ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 27 (1), 2018

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SOLD COMMERCIAL PRODUCTION AND ITS FINANCIAL SECURITY IN POLISH AGRICULTURE

The hypothesis that sold commercial production was most elastic with respect to the Single Area Payment Scheme (SAPS) in Polish agriculture in 2011–2013 (1.074) has been confirmed.
This research was based on the Cobb-Douglas power model with one dependent variable, applied in order to identify the regression dependence for commercial production sold under the SAPS (direct payment) and for a separate payment for fruit, vegetables and sugar (indirect payment) in Polish agriculture in 2011–2013. The models were used to calculate marginal and average productivity as a measure of the effectiveness of financial security in the sector. The correlation of sold commercial production with direct/indirect payment(s) in terms of the financial security under discussion was also examined. It was determined that direct payments remain within the irrational management zone, while indirect payments are within the rational management zone.
JEL: G23, Q14, R51

Introduction

Contemporary finance is the generality of monetary/pecuniary phenomena in relation to economic and social activity, as well as those activities that constitute the financial management of specific entities. The ultimate objective of these phenomena and processes is to generate goods and services that satisfy people's needs. The financial dimension is what enables resources to be allocated in the economy. The connection of financial phenomena and processes with the real economy comprises the economic content of finance. Monetary relationships enable economic transactions of goods and services. Economic and accounting theory describes the regularities and correctness of financial operations.

The stimulatory function of financial phenomena can be positive or negative. Any evaluation of these relationships, however, is conditional upon the expectations of the actors and of the financial phenomena triggered by concrete financial instruments.

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After considering all the options of the European Union's Common Agricultural Policy (CAP) as far as 2020, it would appear that the financial situation of economic entities in the EU agricultural sector is going to deteriorate (cf. European Commission, *CAP Towards Impact Assessment*, 2011).

Polish agriculture has additional difficulties as a result of constantly having to adapt to an environment shaped by changing global competition. Delayed return on investment, long production periods, and limited or restricted mobility of production factors are all characteristic of the sector. Within the framework of a single market, the CAP alleviates these local constraints through Community preferences and financial solidarity. This is implemented via income redistribution instruments, the Single Area Payment (SAP) (direct payment), the separate (indirect payment) payment for fruit, vegetables and sugar, and a special (indirect) support. Since the CAP instruments remain unaltered, the development of a competitive agricultural sector remains mostly unchanged. As a result, the development of agriculture calls for increased risk. In turn, this entails a need to ensure financial security, and to improve its efficiency, in the Polish agricultural sector.

The present research is an attempt to identify the regressive dependence of commercial production sold under the SAPS and the separate fruit, vegetable and sugar payment in Poland in 2011–2013. Moreover, the focus is on determining the marginal and average productivity of these EU payments. These payments ensured the financial security of the sold commercial production in Polish agriculture in 2011-2013.

The underlying hypothesis claims that sold commercial production was most elastic with respect to the SAP for the years under examination. As a direct payment, the SAP, when viewed against the other payments, forms the basic financial security of sold commercial production in the agricultural sector.

The remainder of this article is divided into: a brief review of the reference literature (Section 2); an explanation of the methodology applied (Section 3); a description of the results of the research (Section 4); and initial conclusions (Section 5).

Literature Review

The most exhaustive of the many definitions of financial security designates a cash flow that suffices to cover debt payments (Dahiya et al., 2003). This is a variable category of financial threat (Platt and Platt, 2006).

The impact of the detached EU payments examined here on the financial security of farmers is not all that clear (Kropp and Katchova, 2011). Direct payments are a component of the agricultural safety net that stabilises incomes in the event of market adaptability problems (Hill, 2012). Families should be given a choice by maximising usability over time with the assistance of cash income and constrained technology. Only in the case of non-agricultural activities (financial security) can cash income over time and constrained technology be included in one complete constraint of income (Huffman, 2004).

Brealey and Myers (2003) maintain that the choice of capital structure is basically a marketing issue. In their view, an enterprise can issue dozens of varieties of security in any number of combinations. This leads to finding a particular combination being maximised by the market price. Weston and Brigham (1992) claim that the chief optimum structure of large portions of enterprises maximises the market price. In this way, the value of an enterprise (goodwill) is maximised, or its total capital costs reduced (Abor, 2005).

Research conducted by Cameron and Chamala (2004) concludes that there is a high degree of correlation between those farm managers ready to extend the schemes toward building change and those who want to meet targets. This indicates that change is consonant with business objectives. The low uptake of the innovations that agricultural systems need to develop might be justifiable in certain cases. However, a different approach is essential if we are to do better in future or simply the next time. Innovative solutions must therefore be applied at an early stage of development to formulate expert intelligent systems (Lynch et al., 2004). Innovative stimuli are stronger for the endogenous than the exogenous effects of economic activity. These effects strengthen innovative quantitative competition rather than price competition (Gersbach and Schmutzler, 2003). In Gallacher's (2001) view, agricultural education shortens the time that allocation selection options take to adapt. In the longer term, development coexists with short-term security and investment. Coordinating these elements brings about major changes in making these systems more efficient and integrating them with the local landscape (Frost, 2004).

Cook (1995) holds that industrialising agriculture incorporates farmers into an agency whole (cooperatives). Adapting new technologies, in turn, increases resource allocation and disposable income, and also income inequality (Yifu, 1999). An optimal policy contains costs and transfers their bond to the limits of production or acreage (farming area), so that they appear more expensive for the high incomes of farmers (Innes, 2003). No agricultural producer would ever pass up an opportunity to cut costs without reducing returns (Chambers and Quiggin, 2004). Therefore, production has not only to be tailored for calculations, but also reality. Similarly, the most important types of material outlays should be adapted (Vanecek and Kalab, 2003). Improving the quality of agricultural produce, while making it comparatively cheaper, encourages market allocation of processed food and shifts the limits of these trends (Morrison and MacDonald, 2003). This results from the fact that the relationship between research development and innovation are comprehensive and non-linear; new goods, services, and higher-quality final products are created, along with production processes (Guellec and van Pottelsberghe de la Potterie, 2001/II). Marking products forms "justice brands". This makes customers tend to pay more relative to the mean cost of production per unit of time (DiPietre, 2000). Consequently, when built on the interaction of agricultural and technical progress, technological development stabilises the relative variability of production volume over the longer term (Vizvari and Bacsf, 2002).

Agriculture binds rural and farming areas, and focuses rural communities on increasing incomes across generations, increasing resources with implications for the landscape, and rural activities associated with cultivating crops (Cannarella, 2002). These issues expand the structural levels at which a societal family is built, the special regional features that are developed, and the farms that are extended and/or redeveloped, with family members taking their own subjective actions (Vasa, 2002). The flywheel for economic growth is not

some extra benefits ensuing from technological changes, but rather a continuous process of providing opportunities and potential for technological development in the future (Carlaw and Lipsey, 2003). For its part, industrialisation enables greater diversity among foodstuffs and leads to: more clearly coordinated production and marketing channels, such as contracts; extended use by farmers; and enlarged farms (MacDonald et al., 2004). Barry Eichengreen sees no reason why Europe should not be able to overcome the problems of differences in output per capita and per time unit (Aiginger, 2004).

The risk incorporated in the relevant standard models (with their established inputs and other constraints, imperfect capital markets, and financial management with the potential for bankruptcy) renders the resolution of these effects empirically difficult, if not impossible, with the data currently available unless artificial data are imposed and the construction of timeless priorities included (Just and Pope, 2003). The attempt to prove that there is a constrained efficiency (partial) risk that differentiates the model from the imposed constraints indicates that in this day and age of public safety and security networks, spontaneous shocks may be less indemnified (Dercon and Krishnan, 2003).

Research Methodology

The development and growth of agriculture is based on the relationship between the profitability of individual farming economic units, on the one hand, and their liquidity and solvency (financial security), on the other. While a synthetic evaluation of profitability is plausible, liquidity and solvency offer no clear definition of safe limits for the range of incomings and outgoings (cumulative cash flow) for an economic unit in the farming sector. The revenue on sold commercial production in agriculture would therefore seem legitimate as a synthetic category subject to market valuation. It was therefore used as the dependent variable for productive activity in the sector.

It should be stressed that using agricultural income as a dependent variable has proved somewhat difficult since CAP subsidies directly increase farmers' incomes. In some economic units in Polish agriculture, the share of these subsidies is as high as 70%.

It would appear that aggregations of agricultural economic units in particular voivodeships (administrative regions) of the country may be characterised by proportional development opportunities (Brant, 1990). However, proportion financial contributions do not guarantee the continuation or development of agricultural economic activity.

An examination of the sector's financial macroeconometrics is especially interesting in this situation. Econometric verification extends to identifying changes in the level and rate of commercial production resulting from the SAP, the separate fruit, vegetable and sugar payment, and the special support provided under the market conditions of the sector's activity in 2011–2013.

Variables such as sold commercial production, the SAP, the separate fruit, vegetable and sugar payment, and special support are discrete random variables. They additionally form a finite collectivity (encompassing the whole of Poland) and express regression curves. These

curves map the dependencies between features, i.e. the way(s) of associating the values of the features of two aggregates.

The Polish inflation rate gradually decreased during the period in question – and this disinflation led to a deflation. This enables the sets (N=48) of individual variables contained in all the Polish voivodeships in 2011-2013 to be examined.

The empirical variables used in the Cobb-Douglas model were selected using a matrix of logarithm correlation coefficients. The criteria for selecting variables for the model was a strong correlation between the independent variable(s) and the dependent variable, and a weak correlation between the independent variables. The numerical calculations were made using the SPSS program.

Results and Discussion

The financial security network of the Polish agricultural sector consists of a complex system of direct and indirect financial security whose components are direct payments, e.g. the SAP, which is linked to production decisions based on market demand. Direct payments should stabilise the farmer's income in the event of sudden changes in the market situation or natural disasters. Indirect financial security is provided by separate payments for fruit, vegetables and sugar, and by a special support. Indirect financial security influences market orientation. The EU payments mentioned above are detached and constitute internal and external agricultural financial security.

The linear (Pearson) correlation between commercial production sold (Y3) and SAP (x1) is 0.906; for the separate fruit, vegetable and sugar payment (x2), the rate is 0.567; for the special support (x3), 0.030, the reciprocal relevance being 0.01. The sum of the features of the variables (x2 and x3) comes to 0.416, which does not increase the correlation with Y3 all that much. The relevant reciprocal correlation is 0.01. The Pearson correlation coefficients (r) specified above show that sold commercial production is not correlated with special support (0.030), and that the sum of the features of the indirect security variables (x2 and x3) does not significantly increase the correlation (0.416). The lack of correlation between sold commercial production and special support eliminates the latter from the regression model. This situation regarding reciprocal correlation necessitates the use of single-factor regression, albeit without the special support variable (x3) whose parameter is in any case statistically irrelevant (>0.05). These determinations of the strength of the linear correlations of the features are presented in Table 1.

Table 1 shows that the range of commercial production sold (Y3) exhibits a limited variation between voivodeships and from year to year. A comparison of the internal variability of the variables shows that the feature varies indirectly with the distribution of the commercial production sold in 2011-2013. The feature exhibited the greatest internal variation with distribution in the case of the SAP for the period under study. This means that the SAP exhibits the greatest deviation from the mean. This indicates that this variable plays the most important role in the variability of commercial production sold in the Polish agricultural sector for the period under study. It is almost twice the internal variation of the

feature in the distribution of the separate fruit, vegetable and sugar payment. This shows that this latter variable plays a significantly diminished role in the variation of sold commercial production in the agriculture in the years under study. The feature varies with the distribution of SAP almost three times more than with the distribution of special support in the sector. This shows that this latter variable plays an insignificant role in the variation of commercial agricultural production sold. The curvilinear regression dependence of the variables specified above, which constitute financial security in agriculture, is shown in Table 2.

Table 1

Parameters of the features of variables in voivodeships in the Polish agricultural sector, 2011-2013.

No.	Specification	Years	Measure unit	Symbol	Arithmetic average	Range, min.–max.	Coefficient of variation (%)
1.	Commercial production sold	2011–2013	PLN mln.	Y3	4,566.2	1,442.4–13,415.9	141.4
2.	Single Area Payment	2011–2013	PLN mln.	x1	581.1	185.8–1,361.8	191.3
3.	Separate fruit, vegetable and sugar payment	2011–2013	PLN mln.	x2	41.1	4.5–134.7	107.0
4.	Special support	2011–2013	PLN mln.	x3	15.5	1.0–135.0	67.7

Source: Rocznik statystyczny rolnictwa [The Statistical Yearbook of Agriculture], Central Statistical Office, Warsaw, 2012, 2013, 2014; Author's own calculations.

Table 2

Power regression of sold commercial production (Y3) vs. SAP (x1) and separate fruit, vegetable and sugar payment (x2) in Polish agriculture in 2011–2013.

a*	Regression coefficient		Standard error			T-test			As adjusted, R^2
	x1	x2	a	x1	x2	a	x1	x2	
4.641	1.074		0.462	0.074		3.3	14.6		0.82
1256.387		0.337	0.246		0.072	29.0		4.7	0.31

Source: Author's own calculations.
a* – de-logarithmized intercept.
The significance of all the regression coefficients is 0.00.

The data in Table 2 identify the regression dependence of sold commercial production (Y3), separately from the SAP (x1) and the separate fruit, vegetable and sugar payment (x2) in Polish agriculture in 2011–2013. The variables x1 and x2 explain the variability of sold commercial production in the 31%–82% range. The strength of the association, expressed as the correlation coefficient (R), between commercial production sold and the SAP and separate fruit, vegetable and sugar payments, is measured by the positive square root, R^2, which is in the range of 55.68%–90.55%. However, as correlation does not imply

causation, the regression dependencies were examined. The standard errors for the regression coefficients (parameters) are less than 50% of their absolute values. The absolute values of the t-test are several times higher than the regression coefficient values, and the significance of all the regression coefficients is 0.00.

These statistical evaluations of the regression coefficients (parameters) justify their use in the econometric analysis of the variability of sold commercial production vs. the SAP and the separate fruit, vegetable and sugar payment (financial security) in Polish agriculture in 2011–2013.

The regression coefficients, and the function parameters at x1 and x2, determine elasticity and are therefore the coefficients of elasticity of the commercial production sold relative to the SAP (x1) and separate fruit, vegetable and sugar payment (x2) (financial security) in agriculture. Solow's (1956) explanation is that these measure the elasticity of Y3 with respect to x1 and x2. According to J. B. Clark's marginal theory of distribution, they are the portions of the SAP (x1) and the separate fruit, vegetable and sugar payment (x2) in the sold commercial production in Polish agriculture in 2011–2013. The elasticity coefficient additionally expresses the relations between the relative change in sold commercial production and the relative change in the fund (payment) that causes it.

Sold commercial production (Table 2) is most elastic with respect to SAP in Polish agriculture in 2011–2013 (1.074). This regressive dependence is curvilinear and more than proportional. A 10% increase in the SAP, with no changes in the other funds, produced an increase of 10.74% in sold commercial production in 2011–2013. The elasticity of sold commercial production with respect to the separate fruit, vegetable and sugar payment in Polish agriculture in 2011–2013 was less than a third of that (0.337). This dependence is curvilinear and less than proportional. An increase of 10% in the separate fruit, vegetable and sugar payment, with no changes in the other funds, produced a 3.37% increase in sold commercial production in 2011–2013. This, however, is shaped by the agricultural environment (Rostásová and Chrenková, 2010). The EU payments specified above stimulate the multiplier effects in agriculture, in addition to providing financial security. The highest multiplier effects can be expected to appear with those outlays that diminish the costs of sold commercial production, thereby mobilising agricultural productivity.

With the assistance of J. B. Clark's marginal distribution theory, the structure of financial security in agriculture can be determined from the share of the SAP and the separate fruit, vegetable and sugar payment. The average sold commercial production is 76.12% shaped by the SAP and 23.88% by the latter payment. These determinations imply that the financial security of the average sold commercial production in the agricultural sector was more than 75% influenced by the SAP, and less than 25% by the separate fruit, vegetable and sugar payment in 2011–2013.

With the assistance of the theory of finance, on the other hand, a causal interpretation of financial phenomena and processes can be attempted in order to determine regressive links and dependencies. Sold commercial production in Polish agriculture in 2011-2013 should therefore be fixed within the range of variation of the SAP and the separate fruit, vegetable and sugar payment. This will enable the marginal and average productivity of financial security in agriculture to be determined. These are shown in Table 3.

The data shown in Table 3 imply that when SAP increases, its marginal productivity increases and exceeds average productivity, which increases more slowly, whereas sold commercial production grows at an accelerating rate. These dependencies held in the initial irrational management zone in agriculture in 2011–2013. The increasing SAP is justified as $E_y > 1$, and increasing this payment increases its marginal increments. This implies that increasing the SAP in the above zone is justified.

Table 3

Marginal and average productivity of the Single Area Payment (SAP) in Polish agriculture, 2011-2013

Commercial production sold (Y3), PLN mln.	SAP (x1), PLN mln.	Productivity:	
		Average PLN mln./PLN mln.	Marginal PLN mln./PLN mln.
7,849.6	315.8	24.9	26.7
11,367.2	445.8	25.5	27.4
14,962.6	575.8	26.0	27.9
18,619.2	705.8	26.4	28.3
22,326.2	835.8	26.7	28.7
26,076.2	965.8	27.0	29.0
29,864.0	1,095.8	27.3	29.3
33,685.2	1,225.8	27.5	29.5
37,536.6	1,355.8	27.7	29.7

Source: Tables 1 & 2 (above); Author's own calculations.

The causal dependencies related to the separate fruit, vegetable and sugar payment are shown in Table 4.

Table 4

Marginal and average productivity of the separate fruit, vegetable and sugar payment in Polish agriculture in 2011-2013

Commercial production sold (Y3), PLN mln.	Separate fruit/vegetable and sugar payment (x2), PLN mln.	Productivity:	
		Average PLN mln./PLN mln.	Marginal PLN mln./PLN mln.
3,125,832.8	18.5	168,963.9	56,940.8
3,779,493.2	32.5	116,292.1	39,190.4
4,264,425.4	46.5	91,708.1	30,905.6
4,659,941.2	60.5	77,023.8	25,957.0
4,998,567.2	74.5	67,094.9	22,611.0
5,297,229.1	88.5	59,855.7	20,171.4
5,565,995.1	102.5	54,302.4	18,299.9
5,811,399.2	116.5	49,883.3	16,810.7
6,037,951.5	130.5	46,267.8	15,592.3

Source: Tables 1 & 2 (above); Author's own calculations.

The data in Table 4 show that as the separate fruit, vegetable and sugar payment increases, its marginal productivity decreases, causing a decrease in mean productivity, albeit at a slower rate, while the sold commercial production increases. These dependencies hold in

the rational management zone. In this zone, the elasticity of sold commercial production, relative to the separate fruit, vegetable and sugar payment (x2), was greater than zero and less than one, i.e. $0 < E_y < 1.0$, in Polish agriculture in 2011–2013. The growth rates within the range of the individual variables are shown in Table 5 below.

Table 5

Average growth rates, within the range of variability of commercial production sold (Y3), SAP (x1), separate payment (x2), and marginal/average payment in the agricultural sector (in percent terms).

Specification	%, Table 3	%, Table 4
Commercial production sold	21.60	8.57
SAP (x1)	19.97	
Separate fruit, vegetable and sugar payment (x2)		27.66
Productivity:		
– marginal	1.36	–14.95
– average	1.36	–14.95

Source: Author's own calculations (using the geometric average).

The data in Table 5 show that the aggregate mean rate of sold commercial production (30.17%) was guaranteed by the average rate of increase in SAP (19.97%) and the separate fruit, vegetable and sugar payment (27.66%), with an identical growth rate of marginal and average SAP productivity (1.36%) and an identical negative growth rate of marginal and average productivity of the separate fruit, vegetable and sugar payment in the Polish agricultural sector in 2011–2013.

Conclusion

This study confirms the hypothesis that sold commercial production was most elastic with respect to the Single Area Payment applied in Polish agriculture in 2011–2013 (1.074). This direct EU payment substantially stabilised the relative level of commercial production sold in the sector. These processes occurred within the initial irrational management zone, while the separate fruit, vegetable and sugar payment (indirect payment) occurred within the rational management zone. The aggregate average growth rate of commercial production sold (30.17%) was ensured by the average rate of increase in direct (20%) and indirect (28%) payments. This indicates that EU payments were effective in ensuring financial security in the Polish agricultural sector in 2011–2013.

The aggregated features of the variables of the EU's separate fruit, vegetable and sugar payment and special support (indirect payments) (x2 and x3) only slightly increased their correlation with the commercial production sold (Y3), $r = 0.427$. The special support itself (x3) was not correlated with Y3; its parameter was not statistically relevant, which makes it impossible to determine the impact of special support on the relative increase in the sold commercial production in Polish agriculture in 2011–2013.

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