

Full Length Research Paper

Economic and environmental benefits of sunflower contract farming: Evidence from a Greek region

Siouzanna Gioumatova¹, Christos Karelakis¹ and Polytimi Farmaki^{2*}

¹Department of Agricultural Development, Democritus University of Thrace, 193 Pantazidou Str., Orestiada, Greece.

²Department of Regional Development and Cross-Border Studies, University of Western Macedonia, 50100 Kozani, Greece.

Received 27 August, 2021; Accepted 8 October, 2021

Contract farming involves agricultural production carried out on the basis of an agreement between buyers and producers. The aim of the research is to study the extent to which contract farming affects the income of producers. In addition, to study the indicators for the choice of contract cultivation. A quantitative, descriptive and correlational survey was conducted using an original questionnaire which consisted of closed-ended, open-ended and multiple-choice questions. In the present research 306 producers of South Evros have participated with the majority being over 45 years old, married and graduates of secondary education. The statistical analysis was performed at a significance level of 5%, using the regression and correlational analysis. The 83.4% of the respondents (N=255) stated that their income was significantly affected by their involvement in contract farming, while the 75.3% (N=183) noticed a positive effect. The decision to choose contract farming (with < 5% statistical significance) was affected by profits, the ability to repay debts, the income influence and the positive income influence. The impact of contract farming on incomes was high and positive. Most of the respondents who were willing to choose contract farming were farmers who have seen an increase in profits, a significant and positive impact on incomes, and those who were able to repay their debts.

Key words: Contract farming, contract cultivation of sunflower, water resources for irrigation, income, revenue, prefecture of Evros.

INTRODUCTION

Agriculture comprises are one of the largest “industries” in the world, producing \$ 1.3 trillion worth of goods and, at the same time, being the largest employer in the world, with about 1.3 billion people working directly in it and 2.5 billion to depend on it financially in growing countries. The production, processing, distribution, advertising, and marketing of agricultural merchandise is expected to

absorb half of the financial investments by 2025 worldwide (Pultrone et al., 2012). As a result, it is easy to understand that agriculture is a determining factor of development for many people. It is expected that producers will turn to different management methods to increase their production, profit, and general earnings, and one of these ways is contract farming (Elgilany et al.,

*Corresponding author. E-mail: pmfarmaki@gmail.com.

2012). The simplest and most common form of contracts concerns the conditions under which the production occurs and how the crop will be delivered to the buyer's premises (Rehber, 2018).

Contract farming has been used for decades in agricultural production, but its use seems to have increased in recent years. The idea of contracts is now appealing to many farmers as it can provide both a stable market and access to funding for production (Rehber, 2018). Contract agriculture is often of interest to consumers pursuing a commodity deal for further selling along the value chain or processing. Contract farming provides many benefits for the producer (risk reduction, the possibility of financing), for the business (participation and control in the production process), for the consumer (quality, safety, price), for the environment and the health of residents of the community (environmental and food safety awareness) and of course the local economies (increased investments in the area) (Rehber, 2018).

The contracts' key shareholders are those in the manufacturing industry because the guaranteed deal enables them to optimize processing power. Farmers' contracts may also reduce the risks that may emerge from crop diseases or weather conditions and promote certification demanded by developed markets (Setboonsarng et al., 2008). National economies also have potential benefits, as contract farming leads to balanced economies, which, as Setboonsarng et al. (2008) argued, are compelled to provide a more dynamic agricultural sector. As with any contract, contract farming involves several risks and problems. Common problems include farmers selling to a customer other than the one stated in the contract (known as 'side selling,' out-of-contract marketing or 'pole vaulting') or using the company's resources purposes other than anticipated. On the other hand, the company does not necessarily buy the goods at agreed prices or agreed amounts or degrade the final products' quality arbitrarily (World Bank, 2008). Therefore, an appropriate legal framework is vital for the successful implementation and long-term sustainability of contract agriculture. Within this context, farmers and buyers will be facilitated when negotiating and drafting contracts and being protected from the risks that may arise during the contract, such as abuse of power by the strongest party or breach of contract (European Commission, 2020). Contract Farming represents a significant change in agricultural production organization, both in developed and developing countries (Otsuka et al., 2016). It integrates farmers and rural families into the broader national and global economy by separating land ownership from power, land-use decisions, including cultivation, using chemicals (pesticides, fertilizers) and decisions about the time and method of harvesting. In this way, land management and cultivation do not belong exclusively to farms' owners and land operators (Otsuka et al., 2016).

The main benefit for farmers who have an active

cultivation contract is the reduced financial risk. At the same time, contractors guarantee a stable supply source, allowing farmers to plan investments in large-scale processing systems (Rehber, 2018). Perhaps the most significant disadvantage is that farming families who have entered a farming contract are increasingly marginalized, as they lose their power, since, after the contract, they depend on industry companies to provide them with financial inputs and share know-how (Rehber, 2018). The spread of contract farming has accelerated the decline of developed countries' agricultural genetic base, accompanied by the development and widespread use of new varieties. The farmer sells the labor force instead of chickens, apples, beans, potatoes, and other products (Rehber, 2018).

In the case of sunflower, contract cultivation may be a first-class economic opportunity for farmers, providing income and energy adequacy through biodiesel production. The presence of energy crops in Greece verified sunflower cultivation as one of the most reliable solutions in energy crops, offering a steady income to contract farming with minimal or zero irrigation (Wang and Xia, 2007). Commercially, sunflower contract farming is also viable as companies choose the most efficient farmers to maximize profitability (Bogetoft and Olesen, 2004). Once these farmers have been identified, confidence must then be developed as contracts will only work if both parties can prove they will benefit from this cooperation; that needs collaboration and knowledge sharing (Wang and Xia, 2007). In Greece, few banks provide contract agriculture programs to ensure farmers' effort and interests, and these programs seem to have gained unique acceptance and momentum (Piraeus Bank Greek Agriculture, 2016). For farmers, finding resources, receipts, and revenues to meet their obligations is a factor of uncertainty. These products are continuously integrated into new programs to support and promote contract agriculture (Piraeus Bank Greek Agriculture, 2016).

Internationally, various studies have been carried out on contract farming activities (Setboonsarng et al., 2008; Swinnen and Maertens, 2007; Simmons, 2002), performing a series of case studies in selected Asian countries to determine rice farmers' benefit conditions. The main factors influencing contract farming are a) demographic factors (age, gender, education), b) economic factors (such as farm size, investments in irrigation network design and construction (Douglas, 2020), farmer experience, specialization, risk preference and credit restrictions), c) social market factors (market structure, e.g. number and size of agricultural enterprises, degree of product diversification, etc., the behavior of agricultural enterprises in markets such as strategy, advertising, marketing, research and development etc. and the development of the infrastructure of each economy, and d) the government policy of promoting contract farming. Accordingly, it is

imperative to consider the antecedents of contract agriculture and whether these factors correlate to determine a farmer's final decision to conclude an agricultural contract.

Successful agricultural development is mainly dependent on the availability and financing of new tools such as improved fertilizers and pesticides, unique seeds, the introduction of novel, large-scale technological advances in precision farming. As far as irrigation systems are considered, there must always be adequate water quantities to meet crop requirements. This is worse in small farmers, particularly those living in remote regions and upland areas in most developing countries (Swain, 2008).

Bearing in mind the above mentioned, the present study endeavors to assess the factors that contribute to the adoption of sunflower crop contract farming and affect the income of farmers and the environment. Accordingly, a quantitative survey was administered to farmers in a remote Greek region and employed a series of multivariate methods. The innovativeness of the study lies in the fact that for the first time, the economic benefits resulting from the use of contract farming in the production of sunflower in the studied region. This research is essential not only for the geographical area but also for the economic benefits of contract farming, offering an integrated picture of contract farming and whether it has influenced the farmers who chose it.

THEORETICAL BACKGROUND

Contract farming is an arrangement between farmers and buyers on the production and delivery of agricultural products under predetermined conditions, and sometimes at predetermined prices, e.g., (Pultrone, 2012; Eaton and Shepherd, 2001; Andri and Shiratake, 2003). According to the microeconomic theory, this is an institutional structure that evolves in response to insufficient or incomplete markets (Grosh, 1994; Glover, 1994; Key and Runsten, 1999). In theory, contracts for inputs and supplies enhance smallholder farmers' access to resources, e.g., yield-enhancing inputs, credit, information, services, and market products. Contracting non-price factors, such as technical assistance, access and price of irrigation water, training, and education, may further help farmers improve their production, productivity, and profitability (Ruben and Sáenz, 2008; Chakraborty, 2009). With prices set, farmers will potentially have more stable farm income. Extra revenue earning is a crucial incentive for farmers to enter contracts (Bijman, 2008; Little, 1994).

In general, the term Contract Farming describes the method of organized production based on a contract. Usually, a written production agreement between two parties, the farmer and/or cooperative and a company, working together in a chain activity, for the production

and delivery of agricultural products in advance agreed (Siallagan et al., 2019). As it has been stated, the contract includes terms that specify the mode of production (cultivation method, seeds, use of pesticides, etc.), the quantity and the period in which it must be delivered, the quality characteristics of the products, the purchase price, the possibility of terminating the contract and the manner of compensation in case force majeure (Siallagan et al., 2019). Contractual integration, based on an agreement between equal parties, can be vertical or horizontal (Rehber, 2007). "Vertical integration" is described as a contractual relationship that develops between the individual farmer and the business that buys the agreed produced product and supplies the farmer with the means of production. In this case, the process starts before the production and reaches the processing of the product. "Horizontal integration" refers to the merger of owned companies in the same industry or object of activity and aim to adopt standard practices and actions to organize the product's production and sale (Rehber, 2007). The act of agricultural cooperatives and producer groups falls into the form of horizontal integration. Nowadays, we meet "integration systems" that are financial ensembles, showing horizontal and vertical integration (Rehber, 2007).

Smallholders enter into the contract if their expected contracting gain exceeds their booking utility (Barrett et al., 2012; Da Silva, 2005). While farmers' primary incentive to participate in contract farming is receiving additional income, farmers can also contract for other purposes (Prowse, 2012). Agriculture contracts may also assign liability between the smallholders and the contracting firm (Bogetoft and Olesen, 2004). Smallholders typically bear the risk of development, while the contracting companies generally face marketing risk (Bogetoft and Olesen, 2004; Glover, 1994; Carr, 1993) argue that most smallholders are using contract farming to diversify the risk rather than optimize production volume. It appears that contract agriculture constitutes a significant shift in the organization of agricultural production in both developed and developing countries, according to a thorough review and analysis of results from international literature (Otsuka et al., 2016).

Contract farming models: Advantages and disadvantages of contract agriculture

According to the international literature, there are five basic contract farming models (Prowse, 2012; Melese, 2012). First, the *Centralized Model* refers to the conclusion of a company agreement (buyer/financier) to buy products from a large portion of small growers. Second, the Nucleus Model can be considered as a variant of the *Centralized Model*. The company (buyer/financier) controls and manages a sizeable, cultivated area (or plantation) (Barrett et al., 2005). Third,

the *Multipartite Model* is standard for many different bodies to participate in the cultivation process, such as organizations, state institutions, companies, credit institutions and farmers. It is usually a variation of the *Centralized or Nuclear Production Model* (Barrett et al., 2005). Fourth, the *Informal Model* is characterized by the participation of individual small entrepreneurs / small scale companies. The contracts have a loose/informal form and are mainly seasonal (Barrett et al., 2005). Finally, the fifth *Intermediary Model* involves an intermediary party (broker/intermediary/subcontractor) in the cultivation process, who signs an intermediary agreement with the contract company (Prowse, 2012).

Understandably, contract agriculture offers economic and social benefits; however there are advantages and disadvantages for the involved producers and the processing and marketing of the products (Pultrone, 2012). The advantages for the producers are depicted in Exhibit 1 while disadvantages are depicted in Exhibit 2, herein.

Exhibit 1. Contract agriculture advantages (Domi, 2014)

Advantages for producers:

- i) The scientific assistance and training to improve quality of the product, but also the efficiency of the cultivated areas,
- ii) The decrease of the risk of sales of products, as well as ensure its absorption,
- iii) The guaranteed product price or in the worst case knowledge of the how it is shaped,
- iv) The guaranteed payment time of production,
- v) The possibilities of financing by the company (even with the provision of agro supplies) or access to financial institutions to meet credit needs of production,
- vi) The proper annual financial planning resulting in the compliance with their consumer needs, and
- vii) The new practices and technologies, viii) the experience and skills gained in cultivation itself and recordkeeping and schedules and quality control.

Advantages for agricultural marketing and processing of products

- i) The guaranteed supply of raw materials and therefore correct planning of their production,
- ii) The possibility of consistent delivery of their products,
- iii) The stable and prescribed quality,
- iv) Avoidance of production failure risk,
- v) The detailed tracing of end products,
- vi) The corporate social and environmental responsibility, and
- vii) The reduction of transport costs and, therefore, reduction of production costs.

Exhibit 2. Contract agriculture disadvantages (Domi, 2014).

Disadvantages for producers:

- i) The limited negotiation power against giant companies and the increased financial risk due to specialization in production. Many producers often choose to cultivate more products beyond the ones referred to in contract farming products,
- ii) The difficulty in breaking the contract,
- iii) The loss of their previous product market interfaces,
- iv) The loss of their autonomy and their transformation into employee's companies,
- v) Corruption cases, and
- vi) The forgery of contracts or fraud. For example, in a tomato company, deliberately procrastinating the products' receipt, resulting in the tomatoes' weight loss due to evaporation. This caused the company to benefit from the now concentrated product. The producers were losing the possibility of extra profit.

Disadvantages for agricultural marketing and processing products:

- i) Enterprises involve the increase in operating costs due to the need for supervision of the production,
- ii) The often decreased product quality as a result of non-proper use of production standards by farmers,
- iii) The reduced flexibility for raw materials supply from other sources, with possible better quality or lower price,
- iv) The non-contractual sales of producers, or the infringement of other contractual obligations, and,
- v) The risk of perceiving cooperation as a relationship of exploitation by the farmers, resulting in a bad corporate social responsibility profile.

Impact of contract agriculture on the environment

Contract farming is considered a strategic policy tool to improve farm income and modernize agriculture. As sustainable agriculture's main task is the satisfaction of human needs, sound agricultural practices should have an essential role in contract farming to satisfy the most critical needs of all people. Unfortunately, either farmers, producers, or governments usually ignore sustainability, and as a result, pressing environmental issues arise.

Over-exploitation of groundwater, excess use of fertilizers, heavy metals and pesticides, and monocropping leading to declining soil fertility are some of the most common effects of contract farming on the environment. Agriculture also impacts water use and quality. Environmental degeneration also, because any form of agriculture can become a significant problem if it is not controlled. Legislation for environmental protection and land use for agriculture is rarely enforced in most countries, although there are many legislative and

administrative tools (Pultrone, 2012).

In many countries (Morvaridi, 1995), the primary constraint on agricultural production is the supply of water for irrigation as lack of available water resources for agricultural production is already a significant issue and is expected to grow because of increasing population higher food demand, climate change and the decline of land availability for agriculture use (Elliott et al., 2014).

Most of the time, irrigation water and environmental costs are not specified in contracts between producers and companies. However, they account for a significant portion of production costs (Foundation for Economic and Industrial Research, 2020). Whereas, for non-contract farmers, water availability for irrigation and lower agricultural products prices have been identified as significant problems (Kumar and Kumar, 2008). According to Kumar and Kumar (2008), a high percentage of non-contract farmers were interested in joining contract farming provided that the issue of irrigation was solved.

However, integrated irrigation water management could be succeeded by reducing implementation costs and promoting efficient, equitable, and sustainable water allocations (Saleth and Dinar, 1999). Besides, modernization of existing irrigation systems is of paramount importance to enhance efficiency and respond to the legal framework for water resources and sustainability and environmental protection.

Impact of contract agriculture on technological efficiency, productivity, and revenue

An abundance of literature states significant technological inefficiencies and low returns from smallholder farming (Koopmans, 1951; Farrell, 1957; Schultz, 1964; Timmer, 1971; Bravo-Ureta and Evenson, 1994). It is argued that in small-scale agricultural production, inefficiency is often correlated with factors associated with household demographic characteristics, farm characteristics and the organizational and management system to which farmers are accustomed (Forsund et al., 1980; Battese and Coelli, 1993).

Besides, low technological efficiency rates could be due to loan, insurance, knowledge, and product market failures. Key and Runsten (1999) suggest that these market failures also prohibit farmers from making efficient use of the abundant resources they possess, such as land and labor. The difference between what is currently generated and the level of potential production remains vast. The income is small. Improving smallholders' technological efficiency can improve their production, overall output, and profits without needing cost increases or technology changes. Many studies examine the effects of contract farming on farmers' incomes (Key and Runsten, 1999; Little, 1994; Singh, 2002; Warning and Key, 2002; Miyata et al., 2009) and most of these studies

state a significant positive impact.

Studies evaluating the impact of contract farming on output and/or productivity are, however, limited. Some empirical studies have shown that contract farmers have higher technological output and/or profitability than non-contract farmers (Ruben and Sáenz, 2008; Chakraborty, 2009; Warning and Key, 2002; Ramaswami et al., 2006), while other studies show no (significant) differences (Little, 1994; Miyata et al., 2009; Glover and Kusterer, 1990). Such research, however, does not consider the self-selection of contract farmers and non-contract farmers. Rao et al. (2012), who find that supermarket contracts' involvement contributes to significant productivity gains for Kenyan vegetable farmers, has done the only research that analyses contract farming's causal impact on technological performance and productivity.

Therefore, it is noted that there is a lot of link between the contract agriculture sector and the related economic factors. As a result, this research is geared towards the economic sectors contributed by conventional agriculture. Thus, one of the research questions raised and answered is:

1) To what extent does contractual agriculture affect the income of producers?

This research question refers to the degree and the kind of influence that the participation in contract farming had to the income of farmers. The second research question of the study is stated below:

2) Which are the predictive factors for the choice of contract farming?

This research question refers to the predictive factors for the choice of contract farming, examining the producers' profits, the return on the crop, the possibility of repaying any producers' debts, the significant influence of producers' incomes and the positive influence of income.

METHODOLOGY

Sunflower production in Greece

According to data presented by Markopoulos (2019), sunflower production in Greece takes place mainly in northern areas (Eastern Macedonia and Thrace). The study area of this research is the prefecture of Evros. The high rate of production in this area is easily perceived if one considers, not only the prevailing climatic conditions that contribute to the prosperity of this crop, but also the substantial agricultural (crop rotation-complete crop rotation) and economic (immediate absorption of the product to produce essential goods) benefits to farmers from the exploitation of such crucial raw material. The primary sector in Eastern Macedonia and Thrace, especially agriculture, plays a vital role for GDP (almost 8% of the area GDP). Overall, similarly to the entire agricultural production process, agricultural production also affects both the local economy and the wider region's development. It should not be overlooked here that policies to promote balanced growth can contribute to both the development of the food sector and sustainable economic growth of the region (Markopoulos, 2019).

Research design

The methodology involved a quantitative survey on farmers between August and October of 2018 using 5-level Likert scale, open and closed-type questionnaires as well as multiple response questions. The qualitative interviews concerned the institutional framework and the poverty levels of each village, its history in relation to the development of sunflower production. For the survey regarding sunflower production companies, four companies were interviewed using structured questionnaires that consisted of qualitative questions. These interviews helped the study to fully understand the history of the area, especially regarding the development of the sunflower sector and the socio-political issues faced by households.

The study's dependent variable is the choice of contract farming, while the independent variables involved the profits, the attribution of crops, the ability to repay any debts, the significant influence of income, and the positive influence of income. The quantitative survey was selected because concepts of profits, attribution of crops, ability to repay any debts, the influence of income and choice of contract farming are measurable; thus, the researcher could measure them accurately (Creswell, 2013). The open type question was used for the factors that affect the choice of contract farming to give the farmers the freedom to choose and express their opinion (Creswell, 2013). Furthermore, according to the research questions, there is a need to examine predictive factors of the dependent variable choice of contract farming and reveal relationships between independent variables, which are quickly shown in causal quantitative research, using statistical methods in numerical data (Muijs, 2011; Hejase and Hejase, 2013). The non-experimental design was chosen to identify relationships between specific variables without controlling the effect of other exogenous factors (Salkind, 2010).

Sample

The sample population of the current research was the farmers in the area of Evros, and the sample was collected using cluster sampling from the following five categories:

1. Farmers who have entered into contracts with a state-owned enterprise, including land lease
2. Farmers who have entered into contracts with a state-owned enterprise, which does not include land lease
3. Farmers who have entered into contracts with a private company or cooperative
4. Farmers without a contract (independent sunflower growers)
5. Farmers who do not grow a sunflower.

The sample was 322 people. However, in the present study, only 306 people out of the 322 responded. There were not many non-respondents, therefore the results were not affected. Quantitative data from 306 agricultural households were collected using a questionnaire based on household demographics and the production of sunflower. A demographic survey was conducted only on farmers not cultivating sunflower. Household demographic questionnaires are based on LSMS-type household survey data, aiming to measure and understand the standard of living of households and to investigate factors that determine the efficiency of production and participation in contracts related to the socio-economic characteristics of households. Non-responders did not have any specific characteristics. Regarding the sample, using Cochran's (1963: P. 75) formula:

$$n = [Z^2(q)(p)] / e^2$$

where $Z=1.96$ (95% confidence), p and q are the gender attributes = 0.5 (almost equally distributed in terms of gender) and e is the

required precision of 5%. Therefore, the sample size is 384 farmers. However, the final participating number consisted of 306 farmers in the prefecture of Evros, that is, a response ratio of 79.7% which is a very good response for this research. The majority of the sample aged 46-65 years old, married, who live in Didymotixo, Sterna, Neochori and Alexandroupoli. Most farmers had up to a secondary educational level, without specialization in Business Administration, and they have not worked in another section before starting the agricultural cultivation.

Questionnaire

The sampling process was followed by a household survey between August 2018 and October 2018. The questionnaires delivered to the respondents consist of closed-ended questions written in Greek language. The data are used only for research purposes and the duration of the answers is approx. 15 min. It is also noted that the respondents were given an accompanying form with clear instructions for completing the questionnaire, in order to facilitate its completion. According to data collected for the year 2016-2017 in the region of Eastern Macedonia and Thrace, 4,060 contracts were signed concerning the exploitation of 440,000 acres for the production of sunflower. With an error rate of 5% and a confidence level of 95%, my sample turns out to be 322. However, in the present study, only 306 people out of 322 responded.

The data used for this study are derived from two parts of the survey; one part from the household survey and the other from the village and organization survey. The quantitative information for the sample farmers was accrued using closed type questions, multiple responses, 5-level Likert scale and open type. For the demographic characteristics, seven questions were used regarding gender, age, marital status, residence, educational level, specialization in Business Administration and working in other sections before starting the agricultural cultivation. The dependent variable of study, the choice of contract farming, as well as the independent variables of profits, attribution of crops and ability to repay any debts were coded with 1 for Yes and 0 for No. For the effect of contractual agriculture on producers' income, a dichotomous question (1=positive, 0=negative) was used, while the significant influence of income was measured using a four-point Likert scale 1-4 (1=Not at all, 2=Very little, 3=Much, 4=Very much).

Data analysis

The statistical analysis of the questionnaires was carried out with the statistical program SPSS No.22, in which all the questions and answers of the research participants are registered, then the descriptive analysis was carried out, and finally all the research questions and hypotheses of this project were answered through appropriate statistical studies.

In the first research question, descriptive statistics in the form of percentages and frequencies (Hejase and Hejase, 2013) were used to identify the kind of effect and the degree of contractual agriculture on producers' income. In the second research question, a multi-linear regression model was employed to determine the predictive factors for the choice of contract farming. The mathematical formula of the multiple regression model is described below:

Choice of contract farming = $\beta_0 + \beta_1 * \text{Profits} + \beta_2 * \text{Attribution of crops} + \beta_3 * \text{Ability to repay debts} + \beta_4 * \text{Significant income of influence} + \beta_5 * \text{Positive income influence}$.

Choice of contract farming = $\beta_0 + \beta_1 \text{Profits} + \beta_2 \text{Attribution of crops} + \beta_3 \text{Ability to repay debts} + \beta_4 \text{Significant income of influence} + \beta_5 \text{Positive income influence}$ (1)

Table 1. Results for the effect of contract farming to the income of farmers.

Question	Answer	N	Percent
Were your incomes positive or negative affected?	Positive	183	75.3
	Negative	60	24.7
Do you think that your income has been significantly affected by your participation in contract farming?	Very little	51	16.7
	Much	234	76.5
	Very much	21	6.9

Table 2. Correlations between independent variables.

Pearson correlations	Profits	Attribution of crops	Ability to repay debts	Significant income of influence	Positive income influence
Profits	1				
Attribution of crops	0.732**	1			
Ability to repay debts	0.436**	0.457**	1		
Significant income of influence	0.488**	0.535**	0.452**	1	
Positive income influence	0.538**	0.472**	0.407**	0.673**	1

**p<0.01.

The null hypothesis is that the independent variables do not have a statistically significant impact on dependent variable and the alternative that they have. The degree of adjustment of the multiple linear regression model, was determined by the AdjR² coefficient, where values above 0.25 are considered satisfactory, while the multicollinearity by the VIF coefficient, where values less than 10 are satisfactory.

The independent variables of research were selected with the criterion to have a correlation above 0.5 with the dependent variable using the Pearson correlation. Pearson coefficient values belong to interval [-1,1], where values close to 1 represent high positive correlation, values relative to -1 high negative and values close to 0 no correlation. In all statistical tests, significance was set at 5% (Hejase and Hejase, 2013; Field, 2017).

Ethical issues

The researcher accomplished the necessary ethical issues which are related both to the psychology of the producers who participated in the research and to the very nature of its conduct (British Psychological Society, 2014). The producers who participated in the research were informed about its purpose, the research questions and that the answers they will give will be used only for the needs of the scientific community. In addition, were informed that they participate voluntarily, anonymously and with their own consent as well as that they have the right to leave whenever they want during the research or even a week later. The researcher disclosed his personal information to the producers, in case they want to contact him for any reason.

RESULTS

First research question

Regarding the first research question, 75.3% (N=183) of

respondents said that the producers' incomes were positively affected while the remaining 24.7% (N=60) were negatively affected. The effect was high according to the 83.4% (N=255) of sample. Table 1 represents the results.

Second research question

Table 2 indicates the correlation between independent variables, where a statistically significant positive correlation was found in all cases (p <0.01). Table 3 represents correlations between dependent and independent variables where a statistically significant positive correlation appeared, with value greater than 0.5 in all cases. Table 4 represents results of multiple regression model. A statistically significant effect of the independent variables was observed on the dependent variable (F (5,192) = 52,462, p <0.001). Moreover, 56.6% of the variation in the dependent variable is explained by the explanatory or independent variables. (AdjR² = 0.566 > 0.4). The phenomenon of multilinearity did not occur (VIF <10) (Figure 1).

The effect of profits (Beta = 0.255, t = 3.509, p = 0.001), debt repayment ability (Beta = 0.311, t = 5.505, p <0.001), the importance of income influence (Beta = 0.177, t = 2.474, p = 0.014) and the positive influence of income (Beta = 0.213, t = 3.280, p = 0.001) were considered statistically significant. The regression model is described by the following mathematical formula:

$$\text{Choice of contract farming} = -0.082 + 0.127 * \text{Profits} + 0.005 * \text{Attribution of crops} + 0.249 * \text{Ability to repay debts} + 0.114 * \text{Significant income of influence} + 0.153 *$$

Table 3. Correlations between dependent and independent variables.

Independent variable	Choice of contract farming
Profits	0.611**
Attribution of crops	0.549**
Ability to repay debts	0.589**
Significant income of influence	0.591**
Positive income influence	0.617**

Table 4. Results of multiple regression model.

Dependent	R	R ²	AdjR ²	F (5,192)	p
Choice of contract farming	0.760	0.577	0.566	52.462	<0.001
Independent	B	Beta	t	p	VIF
Constant	-0.082	-	-0.798	0.426	
Profits	0.127	0.255	3.509	0.001	2.406
Attribution of crops	0.005	0.009	0.129	0.898	2.471
Ability to repay debts	0.249	0.311	5.505	<0.001	1.455
Significant income of influence	0.111	0.177	2.474	0.014	2.321
Positive income influence	0.153	0.213	3.280	0.001	1.910

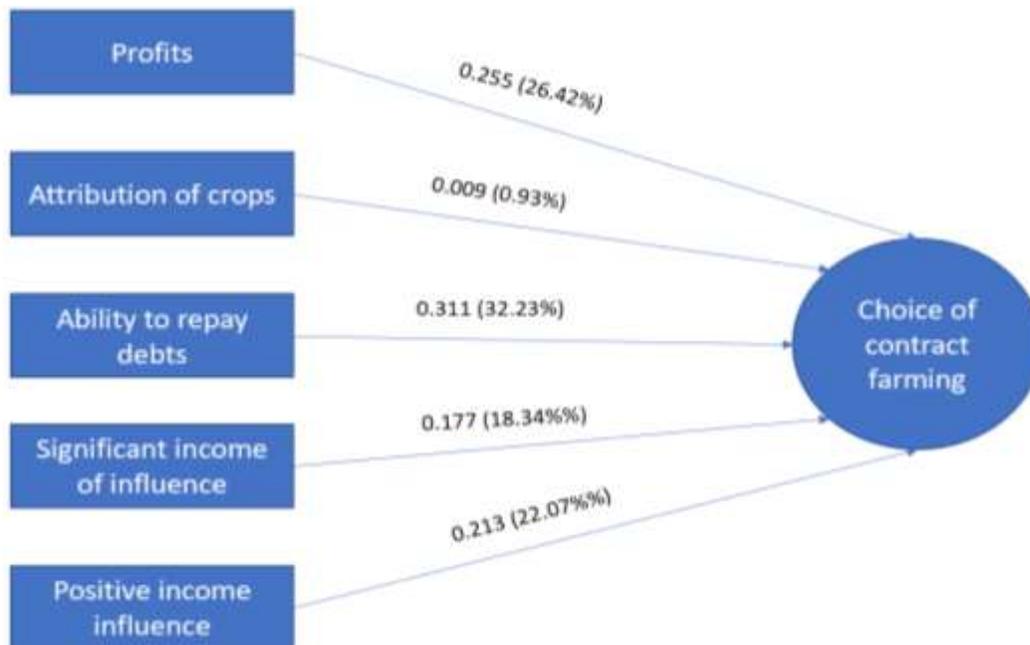


Figure 1. Diagram of the effect of the independent variables on the dependent.

Positive income influence.

$$\text{Choice of contract farming} = -0.082 + 0.127 \text{ Profits} + 0.005 \text{ Attribution of crops} + 0.249 \text{ Ability to repay debts} + 0.114 \text{ Significant income of influence} + 0.153 \text{ Positive income influence} \quad (2)$$

DISCUSSION

The present study involved 306 producers, almost equally distributed in terms of gender, with the majority being over 45, married, up to secondary level of education. Most producers had no training in Business

Administration and that they have not worked in another sector before starting farming. Various places of residence were observed with the most common being Didymoteicho, Sterna, Neochori and Alexandroupoli. This study examined the extent and the kind to which contractual agriculture affects the producer's income, as well as the predictors of choice of contract farming.

As far as it considers the research limitations although the purpose of sample collection is to represent each of the five groups which were selected for the survey, the total number of houses of each group in the area of South Evros is unknown and due to limited time and budget, the two-stage sampling method was applied. This process involves indicative sampling or sampling within the identified complexes. The groups referring to the data from the contract system were identified for the first time; subsequently, the possibility of similar sampling within the complex, for the random selection of households, was applied. The questionnaire consists of seven parts regarding the list of households, housing, assets, basic food consumption, basic expenditure, social capital, and land use and source of income. Data were collected on 145 indicators of socio-economic characteristics of the households and 80 indicators of sunflower production.

In addition to quantitative household surveys, quantitative and qualitative surveys were conducted for selected companies, in order to understand the institutional changes in the survey sector and to investigate the socio-political changes in the area that affect sunflower production. The interviews of the village mayors were conducted with the help of specially designed quantitative questionnaires, in order to collect information on the village regarding demographic characteristics, governance, access to facilities, infrastructure, land use, and prices.

The questionnaires mention the validity and reliability of the survey by measuring these with the statistical tool Cronbach Alpha. Validity concerns the degree of achievement of the goal for which the questionnaire was designed. The researcher has to design the questionnaire in a way that helps create corresponding questions. Thus, it will be able to ensure validity in creating the structure of the questionnaire. Reliability refers to the stability provided by the results of the questionnaire in repeated measurements under the same research conditions. The place where the questionnaire was applied, the familiarity of the respondent towards the interviewer, any anxiety of the respondent, and in general the conditions under which the completion of the questionnaires is carried out, may influence the results of the survey.

Regarding the first research question, which refers to the effect of contractual agriculture on producer's income, the majority stated that their income was positively and highly affected. The positive correlation between contractual farming and income was also expressed in a systematic review (Kozhaya, 2020) about contract farming and its impact. Maridadi (2013), indicated that vast majority

of farmers in the community are satisfied with the profits made by sunflower cultivation through contract farming and also pointed out that contract farming has broken the barriers of mass production, leading more and more farmers to engage in contract farming programs. Gersh (2018) typically states that in India, the opportunity of contract farming provided both higher incomes for members of agricultural cooperatives and higher profits for companies. In the Lao People's Democratic Republic, contract farmers earned significantly higher profits than no contract farmers (Simmons, 2002).

Concerning the second research question, which refers to the determinant factors for the choice of contract, the possible factors that were examined were the profits, the attribution of crops, the ability to repay any debts, the significant influence of income and the positive impact of income. Results indicated that more willing to choose contract farming are farmers who have seen an increase in profits, a significant and positive impact on incomes, and those who are able to repay their debts. The same results are reported by Maridadi (2013), who adds that even more willing to choose contract farming were farmers who received adequate training in cultivation methods. According to Ncube (2020), contract farming provides financially reliable farmers with loan and credit opportunities, otherwise not available, due to the financial crisis.

In addition, here was a high internal positive relationship among predictors. Producers with higher profits would have higher attribution of crops, greater ability to repay and feel the more the positive influence of income. It is a fact that smallholder farmers are dissatisfied with the financial benefits of contract farming. Simultaneously, economic indicators state that the farmer's income's positive effects have a higher likelihood of correlating with high profile farmers (Ruml and Qaim, 2020).

Structural changes are needed in order to increase the farm sizes of contract sunflower farmers, and make them comparable to those of the European Union. Investments in the sector are deemed necessary as well as the introduction of new technologies, research spending and the strengthening of links between agricultural production and processing, in order to make Greek products more competitive. In order to increase the attachment of contracts, farmers should be informed about the economic benefits they will reap, they should be trained in cultivation methods, while special arrangements should be made for farmers who are unable to repay their debts.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Andri BK, Shiratake Y (2003). Existence, types and opportunities of

- contract farming in East Java. *Bulletin of Faculty of Agriculture Saga University* 88:43-55.
- Barrett CB, Bachke ME, Bellemare MF, Michelson HC, Narayanan S, Walker TF (2012). Smallholder Participation in Contract Farming: Comparative Evidence from Five Countries. *World Development*, Elsevier 40(4):715-730. DOI: 10.1016/j.worlddev.2011.09.006
- Battese GE, Coelli TJ (1993). A stochastic frontier production function incorporating a model for technical inefficiency effects. *Working Papers in Econometrics and Applied Statistics* No 69, Department of Econometrics. University of New England, Armidale. Available online: https://www.researchgate.net/profile/George-Battese/publication/245083353_A_Stochastic_Frontier_Production_Function_Incorporating_a_Model_of_Technical_Inefficiency_Effects/links/5726935108aee491cb3f100f/A-Stochastic-Frontier-Production-Function-Incorporating-a-Model-of-Technical-Inefficiency-Effects.pdf (accessed on 5 May 2020).
- Bijman J (2008). Contract Farming in Developing Countries: An Overview, Wageningen University, Department of Business Administration: Wageningen, The Netherlands. Available online: https://www.wur.nl/upload_mm/5/c/b/79333121-6f4b-4f86-9e8e-0a1782e784d6_ReviewContractFarming.pdf (accessed on 18 March 2021).
- Bogetoft P, Olesen HB (2004). *The Design of Production Contracts*. 1st ed. Copenhagen Business School Press, Denmark.
- Bravo-Ureta BE, Evenson RE (1994). Efficiency in agricultural production: The case of peasant farmers in Eastern Paraguay. *Agricultural Economics* 10:27-37. DOI: [https://doi.org/10.1016/0169-5150\(94\)90037-X](https://doi.org/10.1016/0169-5150(94)90037-X)
- British Psychological Society (2014). BPS Code of Human Research Ethics (2nd ed.). <https://www.bps.org.uk/news-and-policy/bps-code-human-research-ethics-2nd-edition-2014>.
- Carr SJ (1993). Improving cash crops in Africa: factors influencing the productivity of cotton, coffee, and tea grown by smallholders (English). World Bank technical paper, WTP 216 Washington, D.C. World Bank Group. Available online: <http://documents.worldbank.org/curated/en/314211468742819527/Im-proving-cash-crops-in-Africa-factors-influencing-the-productivity-of-cotton-coffee-and-tea-grown-by-smallholders> (accessed on 22 March 2020).
- Chakraborty D (2009). Contract farming in India: Unique solution to multilayer agricultural problems. *Review of Market Integration* 1(1):83-102. DOI: <https://doi.org/10.1177/097492920900100105>.
- Cochran WG (1963). *Sampling Technique*. 2nd Edition, New York, NY: John Wiley and Sons Inc.
- Creswell JW (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th Edition, London: SAGE Publications, Inc.
- Da Silva CA (2005). The growing role of contract farming in agri-food systems development. Drivers, theory and practice, FAO. Available online: <https://www.farm-d.org/app/uploads/2019/05/Contract-Farming-in-Agrifood-systems.pdf> (accessed on 18 March 2019).
- Domi S (2014). The Potential Advantages and Disadvantages of Contract Farming. *Horizons International Scientific Journal (Special Edition) Economics*, 12. Available online: <https://www.uklo.edu.mk/filemanager/Horizonti/HORIZONS%20vol.XII.pdf> (accessed on 5 March 2019).
- Douglas N (2020). The Importance of Contract Farming to Small-scale Farmers in Africa and the Implications for Policy: A Review Scenario. *The Open Agriculture Journal* 14(1):59-86.
- Eaton C, Shepherd AW (2001). Contract Farming: Partnerships for Growth. Food and Agricultural Organization of the United Nations, Rome: *Agricultural Services Bulletin* 145p. Available online: <http://www.fao.org/3/y0937e/y0937e00.htm> (accessed on 5 June 2019).
- Elgilany A, Faki HHM, Hussein A (2012). Role of Agricultural Finance in Producing Food Crops. *International Journal of Agriculture and Forestry* 2(2):10-15. DOI: 10.5923/j.ijaf.20120202.03
- Elliott J, Deryng D, Müller Ch, Frieler K, Konzmann M, Gerten D, Glotter M, Flörke M, Wada Y, Best N, Eisner S, Fekete MB, Folberth Ch, Foster I, Gosling SN, Haddeland I, Khabarov N, Ludwig F, Masaki Y, Olin S, Rosenzweig C, Ruane AC, Satoh Y, Schmid E, Stacke T, Tang Q, Wisser D (2014). Constraints and potentials of future irrigation water availability on agricultural production under climate change *Proceedings of the National Academy of Sciences of the United States of America* 111(9):3239-3244.
- European Commission (2020). Common Agricultural Policy. Available online: https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en (accessed on 25 October 2020).
- Farrell MJ (1957). *The Measurement of Productive Efficiency*. JSTOR, Journal of the Royal Statistical Society. Series A (General) 3(120):253290. DOI: 10.2307/2343100
- Field A (2017). *Discovering Statistics Using IBM SPSS*, 5th Edition, UK: Sage Publications, Ltd.
- Forsund FR, Lovell CAK, Schmidt PA (1980). Survey of frontier production functions and their relationship to efficiency measurement. *Journal of Econometrics* 13(1):5-25.
- Foundation for Economic and Industrial Research (2020). Available online in Greek: http://iobe.gr/docs/research/RES_05_F_21102020_REP_GR.pdf (accessed on 15 January 2021).
- Gersh I (2018). Producer organizations and contract farming: A comparative study of smallholder's market strategies in South India. *Zeitschrift für Wirtschaftsgeographie* 62(1):14-29.
- Glover D (1994). Contract farming and commercialization of agriculture in developing countries. In *Agricultural commercialization, economic development, and nutrition*. In: von Braun, Joachim; and Kennedy, Eileen T. Eds.; Baltimore, MD: The International Food Policy Research Institute (IFPRI), Johns Hopkins University Press, 1994; Chapter 10:166-175. Available online: <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/129375> (accessed on 8 May 2019).
- Glover D, Kusterer K (1990). *Small Farmers, Big Business: Contract Farming and Rural Development*. London: Macmillan.
- Grosh B (1994). Contract Farming in Africa: An Application of the New Institutional Economics. *Journal of African Economies* 3(2):231-261. DOI: <https://doi.org/10.1093/oxfordjournals.jae.a036805>
- Hejase AJ, Hejase HJ (2013). *Research Methods: A Practical Approach for Business Students*. 2nd Edition, Philadelphia, PA, UAS: Massadir Inc.
- Key N, Runsten D (1999). Contract Farming, Smallholders, and Rural Development in Latin America: The Organization of Agroprocessing Firms and the Scale of Outgrower Production. *World Development* 27(2):381-401. DOI: 10.1016/S0305-750 X (98)00144-2.
- Koopmans TC (1951). Analysis of production as an efficient combination of activities. *Activity Analysis of Production and Allocation: Proceeding of a conference*, Koopmans TC (ED), New York: John Wiley and Sons, Inc: pp. 33-97.
- Kozhaya RA (2020). Systematic Review of Contract Farming and its Impact on Broiler Producers in Lebanon. *Open Science Journal* 5:3. DOI: 10.23954/osj.v5i3.2410
- Kumar J, Kumar PK (2008). Contract Farming: Problems Prospects and its Effect on Income and Employment. *Agricultural Economics Research Review* 21(2):243-250.
- Little PD (1994). Contract farming and the development question. In *Living Under Contract-Contract Farming and Agrarian Transformation in Sub-Saharan Africa*. Little PD, Watts MJ, Eds. University of Wisconsin Press, Madison, pp. 216-257.
- Maridadi PF (2013). Improving Livelihood to Farmers Through Sunflower Seeds Processing: A case of Mshani Village - Sumbawanga District. Master's thesis, The Open University of Tanzania. <http://repository.out.ac.tz/820/>
- Markopoulos T (2019). Common Agricultural Policy and Local Economy and Development in the Region of Eastern Macedonia – Thrace (Greece). *Journal of Engineering and Technology Review* 12(2):185-223.
- Miyata S, Minot N Hu D (2009). Impact of contract farming on income: Linking small farmers, packers, and supermarkets in China. *World Development* 37(11):1781-1790.
- Morvaridi B (1995). Contract Farming and Environmental Risk: The Case of Cyprus. *Journal of Peasant Studies* 23(1): 30-45.
- Muijs D (2011). *Doing Quantitative Research in Education with SPSS*, Sage UK: 2nd Edition. DOI: <https://dx.doi.org/10.4135/9781849203241>

- Ncube D (2020). The Importance of Contract Farming to Small-scale Farmers in Africa and the Implications for Policy: A Review Scenario. *The Open Agriculture Journal* 14(1):59-86.
- Otsuka K, Nakano Y, Takahashi K (2016). Contract Farming in Developed and Developing Countries. *Annual Review of Resource Economics* 8(1):353-376. DOI: <https://doi.org/10.1146/annurev-resource-100815-095459>
- Piraeus Bank Greek Agriculture (2016). Looking to the future Challenges and perspectives. Available online at http://www.piraeusbank.gr/~media/Gr/Agrotres/Files/EpiGis_No6.pdf. (Accessed on 15 June 2016).
- Prowse M (2012). Contract farming in developing countries: a review. A savoir, Paris: AFD, Agence Francaise de développement, 12. Available online: <https://portal.research.lu.se/ws/files/5824557/5218915.pdf> (accessed on 22 March 2020).
- Pultrone C (2012). An Overview of Contract Farming: Legal Issues and Challenges. NS – Vol. XVII. <https://www.fao.org/uploads/media/Uniform%20Law%20Review%20Unidroit.pdf>
- Pultrone C, da Silva CA, Shepherd A (2012). Guiding principles for responsible contract farming operations. Rural Infrastructure and Agro-Industries Division, FAO: Rome, Italy. Available online: <http://www.fao.org/3/i2858e/i2858e.pdf> (accessed on 5 January 2020).
- Ramaswami B, Birthal PS, Joshi P (2006). Efficiency and distribution in contract farming: The case of Indian poultry growers. International Food Policy Research Institute: Markets, Trade and Institutions Division, Washington DC, USA, Discussion Paper 91. Available online: <https://www.ifpri.org/publication/efficiency-and-distribution-contract-farming> (accessed on 15 May 2020).
- Rao EJO, Brümmer B, Qaim M (2012). Farmer participation in supermarket channels, production technology, and efficiency: The case of vegetables in Kenya. *American Journal of Agricultural Economics* 94(4):891-912. DOI: <https://doi.org/10.1093/ajae/aas024>
- Rehber E (2007). Global Overview of Contract Farming In Contract Farming Prasad, B. Mohanty S. Eds. ICFAI University, pp. 3-34.
- Rehber E (2018). Contract Farming in Practice: An Overview. Research Report No. 7, Charles J. Zwick. Center for Food and Resource Policy Department of Agricultural and Resource. Economics College of Agriculture and Natural Resources, The University of Connecticut, UCONN. DOI: 10.22004/ag.econ.290069
- Ruben R, Sáenz F (2008). Farmers, Markets and Contracts: Chain Integration of Smallholder Producers in Costa Rica. *Revista Europea De Estudios Latino americanos y Del Caribe / European Review of Latin American and Caribbean Studies*. JSTOR 85:61-80. Available online: www.jstor.org/stable/25676330. (Accessed on 18 March 2020).
- Ruml A, Qaim M (2020). Smallholder Farmers' Dissatisfaction with Contract Schemes in Spite of Economic Benefits: Issues of Mistrust and Lack of Transparency. *The Journal of Development Studies* 57:7. DOI: 10.1080/00220388.2020.1850699 Available online: <https://www.tandfonline.com/doi/full/10.1080/00220388.2020.1850699> (accessed on 10 January 2021).
- Saleth MR, Dinar A (1999). Evaluating institutions and water sector performance. Washington, DC: World Bank Technical Paper #447. DOI: <https://doi.org/10.1596/0-8213-4561-3>, Available online: <https://elibrary.worldbank.org/doi/abs/10.1596/0-8213-4561-3> (accessed on 15 December 2021).
- Salkind NJ (2010). *Encyclopaedia of research design*. Thousand Oaks, CA: Sage Publications. DOI: <http://dx.doi.org/10.4135/9781412961288>
- Schultz TW (1964). *Transforming Traditional Agriculture*. New Haven CT: Yale University Press, xiv + 212 pp. <https://onlinelibrary.wiley.com/doi/abs/10.2307/1241992>
- Setboonsarng S, Leung P, Stefan A (2008). *Rice Contract Farming in Lao PDR: Moving from Subsistence to Commercial Agriculture*. Tokyo: Asian Development Bank Institute, ADBI Discussion Paper, No 90.
- Siallagan M, Perdana T, Simatupang T, Handayati Y (2019). Pricing negotiation in contract farming. *International Journal of Business and Globalization* 23:174. DOI: 10.1504/IJBG.2019.10024229
- Simmons P (2002). Overview of Smallholder Contract Farming in Developing Countries, ESA Working Paper, FAO: Rome. Italy. Available online: <http://www.fao.org/3/ae023e/ae023e00.pdf> (accessed on 5 January 2019).
- Singh S (2002). Contracting Out Solutions: Political Economy of Contract Farming in the Indian Punjab, *World Development*. 30(9):1621-1638. Available online: <https://EconPapers.repec.org/RePEc:eee:wdevel:v:30:y:2002:i:9:p:1621-1638>. (accessed on 15 May 2020).
- Swain BB (2008). The role of contract farming in agricultural development in globalize world: an institutional economics analysis, "MPRA Paper 18683, Germany: University Library of Munich. Available online: <https://ideas.repec.org/p/pram/prapa/18683.html> (accessed on 25 October 2020).
- Swinnen JFM, Maertens M (2007). Globalization, privatization, and vertical coordination in food value chains in developing and transition countries. *Agricultural Economics* 37(1):89-102. DOI: <https://doi.org/10.1111/j.1574-0862.2007.00237.x>
- Timmer CP (1971). Using a probabilistic frontier production function to measure technical efficiency. *Journal of Political Economy*, University of Chicago Press 79(4):776-794. DOI: 10.1086/25978
- Wang GQ, Xia ZF (2007). Tissue injury by hot fluid containing nitrogen mustard. *Burns* 33(7):923-926. DOI: 10.1016/j.burns.2006.11.004.
- Warning M, Key N (2002). The social performance and distributional consequences of contract farming: An equilibrium analysis of the Arachide de Bouche program in Senegal. *World Development* 30(2):255-263. Available online: <https://EconPapers.repec.org/RePEc:eee:wdevel:v:30:y:2002:i:2:p:255-263>. (accessed on 15 May 2020).
- World Bank (2008). *World Development Report 2008, for Development*. Washington, DC 2007, World Bank. Available online: <https://openknowledge.worldbank.org/handle/10986/5990> (accessed on 15 November 2020).