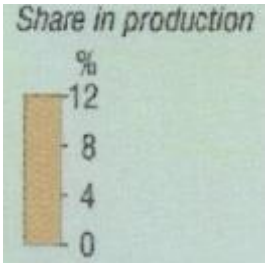


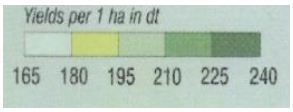
Average wheat yields in 1997- 32,1 dt/ha

[1] Maps are from *Agricultural Statistics Yearbook for Poland (1998) and Agricultural Statistics Yearbook for Poland (2005)*

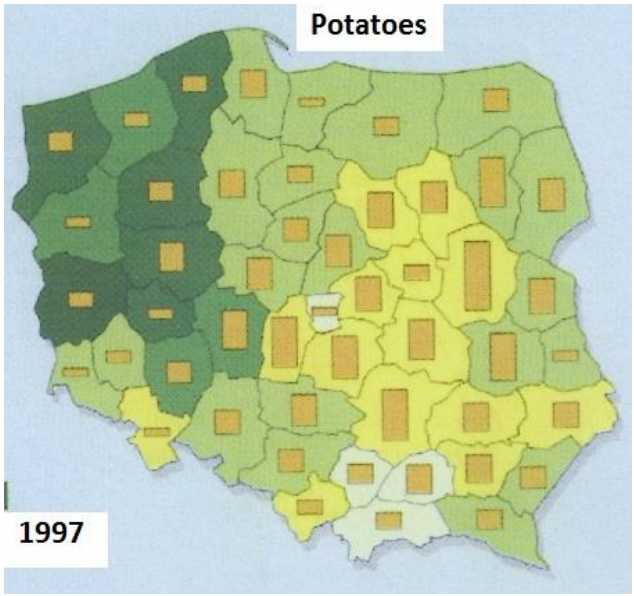
APPENDIX 3.11. Regional division of the potatoes production in 1997 and 2004[1]



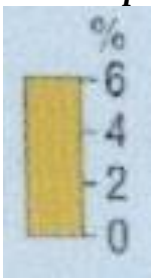




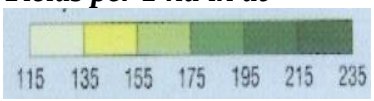
Average potato yields in 2004-196 dt/ha



Share in production



Yields per 1 ha in dt

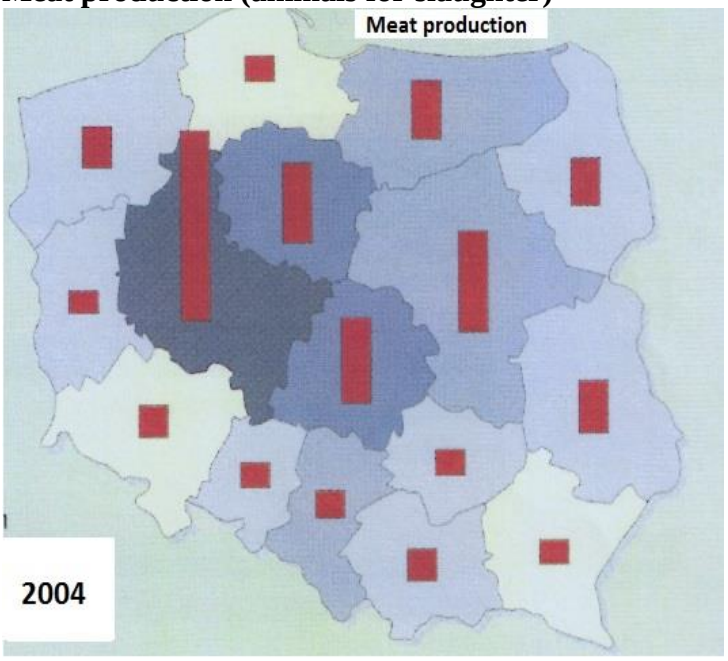


Average potato yields in 1997 -159 dt/ha

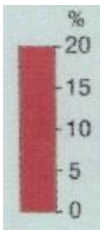
[1] Maps are from *Agricultural Statistics Yearbook for Poland (1998) and Agricultural Statistics Yearbook for Poland (2005)*

APPENDIX 3.12. Regional division of the meat production in 1997 and 2004[1]

Meat production (animals for slaughter)

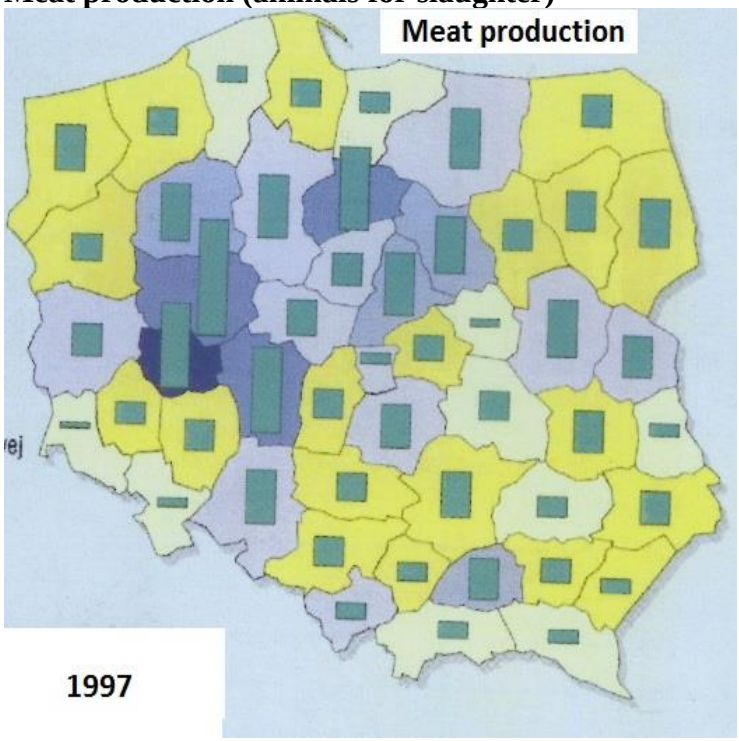


Share in production

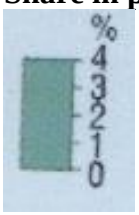


Production per 1 ha of agricultural land

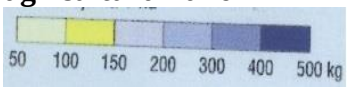
Meat production (animals for slaughter)



Share in production

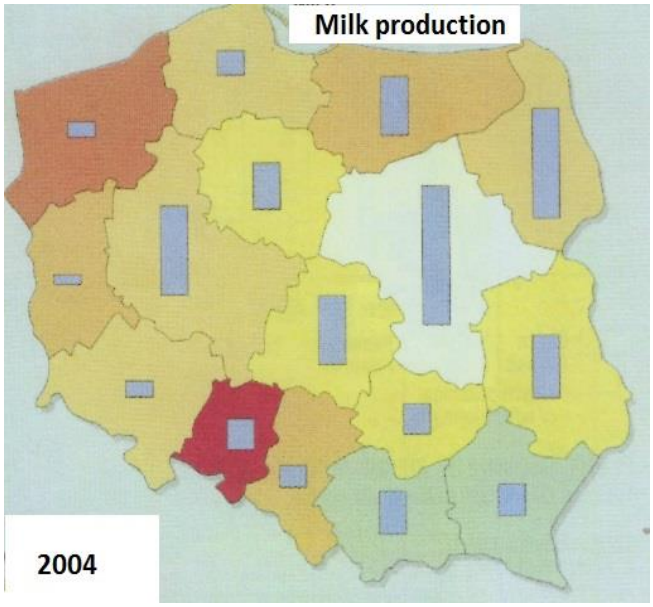


Production per 1 ha of agricultural land

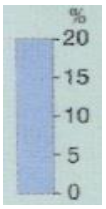


[1] Maps are from *Agricultural Statistics Yearbook for Poland (1998) and Agricultural Statistics Yearbook for Poland (2005)*

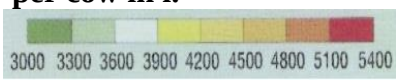
APPENDIX 3.13. Regional division of the milk production in 1997 and 2004[1]

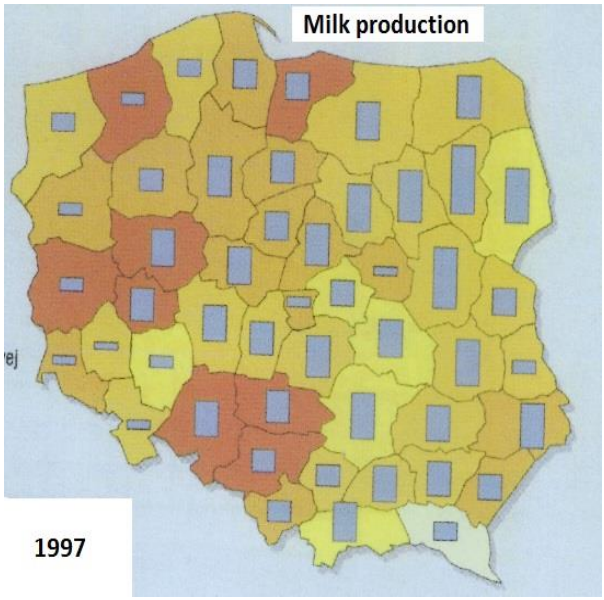


Share in production

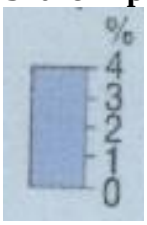


Production of milk per cow in l.

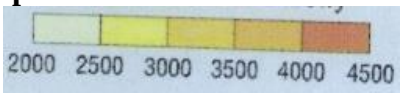




Share in production



Production of milk per cow in l.



[1] Maps are from *Agricultural Statistics Yearbook for Poland (1998) and Agricultural Statistics Yearbook for Poland (2005)*

APPENDIX 3.14. dynamic of NRA, PSE, terms of trade deterioration and GAO [1]

Figure 1. GAO and Terms of trade deterioration

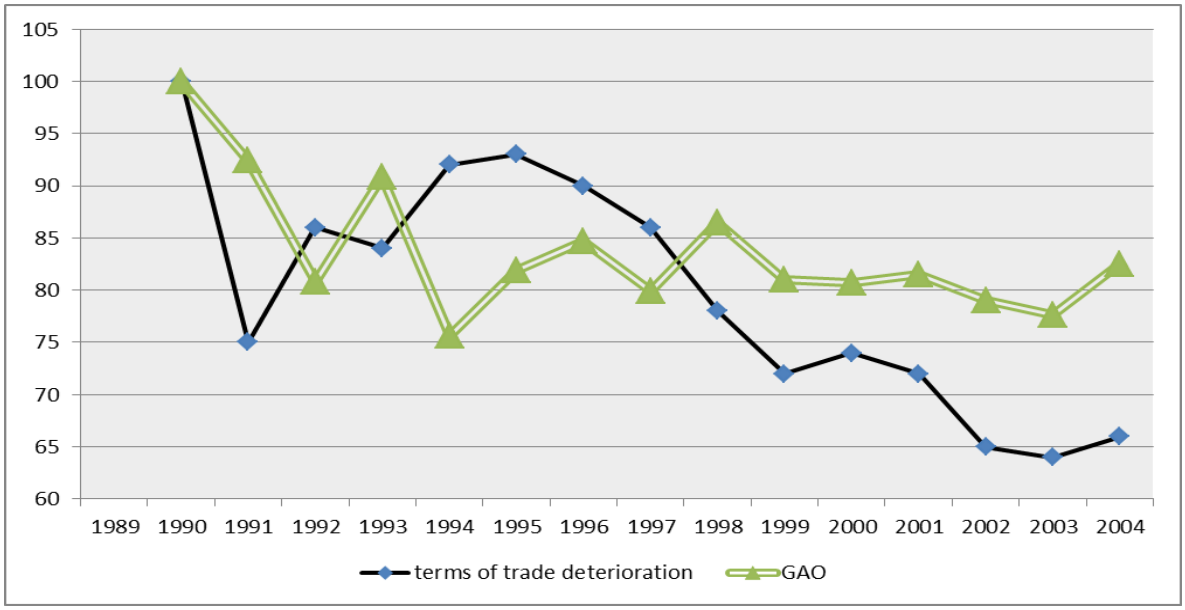
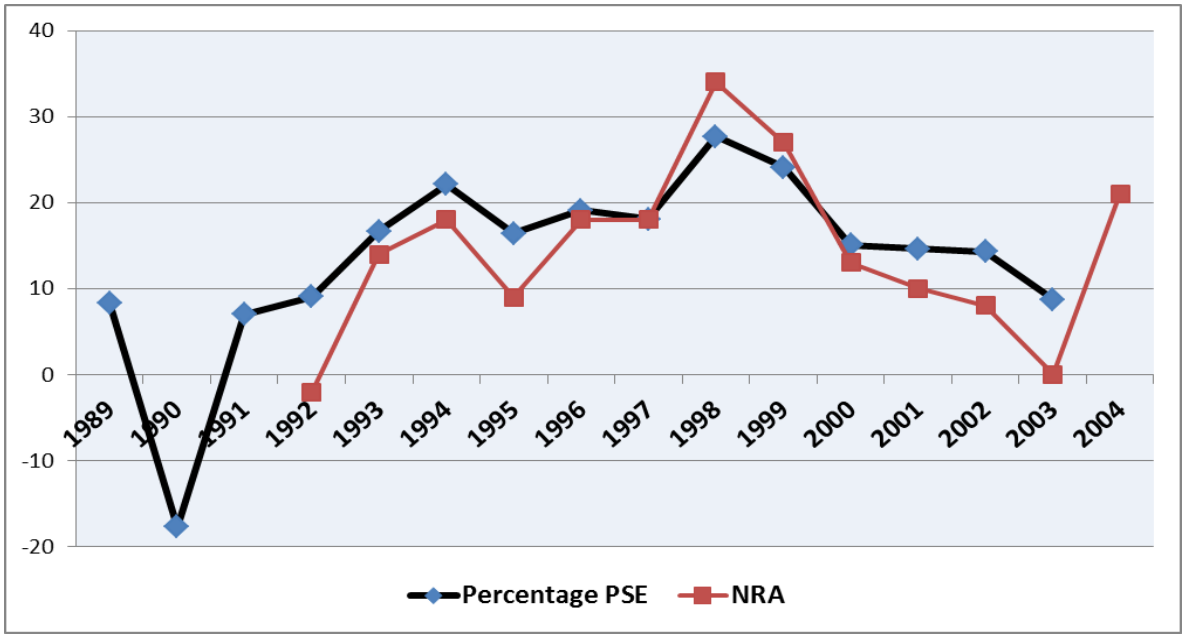


Figure 2. PSE and NRA dynamic



[1] NRA data are from WB database. Available at: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPROGRAMS/EXTTRADERESEARCH/0,,contentMDK:21812190~pagePK:64168182~piPK:64168060~theSitePK:544849,00.html (Accessed: July 25, 2011). PSE data are from OECD databse. Available at: www.oecd.org (Accessed: July 27, 2011). Data for terms of trade deterioration are from *Lukas and Mládek (2006)*; GAO data are from *Figlie (2012)*

APPENDIX 3.15. Agricultural import form developed countries to Poland [1] [2]

Table 1. Agricultural import form developed countries to Poland, 1986-1991

	1986	**1987**	**1988**	**1989**	**1990**	**1991**
mln. US$	594	533	860,4	842,8	465	1.619
1986=100%	100	90	145	142	78	272
1989=100%				100	55	192

Table 2. Agricultural import form developed countries to Poland, 1992-2004

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
mln. US$	1.169	1.293	1.318	1.507	1.971	2.244	1.765	1.762	1.964	2.051	2.260	3.124
1986=100%	197	218	222	254	332	378	297	296	330	345	380	526
1989=100%	139	153	156	179	234	266	209	209	233	243	268	371

[1] Data for 1986 -1991 are from *OECD (1995)*; data for 1992-2004 are from of Polish Institute of Agricultural Economy (IERiGZ).
[2] Developed countries – EU and EFTA countries

APPENDIX 3.16. Agricultural productivity in Poland [1]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVG 1990-2004	2005	2006	2007	2008	2009	2010
Changes in																						
GAO	100	92	81	91	76	82	85	80	87	81	81	81	79	78	83	84	78	77	81	82	84	80
land	100	100	99	99	99	98	97	96	96	96	96	93	89	86	87	95	84	85	86	87	86	87
Labor (workers)	100	96	92	88	84	80	77	72	65	57	57	58	52	52	52	72	52	52	53	54	53	48
Labor (AWU)							100	94	85	74	74	75	67	68	68	78	68	68	68	68	66	62
machinery	100	100	99	98	111	112	110	111	111	111	111	111	116	117	117	109	123	128	132	133	133	133
fertilizers	100	71	89	97	107	112	117	122	114	111	111	113	110	122	120	108	135	141	152	138	137	138
Changes in																						
Land productivity	100	93	81	92	77	83	88	83	90	84	84	88	89	90	95	88	93	90	94	94	97	92
Labor productivity (per worker)	100	97	88	103	90	102	110	110	132	141	141	141	152	149	158	121	149	147	154	152	160	167
Labor productivity (per AWU)							100	100	121	129	129	128	139	136	144	125	135	134	140	141	151	151
Machinery productivity	100	93	81	93	68	73	77	72	78	73	73	73	68	66	71	77	63	60	61	61	63	60
Fertilizers productivity	100	130	91	94	71	73	72	65	76	73	72	72	72	63	69	80	58	55	53	59	61	58

[1] Data are from *Fuglie (2012)*

APPENDIX 3.17.Average number of hours worked per one person in the reference week in the main job by employment status and selected sections in 4th quarter of the year[1]

	1994		1996		2000		2002		2005	
	total for agriculture, hunting and forestry	of which private individual farmers	total for agriculture hunting and forestry	of which private individual farmers	total for agriculture, hunting and forestry	of which private individual farmers	total for agriculture, hunting and forestry	of which private individual farmers	total for agriculture, hunting and forestry	of which private individual farmers
Total	37.1	36.5	35.8	35.1	36	35.6	34.4	34	35.1	34.7
in public sector	42.8	x	43.1	x	40.9	x	41.1	x	40.1	x
in private sector	36.8	36.5	35.6	35.1	35.8	35.6	34.3	34	34.9	34.7
Employees total	42.2	31.6	42.7	37.6	40.1	37.6	40.7	38.9	39.7	38.2
in which employees in private sector	41.3	31.6	42.5	37.6	39.6	37.6	40.5	38.9	38.5	38.2
Employers and own-account workers	39.4	39.3	37.9	37.8	38.4	38.4	36.3	36.2	37.9	37.9
Contributing family workers	27.6	27.6	28	28	28	28	27.8	27.8	26.3	26.3

[1] Data are from *Agricultural Statistics Yearbook for Poland (variouse years)* (Section: working conditions)

APPENDIX 3.18. AVERAGE SALARY AND ANNUAL PRICE INDEXES IN POLAND

Average monthly gross wages and salaries by economic sectors (in Polish zlotych) [1]

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total		690.92	874.3	1,065.76	1,232.69	1,697.12	1,893.74	2,045.11	2,097.83	2,185.02	2,273.44
Agricultural sector		622.57	800.32	967.93	1,136.64	1,542.19	1,688.95	1,893.81	1,936	1,969.12	2,112.58
1995=100%		*100*	*129*	*155*	*183*	*248*	*271*	*304*	*311*	*316*	*339*
Industrial sector		733.37	923.88	1,113.58	1,276.34	1,734.14	1,899.86	2,016.1	2,078.8	2,145.38	2,229.25
Services		658.96	837.29	1,032	1,203.09	1,675.63	1,894.76	2,068.13	2,112.52	2,212.16	2,301.82

Average monthly gross wages and salaries by economic sectors (in US$)

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total		285	324	325	353	428	436	500	514	562	622
Agricultural sector		257	297	295	325	389	389	463	475	506	578
Industrial sector		302	343	339	365	437	437	492	510	552	610
Services		272	311	315	344	422	436	505	518	569	630

Average annual price indexes for consumer goods and services [2]

	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Average annual price indexes for consumer goods and services (1990=100%)	100	556	667	767	857	920	1,013	1,069	1,089	1,098	1,136
Average annual price indexes for consumer goods and services (1995=100%)- *calculated by author*		100	120	138	154	165	182	192	196	197	204

[1] Data are from *Agricultural Statistics Yearbook for Poland* (*various years)* (Section: wages and salaries)

[2] Data are from *Agricultural Statistics Yearbook for Poland* (*various years)*

APPENDIX 3.19. Price and terms of trade deterioration in Poland

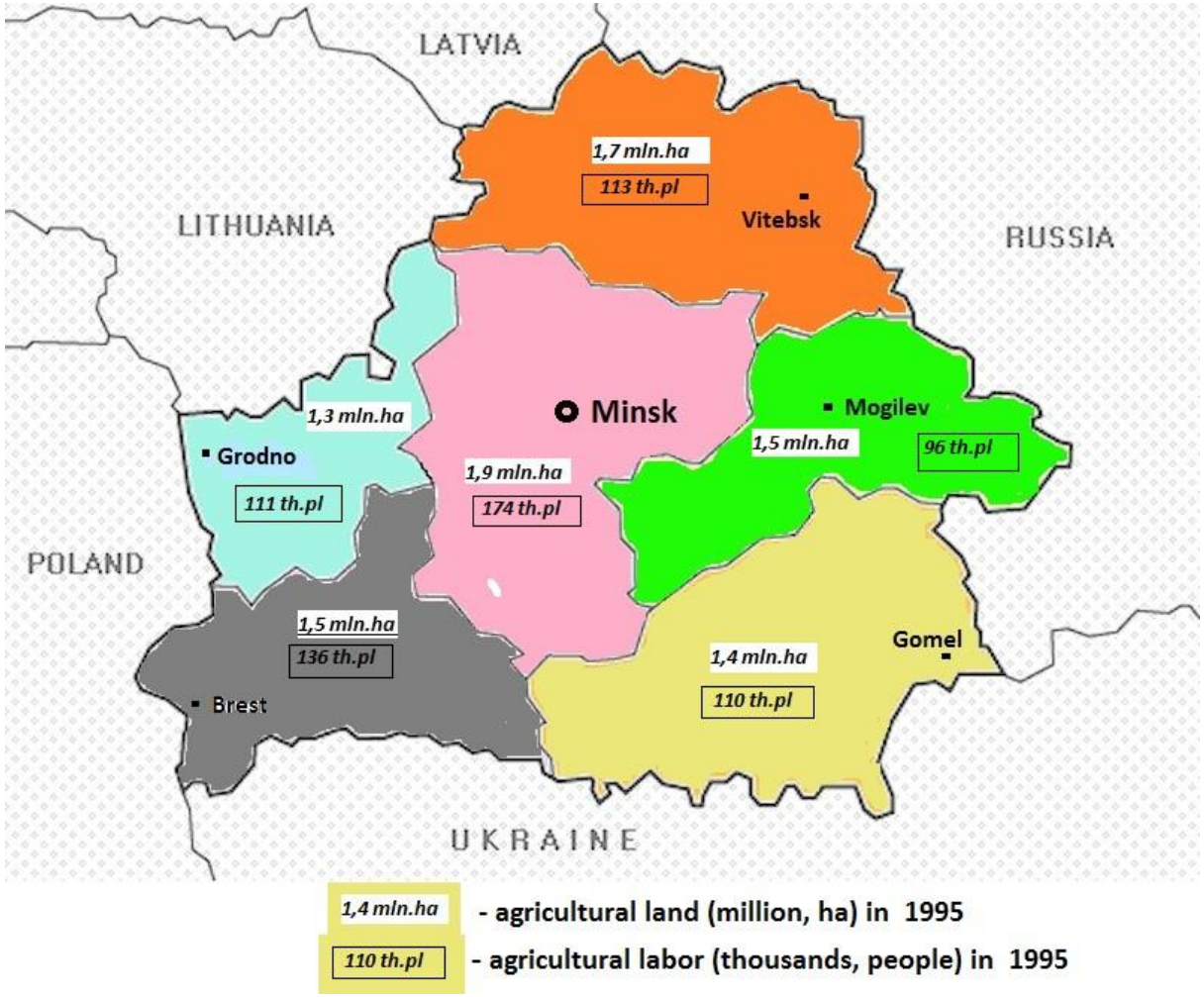
Table 1. Price and terms of trade deterioration

Retail prices of fertilizers and agricultural products in Poland in 1989-1992[1]						
Specification	Period	PRISES EXPRESSED IN:				
		quintals of wheat	quintals of rye	quintals of pork	quintals of veal and beef	hectoliters of milk
100 kg of ammonium fertilizer	***1989 IV***	0.62	0.77	0.06	0.11	0.43
	1990 IV	0.84	1.21	0.07	0.13	0.88
	1991 IV	2.16	3.8	0.15	0.31	1.42
	1992 I	1.76	3.13	0.14	0.24	1.1
	1992 II	1.47	2.73	0.15	0.21	1.1

Dynamic of agricultural input prices, output prices and terms of trade in Poland (%)[2]											
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Input prices	**100**	178	240	327	410	512	617	705	772	828	922
Output prices	**100**	129	207	274	376	478	553	605	606	595	683
Terms of trade	**100**	73	86	84	92	93	90	86	79	72	74

[1] Data are from *Dicke and Misala (1993)*
[2] Data are from *Agricultural situation in the candidate countries. Country Report on Poland (2002)*

APPENDIX 4. 1. Regions' share in total agricultural land and labor in 1995 (%)[1]



[1] Data are from *Belarusian Agricultural Statistics Yearbook (1998)*

APPENDIX 4. 2.

Table. Belarus regional land tenure structure [1]

		1990	1995	2000	2004
Brest region	farmers land	0	0	0	1
	corporate land	94	81	85	85
	household plots land	6	19	14	14
		100	**100**	**100**	**100**
Vitebsk region	farmers land	0	1	1	3
	corporate land	94	79	79	78
	household plots land	6	20	20	19
		100	**100**	**100**	**100**
Gomel region	farmers land	0	1	1	1
	corporate land	93	88	87	87
	household plots land	7	11	12	12
		100	**100**	**100**	**100**
Grodno region	farmers land	0	0	0	2
	corporate land	93	86	85	84
	household plots land	7	14	14	14
		100	**100**	**100**	**100**
Minsk region	farmers land	0	1	1	1
	corporate land	93	82	83	85
	household plots land	7	17	16	14
		100	**100**	**100**	**100**
Mogilev region	farmers land	0	1	1	2
	corporate land	94	87	86	85
	household plots land	6	12	13	14
		100	**100**	**100**	**100**

[1]Data are from *Belarusian Agricultural Statistics Yearbook (various years)*

APPENDIX 4. 3. The dynamic of price indexes for agricultural inputs and output and terms of trade for 1991-2004[1]

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Price indices for industrial products purchased by agricultural organizations									
1991 =100%	**100**	**2,405.0**	**59,090.9**	**1,030,544.4**	**5,554,634.4**	**8,887,415.1**	**16,441,718.0**	**25,484,662.8**	**108,819,510.3**
previous year=100%	100	2,405	2,457	1,744	539	160	185	155	427
Price indices for products sold by agricultural and other organizations									
1991 =100%	**100**	**860,0**	**10,569,4**	**251,234,6**	**1,630,512,8**	**2,510,989,7**	**4,846,210,1**	**8,480,867,8**	**39 690 461,1**
previous year=100%	100	860	1,229	2,377	649	154	193	175	468
Terms of trade*									
previous year=100%	1.0	0.4	0.5	1.4	1.2	1.0	1.0	1.1	1.1
1991 =100%	1.00	0.36	0.18	0.24	0.29	0.28	0.29	0.33	0.36

	2000	2001	2002	2003	2004
Price indices for industrial products purchased by agricultural organizations					
1991 =100%	**321,017,555.4**	**581,041,775.3**	**755,354,307.9**	**989,514,143.3**	**1,266,578 103.4**
previous year=100%	295	181	130	131	128
Price indices for products sold by agricultural and other organisations					
1991 =100%	**110,736,386.5**	**173,856,126.7**	**259,045,628.8**	**300,492,929.5**	**381,626,020.4**
previous year=100%	279	157	149	116	127
Terms of trade*					
previous year=100%	0.9	0.9	1.1	0.9	1.0
1991 =100%	0.34	0.30	0.34	0.30	0.30

[1] Data are from *Ceny v Belarusi (2006, pp. 182-185)*

APPENDIX 4.4 FERTILIZERS PER GRAINS RATIO[1]

Fertilizers per wheat ratio (prices in Euro –ECU)

	1991	1995	2000	2001	2002	2003	2004	**2002/1991**
Belgium	1.11	1.26	1.82	2.00	2.10	1.89		**1,90**
Denmark	1.36	1.54	1.62	2.04	1.87	1.70	1.56	**1,38**
France	1.30	1.58	2.09	2.22	2.35			**1,80**
Netherlands	1.39	1.70	2.15	2.33	2.72	2.28	2.50	**1,95**
Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise/ Soft wheat - prices per 100 kg Euro (from 1.1.1999)/ECU (up to 31.12.1998)								

Fertilizers per wheat ratio (prices in National Currency)

	1991	1995	2000	2001	2002	2003	2004	**2002/1991**
Belgium	1.11	1.26	1.82	2.00	2.10	1.89		**1.90**
Denmark	1.36	1.54	1.62	2.04	1.87	1.70	1.56	**1.38**
France	1.30	1.58	2.09	2.22	2.35			**1.80**
Netherlands	1.39	1.70	2.15	2.33	2.72	2.28	2.50	**1.95**
*Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise / Soft wheat - prices per 100 kg / National currency (including 'euro fixed' series for euro area countries***)**								

Fertilizers per rye ratio (prices in Euro –ECU)

	1991	1995	2000	2001	2002	2003	2004	**2002/1991**
Belgium	1.20	1.33	2.19	2.28	2.66	1.94		**2.23**
Denmark	1.45	1.68	1.76	2.37	2.17	2.03	2.06	**1.50**
France	1.43	1.61	2.42	2.58	2.44			**1.71**
Netherlands	1.50	1.75	2.29	2.53	3.05	2.76	3.13	**2.03**
*Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise / Rye - prices per 100 kg /Euro (from 1.1.1999)/ECU (up to 31.12.1998***)**								

Fertilizers per rye ratio (prices in National Currency)

	1991	1995	2000	2001	2002	2003	2004	**2002/1991**
Belgium	1.20	1.33	2.19	2.28	2.66	1.94		**2.23**
Denmark	1.45	1.68	1.76	2.37	2.17	2.03	2.06	**1.50**
France	1.43	1.61	2.42	2.58	2.44			**1.71**
Netherlands	1.50	1.75	2.29	2.53	3.05	2.76	3.13	**2.03**
*Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise / Rye - prices per 100 kg /National currency (including 'euro fixed' series for euro area countries***)**								

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 3, 2013*)*

APPENDIX 4.5 FERTILIZERS PER MILK RATIO[1]

Fertilizers per milk ratio (prices in Euro –ECU)

	1991	1995	2000	2001	2002	2003	2004	**2002/1991**
Belgium	0.70	0.54	0.67	0.69	0.72	0.78		**1.02**
Denmark	0.65	0.64	0.59	0.70	0.57	0.55	0.63	**0.88**
France	0.79	0.74	0.78	0.81	0.82			**1.04**
Netherlands	0.68	0.68	0.72	0.75	0.81	0.86	0.91	**1.20**
Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise / Whole cows' milk for human consumption - prices per 100 litres /Euro (from 1.1.1999)/ECU (up to 31.12.1998)								

Fertilizers per milk ratio (prices in National Currency)

	1991	1995	2000	2001	2002	2003	2004	**2002/1991**
Belgium	0.70	0.54	0.67	0.69	0.72	0.78		**1.02**
Denmark	0.65	0.64	0.59	0.70	0.57	0.55	0.63	**0.88**
France	0.79	0.74	0.78	0.81	0.82			**1.04**
Netherlands	0.68	0.68	0.72	0.75	0.81	0.86	0.91	**1.20**
Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise /Whole cows' milk for human consumption - prices per 100 litres / National currency (including 'euro fixed' series for euro area countries)								

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 3, 2013)

APPENDIX 4.6 FERTILIZERS PER MEAT RATIO[1]

Fertilizers per cow meat ratio (prices in Euro –ECU)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2002/1991**
Belgium	0.18	0.15	0.22	0.25	0.22	0.34	0.25	0.21		**0.73**
Denmark	0.19	0.17	0.18	0.20	0.21	0.29	0.23	0.22	0.23	**0.81**
France	0.17	0.16	0.17	0.18						
Netherlands		0.19	0.23	0.24	0.22	0.39	0.36	0.36	0.31	
Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise / Cows B (2nd quality) - prices per 100 kg live weight /Euro (from 1.1.1999)/ECU (up to 31.12.1998)										

Fertilizers per cow meat ratio (prices in National Currency)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2002/1991**
Belgium	0.18	0.15	0.22	0.25	0.22	0.34	0.25	0.21		**0.73**
Denmark	0.19	0.17	0.18	0.20	0.21	0.29	0.23	0.22	0.23	**0.81**
France	0.17	0.16	0.17	0.18						
Netherlands		0.19	0.23	0.24	0.22	0.39	0.36	0.36	0.31	
*Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise /Cows B (2nd quality) - prices per 100 kg live weight / National currency (including 'euro fixed' series for euro area countries***)**										

Fertilizers per chicken meat (prices in Euro –ECU)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2002/1991**
Belgium	0.22	0.22	0.25	0.32	0.28	0.28	0.32	0.29		**0.71**
Denmark	0.33	0.33	0.31	0.34	0.34	0.38	0.33	0.32	0.34	**1.01**
France	0.29	0.31	0.34	0.37	0.36	0.36	0.37			**0.79**
Netherlands	0.29	0.33	0.35	0.39	0.38	0.36	0.42	0.42	0.42	**0.69**
Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise / Chickens (live; 1st choice) - prices per 100 kg live weight /Euro (from 1.1.1999)/ECU (up to 31.12.1998)										

Fertilizers per chicken meat ratio (prices in National Currency)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2002/1991**
Belgium	0.22	0.22	0.25	0.32	0.28	0.28	0.32	0.29		**0.71**
Denmark	0.33	0.33	0.31	0.34	0.34	0.38	0.33	0.32	0.34	**1.01**
France	0.29	0.31	0.34	0.37	0.36	0.36	0.37			**0.78**
Netherlands	0.29	0.33	0.35	0.39	0.38	0.36	0.42	0.42	0.42	**0.69**
*Ternary fertilizers: 1 - 1 - 1 (in sacks) - prices per 100 kg merchandise /Chickens (live; 1st choice) - prices per 100 kg live weight / National currency (including 'euro fixed' series for euro area countries***)**										

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 3, 2013)

APPENDIX 4.7 DIESEL PER GRAINS RATIO[1]

Diesel oil per wheat ratio (prices in Euro –ECU)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004*/1991**
Belgium	1.14	1.24	1.45	1.70	2.74	2.53	2.56	2.36		**2.08**
Denmark	1.40	1.43	1.94	2.59	3.50	3.22	3.44	3.28	3.33	**2.38**
Germany**	1.72	3.88	4.47	4.73	5.87	6.47	7.16	6.95	7.34	**4.26**
Netherlands	1.70	1.68	2.31	2.64	3.96	4.00	4.40	3.75	4.39	**2.59**
Sweden	2.39	2.78	4.28	4.37	5.88	5.63	5.88	5.72	6.53	**2.74**
UK	1.53	1.45	1.72	2.07	3.21	2.85	3.10	2.89	3.12	**2.04**
** year 2003 for Belgium **Germany (until 1990 former territory of the FRG)*										
Diesel oil - prices per 100 litres /Soft wheat - prices per 100 kg /Euro (from 1.1.1999)/ECU (up to 31.12.1998)										

Diesel oil per wheat ratio (prices in National Currency)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004*/1991**
Belgium	1.14	1.24	1.45	1.70	2.74	2.53	2.56	2.36		**2.08**
Denmark	1.40	1.43	1.94	2.59	3.50	3.22	3.44	3.28	3.33	**2.38**
Germany**	1.72	3.88	4.47	4.73	5.87	6.47	7.16	6.95	7.34	**4.26**
Netherlands	1.70	1.68	2.31	2.64	3.96	4.00	4.40	3.75	4.39	**2.59**
Sweden	2.39	2.78	4.27	4.38	5.88	5.63	5.88	5.72	6.53	**2.74**
UK	1.53	1.45	1.72	2.07	3.21	2.85	3.10	2.89	3.12	**2.04**
** year 2003 for Belgium ** Germany (until 1990 former territory of the FRG)*										
Diesel oil - prices per 100 litres /Soft wheat - prices per 100 kg /National currency (including 'euro fixed' series for euro area countries)										

Diesel oil per rye ratio (prices in Euro –ECU)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004*/1991**
Belgium	1.23	1.32	1.64	1.85	3.30	2.89	3.23	2.42		**1.98**
Denmark	1.49	1.55	2.03	2.72	3.80	3.75	3.99	3.92	4.40	**2.94**
Germany**	1.87	4.39	4.94	5.12	6.48	7.39	8.42	7.86	9.22	**4.93**
Netherlands	1.83	1.73	2.40	2.73	4.22	4.34	4.93	4.54	5.49	**3.00**
Sweden	2.37	2.99	4.48	4.57	6.28	6.17	6.46	6.38	7.32	**3.09**
** year 2003 for Belgium ** Germany (until 1990 former territory of the FRG)*										
Diesel oil - prices per 100 litres / Rye - prices per 100 kg /Euro (from 1.1.1999)/ECU (up to 31.12.1998)										

Diesel oil per rye ratio (prices in National Currency)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004*/1991**
Belgium	1.23	1.31	1.64	1.85	3.30	2.89	3.23	2.42		**1.98**
Denmark	1.49	1.55	2.03	2.72	3.79	3.75	3.99	3.92	4.39	**2.94**
Germany**	1.87	4.39	4.94	5.12	6.48	7.39	8.42	7.86	9.22	**4.93**
Netherlands	1.83	1.73	2.40	2.73	4.22	4.34	4.93	4.54	5.49	**3.00**
Sweden	2.37	2.99	4.48	4.57	6.28	6.17	6.46	6.39	7.32	**3.09**
* year 2003 for Belgium ** Germany (until 1990 former territory of the FRG)										
Diesel oil - prices per 100 litres / Rye - prices per 100 kg /National currency (including 'euro fixed' series for euro area countries)										

[1] Data are from *FAO database.* Available at: www.fao.org (Accessed: December 3, 2013)

APPENDIX 4.8 DIESEL OIL PER MILK RATIO[1]

Diesel oil per milk ratio (prices in Euro –ECU)

	1991	1992	1993	1995	1998	1999	2000	2002	2003	2004	**2004/ 1991***
Belgium	0.72	0.58	0.61	0.53	0.52	0.64	1.01	0.87	0.98		**1.35**
Denmark	0.67	0.59	0.62	0.59	0.66	0.90	1.27	1.05	1.06	1.34	**1.99**
Germany**			0.42	0.83	0.83	0.90	1.10	2.30	2.55	2.50	**6.00**
Netherlands	0.82	0.74	0.74	0.68	0.73	0.92	1.33	1.31	1.41	1.60	**1.94**
Sweden		0.88	0.95	1.06	1.41	1.47	1.89	1.88	1.77	2.16	**2.47**
UK	0.95	0.87	1.01	0.69	0.78	0.95	1.46	1.30	1.38	1.50	**1.58**
*2003 for Belgium; 1993 for Germany; 1992 for Sweden ** Germany (until 1990 former territory of the FRG)											
Diesel oil - prices per 100 litres / Whole cows' milk for human consumption - prices per 100 litres /Euro (from 1.1.1999)/ECU (up to 31.12.1998)											

Diesel oil per milk ratio (prices in National Currency)

	1991	1992	1993	1995	1998	1999	2000	2002	2003	2004	**2004/ 1991***
Belgium	0.72	0.58	0.61	0.53	0.52	0.64	1.01	0.87	0.98		**1.35**
Denmark	0.67	0.59	0.63	0.59	0.66	0.90	1.27	1.05	1.06	1.34	**1.99**
Germany**			0.42	0.83	0.83	0.90	1.10	2.30	2.55	2.50	**6.00**
Netherlands	0.82	0.74	0.74	0.68	0.73	0.92	1.33	1.31	1.41	1.60	**1.94**
Sweden		0.88	0.95	1.06	1.41	1.47	1.89	1.88	1.77	2.16	**2.47**
UK	0.95	0.87	1.01	0.69	0.78	0.95	1.45	1.30	1.38	1.50	**1.58**
*2003 for Belgium; 1993 for Germany; 1992 for Sweden ** Germany (until 1990 former territory of the FRG)											
Diesel oil - prices per 100 litres / Whole cows' milk for human consumption - prices per 100 litres /National currency (including 'euro fixed' series for euro area countries)											

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 3, 2013)

APPENDIX 4.9 DIESEL OIL PER MEAT RATIO[1]

Diesel oil per cow meat ratio (prices in Euro –ECU)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004/1991***
Belgium	0.19	0.15	0.20	0.24	0.33	0.43	0.31	0.27		**1.41**
Denmark	0.19	0.16	0.20	0.30	0.45	0.46	0.43	0.42	0.48	**2.49**
Germany**					0.60	0.90				
Netherlands		0.19	0.24	0.31	0.41	0.67	0.58	0.59	0.55	**2.94**
*2003 for Belgium; 1995 for Netherlands ** Germany (until 1990 former territory of the FRG)										
Diesel oil - prices per 100 litres / Cows B (2nd quality) - prices per 100 kg live weight /Euro (from 1.1.1999)/ECU (up to 31.12.1998)										

Diesel oil per cow meat ratio (prices in National Currency)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004/1991***
Belgium	0.19	0.15	0.20	0.24	0.33	0.43	0.31	0.27		**1.41**
Denmark	0.19	0.16	0.20	0.30	0.45	0.46	0.43	0.42	0.48	**2.49**
Germany**					0.60	0.90				
Netherlands		0.19	0.24	0.31	0.41	0.67	0.58	0.59	0.55	**2.94**
*2003 for Belgium; 1995 for Netherlands ** Germany (until 1990 former territory of the FRG)										
Diesel oil - prices per 100 litres /Cows B (2nd quality) - prices per 100 kg live weight /National currency (including 'euro fixed' series for euro area countries)										

Diesel oil per chicken meat ratio (prices in Euro –ECU)

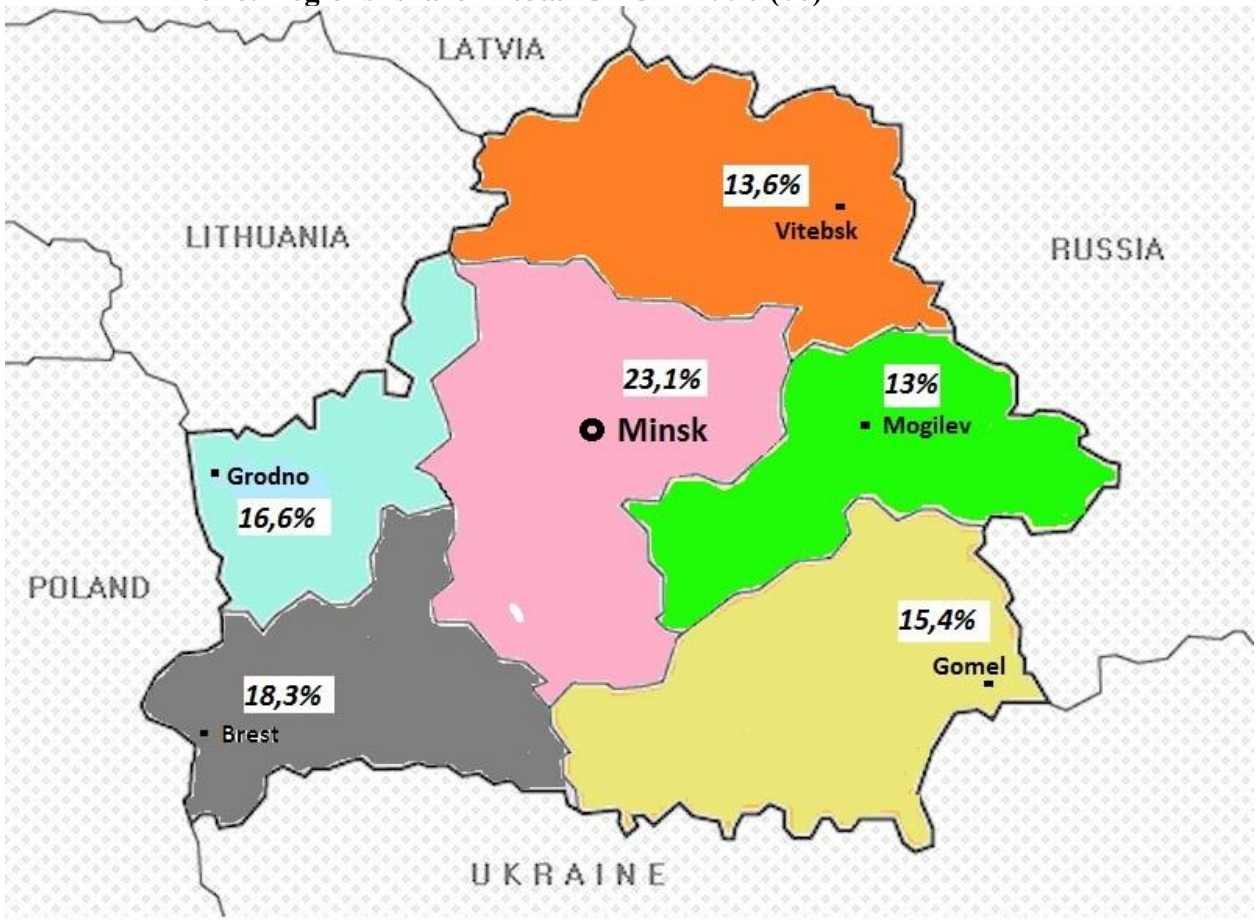
	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004/1991***
Belgium	0.23	0.22	0.22	0.31	0.42	0.35	0.38	0.36		**1.55**
Denmark	0.34	0.31	0.34	0.50	0.73	0.60	0.60	0.62	0.72	**2.12**
Germany**		0.34	0.35	0.40	0.50	0.94	1.01	1.06	1.10	**3.23**
Netherlands	0.35	0.33	0.36	0.50	0.71	0.62	0.68	0.70	0.75	**2.14**
Sweden	0.30	0.43	0.62	0.67	0.86	0.85	0.80	0.86	0.94	**3.13**
*2003 for Belgium; 1995 for Germany ** Germany (until 1990 former territory of the FRG)										
Diesel oil - prices per 100 litres / Chickens (live; 1st choice) - prices per 100 kg live weight /Euro (from 1.1.1999)/ECU (up to 31.12.1998)										

Diesel oil per chicken meat ratio (prices in National Currency)

	1991	1995	1998	1999	2000	2001	2002	2003	2004	**2004/1991***
Belgium	0.23	0.22	0.22	0.31	0.42	0.35	0.38	0.36		**1.55**
Denmark	0.34	0.31	0.34	0.50	0.73	0.60	0.60	0.62	0.72	**2.12**
Germany**		0.34	0.35	0.40	0.50	0.94	1.01	1.06	1.10	**3.23**
Netherlands	0.35	0.33	0.36	0.50	0.71	0.62	0.68	0.70	0.75	**2.14**
Sweden	0.30	0.43	0.62	0.67	0.86	0.85	0.80	0.86	0.94	**3.13**
** Germany (until 1990 former territory of the FRG)										
Diesel oil - prices per 100 litres / Chickens (live; 1st choice) - prices per 100 kg live weight /National currency (including 'euro fixed' series for euro area countries)										

[1] Data are from *FAO database.* Available at: www.fao.org (Accessed: December 3, 2013)

APPENDIX 4. 10. Regions' share in total GAO in 1990 (%)[1]



[1] Data are from *Regions of Belarus Republic (2004)* and *Regions of Belarus Republic (2005)*

APPENDIX 4. 11 Agricultural productivity in Belarus (1990-2010) [1]

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVG 1990-2004	2005	2006	2007	2008	2009	2010
Change of																						
GAO	100	95	90	94	80	77	80	73	73	68	71	72	73	74	84	**80**	83	88	91	99	100	99
land	100	100	100	100	101	102	102	101	101	100	100	95	92	92	91	**98**	91	91	91	91	91	91
labour-1 (economically active population in agriculture)	100	95	99.1	96	90	86	77	75	71	67	63	59	54	50	47	**75**	46	46	45	46	47	47
labour-2 (average salary $)	100	X	7	11	9	27	39	35	34	29	31	35	39	42	58	**30**						
machinery	100	100	118	107	107	99	87	83	73	68	64	58	54	51	48	**81**	47	46	44	44	44	44
fertilizers	100	81	51.6	41	16	19	27	29	29	20	25	23	20	22	34	**36**	40	45	50	61	60	60
Change of the																						
land productivity	100	95	90	95	78	76	78	73	72	67	71	76	79	81	91	**81**	91	96	100	109	109	108
labour productivity -1	100	99	91	98	88	90	103	98	103	101	112	121	134	149	178	**111**	180	192	200	214	214	210
labour productivity -2	100	X	1241	888	899	283	204	211	212	236	228	206	186	176	146	**373**						
machinery productivity	100	95	77	88	74	78	91	88	99	100	112	123	134	145	174	**105**	178	190	204	226	228	227
fertilizers productivity	100	116	175	228	482	415	296	255	254	335	279	314	357	340	247	**280**	211	195	183	162	166	165

[1] Data are from *Fuglie (2012)*

APPENDIX 4.12. Crops' productivity (100kg./ha) [1]

Potatoes	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
total	138	138	117	158	119	132	152	100	114	114	134	123	137	**128.9**	
corporate farms	146	130	105	153	96	113	148	101	127	95	135	100	97	**118.9**	**2**
household plots	132	144	122	159	125	135	152	100	108	116	132	127	142	**130.3**	**1**
individual farms		140	99	142	103	119	130	98	117	113	139	110	110	**118.3**	**3**
Vegetabl.	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
total	188	179	136	166	143	135	138	134	135	133	134	141	157	**147.6**	
corporate farms	209	187	111	166	145	142	144	150	148	134	146	139	123	**149.5**	**1**
household plots	160	175	144	161	143	133	138	130	130	132	131	140	162	**144.5**	**2**
individual farms		158	97	130	127	158	185	131	148	139	145	168	123	**142.4**	**3**
Forage beets	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
total	515	410	273	381	287	294	291	338	309	246	296	303	246	**322.2**	
corporate farms	522	409	267	383	290	297	296	348	317	246	302	303	209	**322.2**	**1**
household plots	459	416	299	366	278	284	276	310	288	246	288	303	296	**316.1**	**2**
individual farms		301	187	291	150	230	198	340	180	170	228	210	164	**220.8**	**3**

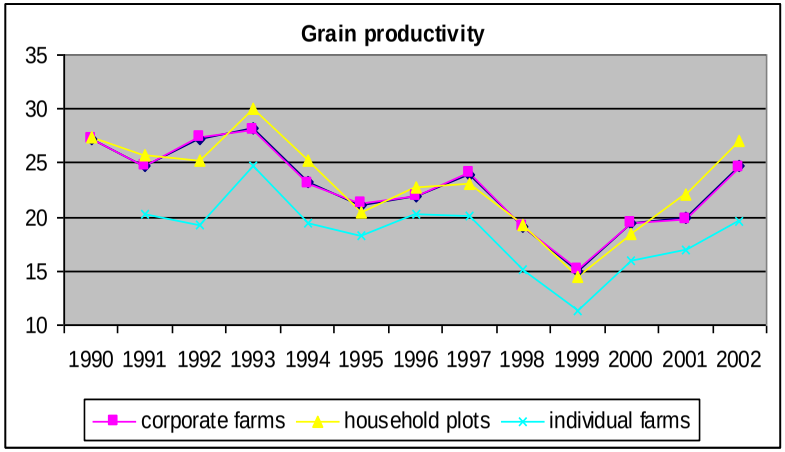
[1] Data are from *Belarusian Agricultural Statistics Yearbook (variuose years)*

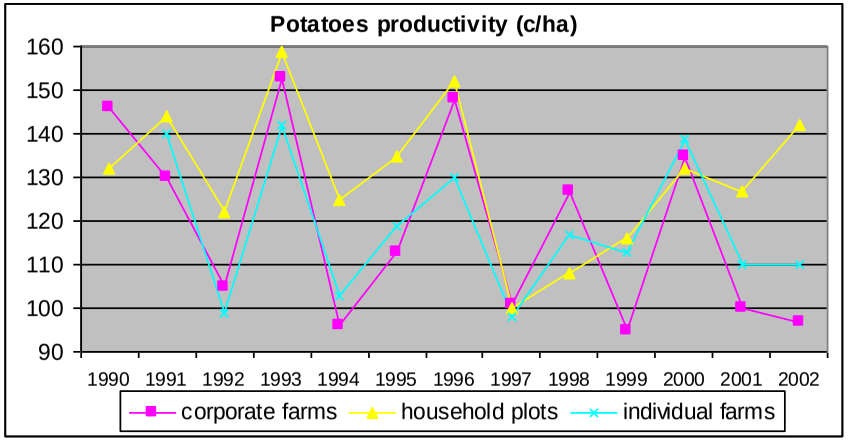
continuation of **APPENDIX 4.12. Crops' productivity growth rates (1990=100%)** [1]

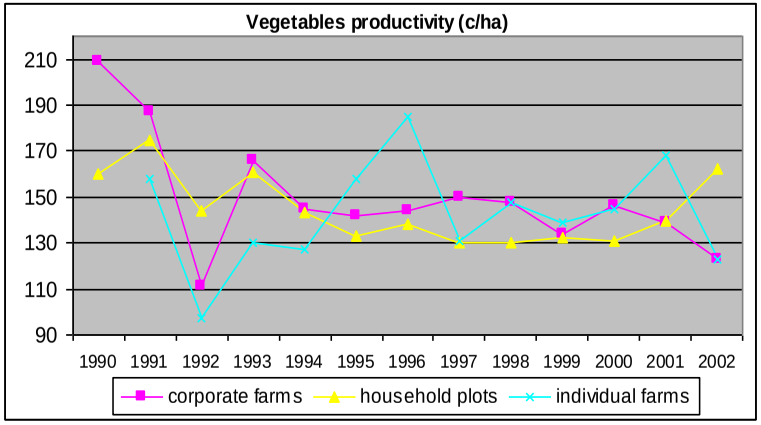
Grain	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**AVG**
total	100	91.2	100	104	85.3	77.6	80.9	87.9	70.2	55.1	71.3	73.2	90.8	**84**
corporate farms	100	90.8	101	103	84.9	77.9	80.5	88.2	70.2	55.5	71.7	72.4	90.4	**84**
household plots	100	93.8	92	110	92	74.8	82.8	84.3	70.4	52.9	67.2	80.7	98.9	**85**
individual farms		100	95.1	122	95.6	90.1	100	99	74.9	55.7	78.3	83.3	96.6	**91**
Potatoes	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**AVG**
total	100	100	84.8	114	86.2	95.7	110	72.5	82.6	82.6	97.1	89.1	99.3	**93**
corporate farms	100	89	71.9	105	65.8	77.4	101	69.2	87	65.1	92.5	68.5	66.4	**81**
household plots	100	109	92.4	120	94.7	102	115	75.8	81.8	87.9	100	96.2	108	**99**
individual farms		100	70.7	101	73.6	85	92.9	70	83.6	80.7	99.3	78.6	78.6	**85**
Vegetables	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**AVG**
total	100	95.2	72.3	88.3	76.1	71.8	73.4	71.3	71.8	70.7	71.3	75	83.5	**79**
corporate farms	100	89.5	53.1	79.4	69.4	67.9	68.9	71.8	70.8	64.1	69.9	66.5	58.9	**72**
household plots	100	109	90	101	89.4	83.1	86.3	81.3	81.3	82.5	81.9	87.5	101	**90**
individual farms		100	61.4	82.3	80.4	100	117	82.9	93.7	88	91.8	106	77.8	**90**
Forage beets	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**AVG**
total	100	79.6	53	74	55.7	57.1	56.5	65.6	60	47.8	57.5	58.8	47.8	**63**
corporate farms	100	78.4	51.1	73.4	55.6	56.9	56.7	66.7	60.7	47.1	57.9	58	40	**62**
household plots	100	90.6	65.1	79.7	60.6	61.9	60.1	67.5	62.7	53.6	62.7	66	64.5	**69**
individual farms		100	62.1	96.7	49.8	76.4	65.8	113	59.8	56.5	75.7	69.8	54.5	**73**

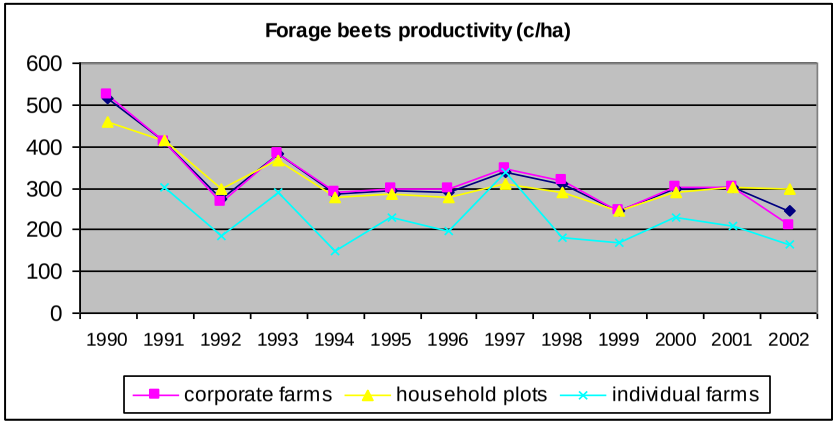
[1] Data are from *Belarusian Agricultural Statistics Yearbook (variuose years)*

APPENDIX 4.13. Crops' productivity









APPENDIX 4.14. Livestock productivity [1]

animal production[2]	**1990**	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
corp. farms	174.73	98.03	90.19	81.97	88.22	88.92	90.03	101.73	**2**
household plots	368.55	152.99	160.55	151.02	151.07	145.23	140.77	181.45	**1**
individual farms	444.44	51.28	45.98	26.11	27.78	46.14	47.66	98.48	**3**
TOTAL	**187.78**	**106.62**	**101.29**	**92.45**	**97.54**	**97.48**	**97.61**	**111.54**	
animal production[3]	**1990**	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
corporate farms	115.83	62.69	59.00	55.73	59.94	60.56	60.47	67.75	**3**
household plots	268.90	111.45	115.91	114.80	113.82	109.44	105.06	134.20	**1**
individual farms	333.33	35.26	29.56	18.28	20.53	32.19	32.28	71.63	**2**
TOTAL	**126.15**	**70.40**	**68.03**	**64.74**	**68.10**	**68.11**	**67.26**	**76.11**	
Milk production [4]	**1990**	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
corporate farms	647.46	394.94	396.72	346.86	385.46	401.46	410.35	426.18	**2**
household plots	2856.69	1318.91	1371.66	1239.58	1288.54	1198.98	1108.97	1483.33	**1**
individual farms	666.67	128.21	123.15	78.33	95.41	159.87	217.52	209.88	**3**
TOTAL	**796.52**	**543.30**	**552.51**	**486.06**	**633.68**	**526.90**	**520.63**	**579.94**	
Eggs production[5]	**1990**	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
corporate farms	257.22	253.97	275.48	267.49	246.55	221.89	213.54	248.02	**2**
household plots	2233.47	917.30	878.02	833.68	862.25	863.10	844.61	1061.78	**1**
individual farms	277.78	208.33	192.12	120.10	27.78	23.61	19.22	124.13	**3**
TOTAL	**390.62**	**361.45**	**372.32**	**355.94**	**341.50**	**322.67**	**312.96**	**351.07**	
Wool production[6]	**1990**	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**#**
corporate farms	73.33	14.19	4.40	1.30	1.17	1.33	1.21	13.85	**3**
household plots	498.26	186.63	155.22	118.90	104.85	97.74	85.83	178.20	**2**
individual farms	1666.67	48.08	16.42	13.05	24.15	21.46	15.37	257.89	**1**
TOTAL	**102.33**	**42.44**	**28.85**	**19.92**	**17.70**	**17.00**	**15.12**	**34.76**	

to be continued on the next page

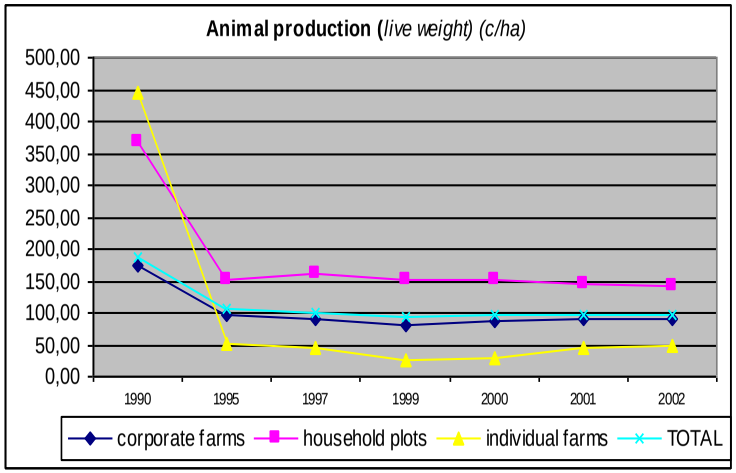
[1]Data are from *Belarusian Agricultural Statistics Yearbook (variuose years)*
[2] Animal production (*live weight (kg/ha)*
[3] Animal production (*slaughtering weight (kg/ha*)
[4] Milk production (*kg/ha)*
[5] Eggs production (*th.pcs/ha)*
[6] Wool production (*unscoured, kg/ha)*

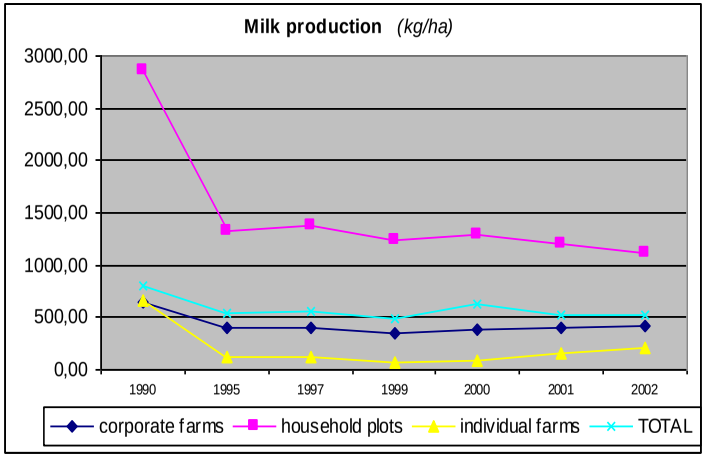
continuation of **APPENDIX 4.14. Livestock productivity growth rates (1995=100%)**[1]

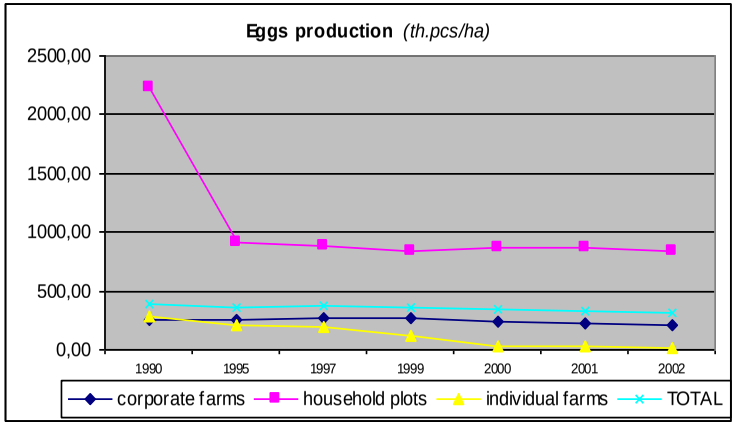
animal production (live weight (kg/ha)	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**rating**
corporate farms	100	92.0	83.6	90.0	90.7	91.8	**91.4**	**2**
household plots	100	104.9	98.7	98.7	94.9	92.0	**98.2**	**1**
individual farms	100	89.7	50.9	54.2	90.0	92.9	**79.6**	**3**
TOTAL	100	95.0	86.7	91.5	91.4	91.5	**92.7**	
animal production (slaughtering weight (kg/ha)	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**rating**
corporate farms	100	94.1	88.9	95.6	96.6	96.5	**95.3**	**2**
household plots	100	104.0	103.0	102.1	98.2	94.3	**100.3**	**1**
individual farms	100	83.8	51.8	58.2	91.3	91.6	**79.5**	**3**
TOTAL	100	96.6	91.9	96.7	96.7	95.5	**96.3**	
Milk production (kg/ha)	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**rating**
corporate farms	100	100.4	87.8	97.6	101.6	103.9	**98.6**	**2**
household plots	100	104.0	94.0	97.7	90.9	84.1	**95.1**	**3**
individual farms	100	96.1	61.1	74.4	124.7	169.7	**104.3**	**1**
TOTAL	100	101.7	89.5	116.6	97.0	95.8	**100.1**	
Eggs production (th.pcs/ha)	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**rating**
corporate farms	100	108.5	105.3	97.1	87.4	84.1	**97.1**	**1**
household plots	100	95.7	90.9	94.0	94.1	92.1	**94.5**	**2**
individual farms	100	92.2	57.7	13.3	11.3	9.2	**47.3**	**3**
TOTAL	100	103.0	98.5	94.5	89.3	86.6	**95.3**	
Wool production (unscoured). kg/ga	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**AVG**	**rating**
corporate farms	100	31.0	9.2	8.3	9.4	8.6	**27.7**	**3**
household plots	100	83.2	63.7	56.2	52.4	46.0	**66.9**	**1**
individual farms	100	34.2	27.2	50.2	44.6	32.0	**48.0**	**2**
TOTAL	100	68.0	46.9	41.7	40.1	35.6	**55.4**	

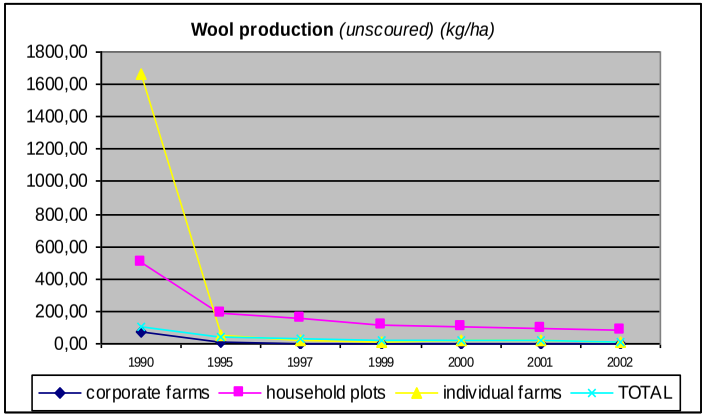
[1] Data are from *Belarusian Agricultural Statistics Yearbook (variuose years)*

APPENDIX 4.15. Livestock productivity









APPENDIX 4. 16

		main issues	methods	time period	countries	objects	variables	variables specifications
1	**Lerman and Grazdaninova (2005)**	allocative efficiency	**VMP** method (value of marginal product estimation)	2003	Russia districts- Rostov. Ivanovo. Novgorod. Leningrad	corporate farms	**land**	agricultural land (ha)
		technical efficiency	**SFA** (stochastic frontier analysis) **DEA** (data envelopment analysis)					land used in agriculture (ha)
							output	gross output
							livestock output	livestock production
							crop output	crop output
							output	separate output for each selected commodity (grain. beef. sunflower. milk and pork)
							labor	total number of workers (people)
							fertilizers	fertilizers used (tones)
							fuel	gasoline (purchased) (tones)
								diesel fuel (purchased) (tones)
							machinery	tractors (pieces)
								grain harvesters (pieces)
								trucks (pieces)
							finance	equity (mln.rubles)
								debt (mln.rubles)
2	**Lerman and Schreinemachers (2002)**	productivity	DEA (data envelopment analysis)	1997	Poland	individual farms	**labor**	labour intensivity
		labour	regression	1999	Russia			size of rural population
		technical efficiency	**SFA** (stochastic frontier analysis)					total labour
		individual farming						labour productivity
		regions					**agricultural output**	
							land	individual farming in land
								total farmland in region
							livestock	livestock herd

3	**Macours and Swinnen (2002)**	initial conditions	regression	1989-94	CEE	countries	**GAO**	GAO 5 years after the start of the reforms relative to the pre-reform output level
		reforms policies		1990-95	FSU	sub-regions (CEE. FSU. Asia)	**terms of trade index**	producer prices/input prices
		output		1978-83; 1981-86; 1986-91; 1989-94; 1990-95	Asia		**prices**	commodity prices
		labour						input prices
		productivity					**land**	share of total ag. land used by individual farms
		liberalization of price and trade						LANDREFORM land reforms progress
		land reform						LANDPRIV land reforms proceeded indicator
		farm restructuring					**labor**	average agricultural labour productivity 5 years after the start of the reforms relatively to the pre-reform value (GAO over the number of persons employed in agriculture)
								AGEMP (share of agriculture in total employment)
							liberalization index	LIB
4	**Macours and Swinnen (2000b)**	initial conditions	regression	1989-94	CEE	countries	**GAO**	GAO - dependant variable
		agricultural performance		1990-95	FSU	sub-regions (CEE. FSU. Asia)	**labor**	ALP -agricultural labour productivity change - dependant variable
				1978-83; 1981-86; 1986-91; 1989-94; 1990-95	Asia		**GNP**	GNP per capita
							labor	share of agriculture in employment
								labour intensivity (labor to land ratio)
							CMEA	share of CMEA export in GDP
							land	legal land ownership (dummy)

5	**Macours and Swinnen (2000a)**	output	Cobb-Douglas production function	1989-1995	Albania	countries	**GAO**	crop output (total annual value of five crops-wheat. maize. barley. sugar beet. oilseeds
		land privatization	TFP		Bulgaria		**land**	total number of hectares used for the crops included in the analysis
		farm restructuring			Czech Republic		**labor**	number of workers in crop production
					Hungary		**capital**	total amount of tractor horsepower in use
					Poland		**fertilizers**	chemical fertilizer in tons pure nutrient
					Romania		**weather**	rainfall in year T during the crucial month for crop production
					Slovenia		**individualization (IND)**	increase in the share of total agricultural land used by individual farms. i.e.. family farms
					Slovakia		**transition disruption (DISR)**	the share of agricultural land that has been involved on restructuring to individual farms if the year of observation or the year before
							privatization (PRIV)	the change in the share of privately owned land
							uncertainty (UNC)	dummy -during the year of major policy changes it takes the value 1. and in the other years it takes the value 0)
							relative price changes (PP/IP)	the ratio of producer prices to input prices
6	**Mathijs and Swinnen (2001)**	parametric measures of technical efficiency	Cobb-Duglas production function	1991-1992	East Germany	family farms	**output**	production value in German marks (DM) deflated by the consumer price index
		non-parametric measure of pure technical efficiency	**DEA** (data envelopment analysis)	1994-1995		partnerships	**crop**	
		non-parametric measure of scale efficiency	Tobit regression on non-parametric efficiency measures			LSO (not liquidated former collective and state farms)	**livestock**	
		non-parametric measure of total technical efficiency					**land**	cultivated land in ha
							labor	number of annual work units
							capital	sum of the value of buildings. machinery. and livestock in DM deflated by the consumer price

								index
7	**Osborne and Trueblood (2006)**	EE.TE and AE explanation	Cobb-Duglas production function	1993-1998	Russia	corporate farms from 40 oblasts	**output**	value of crop output in real 1983 rouble
		efficiency results	parametric approach				**land**	thousands of ha of cropland sown under crops. adjusted for quality
		labour AE efficiency distortions	SFA method				**labor**	Man-days used in crop production
		land AE efficiency distortions					**fertilizer**	both (fertilizer and fuels) were measured on thousands of tons. estimated by dividing total expenditures on fertilizer and fuels by their average prices
		fuel AE efficiency distortions					**fuels**	
		tractor AE efficiency distortions					**machinery**	calculated as the product of total available horsepower and average annual depreciation rates to represent tractors "consumed" in production
17	**Kim and An (2007)**	DEA model	**DEA** (data envelopment analysis)	1992-2003	countries (28 countries totally) grouped in sub-regions		**output**	agricultural GDP at 1990 constant prices
		technical efficiency	frontier approach		CEE	CEE (11 countries)	**labor**	economically active population in agriculture
		productivity changes	Tobit model		FSU	FSU (11 countries)	**land**	total agricultural land including arable land. permanently cropped and permanent pasture
		agricultural and general reforms			Asia	Asia (6 countries)	**capital**	tractor equivalent- total agricultural machinery as a proxy

APPENDIX 4.17. Belarus pooled regression results

Dependent Variable: GAO?
Method: Pooled EGLS (Cross-section SUR)
Sample: 1990 2004
Included observations: 10
Cross-sections included: 6
Total pool (balanced) observations: 60
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LAND_TOT?	0.204884	0.040682	5.036257	0.0000
LAB?	0.293315	0.024957	11.75280	0.0000
CAP?	0.495837	0.033652	14.73432	0.0000
_BR--TREND_BR	0.018915	0.002748	6.883044	0.0000
_GOM--TREND_GOM	0.017840	0.003004	5.938213	0.0000
_GR--TREND_GR	0.022107	0.002684	8.236817	0.0000
_MIN--TREND_MIN	0.019772	0.002882	6.859622	0.0000
_MOG--TREND_MOG	0.029730	0.002869	10.36240	0.0000
_VIT--TREND_VIT	0.031148	0.002626	11.86216	0.0000

Weighted Statistics

R-squared	0.919699	Mean dependent var	36.56144
Adjusted R-squared	0.907103	S.D. dependent var	51.47037
S.E. of regression	1.067637	Sum squared resid	58.13232
Durbin-Watson stat	2.037849		

Unweighted Statistics

R-squared	0.859166	Mean dependent var	4.324119
Sum squared resid	0.157029	Durbin-Watson stat	0.673230

Wald Test:

Test Statistic	Value	df	Probability
t-statistic	-0.981008	51	0.3312
F-statistic	0.962377	(1. 51)	0.3312
Chi-square	0.962377	1	0.3266

Null Hypothesis: C(1)+C(2)+C(3)=1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(1) + C(2) + C(3)	-0.005964	0.006079

Restrictions are linear in coefficients

to be continued on the next page…

Continuation of **APPENDIX 4.17.**

Accounting statistics for Mogilev region

	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND_TOT?	0.204884	-0.015353	0	0.18
LAB?	0.293315	0.056457	0.02	-0.95
CAP?	0.495837	-0.064242	-0.03	**1.83**
trend_MOG	0.02973		0.02973	-1.71
total GAO change		**-0.017369**	**-0.017369**	**-0.65**

Accounting statistics for Minsk region

	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND_TOT?	0.204884	-0.00531	-0.0011	0.12
LAB?	0.293315	0.037651	0.01	-1.19
CAP?	0.495837	-0.03784	-0.02	**2.02**
trend_MIN	0.019772		0.019772	-2.13
total GAO change		**-0.00929**	**-0.00929**	**-1.18**

Accounting statistics for Grodno region

	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C (A*B)***	***D***
LAND_TOT?	0.204884	-0.007877	0	0.13
LAB?	0.293315	-0.023212	-0.01	0.54
CAP?	0.495837	-0.030488	-0.02	1.19
trend_GR	0.022107		0.022107	-1.75
total GAO change		**-0.012662**	**-0.01266**	**0.11**

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Continuation of **APPENDIX 4.17.**

Accounting statistics for Gomel region

	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***b***	***C (A*B)***	***D***
LAND_TOT?	0.204884	-0.010097	0	0.08
LAB?	0.293315	-0.038518	-0.01	0.43
CAP?	0.495837	-0.048745	-0.02	**0.92**
trend_GOM	0.01784		0.01784	-0.68
total GAO change		**-0.026306**	**-0.02631**	**0.75**

Accounting statistics for Vitebsk region

	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***b***	***C (A*B)***	***D***
LAND_TOT?	0.204884	-0.018295	0	0.21
LAB?	0.293315	0.061184	0.02	-1.02
CAP?	0.495837	-0.056206	-0.03	**1.58**
trend_VIT	0.031148		0.031148	-1.77
total GAO change		**-0.01765**	**-0.01765**	**-0.99**

Accounting statistics for Brest region

	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***b***	***C (A*B)***	***D***
LAND_TOT?	0.204884	-0.006057	0	0.08
LAB?	0.293315	-0.021246	-0.01	0.4
CAP?	0.495837	-0.054227	-0.03	**1.72**
trend_BR	0.018915		0.018915	-1.21
total GAO change		**-0.015615**	**-0.015615**	**0.99**

APPENDIX 5.1. Gross Agricultral Production [1]

Table 1. Gross Production Index Number (2004-2006 = 100) - Agriculture (PIN) + (Total)

Advanced Western countries and USSR												
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**	
Denmark	**100**	96	113	134	14	130	139	134	138	14332	149	
Finland	**100**	111	120	124	112	105	108	110	108	112	112	d
France	**100**	122	140	146	145	153	145	144	147	155	155	
Germany	**100**	123	133	139	129	121	120	116	119	129	134	d
Ireland	**100**	111	160	181	183	185	185	181	184	194	190	
Italy	**100**	119	139	125	139	140	135	135	133	140	145	
Netherlands	**100**	136	186	220	217	234	231	226	228	226	220	
Portugal	**100**	115	107	136	142	126	122	126	134	138	143	
Spain	**100**	127	183	214	205	211	202	194	179	257	267	
Sweden	**100**	96	109	114	98	94	106	101	102	106	106	d
Switzerland	**100**	110	125	130	128	134	129	123	125	124	123	d
United Kingdom	**100**	117	139	149	150	152	148	148	149	144	139	d
CEEC and FSU countries												
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**	
Belarus						**100**	104	88	85	78	92	
Czech Republic							**100**	86	88	84	89	
Hungary	**100**	119	174	174	175	137	122	128	125	127	153	
Poland	**100**	116	107	132	122	106	119	99	107	105	108	
Russian Federation						**100**	95	83	78	68	76	
Slovakia							**100**	95	91	73	82	
Ukraine						**100**	100	85	83	68	80	

[1] Data are from *FAO database*. Available at: www.fao.org (Accessed: December 10, 2013)

APPENDIX 5.2. Agriciltural land [1]

Table 1. Agricultural area (1961= 100%)

Advanced Western countries and USSR											
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**
Denmark	**100**	94	92	88	88	87	87	85	86	84	84
Finland	**100**	98	91	86	87	87	86	87	81	80	81
France	**100**	94	92	89	88	88	87	87	87	86	86
Germany	**100**	98	96	93	88	87	89	89	90	88	88
Ireland	**100**	100	102	100	79	78	78	78	78	78	76
Italy	**100**	98	85	81	78	77	77	76	74	76	72
Netherlands	**100**	95	87	87	86	86	86	85	85	85	84
Portugal	**100**	101	103	102	101	100	102	102	101	99	99
Spain	**100**	97	94	92	91	91	90	91	89	90	87
Sweden	**100**	89	87	81	79	79	79	79	77	74	75
Switzerland	**100**	100	93	73	73	73	73	73	73	71	70
UK	**100**	95	93	92	92	91	89	88	88	86	86
USSR	**100**	101	102	103	103						
CEEC and FSU countries											
Belarus						**100**	100	100	99	99	95
Czech Rep.							**100**	100	100	100	100
Hungary	**100**	97	94	91	91	87	87	86	87	83	83
Poland	**100**	96	94	92	92	92	92	92	92	91	80
Russian Fed.						**100**	99	98	98	98	97
Slovakia							**100**	100	100	100	79
Ukraine						**100**	100	100	100	99	99

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[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 10, 2013)

Continuation of **APPENDIX 5.2.** [1]

Table 2. Arable land (1961= 100%)

Advanced Western countries and USSR											
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**
Denmark	**100**	95	94	91	91	90	90	84	83	81	81
Finland	**100**	96	89	85	86	85	85	86	80	82	83
France	**100**	89	89	92	92	92	93	93	93	94	94
Germany	**100**	98	98	98	95	94	96	97	97	97	97
Ireland	**100**	87	70	65	65	63	64	64	65	68	76
Italy	**100**	93	74	70	69	68	66	65	64	66	62
Netherlands	**100**	83	80	89	89	89	89	89	89	92	114
Portugal	**100**	99	97	93	92	91	89	88	86	65	61
Spain	**100**	97	96	94	94	94	92	91	86	82	80
Sweden	**100**	86	84	80	79	78	78	78	78	76	75
Switzerland	**100**	90	95	100	100	100	100	100	103	101	100
UK	**100**	99	96	92	92	91	85	82	83	82	81
USSR	**100**	97	96	95	95						
CEEC and FSU countries											
Belarus						**100**	100	102	102	101	91
Czech Republic							**100**	100	99	97	97
Hungary	**100**	100	97	97	97	91	91	91	93	89	89
Poland	**100**	95	92	90	90	90	90	90	89	88	79
Russian Fed.						**100**	98	97	97	94	93
Slovakia							**100**	100	100	98	89
Ukraine						**100**	100	100	100	98	97

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 10, 2013)

APPENDIX 5.3. Agriciltural labor [1]

Table 1. Agricultural population (1961= 100%)

Advanced Western countries and USSR									
	1980	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**
Denmark	**100**	81	78	75	72	70	68	57	49
Finland	**100**	73	70	68	65	63	61	50	42
France	**100**	70	67	64	61	58	56	44	37
Germany	**100**	58	56	54	52	50	48	38	32
Ireland	**100**	77	75	72	69	67	65	57	53
Italy	**100**	69	66	63	60	57	54	43	36
Netherlands	**100**	87	84	82	80	79	77	68	61
Portugal	**100**	70	68	66	64	63	61	53	47
Spain	**100**	67	64	61	58	56	53	43	37
Sweden	**100**	75	73	71	69	67	65	55	49
Switzerland	**100**	95	92	91	89	88	86	78	72
UK	**100**	84	83	81	80	79	77	71	67
USSR	**100**	94	92						
CEEC and FSU countries									
	1980	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**
Belarus				**100**	96	92	89	71	59
Czech Rep.					**100**	97	94	80	71
Hungary	**100**	80	77	74	72	70	68	56	48
Poland	**100**	98	96	94	92	90	88	77	70
Russian Fed.				**100**	98	95	93	80	71
Slovakia					**100**	98	96	84	75
Ukraine				**100**	97	93	90	74	62

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[1] Data are from *FAO database.* Available at: www.fao.org *(*Accessed: December 10, 2013*)*

continuation of **APPENDIX 5.3.** [1]

Table 2. Rural population (1961= 100%)

Advanced Western countries and USSR											
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**
Denmark	**100**	85	71	66	66	66	66	66	67	67	66
Finland	**100**	86	69	53	52	51	51	50	50	47	44
France	**100**	86	84	86	86	86	85	85	85	80	68
Germany	**100**	104	102	102	102	103	103	104	105	106	106
Ireland	**100**	94	101	100	100	100	100	100	100	102	107
Italy	**100**	95	94	94	94	94	94	94	94	93	95
Netherlands	**100**	107	107	101	99	97	95	93	91	79	72
Portugal	**100**	92	97	90	89	88	87	87	86	82	78
Spain	**100**	88	78	73	73	73	73	73	73	73	77
Sweden	**100**	76	70	72	72	72	72	71	71	71	71
Switzerland	**100**	100	103	68	67	67	68	70	71	73	75
UK	**100**	112	106	110	110	110	110	110	110	110	111
USSR	**100**	96	91	91	91						
CEEC and FSU countries											
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2004**
Belarus						**100**	99	98	97	89	82
Czech Rep							**100**	101	101	103	104
Hungary	**100**	94	88	81	81	81	82	82	82	83	79
Poland	**100**	103	98	97	97	97	97	97	97	97	97
Russian Fed.						**100**	100	100	100	99	99
Slovakia							**100**	100	101	102	104
Ukraine						**100**	100	100	99	94	90

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 10, 2013)

APPENDIX 5.4. Agriciltural tractors [1]

Table 1. Tractors Agric. Total -In Use (1961= 100%)

Advanced Western countries and USSR											
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2003**
Denmark	**100**	136	147	126	124	120	120	114	117	96	95
Finland	**100**	188	258	296	284	284	282	279	237	236	236
France	**100**	165	198	194	190	187	183	179	176	170	170
Ireland	**100**	185	319	371	376	378	380	384	388	361	341
Italy	**100**	225	393	524	534	525	537	548	559	603	616
Netherlands	**100**	218	287	294	294	290	287	284	278	241	241
Portugal	**100**	300	791	1 228	1 223	1 219	1 364	1 377	1 396	1 572	1 572
Spain	**100**	366	737	1 042	1 063	1 078	1 091	1 111	1 133	1 266	1 328
Sweden	**100**	121	122	115	113	114	115	116	116	111	111
Switzerland	**100**	135	175	210	211	211	211	211	211	203	200
United Kingdom	**100**	97	112	110	109	109	109	109	109	109	109
USSR	**100**	163	218	215	213						
CEEC and FSU countries											
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2003**
Belarus						**100**	98	100	92	58	47
Czech Rep.							**100**	100	133	149	142
Hungary	**100**	154	126	112	208	208	209	209	209	256	257
Poland	**100**	314	865	1 656	1 647	1 638	1 614	1 831	1 843	1 826	1 916
Russian Fed.						**100**	96	89	82	58	45
Slovakia							**100**	106	90	76	73
Ukraine						**100**	100	98	92	62	76

[1] Data are from *FAO database.* Available at: www.fao.org *(*Accessed: December 10, 2013*)*

APPENDIX 5.5. Agriciltural tractors per agricultural land [1]

Table 1. Number of tractors per agricultural area

Advanced Western countries and USSR												
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2003**	
Denmark	40.8	58.7	65.2	58.3	57.9	56.3	56.5	54.5	55.4	46.6	46.3	*d*
Finland	29.7	56.9	83.6	101.8	96.5	97.3	97.3	95.4	86.2	87.5	86.4	*d*
France	21.5	37.9	46.5	47.1	46.3	45.8	45.0	44.2	43.6	42.6	42.6	*d*
Germany	53.1	79.1	87.1	86.9	87.5	78.0	75.7	72.9	70.1	58.0	55.5	*d*
Ireland	8.1	14.9	25.3	29.9	38.5	39.0	39.3	39.7	40.2	37.2	35.5	
Italy	13.2	30.5	61.1	84.9	90.7	89.6	92.0	95.2	99.5	105.3	112.7	
Netherlands	26.8	61.7	88.1	90.8	91.4	90.6	89.5	89.3	87.9	76.4	77.7	*d*
Portugal	2.8	8.2	21.4	33.3	33.5	33.8	37.0	37.4	38.2	44.1	44.3	
Spain	2.1	8.1	16.8	24.3	24.9	25.3	25.8	26.2	27.1	30.2	32.4	
Sweden	35.0	48.0	48.9	50.1	49.8	50.5	50.7	51.1	52.8	52.3	52.2	
Switzerland	24.9	33.6	46.9	71.6	72.0	72.1	72.1	72.1	72.1	71.6	70.7	*d*
UK	23.2	23.7	27.7	27.7	27.6	27.7	28.5	28.7	28.8	29.5	29.5	
USSR	2.2	3.6	4.8	4.7	4.6							
CEEC and FSU countries												
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2003**	
Belarus						13	13	13	12	8	7	*d*
Czech Rep.							15	15	20	23	21	
Hungary	6	10	8	8	14	15	15	15	15	19	19	
Poland	4	11	33	63	63	63	62	70	71	71	**85**	
Russian Fed.						6	6	5	5	3	3	*d*
Slovakia							13	13	11	10	10	*d*
Ukraine						12	12	12	11	8	9	*d*

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[1] Data are from *FAO database.* Available at: www.fao.org *(*Accessed: December 10, 2013*)*

Continuation of **APPENDIX 5.5.** [1]

Table 2 . Number of tractors per arable land

Advanced Western countries and USSR												
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2003**	*d*
Denmark	45.9	65.6	71.8	63.5	62.9	61.1	61.1	62.0	65.1	54.0	**54.3**	*d*
Finland	30.8	60.2	89.5	107.5	101.9	102.6	102.1	100.2	91.1	88.9	87.8	*d*
France	37.9	70.6	84.3	80.0	78.2	77.0	74.5	72.6	71.6	68.5	68.5	*d*
Germany	84.1	125.9	134.1	130.9	129.8	115.3	111.3	106.9	102.7	83.8	79.8	*d*
Ireland	28.6	61.3	131.0	162.3	166.2	171.5	169.1	172.1	171.4	152.6	131.1	
Italy	21.2	51.3	113.1	158.7	163.6	163.6	171.3	179.4	184.2	194.1	211.1	
Netherlands	62.5	164.2	225.3	207.3	206.6	202.9	200.7	198.9	195.7	164.3	165.0	
Portugal	4.3	13.0	35.1	56.3	56.9	57.6	65.4	67.3	69.7	103.6	110.3	
Spain	4.4	16.6	33.7	48.3	49.5	50.4	51.7	53.3	57.4	67.1	72.5	
Sweden	41.8	59.0	60.8	60.2	60.0	61.1	61.2	61.8	62.4	61.0	61.9	
Switzerland	131.7	198.9	242.2	275.3	276.7	278.0	278.0	278.0	269.5	265.4	265.6	*d*
UK	64.0	62.9	74.1	76.3	76.1	76.3	82.1	84.6	84.2	85.1	88.4	
USSR	5.1	8.7	11.7	11.6	11.5							
CEEC and FSU countries												
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2003**	
Belarus						21	20	20	19	12	11	
Czech Rep.							19	20	26	30	28	
Hungary	9	13	11	10	18	19	19	19	19	25	25	
Poland	4	15	42	82	82	82	81	92	93	93	109	
Russian Fed.						10	10	9	8	6	5	
Slovakia							20	21	18	15	16	
Ukraine						15	15	15	14	10	12	

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 10, 2013)

APPENDIX 5.6. Fertilizers consumption[1]

Table 1. Total Fertilizers Consumption (1961= 100%)

Advanced Western countries and USSR													
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2001**	**2002**	
Denmark	**100**	139	146	148	135	118	113	109	102	81	72	69	*d*
Finland	**100**	201	202	183	140	143	141	147	141	124	123	121	*d*
France	**100**	192	231	235	230	187	190	194	203	171	172	164	*d*
Germany	**100**	145	158	102	91	87	82	89	86	84	80	79	*d*
Ireland	**100**	209	297	342	328	330	353	371	369	296	291	290	*d*
Italy	**100**	153	242	223	228	220	218	217	209	199	161	164	*d*
Netherlands	**100**	138	144	119	119	116	110	114	114	89	88	71	*d*
Portugal	**100**	93	187	201	187	175	181	179	177	158	151	150	*d*
Spain	**100**	167	228	271	258	216	249	264	256	294	301	296	
Sweden	**100**	166	160	108	96	104	109	107	97	93	88	88	*d*
Switzerland	**100**	138	170	158	149	143	142	136	127	84	92	87	*d*
UK	**100**	135	147	170	155	143	148	158	156	126	133	129	*d*
USSR	**100**	381	692	798	718								
CEEC and FSU countries													
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2001**	**2002**	
Belarus						**100**	54	39	37	58	54	54	*d*
Czech Republic							**100**	110	114	108	129	120	
Hungary	**100**	389	650	316	152	88	136	146	171	194	211	233	
Poland	**100**	288	392	173	126	134	144	160	169	177	176	169	
Russian Federation						**100**	70	27	32	26	29	27	*d*
Slovakia							**100**	103	112	123	122	129	
Ukraine						**100**	50	42	33	16	18	22	*d*

[1] Data are from *FAO database.* Available at: www.fao.org *(*Accessed: December 10, 2013*)*

APPENDIX 5.7. Fertilizers consumption [1]

Table 1. Fertilizers per Arable land (tonnes per ha)

Advanced Western countries and USSR											
	1961	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**2000**	**2002**
Denmark	153	225	238	247	228	200	191	197	189	153	130
Finland	90	189	206	195	148	151	150	155	159	137	133
France	124	267	321	316	309	251	252	257	268	225	215
Germany	268	399	430	280	257	248	229	246	238	232	220
Ireland	127	307	542	665	646	666	700	742	726	557	499
Italy	68	112	223	216	223	220	223	227	220	204	173
Netherlands	474	788	860	638	637	615	585	603	607	459	367
Portugal	55	52	107	119	112	106	112	113	113	134	128
Spain	45	78	107	129	123	104	121	130	133	160	167
Sweden	85	165	163	116	105	114	119	116	106	105	100
Switzerland	260	402	463	409	386	371	368	354	319	215	227
UK	195	267	297	361	331	306	341	375	369	300	311
USSR	12	45	83	96	87						
CEEC and FSU countries											
	1961	1970	1980	1990	1991	1992	1993	1994	1995	2000	2002
Belarus						229	123	87	84	131	**133**
Czech Republic							92	102	105	102	114
Hungary	41	161	278	135	65	40	62	66	77	91	109
Poland	56	170	239	107	78	83	90	100	106	113	**116**
Russian Federation						42	30	12	14	11	12
Slovakia							62	63	69	77	88
Ukraine						81	40	34	27	14	18

[1] Data are from *FAO database.* Available at: *www.fao.org* (Accessed: December 10, 2013)

APPENDIX 5.8. Advanced Western countries pooled regression

Dependent Variable: GGAO?
Method: Pooled EGLS (Cross-section SUR)
Sample (adjusted): 1990 2002
Included observations: 13 after adjustments
Cross-sections included: 12
Total pool (balanced) observations: 156
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	**-0.519028**	**0.452774**	**-1.146328**	**0.2536**
LAND_AR?	0.127869	0.021918	5.833985	0.0000
LAB_RUR?	0.404674	0.083016	4.874639	0.0000
CAP?	0.580197	0.023792	24.38584	0.0000
_DEN--TREND_DEN	0.033185	0.001030	32.22704	0.0000
_FIN--TREND_FIN	0.017454	0.001976	8.832768	0.0000
_FRAN--TREND_FRAN	0.019704	0.001293	15.23627	0.0000
_GER--TREND_GER	0.010836	0.001621	6.683269	0.0000
_IRL--TREND_IRL	0.011126	0.001139	9.769769	0.0000
_ITAL--TREND_ITAL	0.006924	0.000885	7.822418	0.0000
_NETH--TREND_NETH	0.024818	0.002407	10.31054	0.0000
_PORT--TREND_PORT	0.017457	0.002223	7.851751	0.0000
_SPA--TREND_SPA	0.010544	0.002392	4.407578	0.0000
_SWD--TREND_SWD	**0.003193**	**0.001486**	**2.148583**	**0.0334**
_SWZ--TREND_SWZ	0.003955	0.001117	3.541668	0.0005
_UK--TREND_UK	0.006972	0.001453	4.798994	0.0000

Weighted Statistics

R-squared	0.980034	Mean dependent var	303.2183
Adjusted R-squared	0.977894	S.D. dependent var	399.2373
S.E. of regression	1.047663	Sum squared resid	153.6637
F-statistic	458.1167	Durbin-Watson stat	2.169244
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.793167	Mean dependent var	4.619130
Sum squared resid	0.233628	Durbin-Watson stat	1.528022

Wald Test: Pool: RESULTS

Test Statistic	Value	df	Probability
t-statistic	1.478256	140	0.1416
F-statistic	2.185240	(1. 140)	0.1416
Chi-square	2.185240	1	0.1393

Null Hypothesis: C(2)+C(3)+C(4)+C(5)=1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2) + C(3) + C(4) + C(5)	0.145924	0.098714

Restrictions are linear in coefficients.

APPENDIX 5.9. Accounting statistics for Western countries pooled regression

GAO accounts for Denmark				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	-0.011	0.00	-0.14
LAB_RUR?	0.404674	0.002	0.00	0.07
CAP?	0.580197	-0.039704	-0.02	-2.41
TREND_DEN	0.033185		0.033185	3.48
total output change (ggao)		**0.00954**	**0.00954**	**1.00**

GAO accounts for Finland				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	-0.004325	-0.0006	1.42
LAB_RUR?	0.404674	-0.011487	-0.0046	11.95
CAP?	0.580197	-0.024216	-0.0141	36.12
TREND_FIN	0.017454		0.017454	-44.87
total output change (ggao)		**-0.0004**	**-0.0004**	**4.62**

GAO accounts for France				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	0.002206	0.00	0.05
LAB_RUR?	0.404674	-0.010284	0.00	-0.71
CAP?	0.580197	-0.016524	-0.01	-1.64
TREND_FRAN	0.019704		0.019704	3.37
total output change (ggao)		**0.00585**	**0.00585**	**1.07**

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Continuation of **APPENDIX 5.9.**

GAO accounts for Germany				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	0.001048	0.00	0.46
LAB_RUR?	0.404674	0.003782	0.00	5.22
CAP?	0.580197	-0.030979	-0.02	-61.34
TREND_GER	0.010836		0.010836	36.98
total output change (ggao)		**0.00029**	**0.00029**	**-18.68**

GAO accounts for Ireland				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	0.011194	0.00	0.21
LAB_RUR?	0.404674	0.003111	0.00	0.18
CAP?	0.580197	-0.009222	-0.01	-0.78
TREND_IRL	0.011126		0.011126	1.62
total output change (ggao)		**0.006864**	**0.00686**	**1.23**

GAO accounts for Italy				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	-0.005185	0.00	-0.35
LAB_RUR?	0.404674	-0.001099	0.00	-0.24
CAP?	0.580197	-0.002330	0.00	-0.72
TREND_ITAL	0.006924		0.006924	3.67
total output change (ggao)		**0.001885**	**0.00189**	**2.37**

GAO accounts for Netherlands				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
LAND_AR?	0.127869	0.004	0.00	-0.24
LAB_RUR?	0.404674	-0.025	-0.01	5.16
CAP?	0.580197	-0.027674	-0.02	8.16
TREND_NETH	0.024818		0.024818	-12.61
total output change (ggao)		**-0.002**	**-0.002**	**0.46**

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Continuation of **APPENDIX 5.9.**

GAO accounts for Portugal				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	-0.03685	-0.0047	-0.65
LAB_RUR?	0.404674	-0.00971	-0.0039	-0.54
CAP?	0.580197	0.005876	0.0034	0.47
TREND_PORT	0.017457		0.017457	2.42
total output change (ggao)		**0.00722**	**0.00722**	**1.69**

GAO accounts for Spain				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	-0.015548	0.00	-0.08
LAB_RUR?	0.404674	0.000633	0.00	0.01
CAP?	0.580197	0.020551	0.01	0.47
TREND_SPA	0.010544		0.010544	0.41
total output change (ggao)		**0.02544**	**0.02544**	**0.82**

GAO accounts for Sweden				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	-0.00368	0.00	-0.13
LAB_RUR?	0.404674	-0.00212	0.00	-0.24
CAP?	0.580197	-0.00904	-0.01	-1.49
TREND_SWD	0.003193		0.003193	0.91
total output change (ggao)		**0.003519**	**0.003519**	**-0.96**

GAO accounts for Swetzeland				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
LAND_AR?	0.127869	0.001354	0.00	-0.02
LAB_RUR?	0.404674	0.006972	0.00	-0.40
CAP?	0.580197	-0.025008	-0.01	2.05
TREND_SWZ	0.003955		0.003955	-0.56
total output change (ggao)		**-0.007062**	**-0.0071**	**1.07**

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Continuation of **APPENDIX 5.9.**

GAO accounts for UK				
	estimated coefficient	change in variable	contribution to output change	
			absolute	% of total change
	A	***B***	***C(A*B)***	***D***
LAND_AR?	0.127869	-0.01101	0.00	0.26
LAB_RUR?	0.404674	0.00054	0.00	-0.04
CAP?	0.580197	-0.00870	-0.01	0.94
TREND_UK	0.006972		0.006972	-1.30
total output change (ggao)		**-0.00538**	**-0.0054**	**-0.14**

APPENDIX 5.10. Machinery productivity dynamic in Poland and Belarus [1]

Figure 1.

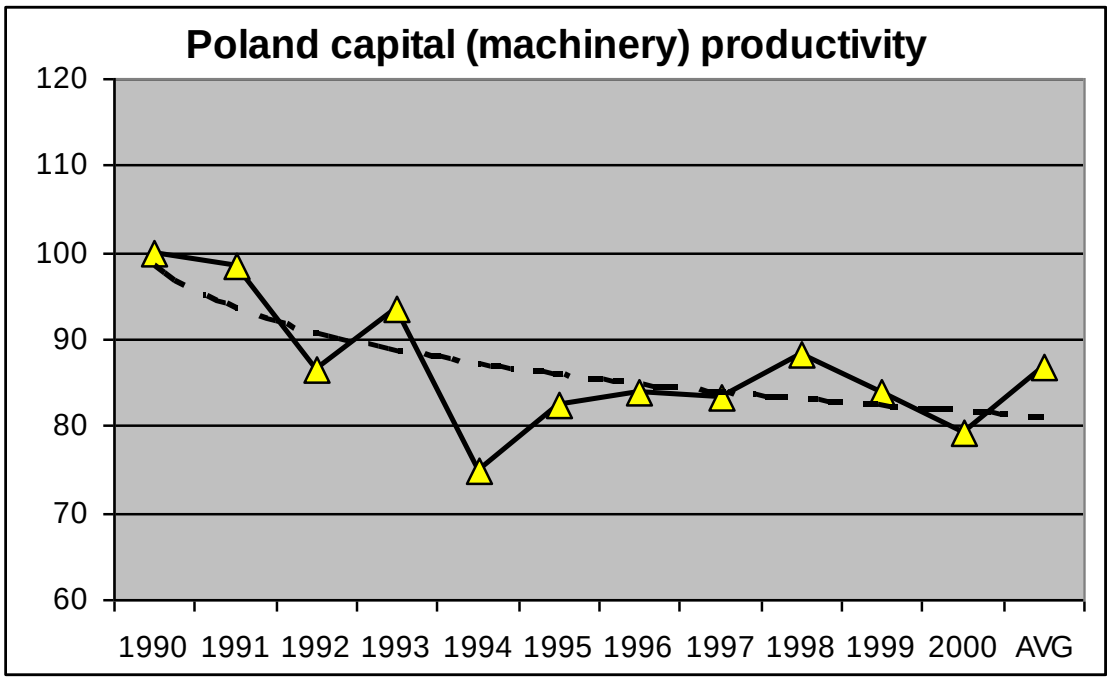
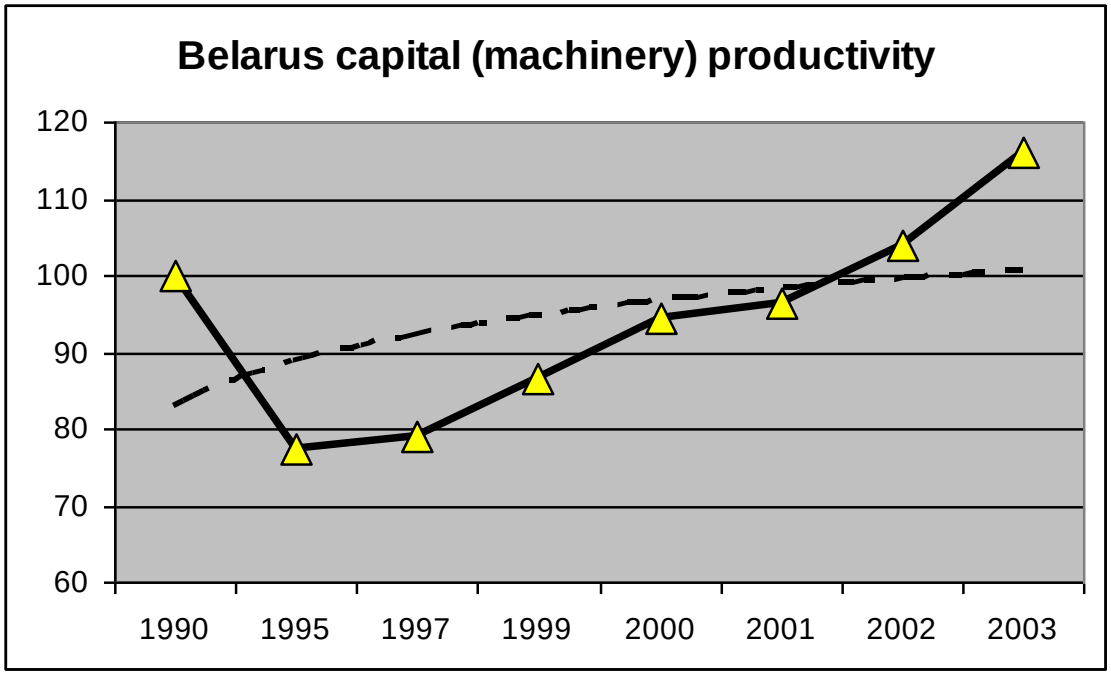


Figure 2.



[1] Data are from *Belarusian Agricultural Statistics Yearbook (variouse years*) and *Agricultural Statistics Yearbook for Poland* (*variouse years)*

APPENDIX 5.11. Fertilizers productivity dynamic in Poland and Belarus [1]

Figure 1.

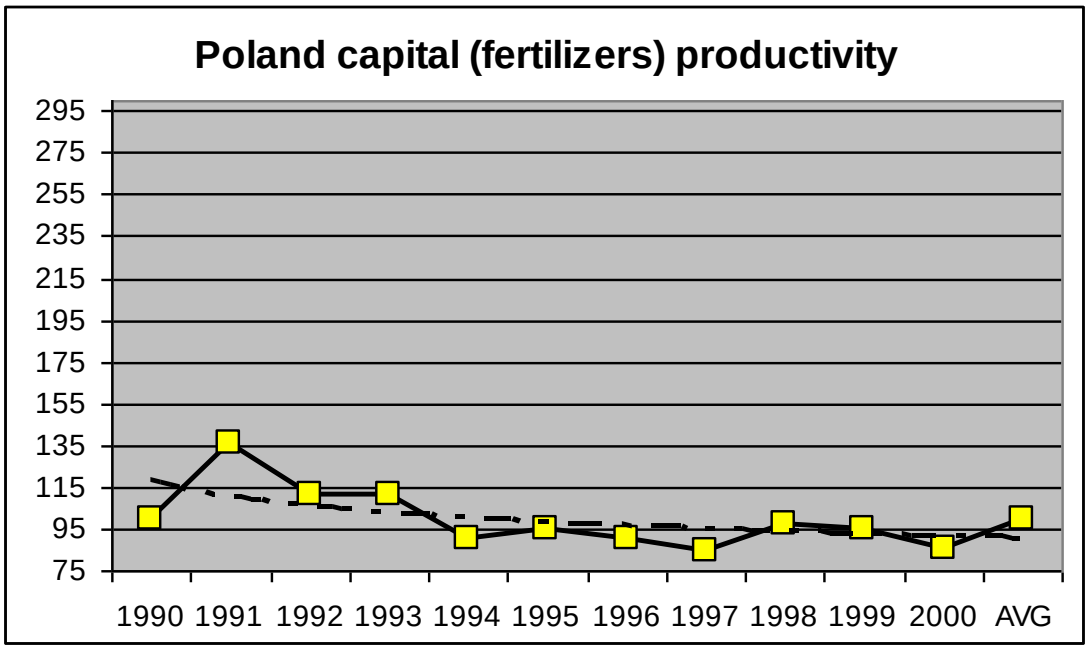
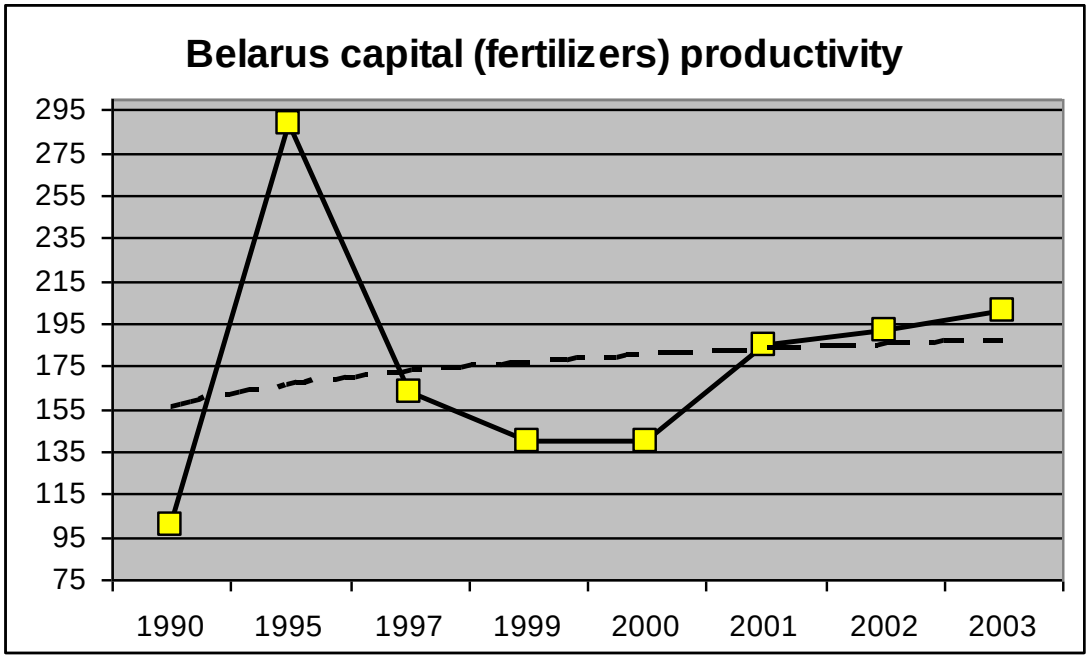


Figure 2.



[1] Data are from *Belarusian Agricultural Statistics Yearbook (variouse years)* and *Agricultural Statistics Yearbook for Poland (variouse years)*

APPENDIX 5.12. Production and productivity dynamic in Poland and Belarus [1]

Table 1. Agricultural production and productivity dynamic in Poland

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	AVG
Change of												
GAO	100	98.4	85.9	91.7	83.2	92.1	92.7	92.5	98	92.9	87.7	**92.3**
land	100	99.8	99.9	99.4	99.4	99.3	97.9	97.7	98.1	98.2	97.7	**98.9**
labour	100	96.4	88.8	87	89.6	93.3	97	97.2	96.8	96.3		**94.2**
tractors	100	99.5	98.9	97.5	110.6	111.3	110	110.6	110.6	110.2	110.3	**106.3**
fertilizers	100	72.8	77.3	83.2	92.6	98.1	103.5	110.3	101	99	102.8	**94.6**
Change of the productivity of												
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**AVG**
Land	100	99.4	86.7	93	84.4	93.5	95.4	95.4	100.7	95.3	90.5	**94**
labour	100	102.1	96.7	105.4	92.8	98.7	95.5	95.1	101.2	96.4		**98.4**
tractors	100	98.5	86.5	93.6	74.9	82.3	83.9	83.3	88.2	83.9	79.2	**86.8**
fertilizers	100	136.1	111.8	111	90.4	94.6	90.2	84.4	97.7	94.5	85.9	**99.7**

Table 2. Agricultural production and productivity dynamic in Belarus

	1990	1995	1997	1999	2000	2001	2002	2003	AVG
Change of									
GAO	100	73.5	71.2	65	70.9	72.2	72.7	75.5	75.1
land	100	97.6	97.2	89.5	88.1	84.8	84.2	83.9	**90.7**
labour	100	95.6	92.8	91	89.4	87.6	85.9	84.1	**90.8**
machinery	100	95	90	75	75	75	70	65	**80.6**
fertilizers	100	25.5	43.8	46.7	50.8	39.1	38	37.6	**47.7**
Change of the productivity of									
	1990	**1995**	**1997**	**1999**	**2000**	**2001**	**2002**	**2003**	**AVG**
land	100	75.3	73.3	72.6	80.5	85.1	86.3	90	**82.9**
labour	100	76.9	76.7	71.4	79.3	82.4	84.7	89.8	**82.7**
machinery	100	77.4	79.1	86.7	94.5	96.3	103.9	116.2	**94.2**
fertilizers	100	288.7	162.5	139.3	139.6	184.5	191.5	201.1	**175.9**

[1] Data are from *Belarusian Agricultural Statistics Yearbook (variouse years)* and *Agricultural Statistics Yearbook for Poland (variouse years).*