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Comparative Analysis of Support to Agriculture in the QUAD Countries in 1986-2014

Abstract. The purpose of this paper is a comparative analysis of support provided to agriculture sector by the QUAD countries in 1986-2014. The authors examined the changes in levels and structures of this support and tried to assess it from the point of view of its impact on the QUAD economies and markets. In the analysis conducted there were used especially the OECD data and indexes measuring state support to agriculture including: Total Support Estimate, Producer Support Estimate, General Services Support Estimate and Consumer Support Estimate. In the last three decades in all the examined economies, there has been a reduction in agricultural support in relation to GDP, although no distinct change has occurred in terms of the amount of aid in absolute terms (in the US its value even increased almost twice). As regards the changes in structure of support, the most favorable tendencies took place in the European Union where the market price support (MPS), i.e. the most distorting aid to the functioning of the market mechanism, was significantly reduced. One can also positively assess the support structure in the United States where about half of the agricultural budget is earmarked to consumers. Canada has very good economic outcomes as regard the agriculture sector even though it allocates the least amount of financial resources to support agriculture in relation to GDP among all the QUAD economies. However, despite a large part of this support is in the form of general services (GSSE), the country is characterized by an unfavorable trend of increasing expenditure on price support. Throughout the period considered the most harmful support policy from the point of view of market competition was led by Japan though it has affected to a lesser extent the functioning of international agri-food markets due to the lower importance of Japanese agricultural production and exports in the world economy in comparison to the EU and the US.

Key words: subsidies, agriculture, European Union, United States, Japan, Canada

Introduction

Despite the global trend of a decreasing share of agriculture in GDP and employment compared to other sectors of economy in recent decades, many countries still regard this sector as a very special field which requires conducting an appropriate agricultural policy. One of the most important features of such a policy is providing state support to compensate for imperfections in the functioning of agri-food markets. Among these market failures one can distinguish (Czyżewski & Poczta-Wajda, 2011, p. 26): the rigidity of demand for agricultural products; a low elasticity of demand with respect to income under consumption pressure; a slower growth in demand for agri-food products in relation to supply which contributes to a decline in agricultural prices; as well as an extended period of return on capital invested in agricultural production. Production of many agricultural commodities is subject to forces that lie beyond the direct control of farmers. The real level

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of agri-food production can be much lower or higher than its planned volume due to natural disasters (like drought, floods or earthquakes) or exceptionally favourable conditions. A shortage in output as well as overproduction lead to fluctuations in agricultural prices and as a result to farmers' income disorders. Furthermore, agricultural price levels and incomes show a tendency to a relative decline with economic growth compared to prices and incomes in non-agricultural sectors. As people's income rises they tend to spend a smaller proportion of it on agri-food products (due to low income elasticity of demand) (El-Agraa, 2001, pp. 232-236 and Pelkmans, 2001, p. 203). Hence farm incomes usually lag behind the incomes of those employed in the non-farm sectors. The problem of agricultural incomes stems also from decreasing agricultural productivity in comparison to manufacturing. Other arguments for supporting farming arise from historical factors, strategic considerations and the strength of agricultural lobby (El-Agraa, 2001, p. 237).

Irrespective of various significance of agriculture across countries, they share a set of similar goals that drive their support for this sector of economy (Pelkmans, 2001, p. 205; Rieger, 2005, p. 169; Winters, 1988, p. 241; Wojtas, 2007, p. 45 and WTO, 2006, p. 120): income redistribution and stabilization (satisfactory and equitable standard of living for farmers); secure and sufficient food supplies; stabilization of domestic agricultural prices; enabling adjustment to exogenous shocks; rural development; preservation and encouragement of family farming; fair prices for consumers; protection of the environment; agricultural efficiency and competitiveness. However, some of these aims are very difficult to obtain at the same time as they can be mutually exclusive. The agricultural policy objectives tend to evolve over time and vary depending on the level of development of economies. The developing countries concentrate their efforts on providing food security, poverty alleviation, rural development, and stabilization of export revenues while the developed countries continue to focus on food self-sufficiency with the growing weigh being put on food safety and environmentally sustainable farming (WTO, 2006, p. 120).

Regardless of the undoubtedly justified goals of agricultural policy its economic outcomes are often quite different from the intended. Agricultural support (Edwards, 2009; Winters, 1987; Baldwin and Wyplosz, 2009): distorts market mechanisms which leads to substantial deadweight losses in economic welfare (due to wrong investment signals, avoiding cost cutting by farmers and discouraging innovation activity); wastes resources by over-expanding agricultural output in high-cost areas and limiting it in low-cost ones; diverts resources from more productive sectors of economy; transfers funds from taxpayers to a small group of large landowners instead of tenant farmers or farm workers; increases food prices to consumers; damages and contaminates the natural environment by fostering too intensive production and excessive use of fertilizers and pesticides; affects farmers' decisions and makes changes in the structure of agricultural production; constitutes a serious hurdle in multilateral trade liberalization process and discourages agriculture of the developing countries by reducing world prices and making them more volatile.

The paper concerns the QUAD countries - an informal group of highly industrialized economies including the United States, Canada, Japan and the EU member states - which are the main actors of the international trading system. This group has a significant share in the world agricultural production and trade and striving to realize its particular interests in the agricultural sector has a large influence on the results of multilateral trade negotiations at the forum of GATT/WTO shaping the rules of agricultural trade on a global scale. The aim of this paper is to compare the QUAD countries in terms of levels and structures of state support to agricultural sector as well as to assess the changes in support measures in

respect of their economic results as regards agricultural production, trade and prices in 1986-2014. The analysis conducted is based mainly on OECD data and indexes measuring state support for agriculture including: Total Support Estimate, Producer Support Estimate, General Services Support Estimate and Consumer Support Estimate. The FAO, WTO and World Bank databases also proved to be helpful. The state support and its impact on the QUAD economies is examined with distinction of three periods (1986-1994, 1995-2005, 2005-2014 or representative years) taking into account the fundamental changes in national agricultural policies as well as multilateral reforms.

Significance of agriculture sector in the QUAD countries

In 2014 the QUAD countries had over 21% share in world agriculture production and almost 25% share in world merchandise trade of agricultural products taking into account extra-EU28 exports and imports. However, considering extra- and intra- EU28 trade the share of QUAD group in world agriculture trade would increase to about 53% in exports and 51% in imports. Despite the growing importance of less developed countries in world agriculture production and trade in recent decades the QUAD countries still belong to the most important players in global markets for agricultural commodities. The European Union and the United States are the first largest exporters of agri-food products in the world and fall also under the group of largest importers.

Table 1. Selected economic indicators concerning agriculture sector in the QUAD countries in 1995 and 2013

| Economic indicator | Japan | | Canada | | EU | | US | |
|---|--------|--------|--------|-------|-------|-------|-------|-------|
| | 1995 | 2013 | 1995 | 2013 | 1995 | 2013 | 1995 | 2013 |
| GDP (bln USD) | 5334 | 4901 | 590 | 1826 | 8838 | 17291 | 7338 | 16853 |
| GDP per capita, PPP (USD) | 22921 | 36069 | 22789 | 42748 | 21704 | 34305 | 28748 | 52985 |
| Share of agriculture in GDP (%) | 1.6 | 1.2 | 2.9 | 1.6 | 2.9 | 1.7 | 1.6 | 1.3 |
| Share of agriculture in employment (%) | 5.2 | 3.4 | 3.8 | 2 | 4.7 | 4.4 | 2.9 | 2.2 |
| Agri-food exports (% of total exports) | 0.4 | 0.5 | 6.8 | 9.9 | 8.3 | 6.7 | 10.9 | 9.6 |
| Agri-food imports (% of total imports) | 12.3 | 7.4 | 5.5 | 7.5 | 9.6 | 6.1 | 4.4 | 5 |
| Agri-food trade balance (mln USD) | -39449 | -58513 | 3817 | 10776 | -8588 | 11319 | 29671 | 36255 |
| Crop in total agricultural production (%) | 76 | 68 | 51 | 58 | 53 | 56 | 61 | 59 |
| Livestock in total agricultural production (%) | 24 | 32 | 49 | 42 | 47 | 44 | 39 | 41 |
| Share in world agricultural production (%) | 7.14 | 1.82 | 0.88 | 1.05 | 19.5 | 10.59 | 9.59 | 7.97 |
| Share in world merchandise exports of agricultural products (%) | 0.79 | 0.6 | 5.47 | 3.86 | 40.55 | 38.06 | 13.66 | 10.32 |
| Share in world merchandise imports of agricultural products (%) | 12.04 | 4.37 | 1.96 | 2.14 | 42.36 | 35.77 | 8.55 | 8.38 |

Note: Data for 2013 or latest available year; EU(15) in 1995 and EU(28) in 2013; Agri-food exports and imports as % of total trade as well as agri-food trade balance for extra- EU flows; Share in world exports and imports of agricultural products for years 1995 and 2014 and for extra and intra - EU trade. Share of extra- EU flows in world exports and imports of agricultural products amounted to 10.1% in 1995 and 9.8% in 2014.

Source: Own elaboration based on: FAO (2016), OECD (2015a, pp. 97, 135, 179, 285), WTO (2015a, p. 77) and WTO (2015b).

Among the QUAD economies the agriculture sector is relatively most important in the EU and Canada in terms of share in GDP, and contributes most significantly to job creation in the EU and Japan. The United States and Canada are consistently large net exporters of agricultural commodities, with agri-food exports accounting for nearly 10% of their total exports in 2013, while the European Union's negative trade balance of agri-food products has reversed scarcely since 2012 and as a result the EU has joined the group of net exporters. The United States and the European Union have very big internal markets for agricultural products which helps farmers to take advantage of economies of scale and Canada benefits from an absorbing market of its closest neighbor destining more than half of its agri-food exports to the United States. Completely different is the situation of Japan, a country with relatively little land, where only 30% of its total area may be used for agriculture or urban development (OECD, 2015a, p. 179). This country is one of the largest net agri-food importers in the world with more than sevenfold predominance of share in world merchandise trade of agriculture imports over exports. Japan's lack of international competitiveness in agricultural product markets stems not only from its limitation in available land but it is also caused by many other reasons, e.g. improper agricultural policy measures such as a high rice price policy to increase farmers' income (Yamashita, 2006, p. 3). Moreover, this country has a very unfavorable agrarian structure with a majority of very small family farms, and many farmers move from the countryside to the cities. That is why the agricultural sector has experienced a decrease of nearly 30% of production, a decline in income of more than 40% as well as a rise in the average age of farmers by 7 years over the last two decades (OECD, 2015a, p. 179).

Analysis of support to agriculture in the QUAD countries

The broadest indicator of state support is Total Support Estimate (TSE). The TSE includes transfers to agricultural producers individually, measured by the Producer Support Estimate (PSE), policy expenditures that have agriculture as the main beneficiary but that do not go to individual farmers, measured by the General Services Support Estimate (GSSE) and budgetary support to consumers of agricultural commodities (as part of the Consumer Support Estimate, CSE). The financial aid of the European Union, Japan, the United States and Canada accounted for most of the total TSE for all OECD countries in the mid-1980s and their shares were 39.5%, 20.5%, 17% and 2.5% respectively, while in the most recent period their shares have decreased (except the US) and equaled 37.8%, 15.6%, 28.8% and 1.98% in 2014. This was mainly the result of the domestic reforms carried out by the QUAD countries in the 1990s as well as of the introduction of provisions of the Uruguay Round of GATT aimed at reducing support for agriculture.

The TSE expressed as a percentage of GDP (%TSE) measures the overall burden of support to agriculture on the economy. In the OECD countries the relative importance of total support to agriculture decreased on average from 2.8% of GDP in 1986-88 to around 0.8% in 2012-2014 (Table 2). The most significant reduction in that period occurred in the EU where %TSE was lowered by 1.9 percentage points but it also fell down in Canada and Japan (by 1.3 and 1.2 p.p.) and to a lesser extent in the US (by 0.5 p.p.). However, the total amount of aid measured in US dollars dropped only in Canada and Japan whereas in the EU it increased by 11% and in the US it almost doubled. Currently, the biggest burden on the economy resulting from supporting agriculture can be observed in Japan. The degree of

protection used to be and still remains higher in Japan than in countries at a comparable stage of development and the difference reflects the particularly difficult state of the Japanese agricultural sector (Hillman, 1985; Jones and Kimura, 2013).

When decomposing the aggregate TSE into its main elements it can be noticed that in the second half of the 1980s the total agricultural support was dominated by the aid to agricultural producers (PSE) which accounted for 86% of TSE in the EU, 85% in Japan, 84% in Canada and 72% in the US with the OECD average at the level of 83% (data for the years 1986-1988). During the analyzed period the share of PSE in TSE dropped significantly in the US and Canada (to 43% and 69% in 2014) whereas in the EU and Japan it was kept at a high level of 84% in 2014. In all the OECD countries it declined on average from 83% in 1986-88 to 72% in 2012-14. In the United States expenditure on supporting consumers (measured as transfers to consumers from taxpayers) constitutes most of the total support to agriculture (an increase from 20.7% in 1986-88 to 52.6% in 2012-14). A considerable share of TSE is allotted to the GSSE expenditures in Canada (27,9% of TSE in 2012-14 which was much above the OECD level accounting for 13.5% of TSE). In Japan and the EU the GSSE share in total support is close to the OECD average whereas in the US it is below that level (detailed information in Table 4).

Table 2. Total Support Estimate by the QUAD countries in 1986-2014

| | 1986-88 | 1995-97 | 2012-14 | 2012 | 2013 | 2014 |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| Canada | | | | | | |
| TSE (million USD) | 7 198 | 4 781 | 8 089 | 9 757 | 7 902 | 6 607 |
| Percentage TSE (% of GDP) | 1.7 | 0.8 | 0.4 | 0.5 | 0.4 | 0.4 |
| European Union ¹ | | | | | | |
| TSE (million USD) | 112 734 | 134 095 | 131 353 | 126 848 | 141 291 | 125 920 |
| Percentage TSE (% of GDP) | 2.6 | 1.5 | 0.8 | 0.8 | 0.8 | 0.7 |
| Japan | | | | | | |
| TSE (million USD) | 58 417 | 78 549 | 63 339 | 77 104 | 60 734 | 52 180 |
| Percentage TSE (% of GDP) | 2.3 | 1.6 | 1.2 | 1.3 | 1.2 | 1.1 |
| United States | | | | | | |
| TSE (million USD) | 48 534 | 48 292 | 90 111 | 86 656 | 87 693 | 95 984 |
| Percentage TSE (% of GDP) | 1.0 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 |
| OECD ² | | | | | | |
| TSE (million USD) | 285 221 | 324 134 | 347 314 | 354 590 | 354 615 | 332 737 |
| Percentage TSE (% of GDP) | 2.8 | 1.5 | 0.8 | 0.8 | 0.8 | 0.7 |

Note: 1986-88, 1995-97 and 2012-14: unweighted averages; p: provisional. 1. EU12 for 1986-88; EU15 for 1995-97, EU27 for 2012-13 and EU28 from 2014 when available. 2. OECD EU countries are included individually in the OECD total for all years prior to their accession to the EU. Slovenia is only included from 1992. The OECD total does not include the non-OECD EU member states.

Source: OECD (2015c).

Producer Support Estimate represents transfers from taxpayers and consumers to producers individually. These transfers include (OECD, 2015a): 1) support based on commodity output (Market Price Support and payments based on output use); 2) payments based on input use (on variable input use, on fixed capital formation, on on-farm services); 3) payments based on current area planted, animal numbers, receipts, or incomes, with

production required; 4) payments based on non-current (i.e. historical or fixed) area, animal numbers, revenue, or income, with current production of any commodity required; 5) payments based on non-current area, animal numbers, revenue, or income, with current production of any commodity not required but optional; 6) payments based on non-commodity criteria (transfers for long-term retirement of factors of production from commodity production, transfers for the use of farm resources to produce specific non-commodity outputs of goods and services and transfers provided equally to all farmers, such as flat rate or lump sum payment; 7) miscellaneous payments.

A very problematic instrument of agricultural policy as regards its influence on market competition is Market Price Support (MPS). It can be defined as transfers from consumers and taxpayers to agricultural producers, arising from policy measures that create a gap between domestic market prices and border prices of specific agricultural commodities. They include trade policy instruments connected both with import (e.g. tariffs, tariff quotas and licensing requirements) and export (e.g. export subsidies, export credits and quantitative restrictions) as well as domestic price support measures (e.g. production quotas, administered prices and intervention purchases) (OECD, 2015b). Supporting domestic prices, stimulating production and raising farm incomes were the dominant features of agricultural policy strategies used by the QUAD countries in the 1980s. In 1986 the value of transfers associated with MPS reached 73642.4 mln USD in the EU, 41553.1 mln USD in Japan, 11070.8 mln USD in the US and 2976.1 mln USD in Canada. This accounted for 86.6% of PSE in the EU, 90.2% in Japan, 29.6% in the US and 49.4% in Canada (OECD; 2015c). This policy measure imposed significant costs on consumers and isolated farmers from market developments. MPS distorted farmers' production decisions and transfers often did not reach the intended beneficiaries. The MPS instrument caused a lot of problems in internal markets of the QUAD countries (overproduction, especially in the EU) as well as in international markets (pumping of agricultural products into the world market at dumped prices due to subsidies negatively affected incomes of the most competitive agri-food exporters). The Uruguay Round Agreement on Agriculture became an external incentive to change the character of agricultural policy support (especially in the EU) (Mucha-Leszko, 2004, pp. 35-39; Swinnen, 2015). The value of MPS transfers decreased in all the QUAD countries in 2014 compared to 1986, most significantly in the EU where it reached 18509.6 mln USD (17.3% PSE) but also in the US (9130.2 mln USD, 22% PSE) and in Japan (34716.4 mln USD, 78.4% PSE). In Japan price support programs cover majority of agricultural output, especially production of rice which is grown on about half of the arable land. In Canada, despite a decreasing value of MPS in absolute terms in 1986-2014 (to the level of 2742.9 mln USD), the share of MPS in PSE increased to 59.4%.

Reforms of support system that were introduced by the EU aimed at reducing intervention prices on wheat, beef and milk markets in combination with introducing Single Payment Scheme whereas in the US they focused on strengthening direct payments. These countries started to provide most of the support via tax-financed payments based on area, animal number, farm receipts or incomes. The share of such payments has increased most significantly in the EU (from 3% of PSE in 1986 to 64.7% of PSE in 2014)³. The US have a longer tradition of using this instrument of agricultural policy, in 1986 the share of direct payments in PSE was 37.6% and in 2014 this share rose to 49.2%. In both the EU and the US a marked shift can be observed - from payments based on current area/animal number

³ All the data on detailed structure of PSE, GSSE and CSE on the basis of: [OECD 2015c].

or farm receipts/incomes with production required towards the use of payments based on non-current area/animal number, farm receipts/incomes with production not required. Japan has also introduced, though to a lesser extent, some payments to farmers not connected with production, although one third of payments is still associated with production (the share in PSE of payments related and not related to production increased from 3.2% in 1986 to 12.8% in 2014). In Canada the importance of payments to farmers remained almost the same during the period analyzed (28.2% in 1986 and 30.6% in 2014) with the predominance of payments based on current area/animal number, farm receipts or incomes and with production required.

Table 3. Producer Support Estimate by the QUAD countries in 1986-2014

| | 1986-88 | 1995-97 | 2012-14 | 2012 | 2013 | 2014 |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| Canada | | | | | | |
| PSE (million USD) | 6 058 | 3 576 | 5 862 | 7 411 | 5 559 | 4 618 |
| Percentage PSE (%) | 35.8 | 16.3 | 11.2 | 13.9 | 10.6 | 9.0 |
| Producer NPC (coeff.) | 1.39 | 1.10 | 1.08 | 1.10 | 1.08 | 1.06 |
| Producer NAC (coeff.) | 1.56 | 1.20 | 1.13 | 1.16 | 1.12 | 1.10 |
| European Union ¹ | | | | | | |
| PSE (million USD) | 97 318 | 116 732 | 111 988 | 107 760 | 121 301 | 106 902 |
| Percentage PSE (%) | 39.2 | 33.8 | 19.2 | 19.1 | 20.5 | 18.0 |
| Producer NPC (coeff.) | 1.70 | 1.33 | 1.05 | 1.05 | 1.07 | 1.04 |
| Producer NAC (coeff.) | 1.65 | 1.51 | 1.24 | 1.24 | 1.26 | 1.22 |
| Japan | | | | | | |
| PSE (million USD) | 49 757 | 58 891 | 53 547 | 65 536 | 50 848 | 44 256 |
| Percentage PSE (%) | 64.0 | 58.1 | 52.3 | 55.1 | 52.6 | 49.2 |
| Producer NPC (coeff.) | 2.65 | 2.31 | 1.94 | 2.05 | 1.94 | 1.82 |
| Producer NAC (coeff.) | 2.78 | 2.40 | 2.10 | 2.23 | 2.11 | 1.97 |
| United States | | | | | | |
| PSE (million USD) | 35 337 | 25 617 | 34 565 | 33 412 | 28 821 | 41 461 |
| Percentage PSE (%) | 21.2 | 11.9 | 8.2 | 7.9 | 6.9 | 9.8 |
| Producer NPC (coeff.) | 1.12 | 1.06 | 1.02 | 1.02 | 1.01 | 1.03 |
| Producer NAC (coeff.) | 1.27 | 1.14 | 1.09 | 1.09 | 1.07 | 1.11 |
| OECD ² | | | | | | |
| PSE (million USD) | 238 465 | 252 958 | 250 881 | 259 930 | 253 712 | 239 000 |
| Percentage PSE (%) | 36.9 | 29.6 | 17.9 | 18.4 | 18.0 | 17.3 |
| Producer NPC (coeff.) | 1.49 | 1.30 | 1.10 | 1.11 | 1.10 | 1.10 |
| Producer NAC (coeff.) | 1.58 | 1.42 | 1.22 | 1.23 | 1.22 | 1.21 |

Note: As in table 2. NPC: Nominal Protection Coefficient. NAC: Nominal Assistance Coefficient.

Source: OECD (2015c).

The OECD's key indicator to measure policy efforts to support agricultural producers is the Producer Support Estimate as a percentage of gross farm receipts (%PSE). Currently, in OECD countries about one-sixth of farm gross receipts depends on public policies. However, over the longer term, the level of such support has been following a downward trend. The producer support in relation to farm receipts remains below the OECD average

for the US and Canada and above that level for the EU and Japan. In the US %PSE was reduced by 13 percentage points between 1986-88 and 2012-14, in Canada by 24.6 p.p., in the EU by 20 p.p. and in Japan by only 11.7 p.p. In Japan the overall support remains high compared to the OECD average and to the other QUAD countries.

The Nominal Protection Coefficient (NPC) for the OECD countries at the level of 1.1 in 2012-14 suggests that farmers received prices that were 10% above international market levels (compared to 49% during the 1986-88 period). The highest prices for agricultural products occur in Japan. Prices obtained by Japanese farmers were 2.65 times higher than those in world markets in 1986-88, this ratio was reduced to 1.94 in 2012-14. The NPC value in Japan has resulted mainly from MPS for rice, Chinese cabbage and Welsh onion. In the EU producer prices were 70% higher than world prices in 1986-88 and only 5% higher in 2012-14 (still due to higher prices received by sugar, beef and poultry producers). In the US producer prices of commodities are mostly aligned with border prices, with the exception of sugar, dairy and sheep meat prices. In Canada higher prices than those on the world market are obtained by producers of milk, poultry and eggs.

The level of producer support can be measured by the Nominal Assistance Coefficient (NAC) which is a ratio that indicates by how much total gross farm receipts are higher than if they were generated at world market prices and without budgetary support. In 2012-14, in the OECD area NAC reached the level of 1.22 which means that in those countries total gross farm receipts were on average 22% higher than if they were only a result of market forces. The NAC index has narrowed significantly from 1986-88 when it accounted to 1.58. Price levels of agricultural products in the US and Canada are the closest to those in world markets among the QUAD countries and their agriculture would be able to survive without any budgetary support. The EU countries and Japan are less competitive and it seems that for the Japanese farmers it would be very difficult to survive with no state support.

Table 4. General Services Support Estimate by the QUAD countries in 1986-2014

| | 1986-88 | 1995-97 | 2012-14 | 2012 | 2013 | 2014 |
|-----------------------------|---------|---------|---------|--------|--------|--------|
| Canada | | | | | | |
| GSSE (million USD) | 1 109 | 1 201 | 2 225 | 2 345 | 2 342 | 1 988 |
| Percentage GSSE (% of TSE) | 15.5 | 25.2 | 27.9 | 24.0 | 29.6 | 30.1 |
| European Union ¹ | | | | | | |
| GSSE (million USD) | 10 504 | 12 600 | 18 051 | 17 338 | 18 822 | 17 993 |
| Percentage GSSE (% of TSE) | 9.3 | 9.4 | 13.8 | 13.7 | 13.3 | 14.3 |
| Japan | | | | | | |
| GSSE (million USD) | 8 769 | 19 418 | 9 784 | 11 558 | 9 878 | 7 914 |
| Percentage GSSE (% of TSE) | 14.9 | 24.7 | 15.5 | 15.0 | 16.3 | 15.2 |
| United States | | | | | | |
| GSSE (million USD) | 3 108 | 4 239 | 8 132 | 6 094 | 10 413 | 7 889 |
| Percentage GSSE (% of TSE) | 6.4 | 8.9 | 9.0 | 7.0 | 11.9 | 8.2 |
| OECD ² | | | | | | |
| GSSE (million USD) | 26 881 | 45 886 | 47 012 | 45 105 | 50 549 | 45 381 |
| Percentage GSSE (% of TSE) | 9.4 | 14.2 | 13.5 | 12.7 | 14.3 | 13.6 |

Note: As in table 2. A revised GSSE definition with new categories was introduced in 2014. When possible, the revision was implemented for the whole time series.

Source: OECD (2015c).

Table 5. Consumer Support Estimate by the QUAD countries in 1986-2014

| | 1986-88 | 1995-97 | 2012-14 | 2012 | 2013 | 2014 |
|-----------------------------------|----------|----------|---------|---------|---------|---------|
| Canada | | | | | | |
| CSE (million USD) | -2 860 | -1 758 | -3 938 | -5 145 | -4 134 | -2 536 |
| Percentage CSE (%) | -22.7 | -11.2 | -12.7 | -15.8 | -13.5 | -8.8 |
| Consumer NPC (coeff.) | 1.33 | 1.13 | 1.15 | 1.19 | 1.16 | 1.10 |
| Consumer NAC (coeff.) | 1.30 | 1.13 | 1.15 | 1.19 | 1.16 | 1.10 |
| European Union¹ | | | | | | |
| CSE (million USD) | -72 556 | -58 542 | -22 220 | -20 503 | -28 973 | -17 184 |
| Percentage CSE (%) | -35.7 | -20.9 | -4.6 | -4.3 | -5.8 | -3.6 |
| Consumer NPC (coeff.) | 1.70 | 1.30 | 1.05 | 1.05 | 1.07 | 1.04 |
| Consumer NAC (coeff.) | 1.56 | 1.26 | 1.05 | 1.05 | 1.06 | 1.04 |
| Japan | | | | | | |
| CSE (million USD) | -61 284 | -76 199 | -57 304 | -70 865 | -53 832 | -47 214 |
| Percentage CSE (%) | -62.3 | -53.6 | -44.3 | -47.8 | -43.1 | -42.0 |
| Consumer NPC (coeff.) | 2.66 | 2.17 | 1.80 | 1.92 | 1.76 | 1.72 |
| Consumer NAC (coeff.) | 2.65 | 2.16 | 1.80 | 1.91 | 1.76 | 1.72 |
| United States | | | | | | |
| CSE (million USD) | -2 629 | 6 157 | 40 900 | 39 895 | 45 284 | 37 521 |
| Percentage CSE (%) | -2.4 | 4.3 | 15.6 | 14.6 | 17.8 | 14.5 |
| Consumer NPC (coeff.) | 1.12 | 1.08 | 1.02 | 1.02 | 1.01 | 1.03 |
| Consumer NAC (coeff.) | 1.03 | 0.96 | 0.86 | 0.87 | 0.85 | 0.87 |
| OECD² | | | | | | |
| CSE (million USD) | -158 691 | -169 553 | -79 930 | -93 692 | -78 554 | -67 544 |
| Percentage CSE (%) | -30.1 | -23.4 | -7.3 | -8.3 | -7.1 | -6.3 |
| Consumer NPC (coeff.) | 1.53 | 1.36 | 1.13 | 1.14 | 1.13 | 1.12 |
| Consumer NAC (coeff.) | 1.43 | 1.31 | 1.08 | 1.09 | 1.08 | 1.07 |

Note: as in table 2.

Source: OECD (2015c).

In addition to the support provided to producers individually (PSE), agriculture is assisted through public financing of services to this sector of economy (GSSE) such as: agricultural knowledge and innovation systems, inspection and control, development and maintenance of infrastructure, marketing and promotion, cost of public stockholding. The GSSE accounts for a much smaller share of total support to agriculture than the PSE in all the OECD countries as well as in the QUAD countries among which the biggest share allocated to the GSSE belongs to Canada. Priorities attached to different categories in the GSSE expenditures differ among the QUAD countries. In 2012-2014 the agricultural knowledge and innovation systems was the most supported category in the EU and the US, it was also important in Canada (second position). This kind of support is crucial for longer term sector development, especially budgetary expenditure financing research and development activities related to agriculture, agricultural programmes in high-level education, training and consulting services for farmers as well as information dissemination networks associated with agricultural production. Expenditures on development and maintenance of infrastructure were of most significance in Japan, and were also quite

important in the EU and the US (second position in both cases). This category of the GSSE classification consists of financing such investments like for example: irrigation and drainage networks, market facilities related to handling and marketing primary agricultural products (silos, docks, elevators, wholesales markets, futures markets), institutional infrastructure connected with the farming sector (machinery user groups, seed and species registries, development of rural finance networks, support to farm organizations). In recent years, Canada has allocated the largest share of the GSSE spending to inspection and control services including: expenditures financing activities related to agricultural product safety and inspection, pest and disease control of agricultural inputs and outputs as well as supporting institutions providing control activities and certification of industrial inputs used in agriculture. In all the QUAD countries (except Japan) there can be observed an increasing share of expenditures on marketing and promotion (e.g. promotion campaigns, participation in international fairs) and a declining share of expenditures covering the cost of public storage of agricultural products.

The Consumer Support Estimate (CSE) measures the annual monetary value of gross transfers from/to consumers of agricultural commodities (at the farm gate level) arising from policy measures aiming at supporting producer prices. In most of the OECD countries as well as in the QUAD countries, except the US, the CSE value is negative which means that the implicit tax on consumers through market price support more than offsets consumer subsidies that lower prices to consumers. The US is the only country where higher domestic prices are more than balanced by expenditures on food aid programmes for consumers. The expansion of such programmes led to a significant increase in %CSE (CSE transfers as a share of consumption expenditure on agricultural products) from -2.4 in 1986-88 to 15.6 in 2012-14. The US provide the highest consumer support (transfers to consumers from taxpayers) among all the OECD countries. On the contrary, Japan is among countries where %CSE is negative and still very substantial (-62.3 in 1986-88 and -44.3 in 2012-14). But the monetary value of consumer costs to support agricultural prices expressed in transfers to producers from consumers is the highest in the EU, although the consumer NPC (the ratio between the average price paid by consumers and the border price, both measured at farm gate) decreased in the EU significantly, from 1.7 in 1986-88 to 1.05 in 2012-14. The consumer NPC has decreased in all the QUAD countries as well as its average level in the OECD (Table 5). Similarly, the consumer NAC (the ratio between the value of consumption expenditure on agricultural commodities at farm gate and that valued at border prices) has decreased on average in the OECD and all the QUAD economies. The lowest level of this indicator - below 1 - is found in the US which means that transfers from taxpayers to consumers balance negative agricultural policy effects.

Economic outcomes of the QUAD countries from the perspective of changes in agriculture support

It is apparent from the data in Table 6 that until 2004 the growth rate of agricultural producer prices was much higher in the QUAD countries than in the world, while in 2005-2014 the trend has reversed. Before the end of the Uruguay Round Japan stood out as having the highest growth rate of producer prices in agriculture, in 1995-2004 the highest increase in prices occurred in Canada, and in the last decade in the United States. Throughout the entire period 1986-2014 the growth rate of world agricultural prices

measured by value added deflator was higher than the growth rate of the overall level of prices in the world economy measured by the GDP deflator. As for the QUAD countries in 1995-2004 Canada and the EU had a similar rate of growth in agricultural prices deflated by the value added to the world's pace (and the EU even slightly lower) while in Japan and in the United States prices were rising much faster. It is worth mentioning a significant decline in the price growth rate in the agricultural sector in the EU since the mid-1990s, that is after the MacSharry reform. In the last decade all the QUAD economies are characterized by a lower growth rate in agricultural prices deflated by value added than the world average which can be associated, among other things, with the decline of Market Price Support transfers in these countries. For many years, the lowest level of prices for agricultural products among the QUAD countries is characteristic for the United States (85% of the OECD average in 2011) which allocate relatively much of their agricultural support to consumers through various food aid programmes, and the highest one for Japan (176% of the OECD average) (OECD, 2016c). The changes of support in the QUAD countries have been significantly associated with the changes in global agricultural prices. In 2000 world prices of agricultural commodities were at the level of 1986, reaching the minimum in 2001 (World Bank, 2016a). Due to the completion of a long-term downward trend in agricultural prices in the nominal and real terms in the early 2000s and following increases in food prices, particularly in 2008 (during the recent global financial and economic crisis) and in 2010-2011 (World Bank, 2016; European Commission, 2015; OECD, 2016, p. 24), the need for price support in the QUAD countries has been reduced, which contributed in part to lower % PSE levels.

Table 6. Comparison of changes in production, trade and prices for agriculture sector in the QUAD countries and the world economy in 1986-2014 based on selected economic indicators

| | Average Annual Growth Rate of Agricultural Production Value ¹ | | | Average Annual Growth Rate of Agricultural Export Value ² | | | Average Annual Growth Rate of Agricultural Import Value ² | | |
|--------|--|---------|---------|---|---------|---------|--|---------|---------|
| | 1992-94 | 1995-04 | 2005-14 | 1986-94 | 1995-04 | 2005-14 | 1986-94 | 1995-04 | 2005-14 |
| Canada | 99.74 | 104.44 | 112.79 | 106.08 | 106.49 | 109.71 | 106.97 | 105.90 | 109.32 |
| Japan | 111.28 | 96.24 | 100.82 | 109.00 | 103.56 | 106.18 | 109.35 | 101.51 | 105.29 |
| US | 105.24 | 103.16 | 107.14 | 106.52 | 102.36 | 110.67 | 103.33 | 106.99 | 107.72 |
| EU | 97.72 | 102.20 | 104.15 | 109.67 | 105.19 | 107.87 | 107.94 | 104.92 | 107.16 |
| World | 105.32 | 102.77 | 109.79 | 107.31 | 104.89 | 110.21 | 106.49 | 105.01 | 109.92 |
| | Average Annual Producer Price Index for Agriculture ³ | | | Average Annual Value Added Deflator in Agriculture, forestry and fishery ⁴ | | | Average Annual GDP Deflator ⁴ | | |
| | 1991-94 | 1995-04 | 2005-14 | 1986-94 | 1995-04 | 2005-14 | 1986-94 | 1995-04 | 2005-14 |
| Canada | 90.10 | 104.06 | 127.42 | 86.78 | 92.60 | 121.00 | 69.89 | 73.70 | 125.00 |
| Japan | 118.47 | 102.26 | 98.74 | 102.56 | 108.80 | 102.70 | 89.89 | 103.70 | 107.30 |
| US | 85.11 | 89.58 | 134.94 | 112.67 | 107.40 | 124.60 | 72.22 | 88.60 | 109.60 |
| EU | 87.62 | 93.69 | 119.54 | 103.42 | 91.79 | 121.51 | 60.52 | 74.31 | 122.78 |
| World | 57.81 | 78.44 | 145.39 | 96.91 | 92.10 | 133.88 | 74.67 | 82.22 | 130.41 |

Note: ¹ Gross Production Value (current US\$), ² Crops and livestock products (current US\$), ³ (2004-2006 = 100), ⁴ Value in US\$, 2005 prices (2005=100).

Source: FAO (2016) and own calculations.

In 1992-1994 the European Union and Canada were distinguished by relatively low growth rates of agricultural production as compared to the other QUAD economies and the world average, and from the mid-1990s this rate has been the highest in Canada which - what's interesting - has least supported agricultural production among the QUAD group. The reason for such good results in terms of increase in agricultural production in the case of Canada was a very high growth rate of labour productivity in agriculture in comparison with other QUAD countries. In 1986-1987, labour productivity in agriculture in the US and the EU accounted for respectively 60% and 47.5% of the level of productivity in Canada, and in Japan only for 40%. Whereas in the last three decades, the United States and Japan have significantly increased their levels of labour productivity in relation to Canada while in the European Union the opposite trend has occurred. In 2014 the US attained a comparable level of labour productivity with Canada, Japan raised its productivity to 78%, and the EU lowered it to only 35.5% of the Canadian level (own calculations based on World Bank, 2016b and FAO, 2016). The European Union and Japan which support to the greatest extent the agricultural sector in relation to GDP in the QUAD group have much lower growth rates of labour productivity in agriculture, which translates into lower growth rates of agricultural production in comparison to other QUAD countries. The comparison of economic efficiency of the QUAD countries in agriculture based on total factor productivity indicators - measuring the degree of organizational changes, technological progress and innovative capacity - falls out the worst for the European Union, where the level of TFP (measured by the TFP index, 1992=100) in 2013 compared to 1992 increased by only 28%, while in Japan by about 53%, in Canada by 45% and in the US by 43% (USDA, 2016 and own calculations). During the whole examined period 1986-2013 the average annual growth rate of TFP in the EU was 1.3%, while in Canada 2.3%, in Japan 1.8% and 1.6% in the US. While in 1986-1994 the highest average annual TFP growth occurred in Canada (3.1%) and the European Union (1.6%), in 2005-2013 the highest values of this indicator were reached by Japan (2.3%) and the United States (1.7%), and in the EU and Canada it amounted to only 1.4% and 1.3% respectively (USDA, 2016 and own calculations).

The analysis of export growth rates indicates that in 1986-1994 the best results in this field were achieved by the EU which applied the greatest export subsidies within the QUAD group. In the subsequent period (1995-2004) the pace of export growth in the world and in the QUAD countries has dropped significantly, except Canada which was characterized by a very high efficiency of agriculture. Whereas in 2005-2014 the growth rate of world exports increased considerably and the United States stood out with the highest growth of exports in the QUAD countries. A good performance in the US exports was favored by a developed policy of encouraging R&D and innovation in the agricultural sector, an integral part of which was the GSSE support. While in 1986-2007 innovation and productivity enhancing support (including agricultural knowledge systems, inspection and control, and infrastructure) accounted for about 50% of GSSE support in the United States, from 2008 to 2015 their share increased to approximately 70% (OECD, 2015c; OECD, 2016b, p. 194) which contributed to TFP growth in agriculture. The relatively high growth rate of exports is also specific for Canada which is currently the most open economy if we consider the growth rate of imports in the QUAD countries. The high level of labour productivity and good results in terms of TFP growth rates translate into the competitiveness of the country in international agricultural trade and taking initiatives in the form of free trade agreements, such as CETA.

Conclusions

In 1986-2014 in all the QUAD countries the share of expenditure on agriculture in relation to GDP decreased significantly. The best results in this regard were achieved by the European Union where state support for this sector was reduced from 2.6% of GDP in 1986 to 0.7% of GDP (equal to the OECD average) in 2014. In terms of value, support to agriculture provided by the United States nearly doubled in the examined period but in relation to GDP it remains one of the lowest in the QUAD group (0.5% of GDP in 2014) as well as in Canada where it currently accounts for only 0.4% of GDP. By contrast, Japanese economy has been characterized over the years by a relatively high share of agricultural spending in relation to GDP that amounted to 1.1% in 2014.

In the second half of 1980s transfers from consumers and taxpayers provided to agricultural producers individually (PSE) prevailed in all the QUAD economies while other types of support, like general services that create enabling conditions for the agriculture sector (GSSE) as well as transfers to consumers from taxpayers (constituting a part of CSE) were of little importance. Nowadays these countries differ to a larger extent in terms of the structure of support to agriculture. The European Union and Japan continue to allocate the majority of funds to individual farmers (their PSE accounted for 84% of TSE each in 2014). However, in Japan price support measures predominate while the EU prefers direct payments. Completely different policies of support to agriculture are carried out by the United States and Canada. The first of these economies devotes about half of its all financial resources supporting this sector to subsidize consumers (transfers to consumers from taxpayers) and only 43% of these funds as PSE. Whereas in Canada the expenditure on general services for agricultural sector is relatively important (30% of TSE in 2014). Except for the United States in other QUAD countries transfers to consumers from taxpayers do not practically function although there is a positive tendency of easing the burden on consumers arising from lowering their transfers to agricultural producers (in 1986-2014 the largest decrease of transfers to producers from consumers occurred in the EU). It is worth emphasizing the decreasing share in PSE of market price support, i.e. the policy measure that is very detrimental to competition and disrupts market functioning, in three QUAD economies (EU, US and Japan). It has fallen to the greatest extent in the European Union from about 87% to 17% over the past three decades. However, in Japan MPS still accounts for above 78% of PSE. In Canada, the share of such transfers within PSE declined in the mid-1990s while today it amounts to 59%, i.e. 10 percentage points more than in the second half of the 1980s.

Economic outcomes of the QUAD economies in terms of agricultural production, trade, prices and economic efficiency indices confirm that much more important than the amount of support for agriculture is an increase in technological progress and productivity which should be favored by a thoughtful agricultural policy and appropriate structure of financial transfers to agriculture. The best results among the QUAD countries in terms of labour productivity and TFP indices and as a result the rapid pace of growth in production and exports are reached by Canada and the United States which are also able to use its competitive advantage in the global market for agricultural commodities. The worst outcomes in respect of market performance in the agricultural sector are achieved by the EU and Japan in recent years despite the use of relatively high subsidies. The EU labour productivity and TFP growth in agriculture is relatively low, and Japan which has favorable rates of TFP growth in the agriculture sector due to natural constraints and the high level of

agricultural prices is not fully able to put them upon to improve the competitiveness of its food products on a global scale.

Changes in the size and structure of state support to agriculture in the QUAD countries reflect the new priorities of agricultural policy which should encourage greater efficiency and competitiveness of agriculture, cause less distortions of the market mechanism, promote economic growth and fight poverty in less developed countries, contribute to the protection of natural environment and biodiversity preservation as well as meet new challenges like climate change. In the context of the realization of these objectives the authors evaluate the policy pursued by the United States as the most appropriate as well as appreciate the positive changes in support policy that have been introduced in the European Union in recent years what is particularly important because of large shares of these two economies in the world's agricultural production and trade. The Canadian policy of support for agriculture can be also assessed as being well designed, even despite the high price support in recent years (which may cause some distortions of market signals), due to the fact that the amount of aid is small and overall economic outcomes are very good. The policy conducted by Japan is the least favorable in terms of competition intensity and free operation of the market mechanism but it has smaller impact on the destabilization of global markets due to the decreasing share of this country in the world's production and exports of agricultural products.

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