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# **The productivity situation in Macedonian agriculture: Gainers and losers during the first decade of the 21<sup>st</sup> century**

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## ABSTRACT

This paper examines the production and productivity growth of Macedonian agriculture. Furthermore, having in mind the distinctive dual structure of Macedonian agriculture, this study investigates the differences in productivity surplus between family farms and agricultural companies. In the period from 1998 to 2008, the sector experienced an increase in terms of volume with an average annual rate of 0.8%, and a productivity or growth rate of 0.7% per annum. The partial productivity of the production factors generally increased throughout the whole period. The productivity growth mainly originated from the increase in agricultural output prices and was distributed to the input suppliers. Additionally, an important benefit was received by family labour with 1.5% of the surplus. Family farms proved to be more consistent in production and productivity growth, despite their small and heterogenic features. In contrast, the production and productivity levels at agricultural companies seem to follow a decreasing trend. The decision makers should consider the source and allocation of productivity gains when formulating the agricultural and rural development policy. This approach also provides ground for monitoring and assessment of the policy, through measurement of the distribution of the increasing governmental support and the EU pre-accession funds.

**Key words:** productivity gains, surplus accounts, Macedonian agriculture

## I. INTRODUCTION

Traditionally, agriculture is one of the most important sectors in Macedonia<sup>1</sup>, participating with around 10% in the Gross Domestic Product (GDP) (SSO, 2010). Coupled with the industry, the share of the agri-food sector in the GDP increases to about 15%. The sector is also a significant absorbent of the labour force, contributing with some 20% to total employment.

The value of the agricultural production amounted to 1,239 million euro in 2008. The largest part of the output value with around 70% belongs to crop production, and the remainder to livestock production. The major crops are vegetables, cereals, grapes and fodder crops; as for the livestock production, dairy farming and sheep breeding are the most significant. Agricultural services contribute with less than 1% to the total agricultural output.

Family farms and agricultural companies (mostly originating from the former state-owned kombinats) constitute the country's farm structure. There are 192 thousand family operated agricultural households cultivating approximately 264 thousand ha of utilised agricultural area (UAA), thus resulting into an average family farm size of 1.4 ha. Additionally, around 300 agricultural companies operate on 70 thousand ha UAA, meaning that the average size of land cultivated by companies is 235 ha (SSO, 2008). Family farms own or lease around 80% of agricultural land, whereas agricultural companies lease the remaining 20% that are in the ownership of the state (SSO, 2008). The largest portion of the total agricultural production is produced at family farms.

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<sup>1</sup> Macedonia's constitutional name is the Republic of Macedonia and this country is being provisionally referred to within the United Nations system as 'the former Yugoslav Republic of Macedonia' (UNSC Resolution 817/1993)

The country is aspiring to join the European Union and integrate into the common European market. The Stabilization and Association Agreement with the EU signed in 2001 provided an opportunity for more intensive access to the EU market. In December 2005, Macedonia officially became a candidate country for EU membership. The market was further liberalised via a number of bilateral free trade agreements and the Central European Free Trade Agreement (CEFTA) membership. The liberalization and integration in these markets challenged the competitiveness of the Macedonian agriculture (Dimitrievski and Kotevska, 2008).

Overall, the Macedonian agricultural sector demonstrated slow but steady growth in terms of value and volume over the past decade. As in most Western Balkan countries, the increase in agricultural production is typically explained as a result of a rise in yields, mostly through improvements in production technology (Volk *et al*, 2010). In this sense, it is necessary to look more thoroughly at the features of the sector and examine the sector development in the past period. Hence, the aim of this paper is to examine the production and productivity of Macedonian farms, with emphasis on the origin and distribution of the productivity growth. The basic idea behind this approach is to determine who is benefiting among stakeholders from an increase in productivity gains: consumers through a decline in output prices, farmers through increase of income or suppliers through increase of input prices. Furthermore, having in mind the distinctive dual structure of Macedonian agriculture, this study investigates the differences in productivity surplus between family farms and agricultural companies.

The paper starts with an overview of the methodology and the applied productivity measurement model, based on the economic accounts in agriculture. Then we provide presentation and discussion of the results on productivity growth of Macedonian agriculture, in general and by farm structure. The conclusions are given in the end.

## II. METHODOLOGY AND DATA

Productivity presents the relationship between the volume of outputs and the volume of inputs. Measuring productivity requires aggregation of the volume of different products and various production factors, such as intermediate consumption, capital, land and labour. An increase in productivity is characterized by a shift of the production function and a consequent change to the output/input relation (Saari, 2006). Surplus value indicates that the output has more value than the sacrifice made for it; in other words, the output value is higher than the value (production costs) of the used inputs (*ibid*). Improvement of the productivity allows lower prices to benefit the consumers and increased earnings of the production factors. The method and productivity measurement model presented herewith was applied in French surplus productivity studies (Bureau *et al*, 1992; Butault *et al*, 1994).

Sector productivity, based on constant returns to scale, can be expressed as an equality between the product of the price of output and volume of output, on the one hand, and the product of the price of input and volume of input, on the other hand. Constant returns to scale imply that all the output revenues that have been generated must be used to pay for the factors of production. This can be demonstrated through a simplified case, where  $p$  is taken as the price of the output ( $Y$ ) and  $w$  is the price of the input ( $X$ ), and the initial period is marked as  $0$  and the final period as  $t$ :

$$p_0 * Y_0 = w_0 * X_0$$

$$p_t * Y_t = w_t * X_t$$

One measure of productivity is the volume of outputs and inputs, but also the ratio of prices of inputs and outputs. The latter is useful in the case where we want to compare productivity between two periods or two sectors. Indeed, it shows how differences in productivity marked changes in either different output prices, or in different trends in the price of inputs. In this context, the productivity index ( $r$ ) can be expressed as ratio of the volume indices between output and input *i.e.* it equals the value indices of expenses and output prices:

$$r = (Y_t/Y_0)/(X_t/X_0) = (w_t/w_0)/(p_t/p_0)$$

The excess – surplus of productivity ( $S$ ) presents the gains provided by productivity *i.e.* the difference between the volumes of outputs and products inputs used. For the sake of clarity, let us assume an industry producing one output with one input; the productivity surplus is then illustrated by the following expression:

$$S = (p_0 * dY) - (w_0 * dX) = (X_t * dw) - (Y_t * dp)$$

The right-hand side of the expression represents the price changes weighted by the final period quantities and can be interpreted as the distribution of the productivity surplus. This surplus may allow for increased prices of input and/or a decrease in output prices. In fact, the price of input may decrease and the declining output price will be stronger than the contribution of productivity gains. Also, the price of output may increase and then the input will benefit from this increase in more productivity gains. Excess productivity may itself be negative and this loss will then be compensated by a change in output and input prices. The alterations represent either a source, or a recipient of the distributable surplus, and the objective of the surplus accounts is to describe these transfers between agents, as shown in Table 1.

**Table 1. Transfer of productivity growth**

	Source (generation)	Distribution (allocation)
Productivity surplus	Positive	Negative
Agricultural prices (consumers)	Increase in output prices	Decrease in output prices
State	Tax cuts; increase in subsidies	Tax increase; decrease in subsidies
Suppliers	Decrease in prices of intermediary consumption	Increase in prices of intermediary consumption
Capital and land	Decrease of usage cost	Increase of usage cost
Return on labour	Decrease	Increase

Source: Butault, 2006

Unlike the productivity rate, the productivity surplus depends on the system of prices. Appropriate indices must be applied when aggregating the quantities of different products and, in this sense, it is possible to generalise the formulation by using indices and apply it

to a wide range of products and price. Diewert and Nakamura (2003) established that the Paasche price index is the implicit counterpart of a Laspeyres quantity index, and the Laspeyres price index is the implicit counterpart of a Paasche quantity index. In the surplus accounts, the volume variations are weighted by the final period price (using Paasche index), while the price variations are weighted by the base period volume (Laspeyres index). The volume indexes are of Sidgwick-type, calculated as the arithmetic mean of the Laspeyres and Paasche indices, and Fisher index is their geometric mean. In this study, Fisher index was applied for volume and prices due to its reversibility (Butault, 2006).

The rate of surplus is defined as ratio of the surplus and the value of the product (cost value):

$$s = (dY * p_0) / p_0 * Y_0 - (dX * w_0) / w_0 * X_0$$

The rate of surplus appears as the difference between the rate of the production growth and that of the production factors (Butault, 2006). Basically, the rate of surplus ( $s$ ) and the rate of productivity ( $r$ ) are equal in approximated values, with negligible variations, as observed with the data in the model. This basically allows presenting the surplus accounts as break-down of the productivity rate.

This study is based on the Economic Accounts for Agriculture and the annual reports that are prepared by the State Statistical Office of the Republic of Macedonia (SSO). These accounts were first published in 1998, following the EUROSTAT methodology. The study period therefore comprises the accounts from 1998 to 2008 (divided into two sub-periods corresponding to the economic and political situation that has changed between the two periods). The data used for the compilation of the agricultural accounts are gathered from regular statistical surveys conducted by SSO, financial reports from the Central Register and data for paid financial aid in agriculture by the Ministry of Agriculture, Forestry and Water Supply. The gross value of production includes the production of “small units” which has a substantial character, as well as the production of the units, for whom the production is part-time activity or hobby.

Since intermediate consumption was only available in terms of value in the accounts, appropriate volume indexes were derived using accessible data on major inputs from SSO. The user cost and volume of capital was calculated as a function of the depreciation value. The volume of land was determined by developments in the utilised agricultural area (UAA). The share of family labour in the total labour force at family farms was based on the 2007 Agricultural Census findings (SSO, 2008); we assumed that agricultural companies engage only paid labour. The distribution of agricultural output and input volumes between family farms and agricultural companies was calculated upon available data from SSO (yields per specific crop and livestock enterprises, input use, land use etc). The balance between the value of agricultural output and all expenses corresponded to net farms income (NFI). This indicator was further calculated per non-paid family labour, expressed in annual working units (AWU).

In the accounts of the sector, output is measured or valued production in producer prices and basic price<sup>2</sup>. The volume index of agricultural production was calculated on the basis

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<sup>2</sup> The producer price is the amount receivable by the producer from the purchaser for a unit of a product minus value added tax, or similar deductible tax, invoiced to the purchaser. The basic price is the amount

of price data. Nominal values at basic prices were initially taken into account. Results are given as averages smoothed over three years. All values are deflated using the GDP price index.

### III. RESULTS AND DISCUSSION

The study of the Macedonian agricultural sector in a period of 11 years (1998-2008) provides an outlook of the production and productivity tendencies, resources' endowments and allocation of the productivity gains. The results are given as aggregated for all farms, and also by farm sub-sectors (family farms versus agricultural companies).

#### Productivity growth on Macedonian farms

In the period 1999-2008 the volume of agricultural production increased by an average annual rate of 0.8% (Table 2). Two sub-periods can be clearly defined; in the sub-period 1999-2003, the production volume actually decreased by -1.25%. In the next few years, from 2004-2008, the volume increased by an average annual rate of 2.88%.

**Table 2. Annual rates of production volume, productivity and prices**

	1999-2008	1999-2003	2004-2008
<b>Volume</b>			
Production at base prices	0.79	-1.25	2.88
<b>Productivity (base price)</b>			
Intermediary consumption	1.63	0.68	2.59
Capital	-0.57	-2.95	1.86
Land	2.86	0.81	4.96
Labour	1.37	-0.29	3.05
Total	0.66	-2.39	3.81
<b>Price indices</b>			
Production at production price	2.53	3.28	1.79
Production at base price	2.67	3.28	2.06
Production with subsidies	2.62	3.28	1.96
Intermediary consumption	3.92	3.70	4.14
Capital	0.51	-0.79	1.83
Land	12.34	1.23	24.68
Paid labour	-4.78	-6.37	-3.17
Family labour	2.70	-3.16	8.92
Total	3.29	0.81	5.84
Total without family labour	2.90	2.15	3.65
Productivity rate	0.66	-2.42	3.77

receivable by the producer from the purchaser for a unit of a product minus any tax on the product plus any subsidy on the product. (EUROSTAT, <http://ec.europa.eu/eurostat>)

In general, the agricultural productivity improved by 0.7% annually. There is a distinctive difference between the two sub-periods: the productivity records an annual fall of -2.4% in the period 1999-2003, and sharp rise to 3.8% in the period 2004-2008, respectively. A productivity growth study in other Balkan countries (Albania, Bulgaria, Romania and Slovenia) estimated that the total productivity increased in the period 1998-2000 with an average rate of 2.1%, than intensified to 6.9% from 2001 to 2004, but then dropped with -3.0% in the period 2004-2006 (Swinnen *et al*, 2010).

The partial productivity of the production factors generally increased throughout the whole period; the land productivity grew most significantly with 2.9% annual rate, the intermediary consumption with 1.6%, and the labour productivity improved by 1.4%. The only fall in productivity in the whole research period is noted with the capital, with annual decrease of -0.6%. The partial productivity of all factors is growing in the period 2004-2008.

In terms of agricultural prices, an annual increase is noted of around 2.5% during the whole period; subsidies have increased the agricultural price slightly to 2.6%. It is important to note that in the first sub-period (1999-2003), no direct subsidies were provided by the state. As of 2004, the state began supporting the agricultural sector through subsidies, so therefore in the period 2004-2008 this was reflected by 0.2% increase in the production with subsidies price index. Prices have increased more substantially in the period 1999-2003, with 3.3% annual rate, and this trend was significantly reduced to 1.8% in the period 2004-2008.

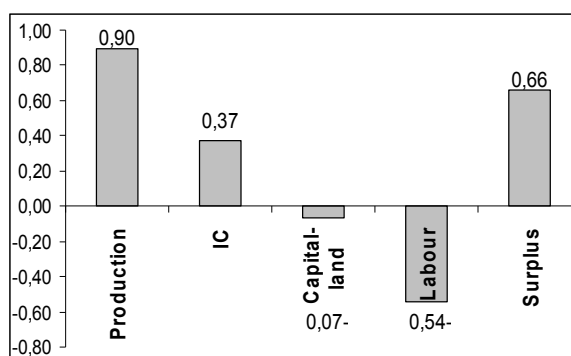
In the surplus accounts (Table 3) the surplus rate amounts to 0.7%, as surplus restored to the average annual production. The surplus rate, as expected, has approximate values to the productivity rate, thus decreased in the first sub-period (-2.5% annually) and then increased in the following sub-period (3.8% annually). Production itself is the major contributor to that growth (Figure 1), with around 0.9% annually.

The largest surplus originated from the increase in agricultural output prices and therefore was ultimately paid by the consumers, with an average rate of 2.5% (Figure 2). The state contributed with an average rate of 0.2%, mainly resulting from the introduction of subsidies in the second sub-period (annual increase of 0.39% in the period 2004-2008). The increase in the prices of intermediary consumption (3.9% annually) corresponds to the distribution of the surplus to the input suppliers with 2.1%.

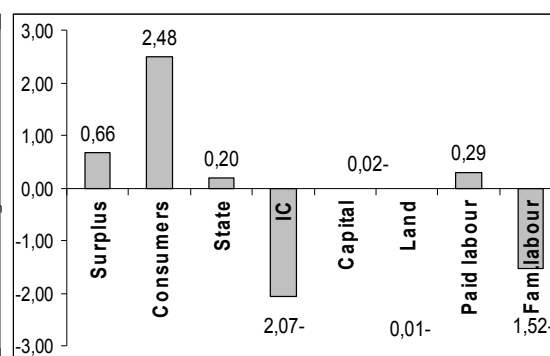
**Table 3. Distribution of the surplus**

	1999-2008		1999-2003		2004-2008	
	Source	Distribution	Source	Distribution	Source	Distribution
Surplus	0.66		-2.48		3.80	
Agricultural prices	2.48		3.31		1.65	
State	0.20		0.01		0.39	
Suppliers		2.07		2.08		2.07
Capital		0.02	0.04			0.08
Land		0.01		0.00		0.03
Paid labour	0.29		0.50		0.07	
Family labour		1.52	0.70			3.74
Total	3.63	3.63	2.08	2.08	5.91	5.91





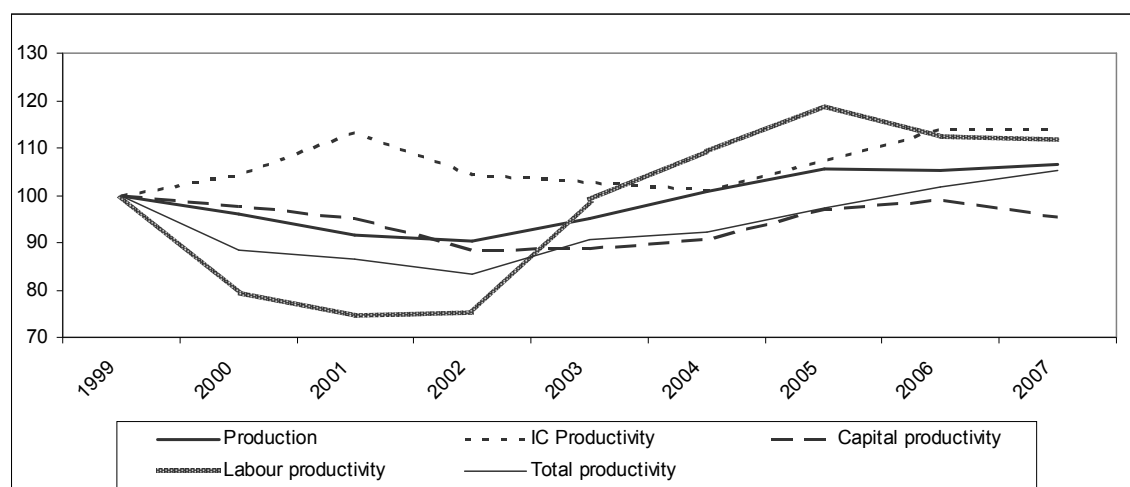
**Figure 1. Productivity gains, 1999-2007**



**Figure 2. Surplus distribution, 1999-2007**

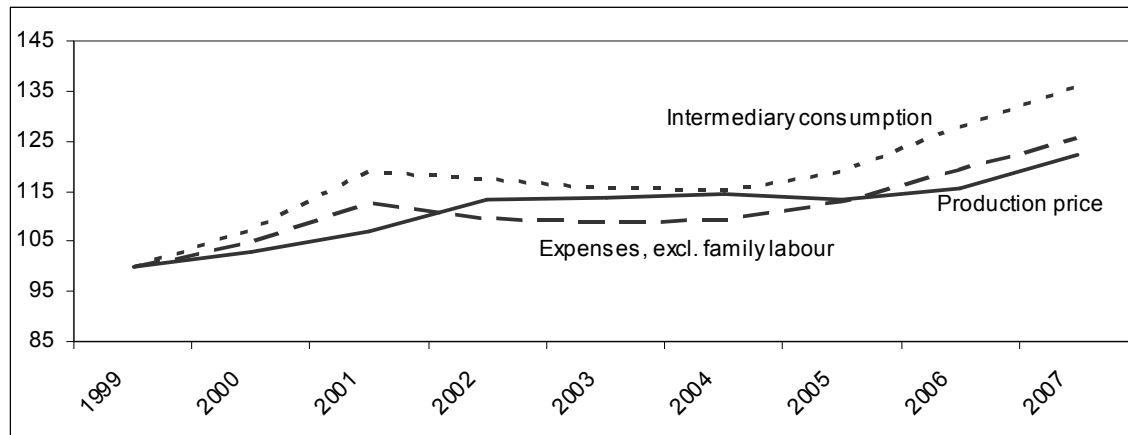
The increase in the net farm income (NFI) per family annual working unit (FAWU) in real terms (2.7% during the whole period, Table 2) corresponds to the benefit received by family labour with 1.5% of the surplus. The family labour also seems to gain from the surplus distribution more significantly in the period 2004-2008. In this context, it is important to mention that the engaged labour in agriculture increased by 17% in the period 1998-2007 i.e. from 111 thousand AWU in 1998 to 130 thousands AWU in 2008. The share of unpaid (family) labour has also increased from 34% of the total labour in 1998, to 46% in 2008.

Overall, the period from 1999 to 2003 featured decreasing productivity, especially in terms of labour productivity. The period from 2004 to 2008 marked increase in all productivity indicators, supporting the upward production trend (Figure 3).



**Figure 3. Production and productivity on Macedonian farms (1999-2007)**

There was a notable increase of prices on all levels (Figure 4); the production price grew throughout the whole period (22%), but the prices of intermediary inputs and expenses have even risen more substantially (35% and 23%, respectively).



**Figure 4. Evolution of real prices in Macedonian environment (1999-2007)**

### **Comparison of the productivity at family farms and at agricultural companies**

The volume of agricultural production showed an increase at family farms by an average annual rate of 2.1%, and a contrasting decrease of -4.3% annually at agricultural companies in the period 1999-2008. At family farms, the production volume fluctuated from 0.1% in the sub-period 1999-2003, to 4.1% from 2004 to 2008, while it remained in stable decline at agricultural companies. At companies, the analysis showed sharp drop in production, especially in terms of volume and productivity, somewhat distorting the results. Year 2008 was characterised by the outbreak of the financial crisis at global level, which obviously had higher impact on agricultural companies than on family farms. It is possible that this effect would have delayed impact on the individual sector after 2008. In order to obtain more realistic picture of this sub-sectors, some results will be presented for a period excluding 2008.

In general, the agricultural productivity increased by 0.6% annually at family farms, and decreased by -1.4% annually at agricultural companies i.e. by -0.2% with 2008 excluded. Again the productivity records the highest reduction in the period 1999-2003 for family farms and in the period 2004-2008 for agricultural companies.

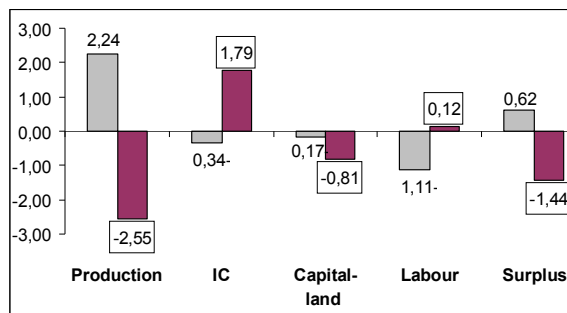
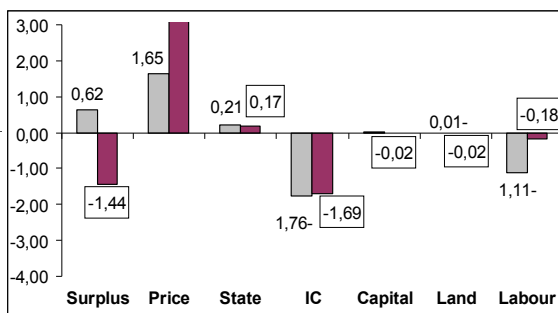
In the surplus accounts (Table 4) the surplus rate amounts to 0.6% at family farms. The situation is quite opposite at agricultural companies, with a shortfall of -1.4% annually (or -0.3% if 2008 excluded). Notably, at family farms, production itself is the sole generator to the growth (Figure 5), while the surplus is distributed mostly to labour and intermediary consumption.

The largest surplus at both family farms and companies originated from increased output prices, with an average rate of 1.7% and 3.2%, respectively (Figure 6). The subsidies from the state contributed to the productivity surplus, with around 0.2%. Since 2008 was a year with an evident increase in state support through subsidies, it is reflected through a smaller rate (0.1%) when this year is left out of the analysis period of productivity surplus at agricultural companies.

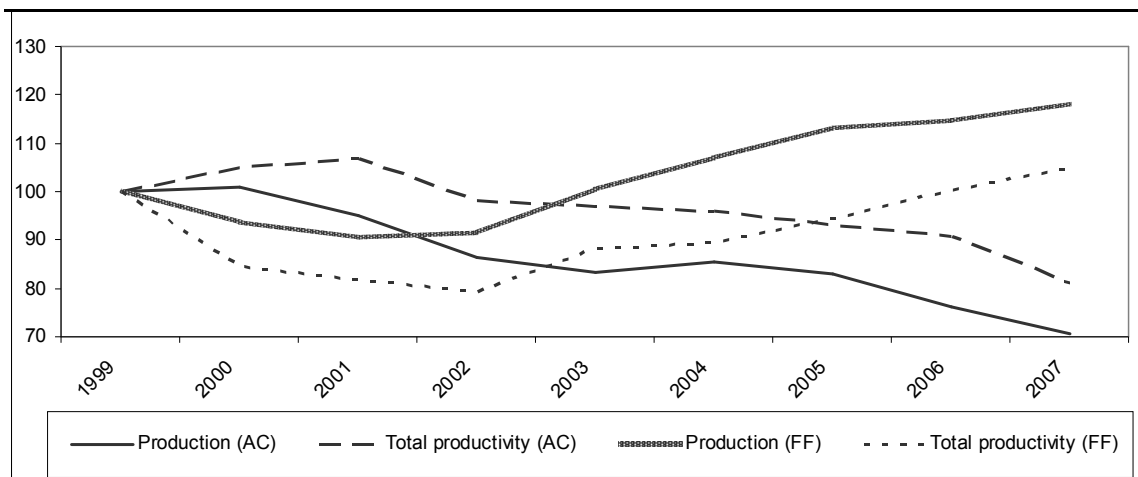
Family labour benefits the productivity surplus at family farms with 1.6%, and paid labour at agricultural companies gains with 0.2%, or even 1.33% without year 2008. The suppliers benefited the productivity surplus with annual rate from 1.4% to 1.8%.

**Table 4. Distribution of the surplus at family farms and agricultural companies**

	Family farms 1999-2008		Ag. Companies 1999-2008		Ag. Companies 1999-2007	
	Source	Distribution	Source	Distribution	Source	Distribution
Surplus	0.62		-1.44		-0.29	
Agricultural prices	1.65		3.17		2.96	
State	0.21		0.17		0.11	
Suppliers		1.76		1.69		1.43
Capital	0.00			0.02		0.01
Land		0.01		0.02		0.01
Paid labour	0.85			0.18		1.33
Family labour		1.56				
Total	3.33	3.33	1.90	1.90	2.78	-2.78

**Figure 5. Productivity gains, 1999-2008****Figure 6. Surplus distribution, 1999-2008**

When analysing the production and productivity indices from 1999 to 2008, the contrast between the two sub-sectors is evident, with an upward trend at family farms and a downward trend at agricultural companies. The total productivity rose by 5% over the course of the study period at family farms, and simultaneously dropped by 19% at agricultural companies (Figure 7). However, the most significant decrease at the production and productivity levels at agricultural companies occurred in 2008; if this year is isolated from the model, then the productivity falls by 10% at agricultural companies.

**Figure 7. Productivity at family farms (FF) and agricultural companies (AC)**

#### IV. CONCLUDING REMARKS

As in most of the Western Balkan countries, the agricultural sector in Macedonia has played a buffer role in a generally deteriorating economic situation, and continues to play an important role in maintaining a social equilibrium. The major factors hindering the development of agriculture are small-scale farms, a low share of market production, poorly-developed market structures, the lack of meeting food safety standards, and limited capacity for exports (Volk *et al*, 2010). In the period from 1998 to 2008, the sector experienced an increase in terms of volume with an average annual rate of 0.8%, and a productivity or growth rate of 0.7% per annum. The partial productivity of the production factors generally increased throughout the whole period. Both production and productivity are distinctively improving after 2003.

The EU approximation process will undoubtedly have an impact on the Macedonian agriculture; primarily, prices and trade flows will change. The results showed that in the past period agricultural prices had an annual increase of around 2.5%. The productivity growth mainly originated from the increase in agricultural output prices and was distributed to the input suppliers, meaning that price increases have played a major role. Additionally, an important benefit was received by family labour with 1.5% of the surplus. The consumers have ultimately provided the largest source of productivity growth by paying higher agricultural prices. However, the farmers did not benefit to the full extent of that situation since producer prices were also influenced by the high input prices.

The EU integration is likely to change the market conditions and that will inevitably have an effect on the farm income. In this respect, the introduction of the pre-accession instruments and funds is intended to prepare the sector for the common market by increasing the competitiveness through modernisation of the farms and more efficient use of resources. The decision makers should consider the source and allocation of productivity gains when formulating the agricultural and rural development policy. This approach also provides ground for monitoring and assessment of the policy, through measurement of the distribution of the increasing governmental support and EU funds through the Instrument for Pre-Accession Assistance for Rural Development (IPARD).

Family farms proved to be more consistent in production and productivity growth, despite their small and heterogeneous features. Although the privatisation process finished and the agricultural companies adopted market-oriented production strategies, the production and productivity levels at this sub-sector seem to follow a decreasing trend. The sector's dual farm structure was rarely examined from such perspective. Hopefully this study will initiate further investigation of these issues and contribute to the better understanding of the factors influencing the agricultural production and productivity growth in a (post)transition economy such as the Macedonian one.

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