Measuring the Immeasurable: The Evolution of the Size of Informal Economy in the Agricultural Sector in the EU-15 up to 2019

Friedrich Schneider, Mangirdas Morkunas, Erika Quendler

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Abstract

This study is the first scientific attempt to calculate the size of the informal economy in agriculture. The Multiple indicators multiple causes model (MIMIC) was developed for the estimation of levels of informal economy in 15 "Old" European Union Member States' agricultural sectors for the period of 1996-2019. The obtained results document the prevalence of higher levels of informal economy in agriculture compared to the overall economy. The impact of subsidies and farm organizations on the development of the informal economy are two important factors for these higher values in agriculture. The effects of taxation, share of import and factor income in agriculture onto the levels of the informal economy in agriculture are sizeable, too. Finally, we disaggregate the informal work into subcategories like entrepreneurial and family work.

JEL-Codes: Q110, Q140, Q190.

Keywords: informal economy, informal work, agriculture, MIMIC, EU-15 countries, causes for informal work.

Friedrich Schneider
Research Institute of Banking and Finance
Johannes Kepler University Linz / Austria
Friedrich.Schneider@jku.at

Mangirdas Morkunas*
Department of Business, Faculty of Economics
and Business Administration
Vilnius University / Lithuania
morkunas.mangirdas@gmail.com

Erika Quendler
Federal Institute of Agricultural Economics,
Rural and Mountain Research
Vienna / Austria
erika.quendler@bab.gv.at

*corresponding author

Thursday 4, 2021, final version 7

1.) Introduction[1]

Agriculture stood at the roots of the term 'informal economy' which was created to describe activities in agriculture considered to be neither legal nor illegal by nature (Conroy, 2019). It encompasses activities that are lawful as regards to their nature but are not declared to the public authorities for various reasons (Renooy et al., 2004; Franic & Williams, 2014). Many types of the informal economy are even considered normal. i.e. within the social norms due to that authorities do not even attempt to register such activities, f.i. growing and selling agricultural products (Renooy et al., 2004) or cooperation at work in the countryside (Ribasauskiene et al., 2019). Some countries even exclude the agricultural sector from their estimates of the informal economy of countries (Chen, 2007) both due to cultural legacy and difficulties in estimations (Schneider, 2014; Kirchgässner, 2017). The informal economy in agriculture is considered to be one of the main and hardly measurable components of the whole informal economy within a country due to the prevalence of subsistence farming, family work (Angour & Nmili, 2019), undeclared employment and illegal migrant work (Pena, 2009), self-employment (Hassan & Schneider, 2016), seasonal work (Mroz, 2018), cooperative help (Hussmanns, 2004), sale of products in local markets without a receipt (Gapsys & Eicaite, 2010), etc. The issues in tackling the informal economy in agriculture also persist but as agricultural production is characterized by a low electricity consumption (Kyle et al., 2001), typical methods based on energy consumption are not applicable in agriculture (Psychoyios, Missiou, & Dergiades, 2019). These difficulties have left the informal economy in agriculture in the shadow of scientific interest, not only creating a knowledge vacuum in this area but also hindering efforts to more precisely calculate and tax the primary sector. Hence, to our knowledge, our paper is a first attempt to estimate the size and development of the informal economy/work in the agricultural sector.

There are various reasons why an informal economy in agriculture is tolerated to some extent. It slows down rural-urban migration, unemployment and social problems in big cities (Dell'Anno, Davidescu & Balele, 2018) and helps to assure food security in less developed countries (Stevano, 2019), to resist sanctions or other artificially imposed constraints onto the economy, and to maintain food supply (Joo, 2010). Although some research points out the side effects of the informal economy in agriculture, such as obstacles for operation and starting agricultural activities (Krstic & Radulovic, 2015), untaxed informal activities act as an implicit encouragement to underground activities which tend to evolve

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even into criminal activities (Katsios, 2006), seriously affecting the conditions for fair competition (Rochlitz, 2017) and even overall economic growth (Schneider & Hametner, 2014).

To repeat, the aim of this paper is to estimate the size and development of the informal economy in the agricultural sector, namely the 'agriculture' sector (NACE Rev.2 A01 Crop and animal production, hunting and related service activities) of the EU-15 countries in the period 1996-2019. We address the following research questions:

(i)   How is informal economy and/or work in the agricultural sector defined?

(ii)   What are the main causes of informal economy/work?

(iii)   How can the size of the informal economy be estimated?

(iv)   Can we disaggregate the total informal work into subcategories, like family production/work?

(v)   How strongly do EU-15 Member States differ from each other in terms of the informal economy/work in the agricultural sector observed up to 2019? Does a stable ranking emerge?

Our contribution to the literature on the informal economy in agriculture is three-fold: **First,** it is the first scientific evidence on the size and development of the informal economy in EU-15. **Second**, we develop a model for a multi-country longitudinal analysis of levels and dynamics of the informal economy in the agricultural sector. **Third**, it is an evidence-based analysis of the agricultural sector, as the implementation of SDG 8 and Addis Ababa Action Agenda (AAAA) require transitioning from the informal to formal economy (IISD, 2015). To our knowledge this is done for the first time.

In our paper we provide the first scientific evidence on the size of informal economy in European Union's agriculture. We reveal the significance of family farming which is a backbone of EU agriculture (Vrolijk et al., 2010) within informal economy of the researched EU Member States. The impact of subsidies on the informal economy in agriculture is confirmed, complementing the ongoing discussions on what are the side effects of various types of subsidies on the agricultural sector (Elinder, 2005; Huang et al., 2011).

The rest of the paper is organized as follows. In section **2** some theoretical considerations are presented, starting with the discussion of the agricultural informal economy in the literature (**2.1**), its main causes (**2.2**) and related hypotheses (**2.3**) as well as

the model applied (**2.4**). Section **3** explains the MIMIC procedure and presents the data sources and the results. Section **4** shows some disaggregated results of the informal work in agriculture with respect to entrepreneurial employment, family, and household work. Finally, section **5** presents a summary and some concluding remarks.

2.) Theoretical background
2.1) Informal economy in agriculture: a literature review

Literature states that the informal economy of a country is concentrated in its agriculture, construction and household service sectors (Krstic, 2015) with rural and suburban informal economy comprising about 2/3 of the overall informal economy within the state, where the informal economy in agriculture accounts for the biggest part (Cling, Razafindrakoto & Roubaud, 2011). Franic & Williamson (2014) reveal that firms in agriculture and related industries are the most likely to recognize competition from unregistered or informal firms as a serious obstacle to their business.

We assume that the informal economy in agriculture is mainly composed of informal employment and self-employment in agriculture (Chen, Schneider & Sun, 2020). Arandarenko (2015) confirms that by adding supplementary work to the equation describing the informal economy in agriculture. The informal economy of agriculture typically exceeds rural borders as informal trade in agricultural products and informal food processing within cities are conducted by farmers in order to shorten the supply chain of their products and to receive a price premium (Diao, Maghalhaes & Silver, 2019). Street vending of food products was also documented by Martínez, Short & Estrada (2017). Informal food processing is confirmed by Petersen & Charman (2018).

The rural societies are still controlled by social norms which are evident not only in the less developed world (Li, Westlund & Liu, 2019). Social trust remains one of the key facilitators of informal economic activities. Various social indicators were employed by Mishchuk et al. (2020) in order to calculate the size of the informal economy, showing them to be more significant in poorer and rural regions. Jensen, Tickamyer & Slack (2019) proved the opposite, showing that the informal economy is prevalent even in the most developed nations. As there are informal norms in agriculture and rural regions, undeclared work in agriculture is considered to be part of rural traditions (Twyman, Muriel & Garcia, 2015). The social acceptance of informal work in agriculture is observed even in the most developed

countries, such as the United Kingdom (Lord, 2019). The distrust to public institutions also serves as a motivational factor for the informal economy (Webb et al., 2013). It is even revealed that higher chances to be caught or harsher punishments do not impact the level of the informal economy, whereas the level of trust in the government does (Williams & Oz-Yalaman, 2020). Some social informal groups with its own rules and informal economic activities are will be used to substitute weak public social protection mechanisms (Stavropoulou, Holmes & Jones, 2017). Arsic et al. (2015) concluded that the bigger the share of agriculture in the economy overall, the bigger the informal economy is within a country, due to the size of internal consumption which is being untaxed. Kireenko & Nevzorova (2019) go further arguing that there is a strong direct positive correlation between the agricultural sector and the overall level of the informal economy within a country. The main reason for this is the role agriculture plays in impeding tax collection in a state (Neog & Gaur, 2021). There are contradicting evidences: Kelmanson et al. (2019) did not find a relationship between the size of the agricultural sector as compared to Gross domestic product (GDP) and the shadow economy within a state. This may be for two reasons: informal economy - which in our paper includes the traditional shadow economy, - and pure shadow economy are slightly different notions which are sometimes used interchangeably (Farzanegan & Hayo, 2019). Another reason may be related to the empirical basis of the analysis. BRICS and EU countries are characterized not only by different development levels but also significantly differ in their inclination towards informal activities (Schneider & Enste, 2013). The relatively rare and week audits and inspections coupled with dubious accountability also provide a boost for the informal economy in agriculture (Arandarenko, 2015b). Some part of agriculture is pushed into the informal side by factors which it cannot control. If the harvest is very big and supply significantly exceeds demand (which does not fluctuate sharply), some of the agricultural production is forced into informal consumption (Chakrabarti, 2014). This situation also leads to a drop in prices of agricultural products and accordingly a lower income of farmers, which, in order to survive, become prone to engage into tax evasion activities (Dalu et al., 2012) or other means to lower operating costs, such as undeclared work, not-counted transactions, etc. (Blades, Ferreira & Lugo, 2014). Hiring informal labor in agriculture appears attractive to some farm owners also because of the possibility not to comply to existing workplace health regulations exposing their illegal workers to higher levels of pesticides and other chemicals than allowed (Ngowi, Mrema, & Kishinhi, 2016). Some informal activities arouse due to different taxation of inputs and outputs of agriculture compared to other non-agricultural production means or final products

(Schneider et al., 2015). Agricultural workers also have more opportunities to evade taxes compared to the labor force in other sectors due to withholding (Lee, 2013). The tendency of the agricultural sector to circumvent laws regulating taxes and working conditions is documented by Saracoglu (2020). Although it is noted that informal employment in agriculture is not stable, peaking in the summer season (Nastav & Bojnec, 2007) and dropping to levels almost comparable to other sectors of the economy during a non-seasonal time (Mitaritonna & Ragot, 2020). Another exogenous factor inducing the growth of the informal economy in agriculture is the necessity of local farmers to compete for unskilled labour with other sectors, such as mining (Hilson, Goumandakoye & Diallo, 2019). In order to maintain wages at a competitive level, farmers are forced into a position to accept informal work. Agricultural subsidies are also a possible source for the informal economy (Chaudhuri, Schneider & Chattopadhyay, 2006). Activities within agricultural cooperatives are seen as a source for informal economy in agriculture (Laumulin, 2013).

Another theoretical stream regarding the informal economy focuses on analyzing the effect of various barriers and restrictions towards the development of the rural Informal Economy. Obstacles to obtain finance also fuel the informal economy in rural areas where financial institutions and their availability are on lower levels than in big cities (Uddin, 2020). Informal credits are prevalent in rural households (Huong & Simoni) as well as in agricultural enterprises (Floro, 2019), or no formal written contract exists at all (Moahid & Maharjan, 2020). In some areas the whole development depends on supply of informal credits (Tang & Guo, 2017). Informal credits are also positive as they help to increase farmer's income to a level which suffices to keep him in agricultural activities instead of leading him to seek employment in urban centers (Shen & Song, 2017). The lack of clear and proportionate regulations sometimes unintentionally pushes the entrepreneurial farmers outside of the informal economy threshold (Escandón-Barbosa et al., 2019). Barriers to enter a formal economy created by social exclusion of minorities are focal in Gusakov (2017) research. Social stratification is named as a reason for prevalence of informal economy by Okeke & Anyadike (2020). Analyzing the reasons for the prevalence of such a high number of the informal economy in agriculture, Salahodjaev (2015) points out to the intelligence levels of people involved, as intelligence is found to negatively correlate with shadow activities and agriculture is not associated with skilled labour (Christiaensen & Martin, 2018).

An interesting conclusion was drawn by Bashlakova & Bashlakov (2020) stating that prevalence of big agricultural entities belonging to the state stimulates the

informal economy in agriculture. It can be explained by a reason: Russian and Belarussian economies served as empirical basis for their research. These countries were characterized by not the toughest control on accounting and production, especially in the analyzed years. The informal economy in agriculture is also characterized by a disproportionate representation of women in unaccounted work (Budlender, 2011). The differences are so high that informal employment in agriculture is even considered to be one of the main obstacles for reaching gender equality within a country (Ampaire et al., 2020). Another characteristic of the informal economy in agriculture is its stability. Although the informal economy in other sectors shrinks with countries' transition to a more developed state with more mature institutions (Medina & Schneider, 2018), the levels of the informal economy in agriculture tend to remain relatively constant (McCaig & Pavcnik, 2015). It is also observed, that the informal economy is more prevalent in smallholder and family agriculture, compared to big agricultural entities (Afreh et al., 2019). Traditional and niche branches of agriculture also display a higher proportion of informal work compared to a production of more popular crops and varieties (Pfau-Effinger, 2017).

Informal work in agriculture is considered to serve also as a damper to economic shocks within a country as it absorbs the surplus of the "mud" workforce from other industry sectors created by various institutional reforms (Harris-White, 2010). Agriculture provides opportunities for the unskilled labor force which is more inclined towards informal work compared to their highly skilled counterparts to acquire sources of financial income (Saracoglu, 2020) as in industrialized world there are less positions available for unskilled labor (Fracasso, Marzetti & Coletto, 2018). For the same reasons informal employment in agriculture is one of the sources of living for refugees and illegal migrants (Altındağ, Bakış & Rozo, 2020). Some of the informal labor in agriculture is forced into this position by the given institutional framework conditions (Mukhamedova & Wegerich, 2018).

2.2) Hypotheses

Defining the informal economy is far from straightforward. No one all-embracing definition exists. Rather a multitude of terms, practices and definitions abound, and these are exacerbated by regional and national differences in fiscal systems and social as well as cultural structures. In addition to the term "informal economy" there exist at least 15 other labels describing informal economic activities such as hidden, black, invisible,

underground, secondary, household, criminal, shadow, undeclared and alternative economy (cf., Henry, 1982, p. 461).

As a working definition, we use the term informal economy to describe an economic activity which is not recorded in official statistics and which operates in the absence of administrative monitoring and control. This interpretation is in line with the standard definition of the informal economy in social science literature in that it excludes criminal activities.

There is an increasing debate about causes of people engaging in underground and/or informal activities (Schneider & Neck, 1993; Schneider, 2004; Choi & Thum, 2005; Feld & Schneider, 2010; Schneider & Buehn, 2018). Both intrinsic motivation and external causes have been presented (Torgler & Schneider, 2009; Williams & Horodnic, 2015; Williams, Franic & Dzhekova, 2015; Williams, 2021) with a focus on institutional and macroeconomic factors in a research based on a group of countries (Thießen, 2010).

The total tax burden within a country is quite frequently used as an indicator to measure informal activities within a country. It was employed in almost all the most important studies in the context of an informal economy (Fleming, Roman & Farrell, 2000; Schneider, 2005; Dell´Anno, 2007, Torgler & Schneider, 2009; Schneider & Enste, 2013) and is considered to be one of the most important factors encouraging informal activities. Since a high importance is attached to this variable towards the formation of an informal economy in relation to the whole economy, we presume it also has an effect on the development of an informal economy in agricultural sector.

Trade intensity is also a well-known determinant for informal activities (Schneider, Buehn & Montenegro, 2010). It is revealed that the bigger is the share of imports, the higher is the possibility for turnover of counterfeit or untaxed products (Plotnikov et al., 2019). The ratio of imports in respect to GDP was employed both as a direct (Kodila-Tedika & Mutascu, 2013) and a proxy (Biswas, Farzanegan & Thum, 2012) indicator for the prevalence of informal economic activities. Specifying our analysis in respect of the agricultural sector, we presume that the share of imports of agricultural goods in imports overall is one of the variables that underpin the emergence of an informal economy in agriculture.

There is an abounding debate about the effectiveness of subsidies in agriculture (Elinder, 2005; Latruffe et al., 2017; Alizamir, Iravani & Mamani, 2019). Higher subsidies

are considered to be leading to relative inefficiency in agriculture (Sakano, Obeng & Azam, 1997). The phenomenon is also observed in EU agriculture (Emvalomatis, Lansink & Stefanou, 2008). Eilat & Zinnes (2002) document the role of subsidies in stimulating the informal economy. This was confirmed also by Davies & Thurlow (2010), Farzanegan (2013), and Brooks (2017). Distortions through agricultural subsidies generating possibilities for informal activities in agriculture were documented by Huang et al. (2011). These scientific evidences motivate us to test the share of subsidies in agricultural factor income as one of the causal variables in our research.

Higher income levels impede persons' motivations toward informal activities (Schneider & Kearney, 2013; González-Fernández & González-Velasco, 2015; Berdiev & Saunoris, 2019). The same assumptions about a negative correlation between income and proneness to informal activities were also made for agriculture (Vanek et al., 2014). In order to test this, we included the variable agricultural factor income into our equation.

One of the most frequently mentioned negative effects of the informal economy is that it lowers the official GDP, which serves as a basis for taxation (Williams & Horodnic, 2017; Horodnic & Williams, 2019). In this way, even the accumulation of inclusive wealth within a country is compromised (Managi & Kumar, 2018). Accordingly, we presume similar tendencies in agriculture where we expect to observe a negative effect of the informal economy in agriculture on the GVA.

One of the main treats of the informal economy are various forms of undeclared, illegal or shadow employment (Schneider, 2012; Camacho, Mariani & Pensieroso, 2017; Enste, 2018). Undeclared work is a crucial for the informal economy in agriculture (Williams, 2019). It is obvious the that informal economy and official employment are negatively related. Undeclared activities simply "consume" part of the available labour (Pfau-Effinger, 2009), thereby lowering official employment. Thus, we consider the share of employment in agriculture as an indicator of the size of the informal economy in agriculture.

Summing up, we expect:

Hypothesis 1 An increase in the total tax burden within a country increases the level of the informal economy in the agricultural sector, ceteris paribus.

Hypothesis 2 An increase in the share of imports of agricultural goods in overall imports of a country increases the level of the informal economy in the agricultural sector, ceteris paribus.

Hypothesis 3 An increase in subsidies (here treated as a regulation measure) for agriculture increases the level of the informal economy in agriculture, ceteris paribus.

Hypothesis 4 An increase in income in agriculture lowers the level of the informal economy in the agricultural sector, ceteris paribus.

Hypothesis 5 An increase in the informal economy in agriculture lowers Gross Value Added in the agricultural sector, ceteris paribus.

Hypothesis 6 An increase in the informal economy in agriculture lowers official employment in the agricultural sector.

2.3) The Model and test equation

The equation depicting the relationship between the latent variable (in our case – informal economy in agriculture, expressed as η) and the causing variables (in our case denoted by X_1 – total tax burden within the country; share of imported agricultural goods in respect of all import – X_2; share of operating subsidies in respect to agricultural factor income – X_3 and agricultural factor income within the country - X_4) is called a structural model (Dell'Anno, 2007). It is formulated as follows:

$$\eta = \alpha + \gamma_1 X_1 + \gamma_2 X_2 + \gamma_3 X_3 + \gamma_4 X_4 \qquad (1)$$

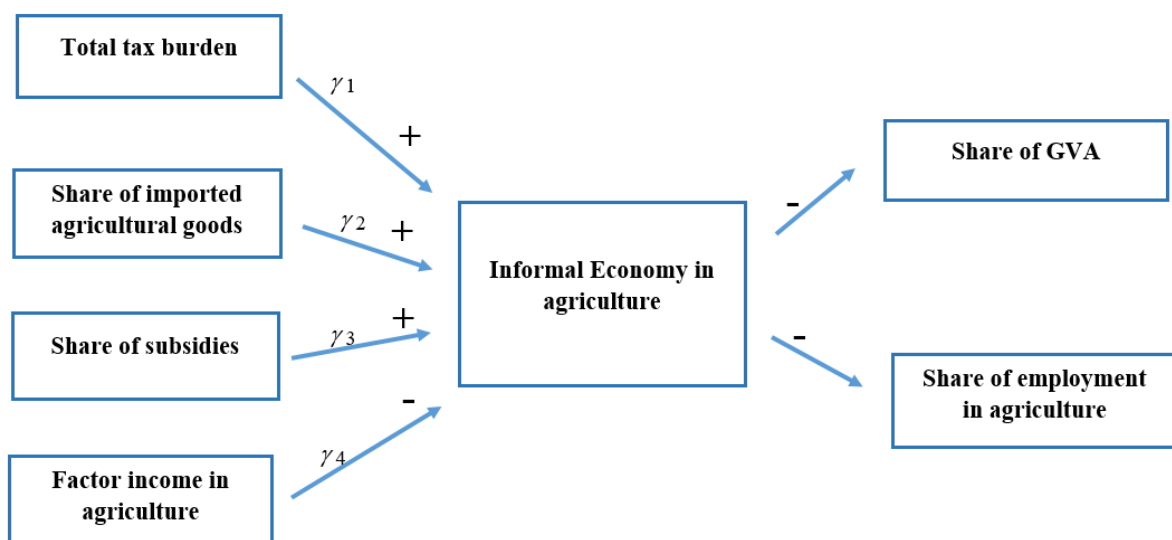A graphical representation of the model is shown in Figure 2.1:

Figure **2.1.** *The MIMIC model of the informal economy in agriculture*

It should be noted that the first three causes, i.e. *total tax burden, share of imports of agricultural products in overall imports* and *share of operating subsidies in factor income of agriculture* are maximizing causal variables and have a positive relationship in respect to the informal economy in agriculture, i.e. the bigger these values are, the higher is the informal economy level within a country. The last indicator, agricultural factor income, is a minimizing one and has a negative direct impact on the informal economy, i.e. with the increase of factor income, the informal economy decreases. To measure the size of the informal economy in the agricultural sector, are the share of gross value added and the share of employment in agriculture are used. Both of them are negatively related to the formal economy in agriculture, i.e. as the informal economy increases, both of these shares decrease.

3.) Mimic-procedure, data, and results

3.1) MIMIC procedure

This paper uses the Multiple Indicators and Multiple Causes (MIMIC) approach which explicitly considers various causes and effects of a country's informal economy (for the more detailed description of the approach, please see Vuletin, 2008; Dell'Anno & Schneider, 2009; Schneider, 2010; Alm & Embaye, 2013; Abdih & Medina, 2013; Williams & Schneider, 2016; and Medina, Jonelis, & Cangul, 2017). The MIMIC model exploits the interactions between observable causes and effects of the informal economy to estimate the size of the informal economy itself (see Loayza, 1996). The model can be described by two equations:

$$y = \lambda IE + \varepsilon \quad (2)$$

$$IE = \gamma' x + \upsilon \quad (3)$$

where the informal economy (IE) is the unobservable latent variable,

$y' = (y_1, \ldots, y_p)$ is a vector of indicators concerning the size of the informal economy,

$x' = (x_1, \ldots, x_q)$ is a vector of causes of the informal economy,

λ and γ are the (p x 1) and (q x 1) vectors of parameters, and ε and υ are the (p x 1) and scalar errors.

Equation (2) relates the informal economy to its indicators while equation (3) associates the informal economy with a set of observable causes. Assuming that the errors are normally distributed and mutually uncorrelated with $var(\upsilon) = \sigma_\upsilon^2$ and $cov(\varepsilon) = \Theta_\varepsilon$, the model can be solved for the reduced form as a function of observable variables by combining equations (2) and (3):

$$y = \pi x + \mu \qquad (4)$$

where $\pi = \lambda\gamma'$, $\mu = \lambda\upsilon + \varepsilon$ and $cov(\mu) = \lambda\lambda'\sigma_\upsilon^2 + \Theta_\varepsilon$.

As y and x are data vectors, equation (4) can be estimated by maximum likelihood using the restrictions implied in both the coefficient matrix π and the covariance matrix of the errors μ.

Since the reduced form parameters of equation (4) remain unaltered when λ is multiplied by a scalar and γ and σ_υ^2 are divided by the same scalar, the estimation of equations (2) and (3) requires a normalization of the parameters in equation (2). A convenient way to achieve this is to constrain one element of λ to some pre-assigned value. Since the estimates of λ and γ are obtained by constraining one element of λ to an arbitrary value, it is useful to standardize the regression coefficients $\hat{\lambda}$ and $\hat{\gamma}$ as $\hat{\lambda}^s = \hat{\lambda} \left(\frac{\hat{\sigma}_{IE}}{\hat{\sigma}_y}\right)$ and $\hat{\gamma}^s = \hat{\gamma} \left(\frac{\hat{\sigma}_x}{\hat{\sigma}_{IE}}\right)$.

The standardized coefficients measure the expected change (in standard-deviation units) of the dependent variable due to a one-standard-deviation change in a given explanatory variable when all other explanatory variables are held constant. Using the estimates of the γ^s vector and setting the error term υ to its mean value of 0, the predicted values for the informal economy can be estimated using equation (3). Then, by using information for one country from various independent studies regarding the specific size of the informal economy measured in percent of a known indicator, such as GDP, GVA, etc., the ordinal within-sample predictions for the size of the informal economy can be converted into percentages of GDP or other relevant measurement indicators in an analyzed area.

3.2) Data

We have chosen the EU-15 countries for our estimations[2]. The reasons for that are the availability of comparable data, collected under the same methodology (defined by Eurostat) and the same regulation regime in the agricultural sector of all countries analyzed. Regulation mechanisms are very important in respect of the formation of an informal economy (Enste, 2010; Mughal & Schneider, 2018) and inflict bias to the results if not represented properly in a model. All countries analyzed comply to the Common Agricultural Policy in running their respective agricultural sectors. Since the regulating regime is the same in all countries, it must not be included as a variable in the model, thus lowering the risk of compromised results. Another reason for limiting our research to EU-15 Member States relates to the method chosen. In order to get plausible MIMIC estimates, one must have quite a long data series (Lee, Cadogan & Chamberlain, 2013), so expanding our analysis to EU-28 countries was not possible.

The paper uses secondary data for MIMIC estimations that cover the years 1996 to 2019. The tax burden of a country (which is the sum of direct, indirect taxes and social contributions) is available from the Database (DB) Economy and finance (Eurostat, 2021a). Data on imports was retrieved from UNCTADStat (UNCTAD, 2021). For each year analyzed we applied US dollar to EUR exchange rate of 4.00 p.m. of 31st of December Greenwich time of the respective year. Exchange rates were taken from London interbank market to convert UNCTADStat data to EUR. The data for factor income, subsidies on products and other subsidies on products were extracted from Eurostat DB Economic Accounts for Agriculture (Eurostat, 2021b).

All data series were standardized. This procedure is necessary as one of our causal variables – factor income in agriculture is not relative but depends on the size of the country investigated. As EU-15 Member States and their respective agricultural sectors differ significantly in size (e.g. Germany and Luxembourg), the standardization of the data must be accomplished before the start of MIMIC estimations.

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[2] We undertook a panel estimation where the estimated coefficients for all countries over the time period overserved are the same.

3.3) Econometric MIMIC results

All our hypotheses were confirmed at the p < 0.01 statistical significance level. The maximum likelihood estimates of the equation weights derived by the MIMIC estimations are provided in table 3.1. All causal variables and indicators have the theoretically expected signs and are statistically significant. As all causal variables were standardized before estimation, the results are comparable and reflect the coefficients of the equation for the estimations of informal economy values in EU-15 agriculture.

Table 3.1. *The results of MIMIC estimations*

Model	1	2	3	4
Causes				
Total tax burden	0.4402683***	0.0005672***	0.2075169***	0.3024048***
Share of imported agricultural goods	0.8500109***	0.0029708***	0.6028301***	0.8486892***
Share of subsidies	0.309148***	0.0006061*	0.3018943***	0.4399368***
Agricultural factor income	-0.346099***		-0.34206***	
Agricultural factor income per capita		-0.026895***		-0.498469***
Indicators				
Share of GVA	-1.0	-1.0	-1.0	-1.0
Share of employment in agriculture	-0.906578***	4.088038***	4.055298***	-0.809072***
Statistical tests				
RMSEA	0.437	0.389	0.382	n.p.
Chi-squared (model vs. saturated)	209.39	166.11	213.75	n.p.
Chi-squared (baseline vs. saturated)	617.22	987.48	702.85	n.p.
Observations	360	360	360	360

Note: RMSEA = root mean square error of approximation.
n.p. – goodness of fit not passed;
***p < 0.01, **p < 0.05, *p < 0.1;

Source: Authors' calculations.

Considering our six hypotheses it is obvious that all six have been confirmed; especially those concerning causal relationships have a quantitatively important influence on the size and development of the informal economy/work in the agricultural sector of these 15 EU countries over 1996 to 2019. Although the first three models exhibit statistically highly significant results, the fourth model does not fully satisfy statistical reliability tests and thus is not considered for further calculations. The second and third models were rejected due to significant differences in indicator coefficients. So the first model was considered the best and was used for the calibration procedure and the estimation of informal economy levels of agricultural sectors of EU-15 Member States.

3.4) Calibration of the informal economy values and discussion

As MIMIC estimation provides relative values, a calibration procedure is required to convert relative values to absolute ones. The Medina and Schneider (2018) results about the size of the informal economy in 157 countries were used as references. We took the year 2003 as a starting point. Based on these base values for EU-15 Member States we can calculate the extent of their respective informal economies in agriculture.

Table **3.2** shows the most important results (absolute values of informal economies in agriculture in thousands of EUR, share in the official GVA, and a share of GDP) for the EU-15 countries in the sample over the period 1996–2019.

Table 3.2. *The development of the informal economy in EU-15 in 1996-2001 (Part 1, ranking based on share in GDP on average)*

Country	Indicator	Average	1996	1997	1998	1999	2000	2001
Luxembourg	IE in agriculture in 1000s EUR	11,754	11,185	10,901	11,107	10,830	10,903	11,319
	Share of the official GVA in agriculture	10.44%	9.43%	10.17%	9.09%	8.38%	9.00%	9.21%
	Share of the official GDP	0.04%	0.07%	0.06%	0.06%	0.05%	0.05%	0.05%
United Kingdom	IE in agriculture in 1000s EUR	1,420,831	1,416,064	1,297,467	1,142,151	1,128,445	1,095,591	1,123,571
	Share of the official GVA in agriculture	14.57%	12.47%	11.77%	11.30%	11.36%	11.08%	11.65%
	Share of the official GDP	0.07%	0.13%	0.09%	0.08%	0.07%	0.06%	0.06%
Sweden	IE in agriculture in 1000s EUR	326,262	291,775	298,638	289,442	250,011	284,892	283,097
	Share of the official GVA in agriculture	20.74%	17.56%	17.78%	18.20%	18.19%	18.19%	19.12%
	Share of the official GDP	0.10%	0.13%	0.13%	0.12%	0.10%	0.10%	0.10%
Austria	IE in agriculture in 1000s EUR	286,743	281,675	242,024	234,288	234,523	251,635	294,314
	Share of the official GVA in agriculture	10.73%	10.37%	9.64%	9.67%	9.73%	10.04%	10.94%
	Share of the official GDP	0.11%	0.15%	0.13%	0.12%	0.12%	0.12%	0.13%
Germany	IE in agriculture in 1000s EUR	3,775,955	3,459,195	3,209,554	2,799,687	2,726,129	3,275,183	3,877,101
	Share of the official GVA in agriculture	22.22%	20.89%	20.14%	18.47%	17.98%	18.90%	19.63%
	Share of the official GDP	0.15%	0.18%	0.16%	0.14%	0.13%	0.16%	0.18%
Finland	IE in agriculture in 1000s EUR	265,739	277,002	270,287	219,571	260,038	290,382	293,944
	Share of the official GVA in agriculture	19.46%	16.67%	16.37%	17.95%	17.57%	17.96%	17.59%
	Share of the official GDP	0.16%	0.27%	0.24%	0.18%	0.20%	0.21%	0.20%
Belgium	IE in agriculture in 1000s EUR	561,973	572,423	581,614	548,610	510,257	575,294	542,468
	Share of the official GVA in agriculture	23.33%	21.39%	21.10%	20.70%	20.52%	20.90%	20.71%
	Share of the official GDP	0.17%	0.26%	0.26%	0.24%	0.21%	0.22%	0.21%
Netherlands	IE in agriculture in 1000s EUR	1,188,660	1,229,132	1,332,755	1,162,048	1,127,854	1,172,612	1,196,786
	Share of the official GVA in agriculture	12.61%	13.59%	13.70%	13.32%	13.45%	13.07%	13.01%
	Share of the official GDP	0.21%	0.35%	0.36%	0.30%	0.27%	0.26%	0.25%
France	IE in agriculture in 1000s EUR	4,591,646	4,610,139	4,561,988	4,724,362	4,486,157	4,433,438	4,368,779
	Share of the official GVA in agriculture	15.80%	15.39%	15.32%	15.16%	14.86%	14.51%	14.44%
	Share of the official GDP	0.25%	0.36%	0.36%	0.35%	0.32%	0.30%	0.28%
Denmark	IE in agriculture in 1000s EUR	595,081	764,764	708,226	497,309	469,734	594,452	731,283
	Share of the official GVA in agriculture	21.32%	20.81%	20.30%	18.35%	18.05%	19.12%	19.87%
	Share of the official GDP	0.27%	0.52%	0.46%	0.31%	0.28%	0.33%	0.40%
Ireland	IE in agriculture in 1000s EUR	438,231	429,457	425,978	407,139	363,075	399,804	400,324
	Share of the official GVA in agriculture	20.66%	14.25%	14.32%	14.43%	14.29%	14.39%	15.41%
	Share of the official GDP	0.29%	0.72%	0.58%	0.51%	0.39%	0.37%	0.33%
EU-15 (unweighted average)	Share of the official GVA in agriculture	19.85%	18.17%	18.02%	17.73%	17.57%	17.69%	18.13%
	Share of the official GDP	0.31%	0.50%	0.46%	0.42%	0.39%	0.37%	0.37%
Spain	IE in agriculture in 1000s EUR	5,488,919	4,811,200	4,866,085	4,925,542	4,569,853	4,885,924	5,476,865
	Share of the official GVA in agriculture	22.77%	21.56%	21.33%	21.34%	21.09%	21.42%	22.18%
	Share of the official GDP	0.63%	0.95%	0.93%	0.89%	0.77%	0.75%	0.78%
Portugal	IE in agriculture in 1000s EUR	700,479	782,832	730,304	680,870	773,538	687,125	744,270
	Share of the official GVA in agriculture	24.02%	22.77%	23.57%	23.72%	23.54%	22.36%	23.12%
	Share of the official GDP	0.46%	0.81%	0.71%	0.62%	0.65%	0.54%	0.55%
Italy	IE in agriculture in 1000s EUR	7,994,675	7,763,513	7,934,262	7,791,604	8,011,125	7,842,690	8,332,278
	Share of the official GVA in agriculture	26.48%	26.99%	26.82%	26.22%	26.59%	26.49%	27.02%
	Share of the official GDP	0.55%	0.75%	0.72%	0.69%	0.68%	0.63%	0.64%
Greece	IE in agriculture in 1000s EUR	2,106,308	2,188,633	2,217,145	2,148,920	2,201,648	2,159,280	2,178,463
	Share of The official GVA in agriculture	32.57%	28.42%	27.96%	28.00%	28.01%	27.99%	27.98%
	Share of the official GDP	1.22%	1.90%	1.75%	1.67%	1.57%	1.51%	1.43%

Source: Authors' calculations.

Table 3.2. *The development of the informal economy in EU-15 in 2002-2008 (Part 2, ranking based on share in GDP on average)*

Country	Indicator	2002	2003	2004	2005	2006	2007	2008
Luxembourg	IE in agriculture in 1000s EUR	13,102	11,167	11,804	11,607	11,714	12,185	11,756
	Share of the official GVA in agriculture	7.99%	9.80%	8.05%	11.59%	11.78%	9.72%	10.50%
	Share of the official GDP	0.05%	0.04%	0.04%	0.04%	0.03%	0.03%	0.03%
United Kingdom	IE in agriculture in 1000s EUR	1,206,821	1,242,854	1,233,578	1,234,787	1,241,477	1,296,574	1,440,810
	Share of the official GVA in agriculture	11.72%	12.20%	12.15%	17.02%	17.60%	16.91%	16.88%
	Share of the official GDP	0.06%	0.07%	0.06%	0.06%	0.06%	0.06%	0.07%
Sweden	IE in agriculture in 1000s EUR	325,499	320,134	293,448	308,180	348,706	394,866	344,649
	Share of the official GVA in agriculture	19.29%	18.60%	17.98%	24.88%	24.19%	23.67%	23.98%
	Share of the official GDP	0.11%	0.11%	0.09%	0.10%	0.10%	0.11%	0.10%
Austria	IE in agriculture in 1000s EUR	272,196	268,017	281,326	277,204	299,934	333,151	323,759
	Share of the official GVA in agriculture	10.85%	10.80%	10.79%	12.54%	12.52%	11.97%	11.69%
	Share of the official GDP	0.12%	0.12%	0.12%	0.11%	0.11%	0.12%	0.11%
Germany	IE in agriculture in 1000s EUR	2,761,876	2,468,507	3,580,752	3,152,109	3,300,338	4,030,728	4,281,904
	Share of the official GVA in agriculture	17.12%	16.70%	19.20%	24.60%	25.06%	25.14%	25.23%
	Share of the official GDP	0.13%	0.11%	0.16%	0.14%	0.14%	0.16%	0.17%
Finland	IE in agriculture in 1000s EUR	284,494	275,070	263,706	272,778	264,268	301,096	267,634
	Share of the official GVA in agriculture	17.41%	17.60%	16.89%	17.80%	24.81%	21.30%	22.25%
	Share of the official GDP	0.19%	0.18%	0.17%	0.17%	0.15%	0.16%	0.14%
Belgium	IE in agriculture in 1000s EUR	487,932	525,982	555,132	504,950	615,662	657,951	537,337
	Share of the official GVA in agriculture	20.49%	21.40%	21.29%	22.75%	24.29%	25.38%	25.39%
	Share of the official GDP	0.18%	0.19%	0.19%	0.16%	0.19%	0.19%	0.15%
Netherlands	IE in agriculture in 1000s EUR	1,085,217	1,140,271	1,025,422	1,054,664	1,274,056	1,252,289	1,125,167
	Share of the official GVA in agriculture	12.31%	12.70%	12.26%	12.18%	13.12%	13.20%	12.78%
	Share of the official GDP	0.22%	0.22%	0.19%	0.19%	0.22%	0.20%	0.17%
France	IE in agriculture in 1000s EUR	4,328,804	4,235,790	4,228,978	3,929,861	4,345,495	4,909,372	4,243,926
	Share of the official GVA in agriculture	14.39%	14.70%	13.90%	13.64%	16.81%	16.80%	15.94%
	Share of the official GDP	0.27%	0.26%	0.25%	0.22%	0.24%	0.25%	0.21%
Denmark	IE in agriculture in 1000s EUR	516,451	499,662	546,476	535,750	592,873	591,597	367,430
	Share of the official GVA in agriculture	17.83%	17.40%	17.61%	23.41%	23.69%	22.67%	20.55%
	Share of the official GDP	0.27%	0.26%	0.27%	0.25%	0.26%	0.25%	0.15%
Ireland	IE in agriculture in 1000s EUR	379,818	387,128	406,774	472,371	413,127	454,853	404,687
	Share of the official GVA in agriculture	15.68%	15.40%	15.40%	24.03%	28.45%	26.00%	28.05%
	Share of the official GDP	0.28%	0.27%	0.26%	0.28%	0.22%	0.23%	0.22%
EU-15 (unweighted average)	Share of the official GVA in agriculture	17.64%	17.73%	17.65%	20.21%	22.01%	21.54%	21.64%
	Share of the official GDP	0.33%	0.32%	0.31%	0.29%	0.27%	0.27%	0.25%
Spain	IE in agriculture in 1000s EUR	5,384,904	6,062,520	5,855,728	5,316,145	5,268,096	6,023,961	5,306,444
	Share of the official GVA in agriculture	22.03%	22.20%	22.07%	21.67%	24.41%	23.93%	23.23%
	Share of the official GDP	0.72%	0.76%	0.68%	0.57%	0.52%	0.56%	0.48%
Portugal	IE in agriculture in 1000s EUR	680,933	695,604	773,826	700,681	698,887	670,643	736,314
	Share of the official GVA in agriculture	22.33%	22.20%	22.95%	23.58%	23.05%	24.61%	25.93%
	Share of the official GDP	0.48%	0.48%	0.51%	0.44%	0.42%	0.38%	0.41%
Italy	IE in agriculture in 1000s EUR	8,112,585	8,024,307	8,369,946	7,083,390	7,062,359	6,909,626	7,098,998
	Share of the official GVA in agriculture	26.91%	26.10%	25.90%	25.06%	25.43%	24.78%	24.88%
	Share of the official GDP	0.60%	0.58%	0.58%	0.47%	0.45%	0.43%	0.43%
Greece	IE in agriculture in 1000s EUR	2,175,177	2,203,853	2,193,849	2,157,391	2,080,510	2,249,360	2,042,869
	Share of The official GVA in agriculture	28.32%	28.20%	28.34%	28.43%	34.88%	37.07%	37.36%
	Share of the official GDP	1.33%	1.23%	1.13%	1.08%	0.95%	0.97%	0.84%

Source: Authors' calculations.

Table 3.2. *The development of the informal economy in EU-15 in 2009-2014 (Part 3, ranking based on share in GDP on average)*

Country	Indicator	2009	2010	2011	2012	2013	2014
Luxembourg	IE in agriculture in 1000s EUR	11,933	11,766	12,610	11,952	11,780	11,824
	Share of the official GVA in agriculture	14.77%	12.09%	14.00%	10.65%	11.46%	9.30%
	Share of the official GDP	0.03%	0.03%	0.03%	0.03%	0.03%	0.02%
United Kingdom	IE in agriculture in 1000s EUR	1,324,917	1,357,234	1,618,030	1,668,583	1,733,035	1,828,483
	Share of the official GVA in agriculture	17.77%	17.38%	16.59%	16.02%	16.01%	15.31%
	Share of the official GDP	0.08%	0.07%	0.08%	0.08%	0.08%	0.08%
Sweden	IE in agriculture in 1000s EUR	253,659	349,629	375,829	383,579	349,802	361,783
	Share of the official GVA in agriculture	24.59%	22.58%	22.13%	21.38%	21.52%	21.28%
	Share of the official GDP	0.08%	0.09%	0.09%	0.09%	0.08%	0.08%
Austria	IE in agriculture in 1000s EUR	257,473	297,775	339,713	325,393	290,579	274,298
	Share of the official GVA in agriculture	11.44%	11.58%	11.26%	10.91%	10.55%	10.05%
	Share of the official GDP	0.09%	0.10%	0.11%	0.10%	0.09%	0.08%
Germany	IE in agriculture in 1000s EUR	2,913,521	4,291,682	5,075,551	4,573,532	5,306,447	5,158,462
	Share of the official GVA in agriculture	23.02%	25.38%	25.62%	25.42%	24.97%	24.76%
	Share of the official GDP	0.12%	0.17%	0.19%	0.17%	0.19%	0.18%
Finland	IE in agriculture in 1000s EUR	297,925	309,637	274,905	279,794	271,070	266,668
	Share of the official GVA in agriculture	22.15%	21.43%	21.81%	20.88%	21.23%	20.96%
	Share of the official GDP	0.16%	0.16%	0.14%	0.14%	0.13%	0.13%
Belgium	IE in agriculture in 1000s EUR	500,699	643,845	548,824	677,334	557,458	529,389
	Share of the official GVA in agriculture	25.30%	25.84%	26.07%	25.12%	24.31%	24.71%
	Share of the official GDP	0.14%	0.18%	0.15%	0.18%	0.14%	0.13%
Netherlands	IE in agriculture in 1000s EUR	955,334	1,217,368	1,036,776	1,112,630	1,279,666	1,212,866
	Share of the official GVA in agriculture	11.98%	12.70%	12.23%	12.25%	12.62%	12.20%
	Share of the official GDP	0.15%	0.19%	0.16%	0.17%	0.19%	0.18%
France	IE in agriculture in 1000s EUR	3,423,005	4,769,529	4,974,960	4,994,099	4,244,654	4,811,759
	Share of the official GVA in agriculture	15.39%	17.12%	17.09%	16.64%	16.09%	16.60%
	Share of the official GDP	0.18%	0.24%	0.24%	0.24%	0.20%	0.22%
Denmark	IE in agriculture in 1000s EUR	359,351	607,629	657,117	914,210	652,468	691,470
	Share of the official GVA in agriculture	20.19%	22.80%	23.51%	24.35%	23.30%	23.24%
	Share of the official GDP	0.16%	0.25%	0.27%	0.36%	0.25%	0.26%
Ireland	IE in agriculture in 1000s EUR	301,314	366,089	469,451	432,616	446,764	460,169
	Share of the official GVA in agriculture	36.59%	26.36%	25.12%	24.26%	22.32%	21.17%
	Share of the official GDP	0.18%	0.22%	0.27%	0.25%	0.25%	0.24%
EU-15 (unweighted average)	Share of the official GVA in agriculture	22.21%	21.70%	21.73%	21.38%	21.11%	20.77%
	Share of the official GDP	0.23%	0.26%	0.26%	0.28%	0.28%	0.28%
Spain	IE in agriculture in 1000s EUR	4,862,718	5,398,379	5,119,508	5,113,677	5,335,861	5,381,719
	Share of the official GVA in agriculture	23.21%	24.14%	24.09%	23.97%	23.59%	23.50%
	Share of the official GDP	0.45%	0.50%	0.48%	0.50%	0.52%	0.52%
Portugal	IE in agriculture in 1000s EUR	628,282	675,776	563,755	597,120	662,319	635,972
	Share of the official GVA in agriculture	23.43%	24.70%	23.71%	25.92%	24.96%	24.50%
	Share of the official GDP	0.36%	0.38%	0.32%	0.35%	0.39%	0.37%
Italy	IE in agriculture in 1000s EUR	6,920,848	6,386,656	7,396,037	7,780,170	9,191,366	8,677,693
	Share of the official GVA in agriculture	26.45%	24.34%	25.72%	25.97%	27.51%	28.08%
	Share of the official GDP	0.44%	0.40%	0.45%	0.48%	0.57%	0.53%
Greece	IE in agriculture in 1000s EUR	2,080,573	2,183,086	2,000,759	2,087,825	1,922,290	1,986,554
	Share of The official GVA in agriculture	36.86%	37.09%	36.94%	36.91%	36.18%	35.87%
	Share of the official GDP	0.88%	0.97%	0.98%	1.11%	1.07%	1.12%

Source: Authors' calculations.

Table 3.2. *The development of the informal economy in EU-15 in 2015-2019 (Part 4, ranking based on share in GDP on average)*

Country	Indicator	2015	2016	2017	2018	2019
Luxembourg	IE in agriculture in 1000s EUR	12,296	11,867	12,065	12,269	12,160
	Share of the official GVA in agriculture	12.21%	11.81%	10.00%	9.77%	9.68%
	Share of the official GDP	0.02%	0.02%	0.02%	0.02%	0.02%
United Kingdom	IE in agriculture in 1000s EUR	1,749,349	1,541,611	1,790,265	1,637,376	1,750,864
	Share of the official GVA in agriculture	15.11%	15.59%	15.44%	15.27%	15.15%
	Share of the official GDP	0.07%	0.06%	0.08%	0.07%	0.07%
Sweden	IE in agriculture in 1000s EUR	370,739	335,055	386,464	297,365	333,036
	Share of the official GVA in agriculture	20.06%	20.41%	19.99%	20.63%	21.44%
	Share of the official GDP	0.08%	0.07%	0.08%	0.06%	0.07%
Austria	IE in agriculture in 1000s EUR	261,887	296,476	329,838	314,652	299,710
	Share of the official GVA in agriculture	9.68%	10.36%	10.22%	10.07%	9.76%
	Share of the official GDP	0.08%	0.08%	0.09%	0.08%	0.08%
Germany	IE in agriculture in 1000s EUR	3,400,048	3,511,536	4,758,100	3,513,736	5,197,249
	Share of the official GVA in agriculture	23.39%	22.75%	23.35%	22.00%	23.53%
	Share of the official GDP	0.11%	0.11%	0.15%	0.10%	0.15%
Finland	IE in agriculture in 1000s EUR	219,866	224,299	225,611	217,848	249,851
	Share of the official GVA in agriculture	20.26%	19.49%	19.37%	19.45%	17.84%
	Share of the official GDP	0.10%	0.10%	0.10%	0.09%	0.10%
Belgium	IE in agriculture in 1000s EUR	594,627	524,150	572,757	523,077	599,575
	Share of the official GVA in agriculture	24.84%	24.32%	24.02%	24.62%	24.49%
	Share of the official GDP	0.14%	0.12%	0.13%	0.11%	0.13%
Netherlands	IE in agriculture in 1000s EUR	1,228,723	1,269,863	1,445,231	1,261,364	1,329,748
	Share of the official GVA in agriculture	12.10%	11.92%	12.31%	11.76%	11.80%
	Share of the official GDP	0.18%	0.18%	0.20%	0.16%	0.16%
France	IE in agriculture in 1000s EUR	5,035,679	4,364,764	5,060,467	5,748,729	5,364,763
	Share of the official GVA in agriculture	17.00%	16.61%	16.97%	17.04%	16.81%
	Share of the official GDP	0.23%	0.20%	0.22%	0.24%	0.22%
Denmark	IE in agriculture in 1000s EUR	459,409	448,014	691,741	520,562	863,972
	Share of the official GVA in agriculture	21.17%	21.30%	22.22%	20.31%	29.58%
	Share of the official GDP	0.17%	0.16%	0.23%	0.17%	0.28%
Ireland	IE in agriculture in 1000s EUR	480,105	490,496	612,465	546,868	566,684
	Share of the official GVA in agriculture	19.42%	20.79%	19.39%	20.65%	19.72%
	Share of the official GDP	0.18%	0.18%	0.20%	0.17%	0.16%
EU-15 (unweighted average)	Share of the official GVA in agriculture	20.20%	20.53%	20.17%	20.12%	20.67%
	Share of the official GDP	0.27%	0.26%	0.27%	0.26%	0.27%
Spain	IE in agriculture in 1000s EUR	5,647,575	6,366,541	6,712,541	6,621,352	6,420,921
	Share of the official GVA in agriculture	23.02%	23.30%	23.27%	23.04%	22.88%
	Share of the official GDP	0.52%	0.57%	0.58%	0.55%	0.52%
Portugal	IE in agriculture in 1000s EUR	684,024	732,369	738,307	747,502	790,236
	Share of the official GVA in agriculture	23.76%	27.41%	24.74%	24.85%	24.75%
	Share of the official GDP	0.38%	0.39%	0.38%	0.36%	0.37%
Italy	IE in agriculture in 1000s EUR	8,666,992	8,769,637	8,883,343	9,590,779	9,271,986
	Share of the official GVA in agriculture	26.38%	27.97%	27.39%	28.32%	28.16%
	Share of the official GDP	0.52%	0.52%	0.51%	0.54%	0.52%
Greece	IE in agriculture in 1000s EUR	2,097,666	1,838,662	2,060,047	1,975,518	2,121,306
	Share of The official GVA in agriculture	34.54%	33.94%	33.87%	34.04%	34.54%
	Share of the official GDP	1.19%	1.06%	1.16%	1.10%	1.16%

Source: Authors' calculations.

The mean value for the size of the informal economy of the EU-15 countries over the sample period is 19.85% of the official GVA of agriculture, and the median is 20.74%, so there is not a strong deviation between the two.

The countries with the smallest informal economies are Luxembourg (10.44%), Austria (10.73%) and Netherlands (12.61% of GVA). The countries with the biggest size of the informal economy in agriculture in EU-15 are Greece (32.57%), Italy (26.48%) and Portugal (24.02% of GVA). The development of the biggest, the lowest and the EU-15 average shares are presented in figure **3.1.**
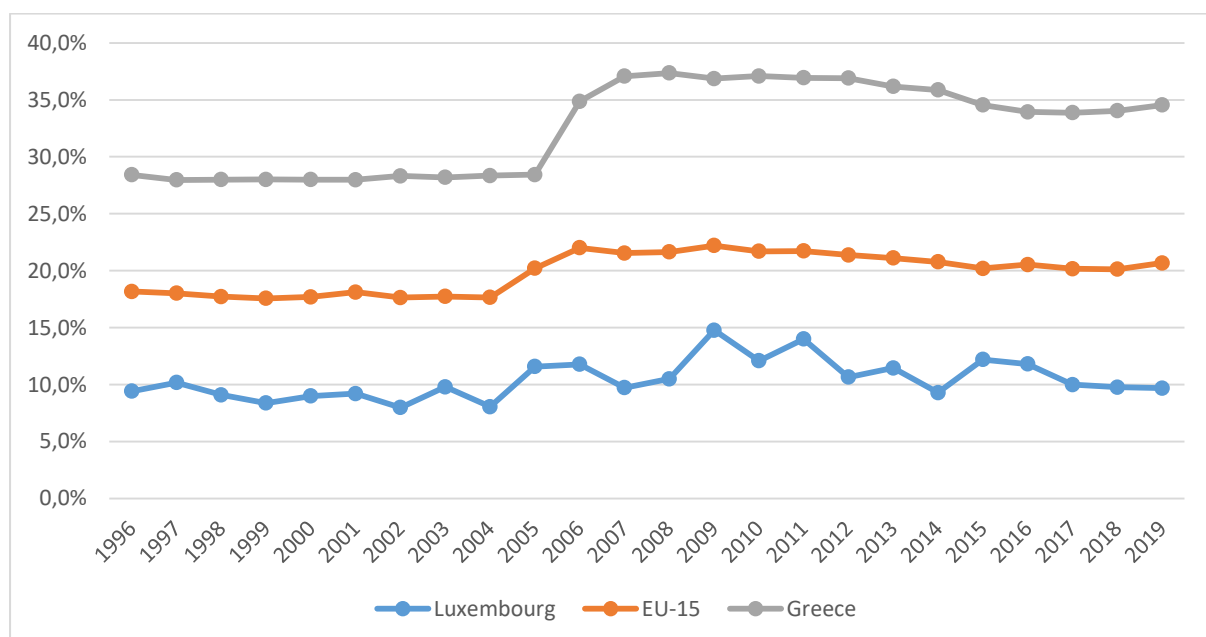
Figure 3.1. *The development of the informal economy in agriculture of the countries, having the biggest, the smallest share of informal economy (in percent of GVA) and the EU-15 unweighted average*

A substantial increase in the informal economy in agriculture can be observed during 2005-2007.[3] After a substantial increase in these years the informal economy settled at a higher level until 2019. The higher level of the informal economy in the agriculture sector is somewhat more distinct in countries with a larger share of the informal economy. Additionally, it can be noted that the bigger was the initial share of the informal economy in

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[3] This corresponds with CAP reform, i.e. the onset of decoupling of financial support. Although the reform was introduced in 2003, all its mechanisms took force with some lag and showed its full potential after 2-3 years (Sorrentino & Henke, 2016). These findings correspond to insights of Swinnen (2011) about flaws cemented in the principles of Fischler's reform. There are also more arguments about deficiencies of the current CAP modification (shielding farmers from healthy competition, stimulating a misbalance in supply and demand leading to overproduction of particular crops, ineffective allocation of resources, etc.) and its implementation mechanisms (see Lovec & Erjavec, 2013; Daugbjerg & Swinbank, 2016; Morkunas & Labukas, 2020).

agriculture, the bigger was the increase of the informal economy in agriculture due to decoupling.

It can be noticed, that in general the picture of informal economy in agriculture does not fully mirror the tendencies of informal economy in a country overall. Shares of the informal economy in agriculture are higher than those of the whole economies in the countries analyzed (where the exact shares for each EU-15 Member States can be found in Schneider, 2020). Apart from the factors inducing informal activities in the whole economy, the higher values of the informal economy in agriculture have specific causes which pertain to for this sector only:

First of all, the presence of family work, which is a backbone of European farming (Wuepper, Wimmer & Sauer, 2021), is a key factor. The bigger is the share of family work, the bigger is the potential for informal economy due to difficulties in separating the internal untaxed work, the work devoted to household activities and the work done in farming.

Second and in addition, due to strong family and social bonds, a lot of help is provided by relatives and friends, but it is not accounted for – this is often called neighbors' help in Austria, Switzerland and Germany. Moreover, if an agricultural sector is characterized by a significant presence of large agricultural entities (e.g. United Kingdom, Luxembourg, Denmark), requiring labor input that cannot be satisfied by family effort, it is likely to have a lower level of the informal economy as hired persons will do the job.

Third, and another objective reason for larger figures of informal economy in agriculture compared to the economy overall, is the exposure of agriculture to possible natural disasters, e.g. floods, droughts, frosts, diseases, etc. Even when part of income losses due to a disaster is compensated by public "rescue" funds, this means, that if a natural disaster occurs, for example at the end of the growing season, this leads to lower yields and correspondingly to lower output while intermediate consumption (with all its informal components) stays almost the same. Such a situation leads to an increase in the relative share of the informal economy in respect to the GVA when, in absolute values, the level of the informal economy remains constant.

The fourth reason which pushes some of the agricultural activities behind the informal economy threshold is related to various niche and part-time farming practices. As an example, consider cork production. The oak bark renews itself over 7-8 years, so in order to

survive during the other periods, farmers typically pursue another casual job (Sierra-Pérez, Boschmonart-Rives, & Gabarrell, 2015). They do not quit their main job but do engage in agricultural activities in parallel to their main job. This leads not only to affording help from relatives/friends/neighbors etc., but also to undeclared work. In some cases, farmers stay in the informal economy, because going formal would create difficulties, f.i. additional inspections, etc. In most countries it is forbidden to work more than a predetermined number of hours per week. So it is illegal to officially add 25 hours worked in farm harvesting cork to 40 hours worked in a main job. This explains slight differences in the levels of the informal economy in agriculture between Portugal (having bigger share of niche production) and Spain, whereas their levels of the informal economy in the whole economy are almost the same.

The fifth reason for discrepancies between the levels of the informal economy overall and the levels of the informal economy in agriculture is related to different labor intensity in agriculture in different EU-15 Member States. Pork or dairy farming require much more labor input than wheat or canola growing. So countries in which the share of crops in the agricultural portfolio is bigger (France) tend to display lower levels of informal economic activities in agriculture than in countries in which diary and/or pork production dominate agricultural production (Ireland, Denmark).

4.) A disaggregation of informal work in agriculture

The results presented in the previous chapter highlight the economic value of informal work. Since the informal work in the agricultural sector is not monitored or registered with the state, nothing is known about how much or which types of employment have created this value and what is the employment potential. In this section, more in-depth insight is provided into both the extent to which different types of work, namely entrepreneurial work, work undertaken in the context of an employment relationship, work by family members and household work, are conducted on an informal basis, as well as the structure of the informal agricultural labour market in each member state of EU-15.

The prevalence of informal work and the its different types were calculated on the basis of Labor Force data of the Farm Structure Survey 2013 (Eurostat, 2021c, see Annex Table **4.1.**) and the percentage of undeclared work by type of employment in the private sector (Williams et al., 2017, p. 15, see Annex Table **4.2.**). For our estimates of housework in EU-15 Member States, we use an average of the household work on a farm, i.e. 31% (Rossier

& Ressig, 2014). A limitation of this calculation is that it is based on secondary data and is not evidenced through primary data analysis. Furthermore, the informal work corresponding to the agricultural sector is calculated on evidence of the private sector because the sample sizes for the agricultural sector in the European Working Conditions Survey are quite small indeed in some EU-15 Member States. On that account, the data from Williams & Horodnic (2018) has not been used. Moreover, Williams & Horodnic (2018) analyze the undeclared work in the agricultural sector, namely the 'agriculture, forestry and fishing' sector (NACE Rev. 2) and also do not consider the different types of work: from entrepreneurial work via family members to employment or household work.

There are significant differences in the size of informal work in the agricultural sector between EU-15 Member States. The highest levels of informal work (relative to total agricultural labour input) can be observed in Denmark, Finland, Luxembourg and Ireland. The lowest share of informal work – and thus below the EU-15 average – in terms of agricultural labour input have been found in the United Kingdom (17.62%), Italy (18.54%), Belgium (19.51%) and Netherlands (25.95% each); for details, see Table **4.3.**

Table 4.3. *Informal work in the agricultural sector (%), 2013*

Country	Types of informal work in %					Total informal work in % of employment in agriculture
	Enterpreneurial work	Work by family members	Employment	Household work	Sum	
Austria	12.53	35.72	1.19	50.56	100.00	31.45
Belgium	14.12	15.52	15.70	54.66	100.00	19.51
Denmark	56.86	26.87	2.13	14.14	100.00	46.93
Finland	43.61	27.72	1.29	27.37	100.00	45.40
France	49.31	24.55	9.12	17.02	100.00	26.91
Germany	34.03	28.23	1.27	36.47	100.00	29.92
Greece	17.11	33.12	1.33	48.44	100.00	25.99
Ireland	41.84	23.74	0.81	33.61	100.00	38.61
Italy	8.42	7.19	7.56	76.83	100.00	18.54
Luxembourg	43.20	28.58	1.36	26.85	100.00	41.98
Netherlands	30.37	24.98	1.38	43.27	100.00	25.95
Portugal	24.02	32.11	0.58	43.28	100.00	35.64
Spain	28.70	24.51	4.80	41.98	100.00	26.33
Sweden	28.68	28.97	3.55	38.80	100.00	28.31
United Kingdom	15.96	22.18	2.05	59.80	100.00	17.62
EU-15 (unweighted average)	26.08	24.33	3.96	45.62	100.00	25.96

Source: Authors' calculation based on Farm Structure Survey 2013 (Eurostat, 2021c) and percentages of undeclared work by type of employment in the private sector by Williams et al. (2017, p. 15).

As Table **4.3.** shows, there are also differences in the scale of the informal work across different types of employment in the agricultural sector:

- The proportion of entrepreneurial work which is informal by MS ranges from 56.90% of all entrepreneurial work in Denmark, 49.55% in France and 43.63% in Finland, to just 14.42% in Belgium, 12.54% in Austria and 8.53% in Italy;

- The proportion of work conducted in the context of an employment relationship which is informal varies from 13.92% in Belgium, 8.69% in France and 7.28% in Italy, to just 1.14% in Austria, 1.14% in Greece, 0.78% in Ireland and 0.56% in the Portugal;

- The proportion of work by family members which is informal breaks down from 35.74% in Austria, 33.19% in Greece and 32.12% in Portugal, to 22.19% in United Kingdom, 15.84% in Belgium and 7.28% in Italy; and

- The proportion of household work which is informal has a range from 77.85% in Italy, 59.82% in the United Kingdom and 55.82% in Belgium, to 26.86% in Luxembourg, 17.11% in France and 14.15% in Denmark.

Examining the structure of the informal agricultural labour market in the EU-15, 45.80% of all informal work occurs in the household, 26.18% is entrepreneurial work, 24.43% is family work and 3.59% is in the context of an employment relationship. This masks considerable national variations, e.g., (i) countries where the majority of informal work is conducted through entrepreneurial work include Belgium, France, Finland, Luxembourg and Ireland; while that (ii) where over half of all informal work is conducted in the context of the household is in Austria, Belgium, United Kingdom and Italy. The structure of the informal labour market, therefore, displays very marked differences across the EU-15. Common is the prevalence of family work that reflects the dominance of family farms in the EU-15 agricultural sector.

5.) Summary and policy conclusions

Summarizing we can say that the informal economy in the agricultural sector of the EU-15 MS did not decrease in the period analyzed, in contrast to the overall levels of the informal economy in countries investigated. The informal economy in EU-15 Member States increased even slightly during the period considered, namely from the 18,17% in 1996 to 20.67% of GVA in 2019. The main contributing factor to this development was the change in the subsidization regime, namely decoupling of support introduced in 2003. This phenomenon not only increased the level of the informal economy in agriculture but also was responsible for a divergent development path, where countries with bigger shares of the informal economy in agriculture started to display are significantly higher increase in the size of the informal economy than that of more moderate countries. Our findings reveal the impact of family work on the development of the informal economy in agriculture. Although we do not discuss the importance of family farming for rural development in the EU (Kasimis

& Papadopoulos, 2013), it is clear that the bigger is the share of family work, the bigger is the potential for an informal economy in agriculture.

Due to the specifics of agriculture it is very unlikely the agricultural sector will show equal or at least comparable levels of informal economic activities as the economy overall. Both policy makers and scientists are bound to acknowledge a higher level of the informal economy in agriculture than in the whole economy. Some of the reasons for this are truly objective and are not under farmers' control.

The first policy conclusion is, that those causal factors that are typically used to measure the informal economy overall, such as tax burden, share of subsidies, share of imports or income levels, are also relevant to the agricultural sector and can be used in order to estimate the size of the informal economy in agriculture.

Secondly, informal economy may also be considered in the current reform of the Common Agricultural Policy and its financial mechanisms. The design of the rules and measures should correspond to the role of informal economy.

The third conclusion concerns a maximum limit of working hours per week. Consideration should be given to providing an exemption for farmers and applying their working time limit to longer periods (e.g. to a quarter or half a year). This is a motivation for farmers to officially declare their working time during peak agricultural activities (land preparation, harvesting, etc.) and also implies 'new, innovative' models dealing with such working peaks.

Finally, we conclude that our paper is a first attempt to measure the size and development of the informal economy and/or work in the agricultural sector in 15 EU countries. We attained some first and preliminary plausible results, but, in order to measure the immeasurable a bit more exactly and in more detail, a lot of work has still to be done.

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Annex

Table 4.1. *Labour force (persons) of the Farm Structure Survey, 2013*

Country	Labour force (persons), 2013			
	Sole holder directly employed by the farm	Members of sole holders' family, excluding the holder, directly employed by the farm	Non-family farm labour force, directly employed by the farm on a regular basis (employees)	Total
Austria	134,890	173,780	28,910	337,580
Belgium	32,730	26,560	15,550	74,840
Denmark	36,420	17,210	25,950	79,580
Finland	52,650	48,390	18,980	120,020
France	353,610	137,440	416,030	907,080
Germany	279,760	249,520	176,970	706,250
Greece	708,700	504,720	25,070	1,238,490
Ireland	139,100	113,180	17,240	269,520
Italy	995,810	996,880	146,370	2,139,060
Luxembourg	1,980	1,810	1,160	4,950
Netherlands	63,110	70,200	59,820	193,130
Portugal	253,490	312,340	60,560	626,390
Spain	793,380	643,810	345,490	1,782,680
Sweden	61,960	46,780	21,970	130,710
United Kingdom	173,970	147,150	110,140	431,260
EU-15 (unweighted average)	4,081,560	3,489,770	1,470,210	9,041,540

Source: Farm Structure Survey 2013 (Eurostat, 2021c).

Table 4.2. *Undeclared work in the private sector (%) of EU-15, LIM estimates 2013*

Country	% of undeclared labour input in the private sector		
	Self employment	Family work	Employee
Austria	9.90	21.90	4.20
Belgium	6.50	8.80	13.20
Denmark	58.90	58.90	3.00
Finland	45.40	31.40	3.60
France	34.90	44.70	5.20
Germany	25.80	24.00	1.50
Greece	7.80	21.20	14.60
Ireland	31.40	21.90	4.70
Italy	3.40	2.90	17.20
Luxembourg	45.60	33.00	2.40
Netherlands	24.20	17.90	1.15
Portugal	21.20	23.00	2.10
Spain	17.20	18.10	6.20
Sweden	17.30	23.15	5.70
United Kingdom	7.00	11.50	1.40

Source: Williams et al. (2017, p. 15).