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# A FINANCIAL-ECONOMIC ASSESSMENT OF THE FOOD SECURITY IN THE EUROPEAN UNION

*Abstract. The food security concept, that is central to international and national institutions, regained importance after the 2007 economic crisis that led to large increase in prices of agricultural products. The study aims to find the existence of relations between measures on food security and financial systems, considering data for the 28 member states of the European Union, for 2008 to 2017 time frame. The obtained results show the negative impact the household debt, social transfers and price indices have on agricultural productivity, altering food security. Moreover, social polarization led to a decrease in agricultural productivity and government support to agricultural research and development, which also impacted the food security. Considering these results, the study emphasizes the need for measures implemented by authorities aiming at poverty and social inequality reduction.*

*Keywords: food security, agriculture, financial system, agricultural productivity, research and development expenditure.*

**1. Introduction**

The financial and food crisis, although generated by various causes, are interconnected and lead to significant effects on economic, political and financial stability, as well as on food security.

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The food security concept gained general acceptance after 1980, being analysed from economic and financial facets, but also in terms of social relevance, considering both the scarcity and the access to food, with a special focus on food prices, revenues of individuals and households, revenues of farmers, social protection measures etc. As the World Bank (1986) defined it in the mid-80s, food security is the access of all people at all time to enough food for an active, healthy life. A more general and widely accepted definition is the one derived from the World Food Summit, as the access of individuals to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life (FAO, 1996).

Initially, it was considered that – in order to guarantee food security – the food availability and storage were also important, but after the 1980s, a new dimension of this concept became accepted, as there is not enough for the individual to have access to food, but also to have available resources (income) in order to obtain it (FAO, 2008).

As there is not enough to temporarily guarantee access to food, a new element was considered, namely the stability, in order to guarantee long term food security (FAO, 2008). This emphasizes the fact that the sustainable development is part of the food security. In the economic literature (FAO, 2006), there are many definitions for the food security concept, as it is analysed from the availability, accessibility, use, stability or durability perspectives, but various studies partially analyse relevant indicators (Istudor et al., 2014).

Each of these characteristics is related to economic variables that explain the food security concept. For instance, the total supply influences the total agricultural output and the international trade, which impact the agricultural market structure and the labour productivity, and, therefore, the availability and the consumption. The accessibility is influenced by prices, individual income and social transfers. Regarding the stability and durability, the risks from the markets, financial system, prices' volatility, economic and financial crisis and occurrence of conflicts and social disturbances are considered amongst the influencing factors.

## 2. Literature review

Even though the fight against poverty is central to the international community efforts, the 2007-2008 food crisis generated by the agricultural products' price increases showed that the population is vulnerable to international turbulences, stressing the need for a wider analysis of the food security concept, not only at a national level, but also considering the regional and international developments.
The food security concept is an important topic for the G20 group, as it considers that the policies in agriculture, trade and investments have a major impact on food security, as almost 80% of the agricultural exports are from the G20 countries (G20 –

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Development Working Group , 2015). Moreover, FAO/CFS (2014) shows that the lack of coherence in designing the food security policies may lead to a negative impact on the investments in agriculture, infrastructure, efficient market functioning and, therefore impacting the food supply and prices.

With more than 800 million people severely affected by starvation in 2016 (and an estimation of 821 million people for 2017), the food security became a difficult task (FAO and al. 2018), being influenced by political factors, conflicts, price stability and environmental issues.

This study aims to emphasize the way food security is influenced by some components of the financial system (market capitalization, size of the banking system), as well as by the agricultural sector productivity and by the state intervention in agriculture, justified by at least three triggers (public goods, economic growth and coping with externalities), and also the poverty and social inequality.

The relation between food security and potential influencing factors was analysed in various studies. As such, some considered the prices of the agricultural products, gross domestic product, Gini coefficient, exports (Aker and Lemtouni, 1999) in the Marrocan case. Using a VAR model, Applanaidu et al. (2014) revealed the existence of other factors, such as exchange rate, governmental spending for research and development, or size of population, that impact the food security.

Most of the studies conducted on the agricultural products' prices impact on poverty derived from the study of Deaton (1989), which revealed the impact on the households' income, but also on the farmers' revenues (Minot and Dewina, 2015, Van Campenhout et al.,2013) or on the agricultural productivity (Christiaensen and Demery, 2007).

The negative effects of the agricultural products' prices increase are also seen on food consumption standards, nutritional characteristics (Anríquez et al., 2013) or households and individuals wealth reduction (Ivanic and Martin, 2014).

Some other empirical analysis evaluated the impact that research and development spending in agriculture have on food security, the results emphasizing that in the Sub-Saharan African countries, the public and private investments in research and development were, in 2011, only 69.3 billion USD from the world total investments (Pardey et al., 2016). On the other hand, some researches argue that the resources that were invested in the research and development would significantly impact the economy after a period of time (Alston et al., 2010,Piesse and Thirtle, 2010).

The diminishing investments in agriculture, mainly in the countries where the economy is based on this sector and where the investment level is below 4% ofthe general spending (World Bank, 2008), increased these countries' dependence on the

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international food markets, making them vulnerable to price volatility, exchange rates and to other changes in the international financial system.

We consider that the reduction of public spending meant to sustain the agricultural sector and downsize of spending supporting the access to proper quality food can generate a low return in the agricultural process, therefore adversely impacting the income and prices, fuelling a potential for conflicts, as well as for food and economic crisis.

Enhancing the agricultural productivity, with an impact on increased revenues and reduced poverty, may only be achieved with active governmental support. The results of a study conducted by Wen and al. (2015) in China show that, beside inflation, price of labour, exchange rate and output, the financial policy conducted by the government influences the price of agricultural products. Considering the impact of the state intervention in the form of subsidies, in a world characterized by global increased agricultural prices, the studies show a negative impact on public finances (Albers and Peeters, 2011).

In the European market, the researchers hold it that the decline of the agricultural sector was due to many different factors, from the diminishing of the agricultural surfaces, with more than 100.000 hectares in EU-28 during 2006-2012 (EEA, 2017), to the reduced farmers' revenues. According to MSA (2017), in 2016, almost 30% of the French farmers had a monthly income below 350 euro; leading to an increase of the risks associated with their indebtedness and, as a consequence, to social exclusion, increased poverty and food insecurity. Fader et al. (2013) supports a similar view, revealing that there are 66 countries worldwide that cannot meet their own food necessities, a number that may increase due to crisis or climate changes.

The effects of the 2007 economic crisis were present also at the European level, leading to a reshaping of the European policy on food security, and inclusion of associated objectives in various European regulations. Although the Common Agricultural Policy meets the challenges related to food security, climate changes, economic growth and creating of new employment opportunities in the rural areas, in the last 30 years, the budget allocated to this sector diminished, to a level below 40% of the European Union budget (EC, 2013).

In the European market, the pressure from the agricultural products market increase competition, but the prices' volatility inhibits investments in this area. Same effects can be seen in the labour productivity, leading to a larger decrease in the average agriculture income, below the income from other economic sectors (40% of the average income at the EU level, for 2010-2014 time frame, according to the EC, 2017).

A different research conducted at the EU level revealed the deficiencies related to the goal of achieving food security, pointing out that these were caused by the

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inappropriate way the term is defined, as well as by the malfunctioning of the EU governance and regulation (Moragues-Faus et al.,2017).

Starting from the analysed studies and from the importance of achieving the objectives set out in 2030 Agenda, this study emphasizes the impact of some variables (related to the financial system) on the food security at the European level.

## 3. Research methodology

In this study, we assess the impact of some financial variables on the food security concept, a relevant component of the Sustainable Development Goal 2 – "Zero hunger" from the 2030 United Nations Agenda (UN, 2015). As a measure for the food security concept, we consider the agricultural factor income per annual work unit (EUROSTAT, 2018), measured as the ratio of the net agricultural factor income (the income generated by farming, used to remunerate borrowed or rented factors of production, as well as own production factors, or, alternatively, the deflated net value added at factor cost of agriculture) and annual work units (defined as full-time equivalent employment). This indicator is used to assess the productivity of the agricultural sector, a larger value being a precondition for food security (considering that an increase in productivity would partially translate in higher incomes for farmers or people employed in agriculture, improving access to agricultural products). In the Greece case, Kaditi (2013) observed that labour factor for the small farms moved from the owners and their families towards employed persons. As such, the internal work force (belonging to the families that own the farms) is influenced by demographic factors (ageing) and the preference for alternative employment possibilities, in more productive economic sectors. On the other hand, the employed work force increased, mainly due to migration (as migrants accept temporary jobs, with low level of payment). Moreover, as an indicator of food security, we also use the governmental spending on research and development in agriculture, expressed as euro/inhabitant, that is used by the European Commission to assess the importance attributed by the European governments to agriculture (EC, 2008). Cervantes-Godoy and Dewbre (2010) revealed that governmental spending on research and development in agriculture influences labour productivity, reducing poverty in the analysed countries. The impact of some measures associated with the circular economy (as a path towards attaining the Sustainable Development Goals) on the economic growth at the European Union level was also analysed by Busu and Busu (2018), that propose an index of measuring the circular economy (that may also apply to the food security concept).

In order to assess the financial sector from the analysed countries, we consider variables that are related to the development of the banking system, such as the private

sector debt (% in GDP), household debt (% in GDP), total financial sector liabilities (million units of national currency), and also of the capital market (market capitalization, as percentage in GDP). Zeller et al. (1996) analysed the relation between the food security for population affected by poverty from 9 countries (Bangladesh, Cameroon, Ghana, Mali, Madagascar, Nepal, Pakistan, China and Malawi) and the access to financial services, both from an institutional perspective (considering the structure, the behaviour and the performance of the financial institutions that provide products to retail clients from these social classes) and from the households' perspective (being considered the access and interaction with the financial sector). Moreover, in order to estimate the impact of governmental policies on food security, we used the figure of government expenditure on agriculture as a percentage of total government expenditure. Considering the relation between reducing poverty and famine eradication, we considered two indicators used for Sustainable Development Goal 1 -„No poverty" (UNDP, 2019), namely the impact of social transfers (excluding pensions) on poverty reduction and the Gini coefficient of disposable income. The impact of social transfers on poverty reduction (EUROSTAT, 2018) is a measure of the reduction in percentage of the risk of poverty rate, due to social transfers, calculated comparing at-risk-of poverty rates before social transfers with those after transfers (without considering pensions). Wiggins et al. (2010) revealed that this indicator has larger values for agriculture-dependent countries (Gambia, Uganda, Nicaragua), where potential turbulences in the markets where agricultural products are traded may lead to large fiscal deficits (as the share of social transfers in GDP increase).

In developing these models, we start from the hypothesis that the variables describing the financial sector and those characterizing the poverty and social inequality have a direct impact on food security. Therefore, we consider the following research hypothesis:

$H_1$: the agricultural factor income per annual work unit is *negatively influenced* by the household debt dynamics;

$H_2$: the prices of agricultural products *positively* influence the agricultural factor income per annual work unit;

$H_3$: enhancing poverty reduction measures *negatively* influences the agricultural factor income per annual work unit;

$H_4$: government expenditure on agriculture *positively* influences the agricultural factor income per annual work unit;

$H_5$: enhancing poverty reduction measures *negatively* influences government support to agricultural research and development;

$H_6$: increasing social inequality *negatively* influences government support to agricultural research and development;

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$H_7$: household debt dynamics *positively* influence government support to agricultural research and development.

In order to identify some relations between the selected variables and the two variables describing the food security concept, namely the agricultural factor income per annual work unit and the government support to agricultural research and development, we use panel data regressions. We use the general equation proposed by Schmidheiny (2016):

$$y_{it} = \alpha + X'_{it}\beta + \mu_i + \vartheta_{it} \quad \text{i=1, ....,N; t=1,...,T} \quad (1)$$

where:

i= cross-section dimension (transversal section);

t=time;

α, β= equation's coefficients;

$X'_{it}$= *it* observation of independent variables;

$u_{it}$= specific/individual effect;

$\vartheta_{it}$= residual.

We estimate fixed effect models and random effect models, and, in order to find the appropriate model, we use the results of the Hausman test.

We use data for 2008-2017 time frame, the longest time frame for which we have identified statistical data in the EUROSTAT database (EUROSTAT, 2018). This interval also includes the financial crisis period, that had a significant impact on some variables considered in assessing food security (mainly, on the agricultural factor income per annual work unit, that decreased in almost all member states of the European Union – EUROSTAT, 2018). Considering the lack of sufficient number of observations necessary to perform an econometric model for time series data, we use panel data regressions, in order to assess a relation between some indicators of food security and those related to financial sector and public finances (social transfers and government spending).

Annual data for 2008-2017 time frame envisaged the agricultural factor income per annual work unit (AWU variable), government support to agricultural research and development, expressed in euro per capita (GOV_SUP variable), impact of social transfers on poverty reduction (SOC_TRANS variable), household debt expressed in percentage in GDP (HOUSE_DEBT variable), private sector debt, expressed in percentage in GDP (PRIVATE_DEBT variable), consolidated banking leverage, domestic and foreign entities (BANKING_LEV variable), total financial sector liabilities (FIN_LIAB variable), market capitalization of listed domestic companies, expressed as percentage in GDP (MK_CAP variable), government expenditure on agriculture, as percentage of total government expenditure (GOV_EXP variable), price indices of the means of agricultural production (PRICE_INDICES

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variable) and Gini coefficient of equivalised disposable income (GINI variable). We used data from the official web pages of EUROSTAT (http://ec.europa.eu/eurostat), World Bank (www.worldbank.org) and Food and agriculture Organization of the United Nations (www.fao.org).

## 4. Results and discussions

Considering the importance of agriculture in the set of measures designed by the national authorities in order to obtain food security, we analyse the relation of this sector with the financial system. According to FAO (2018), worldwide, the share of commercial credit for agriculture in total commercial credit rose from 2.4% in 2016 to 2.9% in 2017, and, for almost half of the world's countries it rose by 3.5% from total credit. The share of credit directed to agriculture is lower than this sector's contribution to GDP (FAO, 2018), revealing an underfinancing characteristic and, therefore, the need to identify proper mechanisms to sustain the financial needs (not only by the banking system, but also by the capital market).

In the European Union, FAO (2018) revealed an upward trend of share of credit allotted to agriculture, towards 4% of the total amount, that represent a very low level, considering the economic importance of that region in world economy. In spite of this finding, the reduced level of financing activities through the banking system and capital markets may be used to devise a potential solution for enhancing food security, by reaching mechanisms that facilitate the access to financial resources for small- and medium-size enterprises from agriculture, as well as for well-established and large enterprises (that may be potential clients for the banking system).

We use data panel regressions to assess the impact on productivity in the agricultural sector (that is an indicator associated with Sustainable Development Goal 2 – „Zero hunger", as defined by the UNDP, 2019), expressed by the AWU variable, that is related to variables that characterize various components of the financial system and measures adopted for poverty and social inequality reduction. We consider a regression model where the dependent variable is AWU and the independent variables are SOC_TRANS, D(HOUSE_DEBT), D(PRIVATE_DEBT), BANKING_LEV, FIN_LIAB, MK_CAP, GINI, GOV_EXP and D(PRICE_INDICES), the results being presented in Table 1. It can be seen that some independent variables characterize the development stage of the financial system for each analysed country, that is a precondition for economic development and, therefore, to reduce the risks related to food security. For the analysed models, we previously tested the existence of unit root for each time series, considering the level where those series are stationary (original or first difference). Using the Hausman test, we find that the relation between the dependent and independent variables is expressed by the fixed effect model.

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In Model 1, that explains in proportion of 93.82% the evolution of the dependent variable AWU considering the other 9 variables, we find a negative relation between the agricultural productivity (as an indicator of food security) and measures associated to poverty and social inequality reduction, such as social transfers, as well as to measures characterizing the financial system (banking sector and capital market).

We also find that 3 of the considered variables, namely SOC_TRANS, D(HOUSE_DEBT and D(PRICE_INDICES), have negative statistically significant coefficients. As such, the results of Model 1 reveal the existence of a negative relation between the dynamics of household debt and productivity from agriculture, as measured by AWU variable (therefore, the $H_1$ hypothesis is validated). This result confirms the empirical observations regarding the negative impact on agricultural productivity derived from an increase in household indebtedness (expressed by the D(HOUSE_DEBT) variable),as – confronted with the inability to make payments associated with the contracted financial services (mainly, loans), the workforce may migrate to better paid sectors (inducing tensions in the labour market, in the form of increasing wages) or be less productive (with a direct impact on the net value added in agriculture). Moreover, the obtained results confirm empirical observations regarding the negative impact of household indebtedness on agricultural productivity, as the shrinkage of disposable income (from which, the population that work in agriculture isgenerally characterized by low wages, as a consequence of low net value added and use of unqualified workforce). Zeller et al. (1996) studied the characteristics of financial systems from 9 non-European countries, confronted with increasing poverty (with a level of GDP per capita below the average in the European Union). But this study considers only a component of the financial system, namely that is devoted to at-risk – of poverty social classes, in societies that are fundamentally different than those from the European countries. According to Model 1, one percentage point increase in household indebtedness lead to a decrease with 338.5036 of the agricultural factor income per annual work unit.

**Table1: Proposed models for AWU variable(2008 -2017 time frame)**
Correlated Random Effects - Hausman Test

|  | Model 1 Prob. 0.0000; R-squared 0.938243 | | Model 2 Prob. 0.0000; R-squared 0.937458 | |
| --- | --- | --- | --- | --- |
| **Test summary** | Chi-Sq. Statistic | Chi-Sq. D.f. | Chi-Sq. Statistic | Chi-Sq. D.f. |
| **Cross-section random** | 62.058640 | 9 | 27.450203 | 4 |
|  | Coefficient | Prob. | Coefficient | Prob. |

| | | | | | |
|---|---|---|---|---|---|
| **Independent variables** | SOC_TRANS | -184.1524 | 0.0336 | -182.858999 | 0.0000 |
| | D(HOUSE_DEBT) | -338.5036 | 0.0001 | -344.095375 | 0.5218 |
| | D(PRIVATE_DEBT) | -8.568547 | 0.7906 | X | X |
| | BANKING_LEV | -69.02613 | 0.4837 | X | X |
| | FIN_LAB | -0.222903 | 0.6195 | X | X |
| | MK_CAP | -33.25157 | 0.1576 | X | X |
| | GINI | -114.5940 | 0.6584 | X | X |
| | GOV_EXP | -298.9564 | 0.4918 | -388.387866 | 0.0006 |
| | D(PRICE_INDICES) | 71.19604 | 0.0153 | 80.896287 | 0.0001 |

*Source: own computation, EViews estimation*

From Model 1, we find that the dynamics of price indices of agricultural production is positively related to agricultural productivity, and the coefficient of the corresponding independent variable is statistically significant ($H_2$ hypothesis being validated). As such, a 1% increase of price indices will lead to an increase of 71.196 for the agricultural factor income per annual work unit. This relation is explained by the persistence of below optimal processes in agriculture and small-scale use of efficient technologies related to resources (at least in the Central and Eastern European countries, including Romania), and an increase in input factors does not lead to productivity reduction (as is the case for a mature technological economic activity).

Furthermore, the results show the existence of a negative statistically significant relation between impact of social transfers on poverty reduction and agricultural productivity, namely, a one percentage point increase of the impact of social transfers on poverty reduction lead to a reduction by 184.1524 of the agricultural factor income per annual work unit. This situation is mainly due to changes in the agriculture labour market, a component of the labour market that is exposed to poverty risk, as the wages in this sector are below average. The empirical observations stress out the fact that an inadequate social system may have a negative impact on the labour market, as devising inadequate social transfers to exposed social classes will lead to changes in behaviour, especially regarding entering the market decision. As such, the $H_3$ hypothesis is validated. Similar results were identified by Kaditi (2013), as the measures designed to support the agriculture in Greece negatively impacted the agriculture labour market, inhibiting the potential employees' decision to entry the market.

On the other hand, the obtained results reveal that the level of government spending to agriculture negatively influences the agricultural productivity (with the corresponding coefficient statistically not significant). An increase by one percentage point in the level of government spending for agriculture lead to a decrease by 298.9564 of the agricultural factor income per annual work unit (a result that rejects

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the H$_4$ hypothesis). This situation is due also to the insufficient efficiency of governmental support mechanisms for development of the agriculture from the analysed countries and to the characteristics of the respective countries (especially new member states, which are on their path to consolidate the agriculture sector). The obtained results emphasized the need to adequately devise mechanisms using public resources to enhance agricultural productivity, mainly to facilitate financing of investments in landslide protection, water-harvesting-based terracing and trenching of unstable slopes (FAO, 2009a).

For variables that characterize the development stage of the banking system and capital markets from the analysed countries, the coefficients are negative and statistically not-significant, with a lower impact for the dynamics of total liabilities from the banking system and private sector debt, compared to the consolidated banking leverage or to the market capitalization. For example, 1% decrease in the private sector debt will lead to an increase by 8.568547 for the agricultural factor income per annual work unit, and 1% decrease in financial sector liabilities will lead to an increase by 0.222903 for the agricultural factor income per annual work unit. Similarly, an increase by one percent for the consolidated banking leverage will lead to a decrease by 69.02613 for the agricultural factor income per annual work unit, and an increase by 1% for the market capitalization share in GDP will lead to a reduction by 33.25157 for AWU variable. We also found a negative relation between AWU and GINI variables, statistically not significant, a result that shows that a more polarized society lead to a decrease in agricultural productivity.

Using the Model 1 results, we confirmed the existence of a negative relation between the agricultural productivity and the direct and indirect measures for financial system, such as household debt, but also with measures intended to fight against poverty (such as the impact of social transfers on poverty reduction) and government expenditure for agriculture. Moreover, we found a positive relation between an indicator of input factors used in agriculture and AWU variable. As such, the Model 1 results confirm the first three hypotheses and reject the fourth.

By eliminating the independent variables with coefficients that are not statistically significant, we obtained Model 2 (from Table no.1). This model points out that the negative relations found using the previous model, between the agricultural productivity and dynamics of household debt, as well as with government expenditure for agriculture (expressed as percentage from total government expenditure) and impact of social transfers on poverty reduction. The results represented in Model 2 emphasize, once more, the marginal role played by the variables characterizing the financial system on agricultural factor income per annual work unit, as a measure of agricultural productivity (even though the coefficient is not statistically significant).

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This result confirms the empirical observations related to the financing of agriculture, mainly the marginal role played by the banking sector (using base financing products).

In order to verify the next three hypothesis ($H_5$, $H_6$ and $H_7$), we consider a model where the dependent variable is the government support to agricultural research and development, measured in euro/capita, and the independent variables are those used to estimate AWU variable. In Model 3 (from Table no.2) are presented the results of a panel data regression. Using the Hausman test, we find that the fixed effect model is appropriate, as the corresponding probability is below the threshold level (5%). Analysing the results of Model 3 (Table no.2), we observe the existence of a negative relation between the impact of social transfers on poverty reduction and the government support for agricultural research and development (the corresponding coefficient being statistically significant), a result that confirms the empirical observations. This situation is due, amongst other, to the effect induced by the increase of social transfers (as a precondition to decrease the poverty risk in exposed social classes) on some other components of government expenditure, such as those devoted to research and development (and, particularly, those related to agriculture). We observe that $H_5$ hypothesis is confirmed, and an increase of one percentage point on the impact of social transfers on poverty reduction lead to a marginal decrease for government expenditure on agricultural research and development (of 0.070903 euro/capita).

**Table 2: Proposed models for GOV_SUP variable** (2008 -2017 time frame)

Correlated Random Effects - Hausman Test

| | | Model 3 Prob. 0.0000; R-squared 0.953781 | | Model 4 Prob. 0.0000; R-squared 0.952315 | |
|---|---|---|---|---|---|
| **Test summary** | | Chi-Sq. Statistic | Chi-Sq. D.f. | Chi-Sq. Statistic | Chi-Sq. D.f. |
| **Cross-section random** | | 44.084575 | 9 | 25.115459 | 3 |
| | | Coefficient | Prob. | Coefficient | Prob. |
| **Independent variables** | SOC_TRANS | -0.070903 | 0.0105 | -0.059287 | 0.0213 |
| | D(HOUSE_DEBT) | 0.095144 | 0.0014 | 0.085709 | 0.0008 |
| | D(PRIVATE_DEBT) | -0.000651 | 0.9497 | X | X |
| | BANKING_LEV | -0.020872 | 0.5302 | X | X |
| | FIN_LAB | -0.000119 | 0.4233 | X | X |
| | MK_CAP | -0.002159 | 0.7696 | X | X |
| | GINI | -0.304725 | 0.0004 | -0.284517 | 0.0005 |
| | GOV_EXP | 0.261490 | 0.0873 | X | X |
| | D(PRICE_INDICES) | -0.003932 | 0.5245 | X | X |

*Source: own computation, EViews estimation*

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Considering the social inequality, the results presented in Model 3 show that an increase in social polarization (as measured by Gini coefficient) lead to a decrease in government support to agricultural research and development (the associated coefficient being statistically significant). As such, a one point increase in Gini coefficient lead to a decrease of governmental expenditure on agricultural research by 0.304725 euro/capita (therefore, the $H_6$ hypothesis being confirmed). This result is derived from the turbulences present in an economy confronted with increasing social inequality, that divert governmental resources towards some sectors considered important for the economy (this being the case for countries characterized by low levels for GDP/capita, such as the new member states).

From Model 3, we find a positive relation between household debt (as a measure for access to financial system) and government support for agricultural research and development. Therefore, enhancing the financial infrastructure and available financial products for households, a sustainable increase in indebtedness may be achieved, with the associated positive effects on the economic growth (the economic growth making possible the governmental support for some economic sectors that are not usually seen as critical - that is common for countries that significantly lag the western European countries). An increase by 1% of household debt leads to an increase by 0.095144 euro/capita for the government support to agricultural research and development ($H_7$ hypothesis being confirmed). On the other hand, we find a positive relation between government expenditure to agriculture and government support to agricultural research and development (despite the existence of a statistically not-significant coefficient), a result that confirms the empirical observations. These results are aligned with the objectives pursued by the international organizations for designing research and development programs in agriculture, in order to devise more performant technologies and improve the productivity (FAO, 2009b).

Eliminating the independent variables with statistically not-significant coefficients, we obtain Model 4 (from Table no.4). Using the Hausman test, the fixed model is appropriate, and the resulted coefficients are statistically significant, having the same signs as the corresponding coefficients from Model 3 (therefore, the results presented in Model 4 confirm $H_5$, $H_6$ and $H_7$ hypothesis).

Considering a 5% threshold, we may observe that the measures associated to food security (as characterized by the used indicators) are directly influenced by measures of the financial system (both banking and capital market components) and other decisions adopted for achieving sustainable development goals that are associated with food security. These results confirm previous studies (Cervantes-Godoy and Dewbre, 2010, Kaditi, 2013 etc.) and dynamics from the analysed countries.

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## 5. Conclusions

Using data for 2008-2017 time frame for the 28 European Union member states, we find some relations between measures of food security and indicators from the financial system, social protection and government support to agriculture (as a precondition to achieve food security). The obtained results show that 1% increase in household debt (expressed as percentage in GDP) lead to a decrease by 338.5036 of the agricultural factor income per annual work unit. This result can be used by the national authorities in banking and consumer protection in order to devise a mechanism for sustainable growth of household debt (that may lead to positive macroeconomic effects, such as economic growth). The positive effects of household debt increase can be also seen in relation with the other analysed measure for food security, namely government support to agricultural research and development (a one percentage point increase in household debt lead to an increase by 0.095144 of government support to agricultural research and development).

Moreover we believe that, in the future, we may consider some other elements, such as the labour market structure from analysed countries, in order to avoid the major distortive effects of measures intended to poverty and social inequality reduction (social transfers may change attitude and behaviour of at-risk-of poverty social classes, by facilitating voluntarily unemployment).

In addition, the proposed models show the insignificant role played by the financial sector in financing agriculture, a sector characterized by the use of non-qualified and low-paid workforce.

The study is relevant for national, regional or local public authorities, that devise national strategies, but also for companies from the agricultural sector, that may design their development programs (anticipating the effects induced by the measures adopted in order to attain the sustainable development goals envisaged for each country).

These models provide pertinent information to companies from the financial and agricultural sectors, as they reveal that achieving food security is not only the result of some administrative measures, but also can be achieved through finding and implementing adequate mechanisms for supporting agriculture. Starting from the objective of establishing the Capital Markets Union, as a way to finance small and medium enterprises, it can be considered the idea of establishing investment vehicles that operate under capital market rules and facilitate the access to capital (as the large dispersion of farmers still persists). Moreover, the measures intended to achieve food security should be drafted in a coordinated manner, considering the potential effects on some other macroeconomic variables.

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Considering the limited number of observations and the persistence of differences between the analysed countries, we may need to look towards new research areas. As such, starting from the impact of macroeconomic measures on some other food security indicators, we can consider possible effects on life quality and social inequality within the European Union. We may also expand the data corresponding to analysed countries, to include in our study 2018, in order to find the new trends and dynamics of the European market.

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