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Farming Standards as a Catalyst for Food Export: Middle-Income European Countries Case Study

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ABSTRACT

IFA GLOBALG.A.P. is a leading private and voluntary worldwide standard for sustainable agriculture. Its implementation and certification are increasingly becoming a prerequisite for exporting food and vegetables to EU countries and other high-income markets. The aim of the paper is to examine farmers' progress in sustainable agriculture as part of the production certification within the IFA GLOBALG.A.P. standard for fruit and vegetables in 13 middle-income European countries. At the same time, the authors examine whether this progress can act as a "catalyst" which improves the export performance of these national economies in the sector of fruit and vegetables. The export performance was represented by the following criterion variables: (a) annual values of fruit and vegetable export in thousand US dollars; (b) annual values of fruit and vegetable export to high-income importing markets, in thousand US dollars and (c) the percentage share of food and vegetable export to high-income markets in the total food and vegetable export. The predictor variable was defined as the number of IFA GLOBALG.A.P. certified farmers. All variables were presented per country and year. The research included the period from 2010 to 2021, while the hypotheses were tested using the panel regression analysis. Individual models were tested for each criterion variable, and all three models were adequate. The results show that the rise of IFA GLOBALG.A.P. certified producers increases the values of all three studied criterion variables. The results that were obtained complement and enrich the scarce academic literature in this field related to developing countries in Europe. In addition, the research offers guidelines and recommendations for directing national policies toward greater implementation of private and voluntary farm certification schemes for sustainable agriculture.

Keywords: *sustainable agriculture, export performance, IFA GLOBALG.A.P. certification standard, developing countries, fruit and vegetables*

JEL Classification: Q17, Q18, Q50

INTRODUCTION

Producing safe and high-quality food, along with positive economic, trade, social, health, and environmental effects of primary agricultural production, is becoming increasingly significant in local and global supply chains. The European Commission, international institutions, and the scientific community clearly and unequivocally believe that agriculture has to meet the growing global demand for food and address the following challenges at the same time: (a) ensure profitability and farmer fair practice rules, (b) strengthen its environmental, social, and health components, (c) adopt green and organic agricultural practices and promote sustainable and

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resilient agri-food systems and food supply chains to protect the environment and restore biodiversity (UN, 2015; Latruffe et al., 2016; FAO, 2018; EC, 2019; EC 2020; Lykogianni et al., 2021; World Bank, 2021; Rad, Ray & Barghi, 2022; Knapp & Sciarretta, 2023).

One way of transforming the agricultural sector into a sustainable system is by implementing different certification schemes for sustainable agriculture. There are as many as 198 of these schemes in the countries of the European Union and third countries (EU, 2022). Private bodies established more than two-thirds of the certified schemes, while one-third are established by public entities (EU, 2022). A number of schemes, which have a large scope of responsibilities for farmers, contribute directly and substantially to nearly all EU sustainability aims in the agricultural sector. Other schemes help to achieve one to three sustainability aims (mainly resource management, environmental protection, animal health and welfare, and, less frequently, climate change). The remaining schemes focus on a single aim, i.e., animal welfare or climate (EU, 2022).

"*Good Agricultural Practices for primary production and the supply chain*" (abbr. GLOBALG.A.P.) is the leading global, private, and, voluntary standard and farm certification scheme for sustainable agriculture and food safety and quality (EU, 2022, p. 39). More than 200,000 agricultural producers worldwide certify their agricultural production according to the GLOBALG.A.P. standard (GLOBALG.A.P. organization, data obtained on request). This standard focuses on sustainable agricultural practices, supply chain traceability, food security and safety, workers' well-being, and, animal welfare (FAO, 2016; EU, 2022; GLOBALG.A.P. organization website). Integrated Farm Assurance (IFA) for fruit and vegetables (F&V) is one of the GLOBALG.A.P.'s core solutions, resulting in the largest number of certificates. Of the total number of IFA certificates, 96.5% are under the IFA F&V scheme, covering four million certified hectares annually (GLOBALG.A.P. organization, data obtained on request; GLOBALG.A.P. organization website). This is a global standard for "*safe and responsible farming practices at primary production level. It is built on a holistic approach that covers the key topics of food safety, environmental sustainability, workers' well-being, production processes, and traceability*" (GLOBALG.A.P. organization website).

The implementation and certification of agricultural production according to different private farm certification schemes are increasingly becoming a precondition for exporting food to high-income markets and for raising the country's competitiveness on the global market of agricultural products (FAO, 2016; Popović & Paraušić, 2016; Niemiec et al., 2019; Flachsbarth, Grassnick & Brümmer, 2020; Rao, Bast & De Boer, 2021). For example, the GLOBALG.A.P. IFA standard for F&V has a substantial impact on the global chain of fresh F&V, considering that certification of production according to this standard is increasingly becoming a prerequisite for entering the EU-15 market and other high-income markets, particularly for lower-income countries (Andersson, 2019; Flachsbarth, Grassnick & Brümmer, 2020; Amekawa et al., 2021). Today, this standard is requested as a trading requirement from farmers and exporters primarily by retailers, supermarkets, and processors in the EU (Flachsbarth, Grassnick & Brümmer, 2020; EU, 2022; GLOBALG.A.P. organization website). As stated by Masood & Brümmer (2014, p. 15), "*Since private standards directly affect trade, even if the adoption of GlobalG.A.P. is voluntary in nature, its compliance could be quasi-mandatory for exporters competing in the international market.*"

Bearing in mind the above-mentioned points, the authors used a sample of 13 middle-income European countries to examine the impact of the GLOBALG.A.P. IFA certification scheme for F&V on national export results in the F&V sector during the period 2010-2021. The authors studied the statistical significance of the impact that changes in the number of GLOBALG.A.P. IFA-certified producers in the sector of F&V have on: (a) the realized export value in the F&V sector; (b) the realized F&V export value to high-income markets, and (c) the percentage share of the realized F&V export value to high-income markets in the total F&V export values. Descriptive statistics and panel regression were used for this analysis.

The aim of the research is to investigate whether the implementation of GLOBALG.A.P.'s flagship standard (IFA for F&V) among farmers in 13 middle-income European countries correlates with improved export performance in the F&V sector of these national economies. The selection of the countries in the sample was determined by the fact that no author had previously considered this group of countries in their studies. On the other hand, there is comprehensive literature on the impact of farm certification schemes on the export performance of farmers and national economies in Africa's and Asia's developing countries.

LITERATURE REVIEW

Examining the impact of GLOBALG.A.P. certification on the export performance of farmers and national economies, a large number of authors unambiguously highlighted its positive effects. A chronological review of the most significant recent research results is given below:

- Using three-year panel data (2010 – 2012) for 74 banana exporting countries, Masood & Brümmer (2014) concluded that the advancement of the countries in terms of GLOBALG.A.P. certification (measured by the number of certified producers and certified area in hectares) was correlated with greater banana export to the EU market;

- Andersson (2019) highlighted that GLOBALG.A.P. acted more as a catalyst than as an obstacle to trade, and that this standard was important for primary producers in the F&V sector who wanted to enter the EU-15 market. The author's findings confirmed the positive relationship between GLOBALG.A.P. certification and trade for high-income and low-income countries. It was estimated that the positive trade impact was higher for low-income countries. Therefore, certification according to private standards might be particularly significant for developing countries which want to enter high-income markets;

- According to Laosutsan, Shivakoti & Soni (2019), the income variable and higher prices on export markets were the most significant factors affecting the adoption of good agricultural practices (GLOBALG.A.P.) by small-scale vegetable farmers in Thailand; also, importers were more confident about the quality and safety of certified vegetables and were willing to pay more for it;

- A study in Poland (Niemiec et al., 2019) showed that the GLOBALG.A.P. standard implementation contributed to greater product safety; significantly increased producers' chances for introducing their products to the international market (through commercial networks); and strengthened farmers' position in export markets;

- A valuable study realized by a group of authors Fiankor et al. (2020) using a sample of 120 countries assessed the impact of GLOBALG.A.P. certification on the export of apples, bananas and grapes to the global market. The authors considered the GLOBALG.A.P. standards to be trade catalysts, indicating that "*the trade effects are higher for exports to high-value EU and OECD markets, but interestingly, they are substantial even for exports to markets outside these regions*" (Fiankor et al., 2020, p. 268);

- According to Flachsbarth, Grassnick & Brümmer (2020, p. 20) "Certification entails substantial benefits, such as better working conditions for farmers and workers, an increase in productivity levels and access to high-value (export markets) with their inherent positive effects for farm income, as well as environmental protection";

- The results of Krauss & Krishnan (2022) indicate that although GLOBALG.A.P. certification did not significantly increase the income of Kenyan farmers and did not strengthen their bargaining capacity, the farmers who invested in the certification were able to expand their export markets and sell into growing regional markets, including Kenyan supermarkets.

There are authors who highlight the negative effects of GLOBALG.A.P. implementation, contrasting with the positive attitudes mentioned above. These authors highlight that private standards do not represent/do not have to represent a trade catalyst for developing countries or a source of strengthening the market and competitive position of farmers and national economies. They state that, due to various factors (extensive demands for farmers and high implementation costs, low total resources of farmers and national economies, non-renewal of certification and contracts with exporters and alike), private standards lead to the exclusion and/or marginalization of small-scale farmers in the international market, as well as to the concentration of agriculture in these countries (Schuster & Maertens, 2015; Kleemann, 2016; Capobianco-Uriarte et al., 2021; Kassem et al, 2021). Using company-level data for 87 export asparagus firms in Peru during the period 1993–2011, Schuster & Maertens (2015, p. 208) analyzed the impact of private standards on the export performance of the firms, and they stated the following: "*We do not find any evidence that certification to private standards in general and to specific individual private standards, has an effect on firms' export performance, neither at the extensive margin nor at the intensive margin, and neither on export volumes nor on export values*". Also, using the example of banana exporting countries and the GLOBALG.A.P. standard implementation, Masood & Brümmer (2014, p. 1) also indicated that "*Small farmers in developing countries who find it difficult to comply with the GlobalG.A.P. standard requirements are driven out of the international banana market.*"

Moderate attitudes indicate that it is not easy to establish and measure the trade and export effects of agricultural products under the GLOBALG.A.P. certification scheme or other farm certification schemes. For example, the GLOBALG.A.P. certification scheme's impact on the export performance of farmers, export companies and national economies depends on various factors, such as: product type, the destination of export markets, location of agricultural production, prices in the mainstream market, price premium, etc. (Subervie & Vagneron, 2013; Laosutsan, Shivakoti & Soni, 2019; Fiankor et al., 2020). Examining the trade (export) effects of GLOBALG.A.P. certification on lychee farmers in Madagascar, Subervie & Vagneron (2013) concluded that this certification had a positive effect on the sales volume and farm gate prices obtained by certified lychee farmers. However, they also stated that positive effects were felt by only a small number of certified farmers who were able to transport their products to the port. In addition, these authors indicated that GLOBALG.A.P. certification had a small effect on the production stage and was more focused on post-harvest requirements (mainly concerning exporters). Consequently, exporters undertook most of the efforts for certification (for example, investing, selecting, and training farmers), and therefore gained most benefits from it (Subervie & Vagneron, 2013).

In general, an interesting observation is that none of the papers show an actual reduction in exports, although they do note some negative effects, especially in developing countries (such as the exclusion and/or marginalization of small-scale farmers in the international food market, and increased concentration in agribusiness, etc.). Otherwise, the authors share opinions that are in the group of moderate attitudes, according to which the impact of the implementation of the GLOBALG.A.P. certification scheme on the export performance (of farmers, export companies and national economies) depends on many factors, different influences and circumstances.

DATA AND METHODOLOGY

In order to investigate the impact of implementing the IFA GLOBALG.A.P. certification scheme (crops base) on the national export results in the F&V sector, using a sample of European developing countries during the period 2010-2021, the authors proposed the following three hypotheses, whose statistical significance was examined:

- *$H_1/1$* – Changes in the number of IFA GLOBALG.A.P. certified producers have a positive impact on the realized export value in the F&V sector;

- $H_1/2$ – Changes in the number of IFA GLOBALG.A.P. certified producers have a positive impact on the realized F&V export value to high-income markets;

- $H_1/3$ – Changes in the number of IFA GLOBALG.A.P. certified producers positively impact the percentage share of the F&V export value to high-income markets in the total F&V export value (to all markets).

To this aim, the following variables were defined per country and year:

- The predictor variable was represented by the number of producers under the IFA GLOBALG.A.P. standard (crops base);

- The criterion variables were represented by: (a) F&V export value, in thousands of US dollars; (b) F&V export value to high-income importing markets, in thousands of US dollars; (c) the percentage of F&V export value to high-income importing markets in the total F&V export value.

The analysis included the 13 middle-income countries of the European continent: Albania, Armenia, Azerbaijan, Bosnia & Herzegovina, Bulgaria, Georgia, Moldova, North Macedonia, Romania, Russian Federation, Serbia, Turkey and Ukraine. The sample was formed based on the World Bank country classification by region and income (World Bank Country and Lending Groups, official website presentation).

As for the group of high-income economies, according to the classification of the World Bank, the threshold for inclusion of countries in this group, as well as for the other groups of economies by income (GNI per capita) varies by years (World Bank Country and Lending Groups, official website presentation). For the 2022 fiscal year, high-income economies are those with a GNI per capita of $12,695 or more. That is a total of 80 countries in the world (EU-15 + 65 others). Middle-income economies are those with a GNI per capita between $1,046 and $12,695 according to the World Bank Country and Lending Groups, official website presentation.

The data on the number of IFA GLOBALG.A.P. certified producers (crops base) per country for the analyzed period were obtained from the global organization GLOBALG.A.P. at the request of the authors (GLOBALG.A.P. organization, data obtained on request).

The data on the export values in the F&V sector were provided by the International Trade Centre (Trade Map, database) for the customs tariffs HS 07 (Edible vegetables and certain roots and tubers) and HS 08 (Edible fruit and nuts; peel of citrus fruit or melons).

Descriptive statistics and panel regression were used for this analysis. The analysis was conducted in the statistical software STATA 12.

RESULTS AND DISCUSSION

Descriptive statistics (presented in Table 1 below, as well as in Table 1 in the Annex and in Figures 1-3 in the Annex) offer good insights into the predictor and criterion variables across the sample of European developing countries from 2010 to 2021.

The average number of IFA GLOBALG.A.P. certified producers (crops base) is 282, with considerable variation between countries (SD=694.2). By country (Figure 1 in the Annex), the greatest average number of certified producers in the analyzed period was found in Turkey (2,537), followed by Serbia (508) and Bosnia and Herzegovina (265). The smallest average number of IFA GLOBALG.A.P. certified producers was recorded in Armenia (1), followed by Azerbaijan (4), Georgia (5), Russian Federation (6), and Moldova (12).

The average export value of F&V in the studied period amounted to 658,252.8 US$, 000, also with considerable variation between countries (SD=1,451,431). Figure 2 in the Annex shows that the lowest average value of this variable is recorded by Armenia (46,282.17 US$, 000), followed by Albania (53,796.73 US$, 000), and Bosnia and Herzegovina (77,503.25 US$, 000). The highest average value of F&V exports is recorded by Turkey (5,442,604.83 US$, 000). Turkish export of

F&V is even 8 times higher than in Serbia (679,123.25 US$, 000), which is right behind Turkey in terms of the value of this indicator (Figure 2 in the Annex).

The average export value of F&V to high-income markets in the analyzed period amounted to 345,255.6 US$, 000, also with considerable variation between countries as the previous one (*SD*=808,029.2) (Table 1). The highest average value of this variable is recorded by Turkey (3,001,435.83 US$, 000), behind which is Serbia with an export value of 464,171.42 US$, 000. The lowest values of this variable are shown by Armenia (950.58 US$, 000) (Figure 2 in the Annex).

Finally, the average share of F&V export value to high-income markets in the total F&V export value by country amounted to 46.4% (*SD*=25.1). The highest value of this variable is achieved by Romania (84.7%), followed by Bulgaria (76.5%) and Serbia (68.4%). The lowest values are observed in Armenia (2.2%), and Azerbaijan (11.6%) (Figure 3 in the Annex).

Table 1. Descriptive statistics

Variables		M	SD	Min	Max	N
Predictor variable						
IFA GLOBALG.A.P. producers (crops base), No.	Overall	282	693.2	0	3,299	154
	Between		694.2	1	2,537	13
Criterion variables						
F&V export value, US $, 000	Overall	658,252.8	1,424,234	8,289	7,120,504	154
	Between		1,451,431	46,282.2	5,442,605	13
F&V export value to high-income markets, US $, 000	Overall	345,255.6	791,517.8	76	3,876,365	154
	Between		808,029.2	950.6	3,001,436	13
F&V export value to high-income markets in the total export value of F&V, %	Overall	46.4	25.1	0.1	93.6	154
	Between		24.5	2.2	84.7	13

Source: Authors' calculations. For Albania and North Macedonia data are given for the period 2010-2020.

The correlation coefficients shown in Table 2 reveal strong positive correlations between the predictor variable (GLOBALG.A.P. certified producers, crops base) and F&V export values, both overall and specifically to high-income markets. The correlation with the percentage share of F&V export value to high-income markets is positive but weaker. These findings align with existing literature supporting the positive impact of GLOBALG.A.P. certification on export performance in the F&V sector.
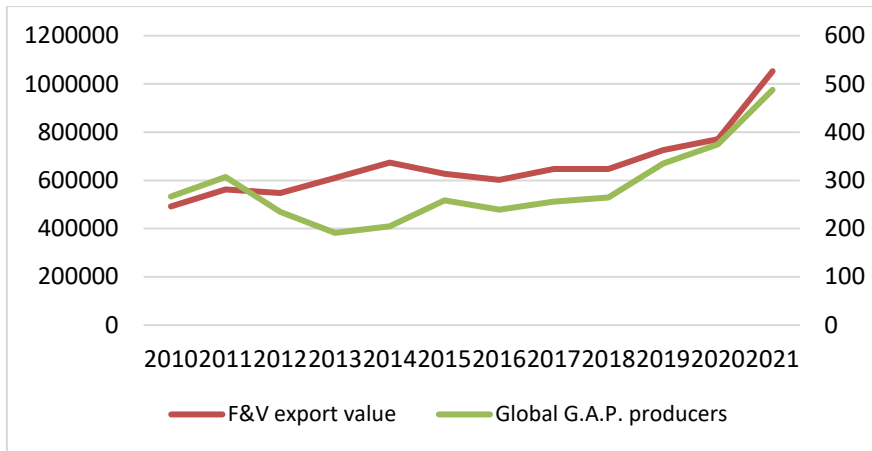
Table 2. Correlation coefficients

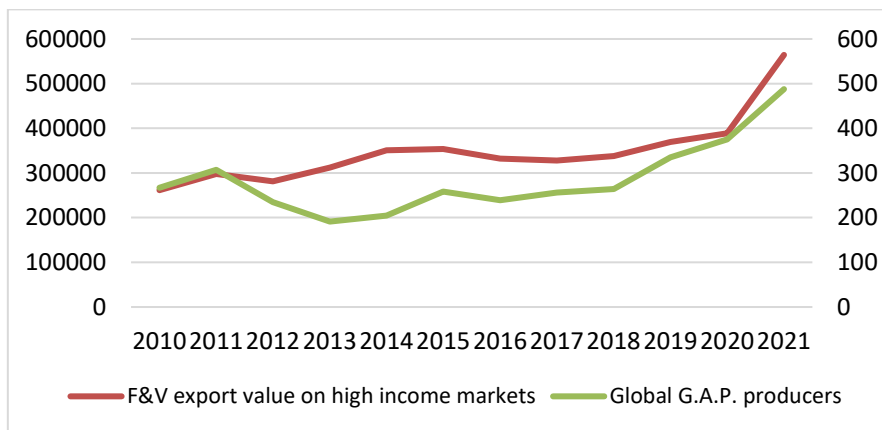|	IFA GLOBALG.A.P. producers	F&V export value to high-income markets	F&V export value to high-income markets in the total export value of F&V, %
F&V export value	0.952 (0.000)**	0.994 (0.000)**	0.112 (0.165)
IFA GLOBALG.A.P. producers, crop base		0.963 (0.000)**	0.212 (0.008)**
F&V export value to high-income markets			0.185 (0.022)*

Source: Authors' calculations.

As the data in Table 2 show, certification under the GLOBALG.A.P certification scheme is positively and strongly correlated with the F&V export value (r=0.952; p=0.00), as well as with the F&V export value to high-income markets (r=0.963; p=0.00). At the same time, the certification has a positive but weak correlation with the changes in the percentage share of the F&V export to high-income markets in the total F&V export value (r=0.212; p=0.01). There is also a statistically significant, strong and positive correlation between the F&V export value and F&V export value

to high-income markets (r=0.994; p=0.00). The following diagrams show the correlation between the predictor variable and the criterion variables (Figure 1, Figure 2, Figure 3).
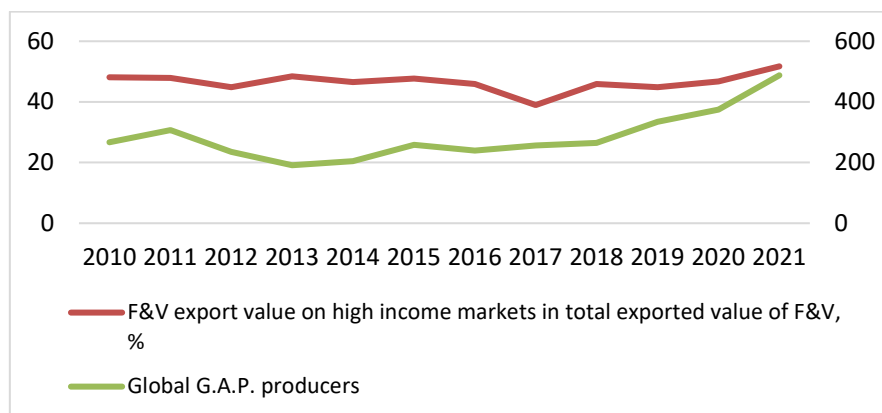

Figure 1. IFA GLOBALG.A.P. producers and F&V export values
Source: Authors' calculations.

Figure 2. IFA GLOBALG.A.P. producers and F&V export value to high-income markets
Source: Authors' calculations.

Figure 3. IFA GLOBALG.A.P. producers and F&V export value to high-income markets in the total export value of F&V, %
Source: Authors' calculations.

The panel regression analysis was used to assess the impact of the predictor variable on the criterion variables. Individual models were tested for each dependent (criterion) variable (Table 3).

A fixed effects model (FE robust) is suitable for estimating the impact of the predictor variable on the export value in the F&V sector, as confirmed by the results of the *Breusch-Pagan LM* ($\chi^2(1)$=96.15; *p*=0.00) and Hausman test ($\chi^2(1)$=63.93; *p*=0.00) (Table 3)*.*

A fixed effects model (FE robust) is suitable for estimating the impact of the predictor variable on the F&V export value to high-income markets, as confirmed by the results of the *Breusch-Pagan LM* ($\chi^2(1)$= 36.25; *p*=0.00) and Hausman test ($\chi^2(1)$=79.08; *p*=0.00) (Table 3)*.*

Finally, a random effects model is suitable for estimating the impact of the predictor variable on the percentage share of the F&V export value to high-income markets in the total F&V export, as confirmed by the results of the *Breusch-Pagan LM* ($\chi^2(1)$= 653.81; *p*=0.00) and Hausman test ($\chi^2(1)$=0.31; *p*=0.58) (Table 3).

Panel regression confirms the positive impact of GLOBALG.A.P. certification on F&V export outcomes. The results indicate that an increase in the number of certified producers leads to significant increases in both total F&V export value and F&V export value to high-income markets. Additionally, there is a slight but significant increase in the percentage share of F&V export value to high-income markets. The results prove the stated hypotheses and show that when the number of GLOBALG.A.P. certified producers is increased by one (Table 3):

- the total export value of the F&V sector increases by US$ 370,819 on average;
- the F&V export value to high-income markets increases by US$ 224,766 on average;
- the percentage share of the F&V export value to high-income markets in the total F&V export increases by 0.003 percentage points on average.

Table 3. Regression coefficients

	F&V export value	F&V export value to high-income markets	F&V export value to high-income markets in the total export value of F&V, %
Constant	553,523 [8,357.867] (0.000)**	281,775.4 [10,300.93] (0.000)**	45.442 [3.121] (0.000)**
GLOBALG.A.P. producers	370,819 [29.593] (0.000)**	224,766 [36.473] (0.000)**	0.003 [0.001] (0.011)*
R²	0.586	0.806	0.586
Test	F(1, 12)= 157.02	F(1, 12)=37.98	$\chi^2(1)$=6.45
P	0.000	0.000	0.011
Wooldridge	F(1, 12)= 2,480.51, p=0.000	F(1, 12)= 290.05, p=0.000	F(1, 12)=6.38, p=0.027
Wald	$\chi^2(13)$= 6.6e+05; p=0.000	$\chi^2(13)$= 1.4e+10; p=0.000	$\chi^2(13)$= 37,808.66; p=0.000
F test	F(12, 140)=36.52; p=0.000	F(12, 140)=33.09; p=0,000	F(12, 140)=91.92; p=0.000
LM test	$\chi^2(1)$= 96.15; p=0.000	$\chi^2(1)$= 36.25; p=0.000	$\chi^2(1)$= 653.81; p=0.000
Hausman test	$\chi^2(1)$= 63.93; p=0.000	$\chi^2(1)$= 79.08; p=0.000	$\chi^2(1)$= 0.31; p=0.579

*Note: ** level of significance α=0.01; * level of significance α=0.05.*

Source: Authors' calculations. Output from the statistical software STATA 12.

The obtained data are in concordance with the studies of numerous authors who tried to prove the positive impact of GLOBALG.A.P. certification on the export performance of farmers and national economies in the F&V sector (Masood & Brümmer, 2014; Andersson, 2019; Laosutsan, Shivakoti & Soni, 2019; Niemiec et al., 2019; Fiankor et al., 2020; Flachsbarth, Grassnick &

Brümmer, 2020; Krauss & Krishnan, 2022). On the other hand, our results do not align with the attitudes of the authors stating that GLOBALG.A.P. certification in the F&V sector does not act as a catalyst for trade and export, primarily due to the small number of certified farmers and the fact that certification is extremely demanding in terms of implementation and costs, particularly for small-scale farmers (Schuster & Maertens, 2015; Kleemann, 2016; Capobianco-Uriarte et al., 2021; Kassem et al, 2021).

Nevertheless, one should be aware that the implementation of GLOBALG.A.P. standards is particularly significant for all developing countries, which have weak food safety and quality standards, as well as other standards related to the environment, social elements of hiring workers and animal welfare, alongside fragmented agriculture with poor application of contracts (Kleemann, 2016; Fiankor, Martínez-Zarzoso & Brümmer, 2019; FAO, 2020; Ramirez-Hernandez et al., 2020; Oppong & Bannor, 2022). In these countries, standards represent a catalyst for transforming production systems into safe and sustainable ones; they serve as a surrogate for undeveloped institutions and a "ticket" for marketing F&V through the global supply chain (Kleemann, 2016; Andersson, 2019; Fiankor, Martínez-Zarzoso & Brümmer, 2019; Flachsbarth, Grassnick & Brümmer, 2020; Oppong & Bannor, 2022). At the same time, in most developing countries it is necessary to promote public policies (those stimulating more effective implementation of environmental regulations, those encouraging investment in clean energy and alike) that give equal emphasis to economic growth and environmental protection (Mitić, Fedajev & Kojić, 2023).

In the agricultural sector, public policies should, among other things, be directed at encouraging farmers to adopt different private and voluntary farm certification schemes (i.e. stimulating the increase in the number of farmers under these schemes, as well as the increase in certified areas in ha). In the process, policymakers should bear in mind that the requirements of private standards are frequently very demanding for small-scale farmers (both in terms of finances and administration). In addition, the standard implementation is hindered by numerous obstacles such as: lack of human, physical, and financial capital, low social capital, low productivity and profitability of agricultural production, etc. (Kleemann, 2016; Annor, Mensah-Bonsu & Jatoe, 2016; Niemiec et al., 2019; Capobianco-Uriarte et al., 2021; Malkanthi, Thenuwara & Weerasinghe, 2021). Also, it is necessary to keep in mind that often "higher prices of the certified products did not compensate the costs connected with certification and adaptation of the farm to the requirements of the standard" (Niemiec et al., 2019, p. 438).

Therefore, future support for farmers should focus not only on financial assistance (subsidies on certification costs), but also on logistic and professional encouragement (through agricultural extension services). This involves educating farmers and strengthening farmers' awareness of the environmental and social components of agriculture, the significance of associating, requirements of international markets, etc. (Laosutsan, Shivakoti & Soni, 2019; Paraušić & Roljević Nikolić, 2020; Amekawa et al., 2022). Agricultural policy measures must ensure investment activities on the farm whose purpose is to adapt the production to the standards' requirements (Niemiec et al., 2019; Oppong & Bannor, 2022). Other crucial activities include undertaking systemic reforms, having strong institutions, improving national competitiveness, fostering a stimulating business environment and developing comprehensive innovation and other infrastructure in the country (Domazet & Marjanović, 2018; Paraušić & Domazet, 2018; Laosutsan, Shivakoti & Soni, 2019; Flachsbarth, Grassnick & Brümmer, 2020; Domazet et al., 2022; Jovanović, Domazet & Marjanović, 2023).

The limitations of the study primarily refer to the impossibility of generalizing the conclusions. Namely, the authors are aware of the fact that the impact of the GLOBALG.A.P. certification scheme on the export performance of farmers, export companies and national economies varies significantly depending on numerous factors, such as: product type, export market destination, location of agricultural production (for example, vicinity of ports, roads, etc.), prices in the

mainstream market, price premium, etc. (Subervie & Vagneron, 2013; Laosutsan, Shivakoti & Soni, 2019; Fiankor et al., 2020).

An additional restriction of the study is the fact that there is only one predictor variable in the model. Therefore, future research will focus on introducing additional predictor variables, particularly in the segments of the F&V prices on the domestic and international market, as well as the F&V production volume in exporting countries.

Also, the authors' intention is to observe the share of certified Global GAP farmers in the total number of farmers in the following work, as well as to form a sample of countries taking into account their similar characteristics (spatial, economic, demographic), in order to avoid very large size of between variations in data.

CONCLUSION

Private and voluntary farm certification schemes are created to support food traceability, safety and security. They contribute to efficient, responsible, resistant and sustainable agriculture. At the same time, their implementation, particularly in developing countries, represents a catalyst for making agricultural systems more efficient and organized, environmentally sustainable and socially equitable, while contributing to the export performance of national economies.

The IFA GLOBALG.A.P. standard is the leading private standard in F&V production, focused on the holistic approach to sustainability and environmental responsibility on farms. The implementation of this standard is increasingly becoming a prerequisite for F&V export to EU countries and other high-income countries.

This study investigates the impact of implementing the IFA GLOBALG.A.P. certification scheme on F&V export outcomes in thirteen European middle-income countries from 2010 to 2021 by employing panel regression analysis on data sourced from GLOBALG.A.P. and the International Trade Centre's Trade Map database. National export performance in the F&V sector was expressed by the following criterion variables: (a) annual export value in the F&V sector; (b) annual F&V export value to high-income markets and (c) the percentage share of F&V export to high-income markets in the total F&V export. The panel regression analysis was used to test individual models for each criterion variable, and all three models were adequate. The results indicate that if the number of GLOBALG.A.P. certified producers increases by one, the total export value in the F&V sector rises by US$ 370,819 on average; the F&V export value to high-income markets rises by US$ 224,766 on average, while the share of the F&V export to high-income markets in the total F&V export increases by 0.003 percentage points on average.

The obtained results add to and enrich the scarce academic literature dealing with the GLOBALG.A.P. standard as a catalyst for trade and export in the developing countries of the European continent. In addition, the research provides guidelines and recommendations for directing national politics toward greater implementation of private and voluntary farm certification schemes for sustainable agriculture.

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ANNEX

Table 1. Descriptive statistics

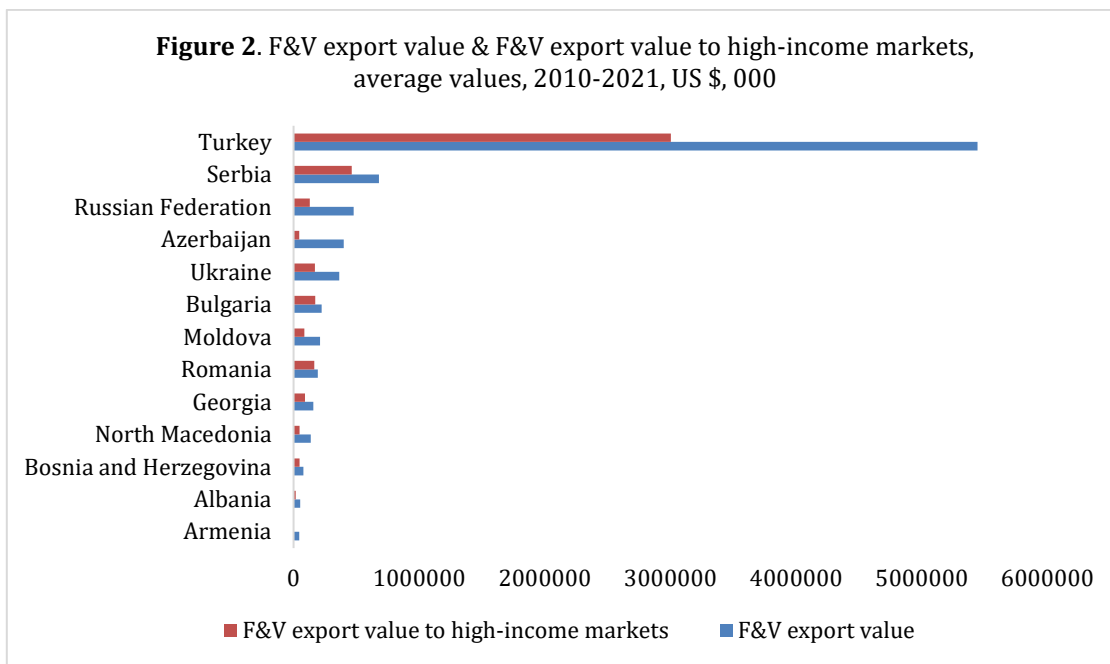|	M	SD
Albania		
F&V export value, US $, 000	53,796.73	35,584.19
F&V export value to high-income markets, US $, 000	16,454.82	11,068.72
F&V export value to high-income markets in the total export value of F&V, %	32.74	6.96
IFA GLOBALG.A.P. producers (crops base), No.	18	34.93
Armenia		
F&V export value, US $, 000	46,282.17	33,741.60
F&V export value to high-income markets, US $, 000	950.58	596.22
F&V export value to high-income markets in the total export value of F&V, %	2.18	1.20
IFA GLOBALG.A.P. producers (crops base), No.	1	0.95
Azerbaijan		
F&V export value, US $, 000	398,487.67	171,608.79
F&V export value to high-income markets, US $, 000	46,244.58	24,533.04
F&V export value to high-income markets in the total export value of F&V, %	11.57	5.22
IFA GLOBALG.A.P. producers (crops base), No.	4	4.85
Bosnia and Herzegovina		
F&V export value, US $, 000	77,503.25	24,920.01
F&V export value to high-income markets, US $, 000	48,886.83	11979.67
F&V export value to high-income markets in the total export value of F&V, %	65.32	9.68
IFA GLOBALG.A.P. producers (crops base), No.	265	106.95
Bulgaria		
F&V export value, US $, 000	224,547.75	53,103.62
F&V export value to high-income markets, US $, 000	172,776.58	50,477.89
F&V export value to high-income markets in the total export value of F&V, %	76.51	5.89
IFA GLOBALG.A.P. producers (crops base), No.	70	58.56
Georgia		
F&V export value, US $, 000	158,230.58	51,052.59
F&V export value to high-income markets, US $, 000	90,335.17	42,827.02
F&V export value to high-income markets in the total export value of F&V, %	55.23	13.47
IFA GLOBALG.A.P. producers (crops base), No.	5	5.32
Moldova		
F&V export value, US $, 000	211,291.67	21,683.66
F&V export value to high-income markets, US $, 000	84,707.17	17,196.04
F&V export value to high-income markets in the total export value of F&V, %	40.12	7.50
IFA GLOBALG.A.P. producers (crops base), No.	12	14.70
North Macedonia		
F&V export value, US $, 000	135,989.45	12,737.69
F&V export value to high-income markets, US $, 000	47,135.64	16,045.23
F&V export value to high-income markets in the total export value of F&V, %	34.23	11.45
IFA GLOBALG.A.P. producers (crops base), No.	22	7.48
Romania		
F&V export value, US $, 000	194,041.67	33,110.76
F&V export value to high-income markets, US $, 000	164.328.33	30,369.22

	M	SD
F&V export value to high-income markets in the total export value of F&V, %	84.69	6.48
IFA GLOBALG.A.P. producers (crops base), No.	162	147.56
Russian Federation		
F&V export value, US $, 000	477,472.67	207,710.93
F&V export value to high-income markets, US $, 000	129,242.00	53,294.59
F&V export value to high-income markets in the total export value of F&V, %	30.29	12.01
IFA GLOBALG.A.P. producers (crops base), No.	6	8.21
Serbia		
F&V export value, US $, 000	679,123.25	188,528.34
F&V export value to high-income markets, US $, 000	464,171.42	145,581.16
F&V export value to high-income markets in the total export value of F&V, %	68.36	5.09
IFA GLOBALG.A.P. producers (crops base), No.	508	351.93
Turkey		
F&V export value, US $, 000	5,442,604.83	752,981.74
F&V export value to high-income markets, US $, 000	3,001,435.83	382,284.88
F&V export value to high-income markets in the total export value of F&V, %	55.29	3.08
IFA GLOBALG.A.P. producers (crops base), No.	2,537	473.51
Ukraine		
F&V export value, US $, 000	364,021.00	89,099.92
F&V export value to high-income markets, US $, 000	169,410.92	87,524.35
F&V export value to high-income markets in the total export value of F&V, %	44.51	12.71
IFA GLOBALG.A.P. producers (crops base), No.	19	18.73

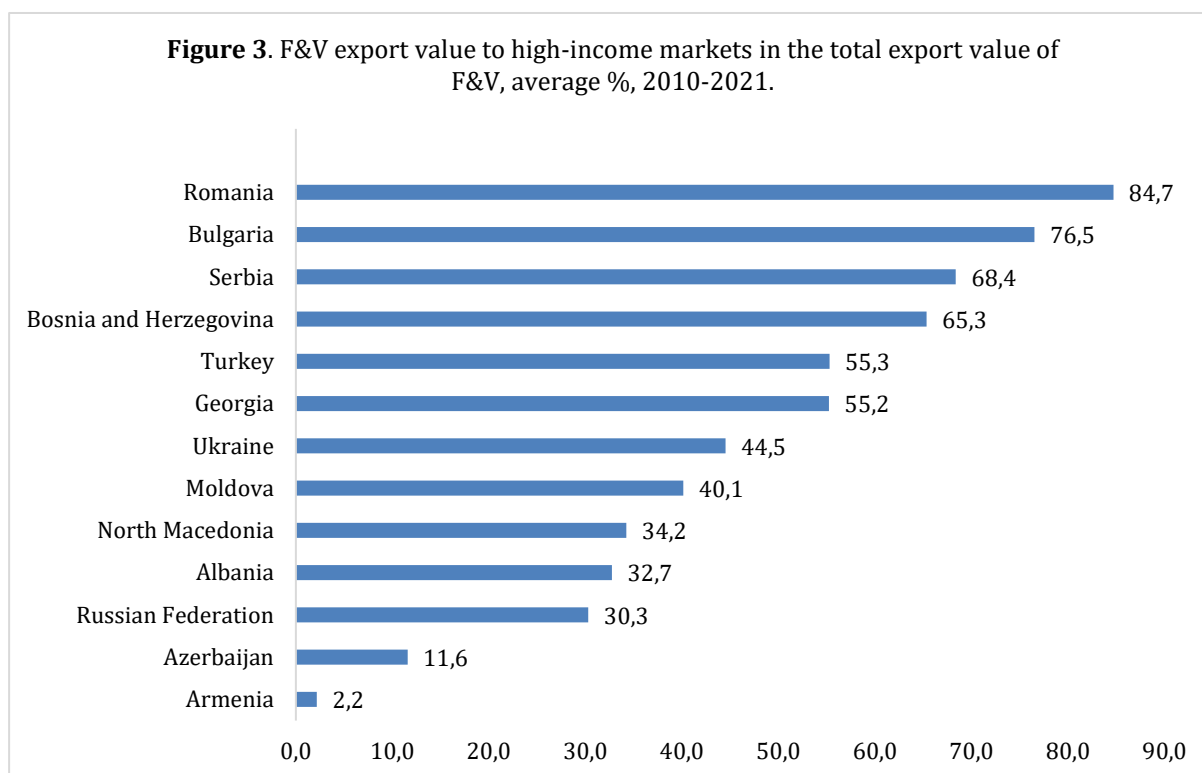*Source: Authors' calculations. For Albania and North Macedonia, the average is given for the period 2010-2020.*

Figure 1. IFA GLOBALG.A.P. producers (crops base), average number, 2010-2021.

Source: Authors' calculations. For Albania and North Macedonia, the average is given for the period 2010-2020.

Figure 2. F&V export value & F&V export value to high-income markets, average values, 2010-2021, US $, 000

Source: Authors' calculations. For Albania and North Macedonia, the average is given for the period 2010-2020.

Figure 3. F&V export value to high-income markets in the total export value of F&V, average %, 2010-2021.
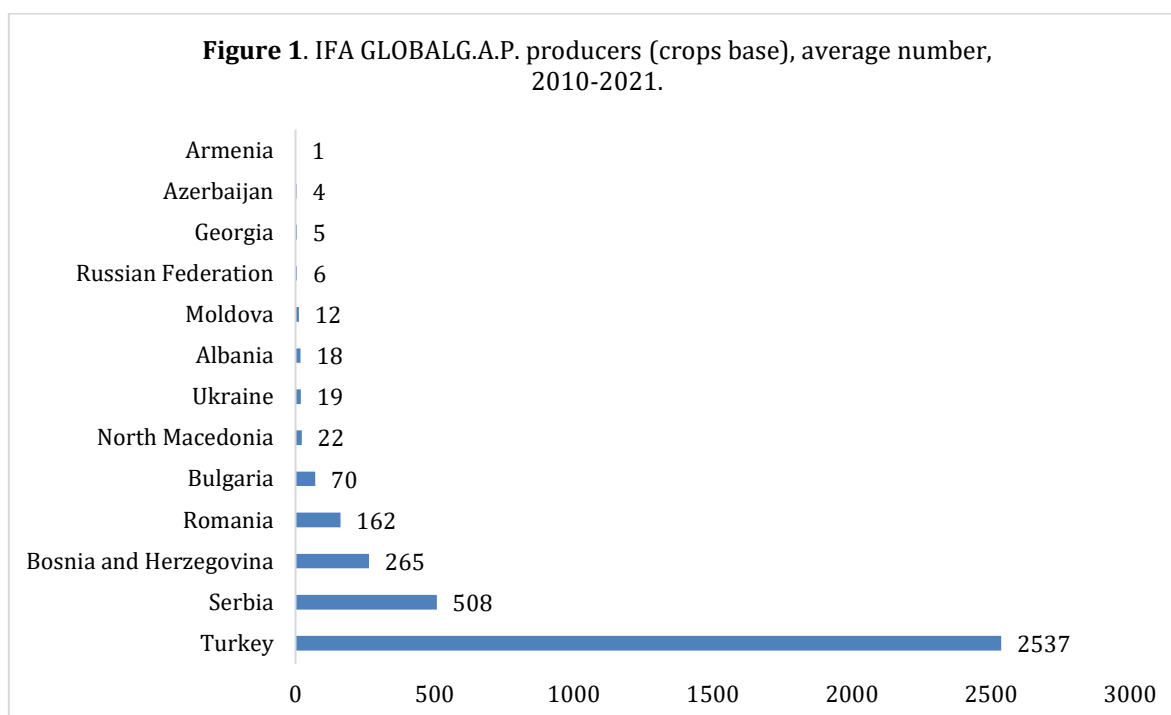
Source: Authors' calculations. For Albania and North Macedonia, the average is given for the period 2010-2020.

Table 2. Feasible GLS

	F&V export value	F&V export value to high-income markets	Share of F&V export value to high-income markets in the total export value of F&V
Constant	103,223 [21021.37] (0.000)**	1,415.656 [1139.797] (0.214)	45.442 [3.121] (0.000)**
IFA GLOBALG.A.P. producers, no	41.584 [20.831] (0.046)*	43.888 [17.436] (0.012)**	0.003 [0.001] (0.011)*
R²	0.964	0.922	0.874
Wald	χ²(1)= 3.98; p=0.046	χ²(1)= 6.34; p=0.012	χ²(1)= 6.45; p=0.011

Table 3. Panel Corrected Standard Errors

	F&V export value	F&V export value to high-income markets	Share of F&V export value to high-income markets in the total export value of F&V
Constant	105,829.4 [17877.87] (0.000)**	34,701.9 [11,670.12] (0.003)**	44.237 [0.886] (0.000)**
IFA GLOBALG.A.P. producers, no	1955.976 [114.863] (0.000)*	1,099.58 [62.656] (0.000)**	0.008 [0.001] (0.000)*
R²	0.907	0.928	0.044
Wald	χ²(1)= 289.98; p=0.000	χ²(1)= 307.28; p=0.000	χ²(1)= 78.16; p=0.000

Checking the results obtained by panel regression with fixed and random effects was done using the Feasible GLS and Panel Corrected Standard Errors estimators. The results of the analyses are presented in Table 2 and Table 3 in the Annex, from which it can be seen that these estimators also confirm the results obtained using fixed and random effects estimators. All models are significant, and the variable `IFA GLOBALG.A.P. producers` significantly contributes to explaining the variation of the dependent variables. Also, all models, except the one where the dependent variable is the F&V export value to high-income markets as a percentage of the total F&V export value, using the PCSE estimator, have a high coefficient of determination, which indicates that the models explain the variation of the dependent variables well.