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**CHANGES IN COMPETITIVENESS OF FARM SECTOR
IN CANDIDATE COUNTRIES PRIOR TO THE EU ACCESSION:
THE CASE OF POLAND**

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*Paper prepared for presentation at the 11th Congress of the EAAE
(European Association of Agricultural Economists),
'The Future of Rural Europe
in the Global Agri-Food System'
Copenhagen, Denmark,
August 24-27, 2005*

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Abstract¹

Prior to the EU accession Polish agricultural sector was experiencing serious structural problems. Not surprisingly Polish agricultural negotiations with EU were the toughest. Polish officials wanted to convince domestic rural electorate that the farms will operate on the competitive basis in enlarged EU. This paper investigates, however, how the competitiveness has been evolving yet prior to the accession, given the strong pressures within which it had to operate. We asked if Polish farms were responsive to this pressure - that is whether they were able to increase their productivity sufficiently to counter negative forces at work and maintain their competitiveness. The research showed a gloomy picture of declining farm productivity together with deteriorating relative agricultural prices over 1996-2000 which revealed falling competitiveness in the sector. This can partially explain why the rural electorate in Poland was very much against the EU accession till the very end. The Polish experience can be useful for the next EU candidate countries.

Keywords: competitiveness, productivity, farm sector, transition, Poland

JEL: Q12

Introduction

All countries which decide to join the European Union (EU) implicitly assume that they will be able to successfully compete on the Single Market with the other, 'old' member countries. They obviously want to gain from the accession be able to respond to the increasing pressure on competitiveness of the sector. Since countries joining the EU are usually more rural in their nature (as it was the case last time and will be in the next wave) the competitiveness of their farm sector is an important issue both from economic and political point of view. However, how successful they can be in improving the competitiveness before the accession depends to high extent on the understanding the dynamics and sources of the pressure stemming to the sector. The competitiveness will be determined not only (and probably not primarily) by agricultural policy itself but by the overall internal and external forces which will affects the agricultural sector in terms of relative agro-food prices, costs and accessibility of credits, changes in exchange rate, etc.. The pressure may come both from within the economy (transition process) and from abroad (CAP reform, WTO negotiations, big and expansive markets like China, Russia, India, etc). Polish agricultural sector after 1989 is a good example of it, as it was exposed to the forces like: rapid trade and price liberalization, declining world agricultural prices, appreciation of own currency, etc. and therefore had to face the problems of increased input-output prices, high costs of credits, declining attractiveness of agricultural export expressed in foreign currency, etc.

This work is also an attempt to reconcile macroeconomic and microeconomic perspectives, which are all too often applied separately in studies on the sector's competitiveness in transition economies. As such, it draws mainly on the theory of dynamic comparative advantage, but also refers to theories of growth. It analyses *dynamic comparative advantage* as a result of three main elements: (i) changes in relative agricultural prices (output-input), (ii) changes in total factor productivity and (iii) adjustments in factor proportions. Since productivity is widely perceived as one of the most important offsetting responses that agricultural producers have to combat to any unfavourable and unavoidable pressures stemming from outside the sector, much attention is paid in the paper to productivity changes and its decomposition. The data envelopment analysis (DEA) is employed where total factor productivity (TFP) is broken down into technological changes, 'pure' technical efficiency changes and scale efficiency changes. The article is structured as follows. The next section reviews previous studies on competitiveness of farms in Poland, then theoretical model for studying competitiveness is proposed and empirically verified. Last section draws conclusions.

Previous studies on competitiveness of agricultural sector in Poland

Few topics in economics have generated as much discussion and controversy over recent years as competitiveness (Dunning et al., 1998). This is probably because the concept has so many dimensions. Firstly, its range of possible applications is wide - from individual and company activity to sector and sector cluster activity, through to regional and state levels (Porter, 1990; Dunning et al.,

¹ The author would like to thank the Institute of Agricultural and Food Economics (IERiGŻ) in Warsaw for providing the data, especially dr Lech Goraj (Head of the Department) and dr Dariusz Osuch (Senior Specialist)

1998). Secondly, competitiveness can be conceived of either as potential (assessed ex-ante) or revealed (assessed ex-post). Thirdly, it finds its roots planted in diverse theories: trade theory, managerial and business theories, etc. Fourthly, the concept also has a temporal element – short-term and long-term competitiveness may be thought of in very different terms (Boltho, 1996). Last but not least, it is a relative term, with potentially diverse points of reference, for example, differences across nations (external competitiveness) or sectors within nations (internal competitiveness) (Woś, 2001).

Therefore, there is no single theory nor ideal measure of competitiveness. However, most theories stress technology and productivity as the prime determinants of long-term competitiveness (Abbot and Bredahl, 1994). Furthermore, measures of competitiveness include either a *technical component* (productivity or efficiency) or a *relative price component* (prices of inputs and outputs or private versus social prices) or both (Bureau and Butault, 1992).

The literature on competitiveness of Polish agriculture, especially in the context of European Union entry, is already quite rich. It can be divided into two broad categories: empirical and descriptive, with the latter far outweighing the former. There are some common conclusions from both kinds of studies, as follows: (i) the potential of Polish competitiveness results mainly from low production factor costs (mainly wages) relative to other sectors in the economy and relative to agricultural sectors in Poland's main trade partners, i.e. EU countries; (ii) Poland has a revealed comparative advantage in the production of labour-intensive products; (iii) general speaking, larger farms proved more competitive so far than small ones, (iv) the competitiveness of basic agricultural products is relatively higher than that of processed ones; (v) the competitiveness of agriculture is relatively low in the economy compared with other sectors; (vi) competitiveness is determined mainly by productivity and profitability. How these results were found is explored below.

Empirical studies on the competitiveness of Polish agriculture are most frequently based on the concept of *comparative advantage*, though most are of a static character. Both approaches to comparative advantage, the Ricardian (ex-ante) approach and Balassa's (ex-post) revealed comparative advantage have been applied. A comparison of results from those two approaches and even within them is not straightforward because the studies differ in too many aspects, for example they assess competitiveness based on a broad range of comparative advantage indicators, in different time spans, with different points of reference, different sets of products, at different levels of aggregation, etc.. Nevertheless, some very general similarities and lessons can be drawn. This type of studies are summarised in Table 1.

It is worth mentioning one more category of empirical studies, which tackles the competitiveness through studying selected determinants of it, such as: factor productivity, profitability and efficiency. Although they do not explicitly refer to (or measure) competitiveness, they do contribute considerably to the overall understanding of the competitiveness of the Polish agricultural sector. The methodology applied in these studies and the main results are summarised in Table 2.

Methodology for assessing changes in competitiveness

The analysis of changes in the competitiveness of the agricultural sector in this paper is undertaken according to a theoretical model proposed by the author, which is not based on any single theory or method but a combination of theories and methods. The eclectic approach towards competitiveness was already suggested earlier by Berkum and Meijl (1999), Abbott and Bredahl (1994) and other agricultural economists. Therefore, the author puts competitiveness in a broad context linking macro- and microeconomic analysis, which seems especially appropriate for transition countries, where macroeconomic changes are dynamic and overwhelming for all sectors in the economy².

² Presenting the sector in macroeconomic context, has been popularised before by non-Polish economists (to name only a few: M. Banse, K. Macours, W. Münch, S. Tangerman, J. Swinnen) and some Polish ones (to name only a few: W. Guba, W. Orłowski, W. Piskorz, M. Safin, J. Wilkin, A. Woś).

Table 1. Quantitative studies on comparative advantage in Polish agro-food sector

Projects	Years covered	Commodities/aggregation	Measures used
Majewski and Dalton (eds.) (2000) Frohberg, K Gorton, M. et al.	1995-1998 1996-1998	21 primary and processed products 9 Products: wheat, rye, rape seed, potatoes, sugar beet, pigs, beef, milk Farms: small, medium, large	XRCA, MRCA, RTA, XCA, MP, MRTA, IIT DRCs
Poganietz and Frohberg (eds.) (2000) Banse, et al. Czyżewski, et al.	1995 and 2005 1993-1995	24 primary and processed products (at two stages of processing) 8 products/activities: wheat, sugar beet, rapeseed, potatoes, live pigs, beef cattle, dairy cows, apples Farms: small and large	DRCs, PRCs DRCs, PRC
Guba (2000)	1997 and 2007	Milk processing industry	DRCs, PRCs
Guba (1999)	Base years 1993-1995	8 products/activities, small and large farms	DRCs, PRCs
Guzek, et al. (1999)	Base years 1993-1997 Forecast until 2002	92 products	r_i^t coefficient (PRA)
Tangerman and Münch (eds.) (1997) Safin, M. and Rajtar, J. Münch, W. Rajtar, J. Safin, M. Misala, J.	1990-1995 forecast for 2002 1992-1995	Agro-food various products, Primary products and processing Farm-gate level Processing CN 2-digit and CN 4-digit	DRCs C, IIT, RCA
Safin (1995)	1990-1993	2 products: pigs and cattle	DRCs
Mroczek (1995)	1990-1993	2-digit CN	RCA, TC, IIT
Guzek (1993)	Base period 1986-1991 Forecast period 1992-1996	65 agro-food products broken down into 12 sections of agriculture and processing	PRA

Source: The author's compilation based on the above studies

Table 2. Studies on determinants of competitiveness in Polish individual farms in transition

Study	Core analysis	Methodology	Period covered and data	Results
Latruffe et al. (2005)	Differences between crop and livestock farms in Technical and Scale Efficiencies	-Data Envelope Analysis - Confidence intervals from bootstrapping	1996 and 2000 IERiGŻ farm survey	- Livestock farms more technically and scale efficient than crop farm, - Inefficiency is rather technical than scale; - Inefficiency dropped in 2000 from 1996;- Low education of farmers and overcapitalisation; - Most of the crop and about half of livestock farm operating under increasing returns to scale
Lerman (2002)	Efficiency and partial productivity	- Data Envelope Analysis (DEA) -Productivity of land and labour	2000, Survey conducted by the World Bank	- Most farms very inefficient; - Small group of leaders in efficiency; -Larger farms on average more efficient; -Land and Labour productivity increases with farm size
Brümmer et al. (2002)	Decomposition of productivity growth for individual farms	- TFP; - Malmquist index decomposition; - Parametric approach, translog funcion	1991-1994 IERiGŻ farms survey	- Sharp decline in TFP; Technological regression - Small increase in technical efficiency and scale efficiency
Davidova et al. (2002)	Spatial analysis of Total Factor Productivity and profitability in Poland (+some other CEE and EU countries)	-Total Factor Productivity (TFP); - Tornqvist-Thail index; - Three cost revenue ratios (one taking account of alternative costs)	1999, 2000 IERiGŻ farms survey	- Very low profitability of individual farm sector and most farms unprofitable; - Generally low TFP, most farms unproductive; - Low quality of education and land hamper productivity; - Positive relationship between farm size and TFP and profitability
Munroe (2001)	Technical efficiency	Cobb-Douglas stochastic frontier	IERiGŻ farm survey (1996)	Farms above 15ha are less efficient. Positive correlation between specialisation and efficiency, negative with age
Mech (1999)	Comparing productivity and gross margin between size groups of family farms	- Partial productivities- labour, land, capital; - TFP- Tornqvist index. - Gross margin index by farm size	1988-1994 IERiGŻ farm survey	- Land productivity decreases with size; - Labour productivity, increases with size. The smaller the farm, the higher the labour intensity;- Capital productivity increases with farm size;- TFP increases with size; values larger than 1 in farms above 10 ha; - GM index increases with size, values larger than 1 in farms above 7 ha.
van Zyl et al. (1996)	Total factor productivity, and technical and scale efficiency for different size groups of family farms	- TFP-Tornqvist-Theil index at private prices and at opportunity costs - DEA	1993 IERiGŻ farm survey Two regions in Central-West Poland	- Large farms are not more efficient than smaller farms; -Differences in scale efficiency between large and small farms are insignificant; -Total efficiency does not differ significantly between the two groups; - Smaller farms are more labour-intensive

Source: The author's compilation based on the above studies

The model presented here is a combination of methods which have their roots in trade theory, growth theory and theory of the firm. From the first two, the ideas of dynamic comparative advantage and endogenous growth are borrowed, and from the third, the production function. Various methods well defined in the literature were also chosen. These, combined with some general economic knowledge, allowed for a formalisation of a logical model with two goals: the introduction of discipline (structure) into the analyses and tools to enable the formulation of testable hypotheses. As such, the work is not a single econometric model, but a combination of formal methods which lead to a verification of the hypotheses and formalise the framework within which competitiveness is defined. The logic of the model is depicted in Figure 1.

The upper part of the model is based on a methodology developed by Nishimizu and Page (1986), called the decomposition of dynamic comparative advantage. According to it, the changes in competitiveness, measured for example by domestic resource costs (DRC), can be broken down into changes in: relative prices (factor costs and terms of trade), changes in total factor productivity, and changes in techniques of production (defined as changes in factor proportions). The formal derivation of these elements is presented in the Appendix, Box 1. The logic of the method is as follows: in a small, open economy agricultural prices are determined by changes in international prices on foreign markets. This in turn influences relative domestic agricultural prices, i.e. relative factor and output-input prices. If output prices (tradables) decline due to pressure from outside and input prices (a mixture of tradables and non-tradables) do not follow, then producers are under cost pressure, which squeezes the profitability of their production. Importantly, producers do not have much influence on the relative prices (the prices are exogenous from their point of view). However, according to the model, producers may respond to this outside pressure by increasing their total factor productivity (e.g. by increasing their efficiency) and techniques of production (i.e. replacing expensive factors with cheaper ones, given the changes in relative prices) because they are endogenous from the point of view of producers. Generally, changes in factor proportions are limited, so the main offsetting power in the hands of producers, to maintain or improve competitiveness, lies in improving their factor productivity.

The left-hand side of the model is based on a framework developed by Quiroz and Valdes (1993) and shows that relative prices are influenced by domestic policies both directly (by sector-specific interventions and trade policy instruments) and indirectly (by macroeconomic policy). The authors show that indirect or economy-wide effects result from the impact of macroeconomic policies on the real exchange rate and, thereby, on the relative price between tradables and non-tradables. Sometimes, indirect interventions (macroeconomic) are stronger than the sector-specific ones because they directly influence input prices in the economy such as labour, capital and land costs. This method disentangles the effects of exogenous factors (border prices) from the effects of real exchange rate evolution (due to e.g. the Harrod-Balassa-Samuelson effect) and of domestic price policy. This approach helps to understand the extent to which economic performance determines agricultural competitiveness.

The central part of the model explains the importance of total factor productivity for competitiveness. It deals, as such, with determinants of total factor productivity and decomposition of TFP changes. The components of TFP changes are calculated based on a methodology suggested first by Färe et al. (1994). Using the Malmquist index derived from the non-parametric approach we can distinguish the importance of technological progress, 'pure' technical efficiency, and scale efficiency in productivity changes. The formal presentation of the approach is presented in the Appendix, Box 2.

The right-hand part of the model concerns changes in techniques of production, narrowly defined as proportions in production factors dictated by their prices. In the original approach developed by Nishimizu and Page (1986) this element was residual, while in this paper it is proposed that the competitiveness is residual instead. However changes in factors proportions have very limited influence on competitiveness, especially in the agricultural sector where the proportion of production factors are subordinated to strict production requirements³. This part of our model then has a largely descriptive character.

³ Note that this element was also negligible in the study by Nishimizu and Page (1986), where the changes in factor proportions did not exceed 0.75% annually.

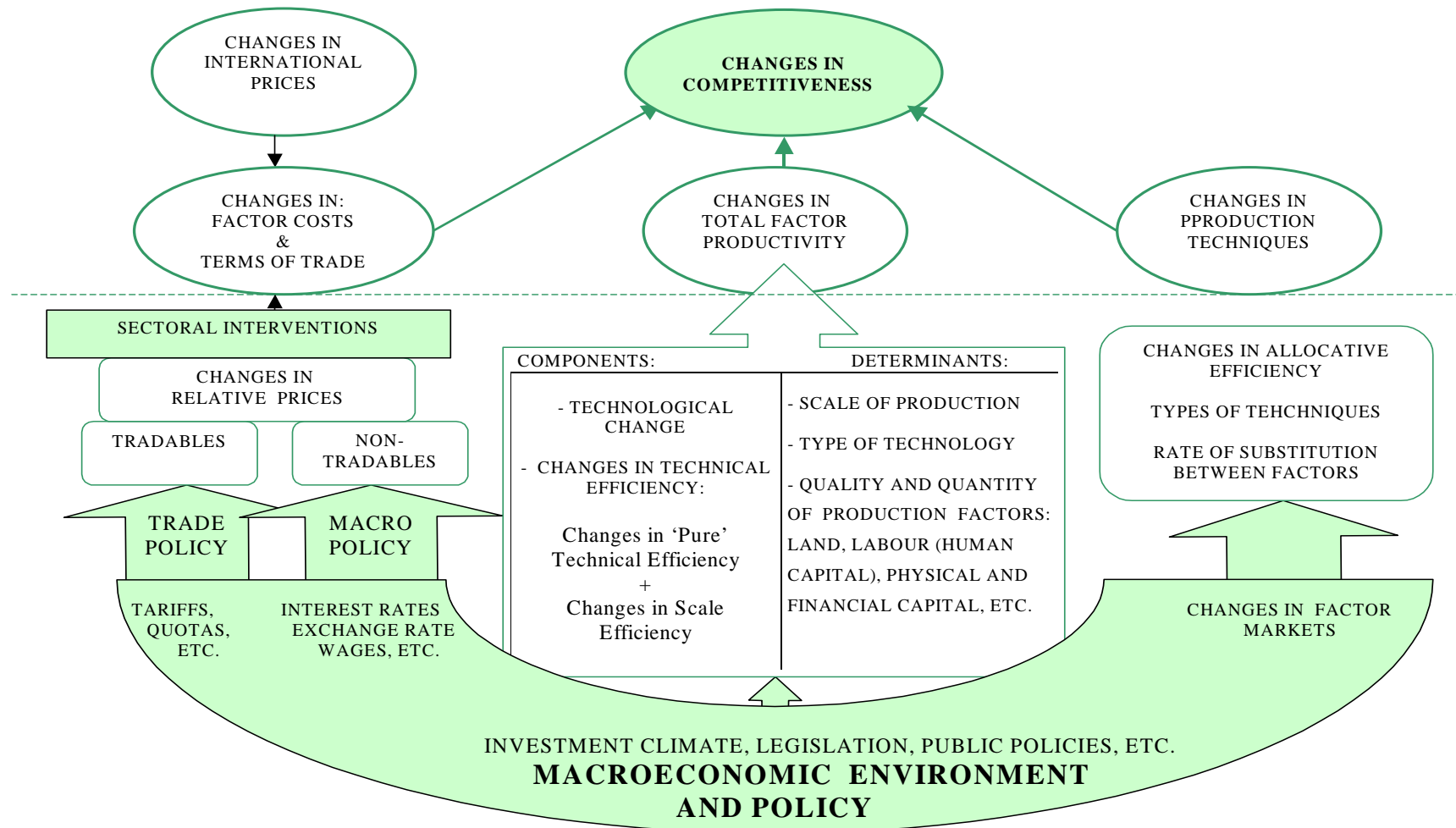


Figure 1. Theoretical Model for the Mixed (Micro- and Macro-) Dynamic Approach to Competitiveness

Source: Author's own conception based mainly on Nishimizu and Page (1996), Quiroz and Valdes (1993), Färe et al. (1994).

The last, bottom part of the model is descriptive. Its ultimate goal is to show the relationships between the development of the whole economy and its influence on the agricultural sector. Both the direct and indirect influence of government policies on agriculture should be considered and the most characteristic elements of the transition process identified (those concerned with the convergence of the Polish economy to the EU, structural adjustment, liberalisation, etc.).

Empirical assessments of the changes in competitiveness

Based on the methodology proposed in the previous section we attempt to measure the strength of main determinants of the competitiveness: (i) changes in macroeconomic fundamentals, which indirectly but strongly influence relative agricultural prices, and (ii) changes in microeconomic fundamentals, which manifest themselves in productivity and technology shifts. We formulate below two main hypotheses to be verified.

Hypothesis 1: Relative agricultural output-input prices deteriorated during the analysed period mainly due to the strong pressure of macroeconomic forces which, however, was too strong to be offset by sectoral policy interventions.

Data

For the purposes of this analysis the data range was 1990-2000. The main variables used were the following: i) domestic market prices of 11 basic agricultural commodities (wheat, maize, barley, oil seeds, sugar beet, milk, beef, mutton, pig meat (pork), poultry, eggs) in Polish zloty PLN obtained from Main Statistical Office (GUS) and the OECD CSE/PSE Database; ii) border (reference) prices of all the commodities were c.i.f. or f.o.b. prices (depending on whether the commodity was net imported or net exported in the case of Poland) obtained from the OECD CSE/PSE Database; iii) exchange rates - nominal exchange rates (PL/EUR and PLN/US\$), as well as CPI for Poland and countries of the European Monetary Union (as a proxy for EU) and CPI for the USA all came from IFS Database published by the IMF. In this analysis the CPI indices were used to deflate output prices as in the original paper by Valdes (1996), who initiated the method. The base year for all indices is 1991.

Results

We analysed the decomposition of real output commodity prices in three time sub-periods characterized by different policies (especially toward trade) 1991-1993, 1994-1995, and 1996-2000 and for the whole ten-year period (see Table 3). At the beginning of the transformation (1990 to mid-1991), liberalisation of agricultural trade coincided with a fall in the world prices, which resulted in strong pressure on the domestic market and a considerable decline in real output prices, strongly manifested also in farmers lobbying for restoration of border measures. Protection as such increased over 1991-1993. This was not only positive, but also the highest of all analysed sub-periods (it changed by a cumulative 57.3%). However, at the same period there was the quickest appreciation of Polish zloty (by 63.3% cumulative change) and, in addition, world agricultural prices declined (by 14%). The latter was due to the fall mainly in pork, maize and poultry prices. This resulted in the overall decline in real producers' prices by 20% (Table 3).

During 1994-1995, the situation has changed quite substantially. World prices increased, which although did not last long, was substantial (34.4%), and at the same time the overall appreciation of the domestic currency was weaker than before (14.8%). This allowed for a small increase in real product prices despite the fact that the sector was actually net taxed at that time.

Between 1996-2000, the decline in real commodity prices was the largest of all periods (44.2%), as international prices fell substantially again (almost 40%), which was additionally reinforced by real exchange rate appreciation (19.2%). The policy was far too weak to respond to this, as border protection had little room for tightening at that time, on the contrary, in fact various tariff-quotas and other liberalising measures were undertaken.

Table 3. Decomposition of Real Agricultural Output Prices in Poland, 1991-2000

Changes (in %) :		1991-1993 (v)	1994-1995 (v)	1996-2000 (v)	1991-2000 (v)
Total changes in: (vi)	real domestic price (i)	-20.0	3.6	-44.2	-60.6
	real border price (ii)	-14.0	34.4	-39.8	-19.4
	real exchange rate (iii)	-63.3	-14.8	-19.2	-97.4
	intervention (1+t) (iv)	57.3	-16.0	14.8	56.2
Wheat	real domestic price	-9.9	-14.2	-23.3	-47.4
	real border price	-7.9	15.4	-8.2	-0.7
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	61.3	-14.7	4.0	50.7
Maize	real domestic price	-14.1	9.5	-47.9	-52.4
	real border price	-17.6	32.6	2.8	17.9
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	66.8	-8.3	-31.5	27.1
Other corps	real domestic price	0.0	-19.7	-19.1	-38.9
	real border price	26.8	23.9	8.9	59.6
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	36.5	-28.7	-8.9	-1.1
Oilseeds	real domestic price	4.6	-21.8	-24.4	-41.6
	real border price	-5.6	14.8	-35.7	-26.5
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	73.6	-21.8	30.5	82.3
Sugar	real domestic price	-28.6	15.6	-62.6	-75.6
	real border price	-14.2	34.5	-61.9	-41.6
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	49.0	-4.1	18.5	63.3
Milk	real domestic price	17.4	5.8	-0.8	22.5
	real border price	13.6	18.5	10.9	42.9
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	67.2	2.2	7.5	77.0
Beef	real domestic price	-18.3	16.6	-101.0	-102.7
	real border price	10.4	24.4	-10.0	24.7
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	34.6	7.1	-71.8	-30.1
Mutton	real domestic price	-22.8	25.8	-8.6	-5.6
	real border price	17.9	26.1	20.2	64.2
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	22.6	14.5	-9.5	27.6
Pork	real domestic price	-46.8	-7.9	-51.5	-106.3
	real border price	-31.3	14.4	-17.7	-34.7
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	47.8	-7.4	-14.6	25.8
Poultry	real domestic price	-45.9	4.6	-62.8	-104.0
	real border price	-15.5	30.9	-16.8	-1.4
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	33.0	-11.5	-26.8	-5.3
Eggs	real domestic price	-5.8	-9.5	-30.9	-46.2
	real border price	-9.2	-12.4	16.5	-5.0
	real exchange rate	-63.3	-14.8	-19.2	-97.4
	intervention (1+t)	66.7	17.7	-28.2	56.2

(i) = (ii) + (iii) + (iv), i.e. (i) $\Delta \ln Pit = \Delta \ln P^{wit} + \Delta \ln RERt + \Delta \ln (1+Tt)$ Where:

Pit = real domestic price of good i = nominal price in PLN at time t / domestic CPI

P^{wit} = real world price of good i = nominal price converted by Nominal Effective Exchange Rate (NEER) / world CPI

and: Nominal Effective Exchange Rate equals $-0.6*PLN/EUR+0.4*PLN/US\$, and World CPI = 0.6*CPI_{EU}+0.4*CPI_{USA}$.

$RERt$ = Real Effective Exchange Rate = $(NEER / domestic CPI) * world CPI$

Tt = rate of direct intervention (calculated as a residual)

(v) cumulative percentage change

(vi) The weights used for summing the results are the shares of the products in global production

Source: The author own calculations

All in all, the results indicate that the main factor underlying the considerable decline (by 60% cumulative change) in real domestic agricultural prices during the 1990s was the real exchange rate appreciation (97.4% cumulative change), amplified by the fall in border prices (19.4% cumulative change) (see Table 3). The pressure stemming from those two factors acting together was so strong that policy interventions could compensate only for half the decline in real domestic prices of agricultural commodities - if there had been no intervention at the time, the decline in real domestic prices would have amounted to nearly 117%, instead of 60%. From the policy point of view, it is important to note that the interventions were too weak to compensate real domestic prices when both real exchange rate (RER) and world prices worked simultaneously. However, it most often attempted to act counter-cyclically (for most products) and managed to prevent a higher decline in real prices than would otherwise have been the case (from RER and world prices together). For example, 6 out of 11 analysed product were under pressure from both decreasing world prices and real appreciation at the same time (see column 1991-2000 for each product), and in 5 such cases policy responded in the intended direction, in the sense that it managed at least partially to prevent the transmission of external 'shocks' into real prices of those commodities (Table 3).

Last but not least, since we know that there was what became known as the 'price scissors' phenomenon during the 1990s (i.e. the index of input prices outweighed the index of output prices in most of the years) and since we have showed that real output prices declined considerably over the period we can conclude that the relative output-input prices declined as well. Hence, we can positively verify Hypothesis 1 and conclude that relative prices indeed declined during the 1990s, the main reason being a strong real exchange rate appreciation amplified by an overall declining trend in world prices, not able to be offset by domestic intervention policy.

According to the theoretical model the deterioration in relative prices can only be compensated for, in a sustainable way, by improvements in total factor productivity in the farm sector (and to a very limited extent also by changes in factor proportions) if competitiveness is to be maintained. Therefore, below we formulate the following hypothesis:

Hypothesis 2: Changes in total factor productivity (TFP) did not offset the pressure of deteriorating relative prices during the analysed period and hence the competitiveness of the sector declined in the analysed period.

Verification of this hypothesis requires answering the following research questions: (i) were the changes in TFP positive or negative during the analysed period (1996-2000), (ii) if the changes were positive, how strong was the productivity increase? Was it strong enough to offset the deterioration in agricultural relative prices?; (iii) if the changes were negative, how strong was the productivity decline, and due to which elements: technological or efficiency change?

Data

For the analysis a rich set of farm accounting data was provided by the Institute of Agricultural and Food Economics (IERiGŻ) in Warsaw. The balanced sample (i.e. the same farms repeated in all the years) was drawn, consisting of 914 each year, however, it had to be reduced to 811 farms due to methodological requirements (the analysis was very sensitive to outliers so they had to be deleted in order to assure stability of the results). It should be mentioned that sample is biased towards larger and market oriented farms comparing to Polish average. However, for our analysis it is not a large problem because the issue of competitiveness relates mainly to the farms which market their produce and they are analysed here (semi-subsistence farms do not really compete so we did not really need a representation of such farms in our survey).

For the analysis of productivity changes, output and input data were aggregated into one category of output and four categories of inputs. OUTPUT is expressed as a value of total output and comes from aggregation of 10 basic products selected from the data set: wheat, rye, barley, rape seed, sugar beet, potatoes, milk, beef, pork, poultry as well as of two categories of other crop and other livestock products. Inputs are aggregated into four categories: LAND, expressed as utilised

agricultural area in hectares; LABOUR, recalculated into annual work units (AWU⁴), CAPITAL, approximated by the sum of capital depreciation⁵ (i.e. the reduction in the value of assets arising from wear and tear) and interest paid from investment credits (i.e. forgone return on financial capital) as suggested by Corden (1984) and Griliches (1960). The final category, INTERMEDIATES, includes the following intermediate inputs: seeds, fertilisers, minerals, chemicals, feeds, fuel and other energies, expressed in values. All the variables, before aggregation, were converted into real terms, i.e. all the nominal values of variables were deflated by appropriate price indices to take account of substantial inflation, which persisted during the analysed period. They were then transformed into implicit quantity indices (with 1996 as the base year).

Productivity changes and farm size

Productivity results vary substantially between different groups of farms, depending on their size, type of activity and specialisation.

As for size groups, the larger the farm, the higher the technological progress, which means that in groups of larger farms the leaders (efficient farms) can improve their technologies quicker than their counterparts in groups of smaller farms. This is what one might expect, as larger farms are usually more likely to be technologically advanced for several reasons. Firstly, as they are generally better off than smaller farms they have easier access to capital (credits, etc.) and can invest more in new technologies. Secondly, they usually have more capital-intensive and less labour-intensive production techniques, which form *embodied* technological change. Thirdly, they may also have higher investment incentives due to the forward-looking approach to their business, etc. The technological progress in the group of the largest farms (over 30 ha) was 2%, while in the two groups of smaller farms it was 1.6% (15-30 ha) and 1.3% (5-15 ha).

In contrast, the smallest farms (1-5 ha) noted technological regress (2.3% annually), perhaps indicating that even the best farms (those which create technological progress) in this group could not afford the sufficient (i.e. enough to lead to positive growth effects) investments in technology. Most probably, this was due to a squeeze in profitability of their production and declining incomes which restrained them from investing. However, these small farms were able to offset the deterioration in technological change by increasing their scale efficiency (by 1.4% annually). The technological decline and overall technical efficiency growth (by 2.4%) means that this group became more consolidated in the sense that while the best farms become worse on average over those five years, the previously weaker farms did catch-up in terms of factor productivity with the better ones in this group. The fact that the catch-up effect was due to an increase in scale efficiency and not 'pure' technical efficiency can be logically explained by the fact that in the short- to medium-term it is easier for small farms to adjust their scale of production towards more optimal (i.e. enlarge the farm), rather than more advanced technology (which requires not only financial capital but also knowledge) and/or improvements to farm management (which also requires sufficient education).

Surprisingly, in the group of the largest farms (above 30 ha), despite the fact that technological progress was the highest there, there was also the highest decline in technical (in)efficiency (by 3.4%) which overweighed the progress made, and resulted in the highest productivity drop (by 1.5%) of all the size groups. The decline in technical efficiency was not attributed to a drop in scale efficiency but stemmed from 'pure' technical inefficiency. Hence, the results reveals the fact that while the best farms improve quickly and move the production frontier upwards, the rest of the farms do not catch-up with them (cannot increase their efficiency more than proportionally to the shift in the frontier). Another feature is that the changes in efficiency of scale were less important (0.4% decline) than changes in 'pure' technical efficiency (a 3% decline). This generally suggests that it was not size-related but management-related problems that occurred amongst these farms. Another possible

⁴ AWU is a commonly used variable representing labour input. It is expressed in full-time working units per annum, instead of hours. It recalculates the hours into the equivalent of full-time workers.

⁵ Depreciation was provided in original database. It was calculated by IERiGŽ in linear way according to the current accounting standards.

explanation concerns investments undertaken by the farms (at the time capital intensity increased in the group above 30 ha). Bought machinery could perhaps not be fully utilised due to lack of owner knowledge (e.g. some of their functions were not used) or improper size (the machine's capacity was unadjusted to the scope of production), or due to obsolete capital. There is evidence of negative effects of over-capitalisation and ageing of capital on the efficiency of Polish farms (Latruffe, et al. 2005).

Productivity changes and type of activity

There were also considerable differences in TFP patterns between groups of different activities. Only the arable farms were able to slightly improve their productivity (by 0.3%), while livestock and mixed farms experienced a considerable fall in productivity (1.0% and 2.2% respectively) over the analysed period. In crop farms this was mainly driven by a high technological progress (2.1%), which may be explained in various ways. For example, crop production in Poland appears to have had a higher initial technological lag than in livestock production and the initial inefficiency was also larger in arable farms than in livestock ones. Therefore, an improvement in the technology of crop production was more desirable and hence was able to trigger investments in technology, which could bring about a quicker advancement (higher marginal effect of those investments) than in livestock farms. Besides, the crop producers benefited from a more favourable intervention policy than livestock producers over the analysed period. This was visible, for example in higher (by a few points percentage) producer subsidy equivalents (PSE) for crop products than for livestock during this period. Another hypothetical explanation is that the arable farms, to a larger extent than livestock farms, benefited from advancement in intermediate inputs, with better quality fertilisers, certified seeds, chemicals, pesticides, etc becoming more common. Lastly, this positive technological progress could be explained by various indirect effects, as, for example, the fact that they were on average, larger and better-off farms, and probably as such had better access to preferential investment credits and hence invested more at that time, etc.

However, technological progress in arable farms was accompanied by a decline in technical efficiency (1.8%), which was due to decline in 'pure' technical efficiency (3.0%) and this despite a considerable improvement in scale efficiency (1.2%). The latter was most probably due to the fact that the farms, while operating at that time under increasing returns to scale (Latruffe, et al. 2005), were able to consolidate their land – the average size of farms in this group increased by 6 ha over the five years. However, the decline in 'pure' technical efficiency might indicate managerial problems. According to Latruffe et al. (2005), these problems are related to the fact that arable farms in Poland usually hire more external labour and rely less on family labour (similar as in the case of large farms) and again the reliance on family labour proved more beneficial to the efficiency of farms as 'pure' technical efficiency in arable farms declined much more than in livestock farms. It is important to note, that arable farms proved quite heterogeneous, i.e. while the best farms in this group grow quickly and shift the production frontier (causing significant technological progress), the other farms cannot catch-up with them as they cannot improve their efficiency, especially that connected to bad management practices and maybe also with principle-agent dilemmas.

Livestock and mixed farms also experienced a positive technological change (led as always by the best farms in the groups), although both also experienced a decline in technical efficiencies (by 2.2% and 2.7% respectively). This means that the majority of the farms were not able to catch-up with technological advancement dictated by the leaders, neither by increasing their efficiency of scale, nor technical efficiency, hence TFP in both these activity groups declined. A higher decline was in mixed farms than in livestock farms, probably due to differences in level of specialisation (this is discussed in the next section).

Productivity changes and specialisation

Patterns of TFP changes also depended on farm specialisation. The best performing farms were those with two or three stable types of activity - only in this group did productivity increase (1.1%). In contrast, groups of farms which had a single type of activity or various and changeable types of

activities experienced declines in productivity of 1.5% and 1.1%, respectively. The success of the group with two or three stable activities was due to high technological progress (2.0%), accompanied by a small drop in technical efficiency performance (0.8%). This means that the shift in technology (dictated by leaders) was followed by the rest of farms in the group, i.e. they were able to improve their efficiency and technology more than proportionally and move closer to the production frontier (and to the leaders). This may possibly be explained by the fact that this group, although specialised in one production, also however maintained other activities, so if one activity became less profitable they could benefit from the others. As such, the success of the group could be probably attributed to good risk management on-farm risk diversification.

Surprisingly, the group with single activity, although it had similar technological progress (1.8%) as the former group, was so diverse that while leaders were shifting the frontier upwards, the rest of the farms lagged increasingly behind them. As a result, overall technical efficiency decreased substantially (3.2%) and productivity declined by half of this (1.5%). This may be explained, for example, as follows: if one activity was profitable over the analysed period, then the farm specialising in this activity had resources to invest in better technology of production and, hence, grew quickly and boosted technological progress. However, farms with activity that became unprofitable in that time, underwent serious problems because they needed time and resources to change or diversify their single production. Hence, at first they had to cover losses and only later invest in change of the activity type, and as such were not able to catch-up with profitable and well-off farms. Generally, their failure was due to the large risk of single specialisation. It would seem that the profitability of different activities divided the group into profitable leaders pooling the progress and unprofitable followers struggling with profitability and hence unable to catch-up with their more fortunate counterparts. For each specialisation group it would be interesting to examine (in future studies) which single activities were building and pushing the frontier upwards and, which was in a catch-up position. This explanation appears consistent with the general observation of high instability of farm markets over the period, including ineffective stabilisation policy.

A different situation occurred in the case of the group of farms with various and changeable activities, which experienced negative technological change (1.5%). One conceivable explanation may be that even the best farms lacked a minimum level of specialisation, so they had no incentives to sufficiently invest in a certain technology, because they probably could not find one technology which could serve all the types of production they had. There was a slightly positive increase in technical efficiency (0.3%) in this group, which indicates that while the leaders failed and pushed the frontier inwards, the rest of the farms were able to catch-up with them and the group probably became more homogenous.

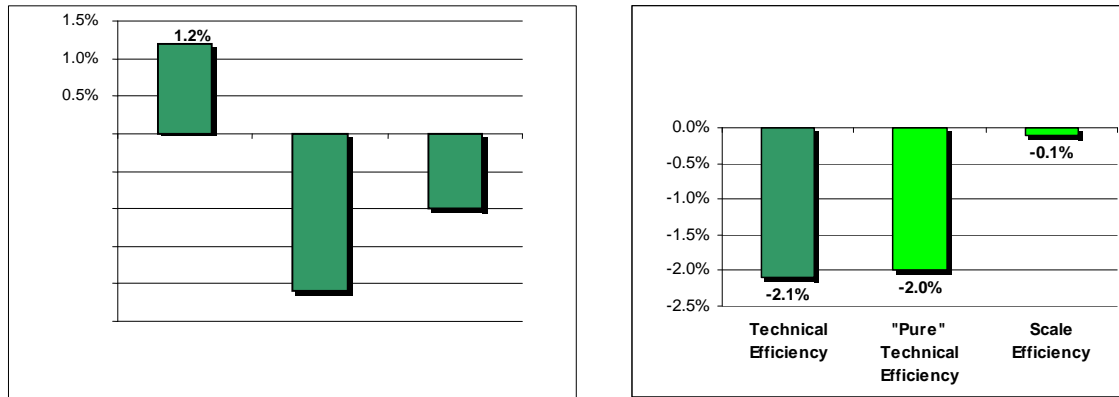
Overall productivity changes

All the findings on productivity decomposition discussed above can be aggregated as in the Figure 2. Technological progress (defined as in the Malmquist decomposition methodology) turned out to be rather weak (1.2% annually) and by far outweighed by the decline in technical efficiency (-2.1% annually), which declined mainly due to a fall in 'pure' technical efficiency (-2%), rather than scale efficiency (as the latter was negligible, -0.1%). As a result, Polish farms experienced an annual average decline in total factor productivity of 1% between 1996-2000.

It is clear that this fall in productivity was due to lack of good management and a technical lag rather than scale inefficiency. This does not, however, mean that the latter should not be improved. On the contrary, it should be improved as the arable farms operate under increasing returns to scale (IRS) and livestock farm under decreasing returns to scale (DRS) as indicated by Latruffe, et al. 2005, so both can still adjust their size to that which is optimal.

As all initial research questions have now been addressed, the thesis can now move onto verification of its underlying hypothesis. The earlier outlined suspicion that changes in total factor productivity may have been weak, but positive, turned out to be incorrect, as actual changes were negative. Consequently, the hypothesis that changes in TFP did not offset the changes in relative

prices during 1996-2000 was accepted. To conclude, the outlook was gloomier than had been initially thought, as although slow but positive TFP growth had been expected, it turned out to be negative. Thus, productivity not only did not offset pressures on the farm sector but even contributed to its decline. This TFP fall was caused mainly by a drop in technical efficiency. At the same time technological progress was evident but slow.



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All in all, we can positively verify the Hypothesis 2, since the total factor productivity of the Polish farm sector declined in the second half of the 1990s and, therefore, not only did not offset the adverse effects of the changes in relative prices but even amplified them.

Conclusions

This paper analysed changes in competitiveness of Polish farms few years prior to integration with the EU. Two main hypotheses were tested. The first stated that relative agricultural prices deteriorated during the analysed period mainly due to the strong pressure stemming from outside of the sector (changes in macroeconomic fundamentals and international markets), which, however, was too strong to be offset by the intervention policy. The second one stated that changes in total factor productivity (TFP) did not increase and hence did not compensate for the deteriorated relative prices. The positive verification of these two hypotheses together allowed us to conclude that overall competitiveness of the farm sector in Poland declined between 1996-2000.

The results indicate a more gloomy picture than initially expected. Productivity should have been improved not only due to relative price pressure but mainly due to the fact that it already lagged behind the other sectors in the economy (it is 1/6 of general labour productivity in Poland) and behind the EU agricultural sector (it is 1/8 of the EU average level). If agriculture is to positively contribute to the overall well-being of the country, it has to catch up with productivity and although the process of preparing to the EU make an additional pressure to this (plus coincides with transition), the sector may not be responsive enough to cope with this. However, technological progress itself does not assure positive productivity growth, as we can see from the research. It turned out that it must be accompanied by an improvement in efficiency in order to boost factor productivity. The main obstacles to efficiency improvement occurred low education of farm owners (heads), suboptimal farm size (fragmentation of land in too many plots), and obsolete capital.

There are at least two lessons for policy makers especially in the new candidate countries (Bulgaria, Romania, Turkey). First, agricultural policy in transition should be 'productivity oriented' because it proves much more effective and longer-lasting than the policy of price intervention (oriented toward maintaining favourable relative prices). Second, if the policy does not support productivity it allows for a decline in competitiveness of the sector and then, before EU accession, it is very likely that farmers will be a strong opposition to the integration process and may vote against it.

References

- Abbott, P.C. and Bredahl, M.E. (1994). Competitiveness: Definitions, Useful Concepts, and Issues. In Bredahl, M.E., Abbott, P.C., Reed, M.R. (eds), *Competitiveness in International Food Markets*. Westview Press, Boulder, San Francisco, Oxford.
- Balassa, B. (1965). Trade Liberalization and 'Revealed' Comparative Advantage. *The Manchester School* 22: 99-123.
- Boltho, A. (1996). The Assessment: International Competitiveness. *Oxford Review of Economic Policy* 12(13).
- Bureau, J.-C. and Butault, J.-P. (1992). Productivity Gaps, Price Advantages and Competitiveness in E.C. Agriculture. *European Review of Agricultural Economics* 19: 25-48.
- Corden, W. M. (1971). *The Theory of Protection*. Clarendon Press, Oxford.
- Davidova, S., Gorton, M., Ratering, T., Zawalińska, K., Iraizoz, B., Kovács, B. and Mizo, T. (2002). An Analysis of Competitiveness At The Farm Level in The CEECs'. Idara Working Paper,
- Dunning, H.J., Bannerman E., Lundan, S.M. (1998). *Competitiveness and Industrial Policy in Northern Ireland*. Northern Ireland Economic Council, Belfast.
- Griliches, Z. (1960). Measuring Inputs in Agriculture: A critical Survey. *Journal of Farm Economics* 42(5): 1411-147. 2/11, Wye, January 2002.
- Färe, R.S., Grosskopf, M. Norris and Zhang, Z. (1994). 'Productivity Growth, Technical Progress, and Efficiency Changes in Industrial Countries', *American Economic Review*, 84, pp.66-83.
- Guzek, M. (1993). *Analiza komparatywnych przewag Polski wobec WE w zakresie wybranych produktów rolnych i żywnościowych*. Biała Księga. Polska –Unia Europejska, Office of the Council of Ministers: Warsaw.
- Latruffe L., Balcombe K., Davidova S. and Zawalinska K. (2005). Technical and Scale efficiency of Crop and Livestock Farms in Poland. Does Specialisation Matter?. *Agricultural Economics* 32 (3) 281-296
- Latruffe L., Balcombe K., Davidova S., Zawalinska K. (2004). Determinants of technical efficiency of crop and livestock farms in Poland. *Applied Economics* 36(12): 1255-1263
- Lerman, Zvi. (2002). Productivity and Efficiency of Individual Farms in Poland. Working Paper, No. 20118, The Center for Agricultural Economic Research, Rehovot, Israel.
- Majewski E. and Dalton G. (eds.) (2000). *The Strategic Options for the Polish Agro-food Sector in the Light of Economic Analyses*, PHARE Project P 9704-01-03/04/13/17, FAPA, Warsaw.
- Mech, D-M. (1999). *The Survival of Peasant Agriculture in Poland*, PhD Thesis, Wye College, University of London, unpublished, mimeo.
- Nishimizu, M. and Page, J. M. Jr. (1986). Productivity Change and Dynamic Comparative Advantage. *The Review of Economics and Statistics* 68(2): 241-247, May.
- Poganietz W., Zezza A., Froberg K., Stamoulis K. G. (eds.) (2000). *Perspectives on Agriculture in Transition: Analytical Issues, Modelling Approaches, and Case Study Results*, FAO and IAMO: Halle (Saale).
- Porter, M. (1990). *Competitive Advantage of Nations*. New York: Simon & Schuster Trade.
- Quiroz, J. and Valdes, A. (1993). Agricultural Incentives and International Competitiveness in Four African Countries: Government Interventions and Exogenous Shocks. In Valdes, A. and Muir-Leresch, K. (eds), *Agricultural Policy Reforms and Regional Market Integration in Malawi, Zambia, and Zimbabwe*, IFPRI, Washington DC.
- Ricardo, D. (1817). *On the Principles of Political Economy and Taxation*. London, John Murray.
- Safin, M. (1995). Direct and Indirect Policy Impacts on the Polish Livestock Sector and the Perspective of the Accession to the European Union. PhD thesis, unpublished, mimeo, Wye College, University of London.
- Valdes, A. (1996). Surveillance of Agricultural Price and Trade Policy in Latin America during Major Policy Reforms. *World Bank Discussion Paper* No. 394.
- van Zyl, J., Miller, B. and Parker, A. (1996). *Agrarian Structure in Poland: the myth of large farm superiority*. Policy Research Working Paper No. 1596. Washington D.C.: The World Bank.
- Woś, A. (2001). *Konkurencyjność Potencjalna Polskiego Rolnictwa*. Projekt badawczy nr 5 H02C 07021, Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej, Warszawa.

Appendix

Box 1.1 Decomposition of Domestic Resource Costs by Nishimizu and Page (1986)

From the definition of DRC, and assuming two factors of production, we can express this as a ratio of domestic factor costs at shadow prices to value added at world prices (see also Tsakok,1990):

$$(1) DRC = \frac{wL + rK}{pV}; \text{ where } w \text{ is a vector of shadow wage rates, } r \text{ is a vector of shadow rental costs of capital, } L \text{ and } K \text{ are vectors of labour and capital input requirements, respectively; } p \text{ is defined as the world price and } V \text{ as value added (both shadow prices can be directly expressed in terms of foreign exchange – following the convention set by Little and Mirrlees,1974. Assuming value added is a well-behaved function of primary inputs and time } V = f(K, L, T) \text{ then:}$$

(2) $\frac{dV}{V} = a_L \frac{dL}{L} + a_K \frac{dK}{K} + a_T dT$; where the weights a_L and a_K are the value added elasticities of labour and capital, respectively, and $a_T dT$ is the rate of change of TFP. Then proportionate change in the DRC ratio can be expressed as:

$$(3) \frac{dDRC}{DRC} = s_L \frac{dw}{w} + s_K \frac{dr}{r} - \frac{dp}{p} + (s_L - a_L) \frac{dL}{L} + (s_K - a_K) \frac{dK}{K} - a_T dT$$

Competitiveness Factor cost effect ToT effect Changes in techniques TFP effect

$$\text{where: } s_L = \frac{wL}{wL + rK} \text{ and } s_K = \frac{rK}{wL + rK} \text{ are the shares at shadow prices of labour costs and capital costs in total primary factor costs.}$$

Box 1.2. Data Envelopment Analysis (DEA)

The TFP decomposition method requires linear programming techniques to identify the technology frontier and measure the distance to that frontier for each observation (firm) in the sample. This is termed Data Envelopment Analysis (DEA). DEA was originally designed in fact only for calculating efficiencies of individual firms and was first proposed by Charnes et al. (1978). However, following Fare et al (1994), one can use DEA-like linear programming to calculate the appropriate distance functions to also measure TFP changes over time, and TFP decomposition into particular efficiency changes. For the i -th firm, in order to measure the TFP change between two periods (t and s), output-orientated under constant returns to scale (CRS), we would have to solve the following 4 Linear Programming (LP) problems (Coelli et al. 1998):

$$\begin{aligned} \max_{\phi, \lambda} \phi &= [d_o^t(y_t, x_t)]^{-1} & \max_{\phi, \lambda} \phi &= [d_o^s(y_s, x_s)]^{-1} \\ \text{subject to } & -\phi y_{it} + Y_t \lambda \geq 0 & \text{subject to } & -\phi y_{is} + Y_s \lambda \geq 0 \\ & x_{it} - X_t \lambda \geq 0 & & x_{is} - X_s \lambda \geq 0 \\ & \lambda \geq 0 & & \lambda \geq 0 \end{aligned}$$

$$\begin{aligned} \max_{\phi, \lambda} \phi &= [d_o^t(y_s, x_s)]^{-1} & \max_{\phi, \lambda} \phi &= [d_o^s(y_t, x_t)]^{-1} \\ \text{subject to } & -\phi y_{is} + Y_t \lambda \geq 0 & \text{subject to } & -\phi y_{it} + Y_s \lambda \geq 0 \\ & x_{is} - X_t \lambda \geq 0 & & x_{it} - X_s \lambda \geq 0 \\ & \lambda \geq 0 & & \lambda \geq 0 \end{aligned}$$

where: X and Y are matrices of the inputs and outputs respectively of all observed (N) farms; x_i and y_i are respectively the input and output vectors of the i -th farm; λ is a $N \times 1$ vector of constants; ϕ_i is the technical efficiency of the i -th farm, bounded by 0 and 1, with a value of 1 indicating a technically efficient firm. The variable returns to scale (VRS) DEA model is obtained by adding the constraint $N1' \lambda = 1$, where $N1$ is a $N \times 1$ vector of ones. This is a convexity constraint ensuring that a firm is benchmarked against firms of a similar size. When conducting both constant returns to scale (CRS) and variable returns to scale (VRS) DEA, the scale efficiency is obtained as a ratio of the CRS efficiency measure over the VRS measure. Technical efficiency under CRS is called total technical efficiency and technical efficiency under VRS is called pure technical efficiency.