AN INTERNATIONAL COMPARISON OF THE EFFECT OF GOVERNMENT SUPPORT ON AGRICULTURAL PRODUCTIVITY

Olena Oliynyk

National University of Life and Environmental Sciences of Ukraine

Key words: government support, labor productivity, agricultural policy.
Słowa kluczowe: wsparcie rządowe, wydajność pracy, polityka rolna

A b s t r a c t. This paper provides an econometric evaluation the effect of government support to agriculture on a measure of the agricultural labor productivity in 16 countries with different level of support. The econometric model we construct specifically utilizes two values calculated by the Organization for Economic Cooperation and Development (OECD): Producer Support Estimates as a percentage of gross farm receipts and the Consumer Nominal Protection Coefficient. These two variables represent transfers from taxpayers and consumers to agricultural producers through government programs and transfers from consumers to government or vice versa, respectively. By using regression model, we draw conclusions for groups of countries on the basis of their relevant levels of government support.

INTRODUCTION

The main objectives, which are usually laid in the implementation of the government support to agriculture are: to increase the productivity of production factors used in agriculture, mainly the labor force; to increase farm income; to stabilize agricultural markets; to guarantee agricultural products provisions; to guarantee reasonable prices to the consumers Agricultural products, and mainly food products of course, must be available in appropriate quantity and quality for the whole. These are the goals of the Common Agricultural Policy of the European Union were clearly defined in the article 39 of the Treaty of Rome, signed on March 25, 1957 [Burny 2010].

Every year the world release huge amounts of money to finance agriculture from the budget. Thus, the total cost of the planned budget of the European Union CAP for the period 2007-2013 accounts approximately 42% [Gorton 2009].

But the question how the implemented government support to agriculture achieves its goal, i.e. provides increase the productivity of production factors used in agriculture, mainly the labor force, increase farm income and so on. We can answer on this question by using econometric methods.

The articles published over the last years in related disciplines have attempted to determine the factors that identify the productivity of the agricultural sector. Such studies have analyzed the factors that define labor productivity in the agricultural sector and

empirically calculated the impact of each determinant on the shaping of productivity and added value by using statistical data [Polyzos, Arabatzis 2005] or have investigated the relation between labor productivity and food prices [Future Agriculture 2012] or have estimate total factor productivity using a conventional DEA model [The World Bank, 2009]. However, far fewer research articles in academia have empirically investigated any presupposed relationship between agricultural labor productivity and agricultural policy.

We attempt to investigate in this paper how the government support to agriculture effect on the agricultural labor productivity by using econometric model.

The model in this paper uses data from the OECD and the World Bank to evaluate the effects of the OECD measure of government support to agriculture, known as a producer support estimate (PSE), and the Consumer Nominal Protection Coefficient (CNPC), a complementary measure of the effects on consumers of government policies. These effects are measured for 16 nations.

DATA

Because of our interest in the effect of agricultural policies on the agricultural labor productivity, we take the ratio "agriculture value added per worker" as a dependent variable in the model. This ratio is reported by The World Bank. Value added in agriculture measures the output of the agricultural sector less the value of intermediate inputs. Agriculture comprises value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production. Data are in constant 2000 USD. The agriculture value added per worker data is available through 2010.

The effect of government support on agricultural productivity is measured for 16 countries such as Ukraine, Russia, Australia, USA, New Zealand, Norway, Japan, Switzerland, Canada, Turkey, Brazil, China, Chile, Korea, Mexico, and South Africa.

The model uses two independent variables: Producer Support Estimate (PSE) as a percentage of gross agricultural receipts and the Consumer Nominal Protection Coefficient (CNPC) as reported by the Organization for Economic Co-operation and Development (OECD).

The model uses 16 observations for each variable in each country from 1995 to 2010.

The measure of agricultural support in each country in our model is the PSE as a percentage of gross agricultural receipts, values that OECD reports for each nation. OECD describes PSE as the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm gate level, arising from policies that support agriculture, regardless of their nature, objectives or impacts on farm production or income [OECD 2011]. We include this measure to represent transfers from taxpayers to agricultural producers. We use the value as a percentage of agricultural receipts to control for the size of each nation's individual economy.

Figure 1 depicts the values of the PSE data as reported by OECD, in this case, the average values over 1995-1997, the beginning of the period, and the average value at the end of the period, 2008-2010.

Figure 1 indicates that Norway, Japan, Switzerland, Korea provide relatively much higher levels of support compare with the other countries. This comparison holds at both the beginning and end of the period. The countries such as Ukraine, Russia, Turkey, Brazil, China, and Mexico have a higher value at the end of the period than at the beginning. Other countries had the opposite tendency.

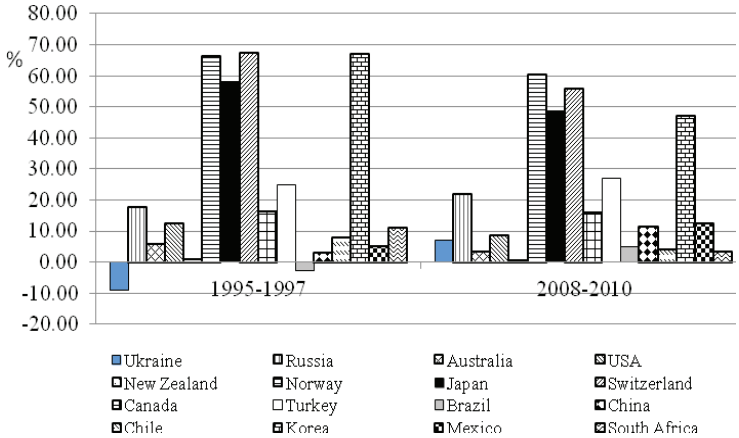

Figure 1. Producer Support Estimates as a Percentage of Gross Farm Receipts, Averages 1995-1997 and 2008-2010
Source: [OECD, PSE/CSE Database 2012].

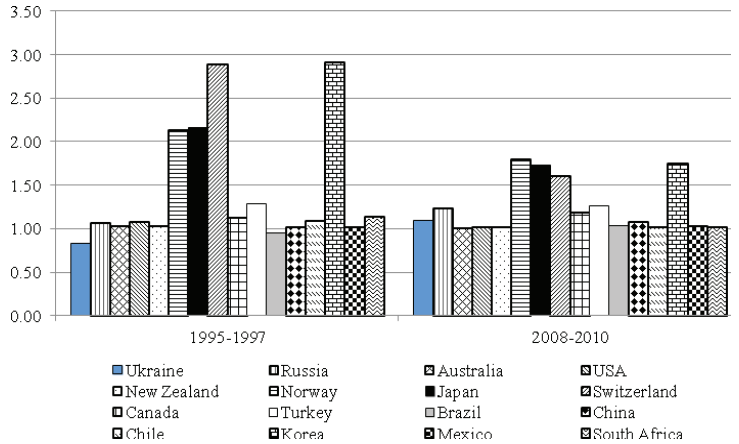

Figure 2. Consumer Nominal Protection Coefficients, Averages 1995-1997 and 2008-2010
Source: [OECD, PSE/CSE Database 2012].

The another independent variable included in our model is also a measure of agricultural support reported by OECD – Consumer Nominal Protection Coefficient (CNPC). OECD describes CNPC as the ratio between the average price paid by consumers (at farm gate) and the border price (measured at farm gate) [OECD 2011, p.135]. The CNPC shows the effects on consumers of a nation's protectionist agricultural policies. The CNPC is effectively the average rate of the implicit import tax applied in the domestic market [Miller, Coble 2008]. A value of 1.00 reflects that the domestic price equals the "border price", or the price consumers pay at the farm gate in the absence of trade restrictions. A value of less 1.00 indicates that there are transfers from taxpayers to consumer. A value of larger 1.00 indicates that there are transfers to producers from consumers.

Figure 2 depicts the values of CNPC data as reported by OECD. Analysis of CNPC measures indicated the same relationships as for the PSE. The countries such as Norway, Japan, Switzerland and Korea have the highest value of this indicator. Almost all countries (except Ukraine, Russia, Brazil, China, and Mexico) have a lower value at the end of the period than at the beginning. It should be noted, the countries with the highest values of CNPC in the 1995-1997 period decrease significant the values of CNPC in the 2008-2010 period compare with other countries.

Thus, as we can see from the figures, surveyed countries characterized by large difference of level government support. Therefore, the selected countries were divided into similar groups by level of support. For the selection of countries with middle level of support were calculated bottom 35th percentile and the upper 75th percentile for PSE. Consequently, countries with average level of support for PSE more 75th percentile (35.25) were classified as the group of countries with a high level of support. It is countries as Norway, Japan, Switzerland and Korea. Countries that had by 1995-2010 average level of support for the PSE less value 35th percentile (8.02) were classified as the group of countries with low levels of support. Such countries are Ukraine, Australia, New Zealand, Brazil, China, Chile, and South Africa. All other countries were classified as the middle level of support, including Russia, USA, Canada, Turkey, and Mexico.

MODEL

We estimate a regression models for each group countries (high support, low support, middle support countries) with the variables as defined above. The equation for each country in the models is initially:

$$PA_{it} = B_0 + B_1 PSE_{it} + B_2 PC_{it} + e_{it}$$

where, for each country i (i = 1, 2, . . . , 16) in each year t (t = 1995, 1987, . . . , 2010), PA is the ratio of the agriculture value added per worker, PSE is the PSE as a percentage of agricultural receipts, and PC is the CNPC.

We use the Statistica software package to execute regression model. Tables 1-3 present the results of this model.

RESULTS

All three models showed statistical significance checked by an F-test. It means that the models are adequate, i.e., the model that best fits the population from which the data were sampled.

Constructed models for countries with a high levels of support and low levels of support can be used for decision-making and forecasting, as the

Table 1. Results of regression model for high support countries

Indicator	B	Std. err.	t(61)	p-level
Intercept	25.3565	9.0037	2.8162	0.0065
PSE	0.6753	0.2385	2.8316	0.0063
PC	-19.1961	4.0217	-4.7732	0.0000

Source: own study.

Table 2. Results of regression model for middle support countries

Indicator	B	Std.err.	t(61)	p-level
Intercept	76.6167	29.0243	2.6398	0.0100
PSE	0.4578	0.5934	0.7714	0.4428
PC	-58.0196	32.8180	-1.7679	0.0810

Source: own study.

Table 3. Results of regression model for low support countries

Indicator	B	Std.err.	t(61)	p-level
Intercept	1165.2021	446.4159	2.610	0.0103
PSE	20.6580	6.3393	3.259	0.0015
PC	-1158.4932	459.1986	-2.523	0.0131

Source: own study.

models based on the F-Fisher criterion generally adequate and all the regression coefficients are significant (Student's t-test).

The model constructed for countries with middle level of support is suitable for some decisions, but not for the forecasts, as the model is based on the F-Fisher criterion generally adequate but some of the coefficients are not significant (Student's t-test).

The coefficient of determination for countries with a high level of support is 30.0%, indicating that almost 30% deviation from the average value of the agricultural labor productivity caused by indicators that measure the government support to agriculture.

The coefficient of determination for middle and low support countries were respectively 7.7 and 9.8%, indicating the limited impact of government support to labor productivity in these countries.

PSE as a percentage of agricultural receipts is a significant and positive variable at the 0.05 level for high and low support countries. This variable indicates that as a country's PSE estimate becomes larger relative to agricultural receipts, labor productivity becomes higher.

The coefficient on the variable for PSEs for the low support countries has more size as the coefficient for the variable for PSEs for high support countries. It means for low support countries transfers from taxpayers to agricultural producer through government programs have a lager effect on the agricultural labor productivity relative to high support countries.

PSE as a percentage of agricultural receipts for middle support countries is not significant at the 0.05 level, indicating the share transfers from taxpayers to agricultural producers in their gross receipts does not significant affect our measure of labor productivity.

The other variable measuring support to agriculture, the CNPC, is also significant for high and low support countries. Its coefficient value is negative, indicating that protectionist measures make less agricultural labor productivity. The coefficient on the variable for CNPC for the low support countries has considerably more size as the coefficient for the variable for CNPC for high support countries. It means the value of agricultural labor productivity changes considerably lager for low support countries relative to the high support countries when CNPC is varied.

CNPC for middle support countries is not significant at the 0.05 level, indicating that protectionist measures do not significant affect agricultural labor productivity.

CONCLUSIONS

In this paper, we try to evaluate econometrically the effect of government support to agriculture on a measure of the agricultural labor productivity in 16 countries. The econometric model we construct specifically utilizes two values calculated by the OECD: Producer Support Estimates as a percentage of gross farm receipts and the Consumer Nominal Protection Coefficient. These two variables represent transfers from taxpayers and consumers to agricultural producers through government programs and transfers from consumers to government through protectionist measures, respectively.

For middle and low support countries with relatively low levels of government support and few protectionist measures over the period we examine, our results indicate government involvement in agriculture has little effect on the agricultural labor productivity in these countries.

For the high support countries such as Norway, Japan, Switzerland and Korea in our model, we find PSEs as a percentage of gross farm receipts and CNPCs both significantly affect our measure of the agricultural labor productivity. Moreover, the increase of transfers from taxpayers to agricultural producers has a positive effect on productivity, and protectionist measures have negative effect.

The results obtained allow to conclude that a substantial government support significantly affects the agricultural labour productivity. The results should be considered in the development of agricultural policy, as well as in determining the scope and program of government support. It should also be noted that preference should be given not protectionist measures, but support measures in the development of agricultural policy in order to achieve a positive effect on labour productivity.

LITERATURE

Agricultural labor productivity and food prices: Fundamental development impacts and indicators. 2012: Future Agriculture. Policy Brief 53, Internet site: http://future-agricultures.org

Belarus. Agricultural Productivity and Competitiveness. Impact of State Support and Market Intervention, 2009: The World Bank, Internet site: http://siteresources.worldbank.org

Burny P. 2010: *Reforming the Common Agricultural Policy perspective of 2013 and beyond*, AAB Bioflux, Vol. 2, Issue 2, 175-186.

Gorton M., Hubbard C., Hubbard L. 2009: *The folly of European Union policy transfer: why the Common Agricultural Policy (CAP) does not fit Central and Eastern Europe,* "Regional Studies", Vol. 43.10, 1305-1317.

Miller C., Coble K. 2008: *An International Comparison of the Effects of Government Agricultural Support on Food Budget Shares.* "Journal of Agricultural and Applied Economics", Vol. 40.2, 551-558.

OECD. Producer and Consumer Support Estimates OECD Database 1995-2010. Internet site: http://stats.oecd.org/Index.aspx?DataSetCode=MON20113_1, accessed September, 2012.

OECD's producer support estimate and related indicators of agricultural support. Concepts, Calculations, Interpretation and Use (The PSE Manual), 2011: Internet site: http://www.oecd.org/tad/agriculturalpoliciesandsupport/psemanual.htm

Polyzos S., Arabatzis G. 2005: *Labor Productivity of the Agricultural Sector in Greece: Determinant Factors and Interregional Differences Analysis*, Internet site: http://www.prd.uth.gr/research/DP/2005/uth-prd-dp-2005-12_en.pdf

The World Bank, Internet site: http://data.worldbank.org/indicator, accessed September, 2012.

Olena Oliynyk

WSPARCIE PAŃSTWOWE A PRODUKTYWNOŚĆ PRACY W ROLNICTWIE

Streszczenie

Artykuł przedstawia ekonometryczną ocenę wpływu wsparcia państwowego dla rolnictwa ze szczególnym uwzględnieniem wskaźnika produktywności pracy w rolnictwie w 16 krajach o różnym poziomie wsparcia. Model ekonometryczny wykorzystuje dwie wartości obliczone przez Organizację Współpracy Gospodarczej i Rozwoju (OECD): *Producer Support Estimates j*ako procent przychodów brutto gospodarstw rolnych i *Consumer Nominal Protection Coefficient.* Te dwie zmienne stanowią transfery od podatników i konsumentów do producentów rolnych w ramach programów państwowych i transferów od konsumentów do państwa lub odwrotnie. Za pomocą modelu regresji zostały przedstawione wnioski dla grup krajów wydzielonych, w zależności od poziomu rządowego wsparcia w tych krajach.

Correspondence address:
Olena Oliynyk PhD, Associate Professor
National University of Life and Environmental Sciences of Ukraine
11 Heroyiv Oborony,
Kyiv 03041, Ukraine
e-mail: olenaolol@ukr.net,
olenaooliynyk@gmail.com