

Exploring the factors that influence the market value of small farms in Romania*

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Abstract

The study aims to analyse factors that influence the market value of small farms in Romania. The research methodology involved a Gibbs sampling and updates of the Metropolis-Hastings algorithm. Findings demonstrate distinction in the estimated market values of small farms and their features across households and explain the role and influence of socio-economic, institutional, and marketing factors. The impact of the independent variables shows that the level of education, support for agri-environmental activities, unfavourable areas and sales to processing plants, have positively influenced the estimated market value of small farms.

Keywords: market value, marketing channels, Bayesian analysis, agri-food marketing

JEL Classification: C11, D30, Q13

Introduction

Globalisation, demographic change, market liberalisation, information technology, climate change, and economic crises are affecting the work of small farmers around the world. The specialised literature in the field addresses the importance of trade for the development of agriculture and economy, the role of agriculture in the economic development of Romania, the importance of marketing and agricultural reforms for the activity of small farmers, and the role of institutions and financial measures in improving the lives of those living in rural areas.

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A relatively small body of literature has documented aspects related to small farms with Bayesian analysis in general, and Gibbs sampling as an update of the Metropolis-Hastings algorithm, respectively. Balcombe and Tiffin (2010) discovered a reversible jump approach to the Bayesian Model Averaging for the Probit model with uncertain regressors in their research for Organic Production and Computer Usage among UK farmers. Holloway et al. (2002) emphasised two Bayesian models that were tested during the last twenty years to implement truncated and discrete-choice data, namely, the spatially autoregressive Probit (SARP) model and Markov-chain Monte Carlo method (MCMC) using normal data and outline the Gibbs sampling algorithm.

This study aims to provide a one at a time and in a particular order method to the Metropolis-Hastings sampling algorithm and Gibbs sampling as an update algorithm. This aspect represents a novelty that can bring additional value to the literature.

The present study analyses the main factors of market value of small farms by adopting a Bayesian approach to a selected survey dataset from all historical regions of Romania. Many agricultural economists investigate small farm production and commonly emphasise market prices, farmer education, distribution channels, marketing channels and related socio-economic factors thought to influence on-farm outputs. In our scientific approach, we attempt to estimate the market value of small farms in Romania based on four pillars: socio-economic factors, agricultural support and investment, marketing forces and marketing channels. However, it is noted that some authors analyse agricultural production using a Bayesian analysis with a design matrix that incorporates all data from the explanatory variables, (i.e. the factors that may influence crop), a vector of regression coefficients which measures how much of the variation of crop yield is accounted for by the explanatory variables, and independent Gaussian noise terms (Wang et al., 2019). Moreover, we found that some authors (Moglia et al. 2018) outline a Bayesian Network model for exploring the relative likelihood of technology implementation concerning a specific category of crop (i.e. rice-based agricultural systems) as well as the influence of diverse sensitivities of technology. Additionally, some authors pointed out that the mean output of a specific farmer can be assessed with a Bayesian Stochastic Frontier Model (Chakuri et al. 2022), which implies some errors of measurement, and a non-negative error term that represents the technical inefficiency (i.e. the quantity by which the firms output decrees).

1. Literature review

Farmers living far from road infrastructure and agri-food markets tend to market a smaller share of their production. On the other hand, changes in consumer behaviour and new technologies have led to an increase in the role of supermar-

kets and food-processing industries in the distribution of agri-food products from small farms. In 2019, the trade of food retailers in Romania exceeded a record level of 100 billion lei (over 21 billion euros). Small farmers are affected by such changes and need to adapt to these growing markets, as supermarket chains require certain distribution chains to ensure the consistency of agri-food supply at certain food quality and safety standards. According to Ouma et al. (2010), smallholder farmers do not have reliable information on the market and marketing channels. Some small farm owners are constrained by insufficient marketing information on price and their level of education (Mmbando/Baiye-gunghi 2016). For small farmers and processors, an alternative to this would be the individual and direct approach to niche markets through cost management or a differentiation strategy. There is no unanimously accepted international or European definition for small farms. Also, the concept of subsistence farms has different approaches in the literature. Two important criteria are used to delimit farms according to their size: standard output or utilized agricultural area. To implement the measures imposed by European policies, Romania has provided in its regulations the definition according to which subsistence farms have an economic size between 2 and 8 ESU (European Size Unit). According to data provided by the National Agency for Rural Development in 2022, there are 3.140.000 farms in Romania with an average surface area of 2 ha for those between 2 and 4 ESU and an average area of 3 ha for those between 4 and 8 ESU. For a more detailed discussion of the definition of small and semi-subsistence farms, see Fritzsche et al. (2008).

According to European Commission Data available on the Eurostat platform, there were 9.1 million agricultural holdings in the EU in 2020, of which 2.9 million holdings (the equivalent of 31.8 %) were located in Romania. Almost two-thirds of the EU's farms were less than 5 hectares (ha) in size in 2020.

Romania is the Member State with the highest number of farms; nine in every ten farms (90.3 % or 2.6 million farms) were smaller than 5 ha, but 0.9 % of farms of 50 ha or more in size farmed a little over one-half (54.0 %) of all the utilized agricultural area (i.e. UAA), in the country. Small farms of under 5 ha were also typical in Malta (96.6 % of the total), Cyprus (87.5 %), Greece (74.0 %), Portugal (73.4 %), Croatia (70.6 %), Hungary (64.9 %) and Bulgaria (64.0 %), as well as in some regions of Southern Poland and coastal regions of Spain and Italy.

The market value of small farms varies depending on their size and type of farming activities. Small farms can enhance market participation through innovations and niche markets, but face challenges due to globalisation favouring larger operations and market concentration by large companies (Werbrouck/Bresnayan 2012).

According to Pingali et al. (2019), smallholder farmers play a significant role in the agricultural sector, contributing to food production and rural economies. Here, the market value of small farms is also influenced by market infrastructure and costs.

Factors influencing the market value of small farms include socio-economic aspects like age, gender, education level, and household size; institutional factors such as access to credit and extension services; market factors like prices and transport, and external factors like natural calamities affecting crop yields (Galli et al. 2018).

Market access, reduced transaction costs, improved market infrastructure, and limiting intermediary influence are essential for small farms to effectively link to value chains and new marketing platforms, enhancing their market value and participation in commercial production (Rapsomanikis 2015).

2. Research Methodology

The primary data were collected based on a survey conducted on a sample of 900 small farms in Romania distributed over the 5 historical geographical areas: Transylvania, Oltenia, Muntenia, Moldova, and Banat. The survey was conducted between June and October 2019 by holding structured face-to-face interviews with representatives of small farms from the different geographical regions of Romania mentioned above. Interviewers were appointed as data collectors for the County Directorates for Agriculture. From the total of 900 questionnaires, 887 were validated. A purposeful and random selection of the research sample was used. In the first stage, small farms were selected. The first criteria adopted for the selection of farms were the utilized agricultural area (i.e. UAA – ha), up to 20 ha, and standard output (i.e. SO – thousand EUR) 15.000 euro. The lower limit (15,000 instead of 50,000) was chosen for several reasons: first, the high level of fragmentation of the agrarian structure. Second, according to the Romanian National Institute of Statistics 3.053.088 farms (91,58 %) had a UAA under 5 ha; 3.188.660 farms (93,18 %) had a SO up to 8.000 euro and only 114.168 farms (3,34 %) achieved up to 15.000 euros in 2016. These criteria of small farms are most often met by family farms. While this is a very heterogeneous group, it also is the most frequent type of farm in Romania. Family farms, apart from owning agricultural land and running agricultural activities, are characterized by agricultural work using the labour force of the farm, i.e. family members. Analysing the structure of small farms based on age as a socioeconomic variable (i.e., SE1), there are 4 frequency ranges (i.e., 4 quantiles of SE1). The most significant frequency (i.e., 243 farms) is farmers who are between 23 and 38 years old. The lowest frequency (i.e., 205 farms) is farmers aged between 39 and 47 years. The minimum age is 23 years, the maximum is 77 years, and the average is 47 years (Table 2).

Regarding education as a socio-economic variable (i.e., SE2), the following levels were considered in the survey questionnaire: level 1 – no education, level 2 – primary, level 3 – secondary, level 4 – vocational, level 5 – general, level 6 – bachelor's degree and level 7 – master's degree. From the analysis of the structure of small farms according to SE2, it can be observed that 45 % of farmers have level 5 studies – general, and approximately 20 % of farmers have level 4 studies – vocational. Approximately 17 % of farmers have a level 6 bachelor's degree (Table 1).

Related to the socio-economic variable number of household members (i.e. SE3), it is noted that the most significant share is given by households with 3 members or approx. 34 %, which translated in absolute sizes represent 304 small farms, followed by households with 2 members at approx. 26 % (i.e. 231 small farms), and those with 4 members, approx. 24 % (i.e. 214 small farms) (see Table 1).

Table 1. The structure of small farms according to all variables

| Variables | N / Freq. | Min / Per cent | Max /Cum. |
|-----------------------------------|-----------|----------------|-----------|
| SE1 Age (4 quantiles of SE1) | | | |
| 1 | 243 | 23 | 38 |
| 2 | 205 | 39 | 47 |
| 3 | 229 | 48 | 56 |
| 4 | 210 | 57 | 77 |
| Total | 887 | 23 | 77 |
| SE2 Education (from level 1 to 7) | | | |
| 1 | 1 | 0.11 | 0.11 |
| 2 | 11 | 1.24 | 1.35 |
| 3 | 128 | 14.43 | 15.78 |
| 4 | 177 | 19.95 | 35.74 |
| 5 | 400 | 45.10 | 80.83 |
| 6 | 146 | 16.46 | 97.29 |
| 7 | 24 | 2.71 | 100.00 |
| Total | 887 | 100.00 | |
| SE3 Number of household members | | | |
| 1 | 48 | 5.41 | 5.42 |
| 2 | 231 | 26.04 | 31.45 |
| 3 | 304 | 34.27 | 65.73 |
| 4 | 214 | 24.13 | 89.85 |
| 5 | 69 | 7.78 | 97.63 |
| 6 | 16 | 1.80 | 99.44 |
| 7 | 3 | 0.34 | 99.77 |
| 8 | 1 | 0.11 | 99.89 |
| 9 | 1 | 0.11 | 100.00 |
| Total | 887 | 100.00 | |

| Variables | N/ Freq. | Min / Per cent | Max /Cum. |
|-------------------------------------|----------|----------------|-----------|
| ASI1 – Direct payments (%) | | | |
| <79 | 62 | 6.99 | 6.99 |
| 80 | 30 | 3.38 | 10.37 |
| 90 | 30 | 3.38 | 13.75 |
| 91–97 | 27 | 3.04 | 16.80 |
| 100 | 738 | 83.20 | 100.00 |
| Total | 887 | 100.00 | |
| ASI2 – Support for Agri-env. & LFA* | | | |
| 0 | 820 | 92.45 | 92.45 |
| 1 | 67 | 7.55 | 100 |
| Total | 887 | 100.00 | |
| BEMVF (4 quantiles) | | | |
| 1 | 223 | 0 | |
| 2 | 221 | 51,400 | 51.3 |
| 3 | 222 | 88,676 | 88.5 |
| 4 | 221 | 191,000 | 190.0 |
| Total | 887 | 0 | 1,250.0 |

Note: * true = 1 false = 0;

Related to the type of agricultural support instruments (i.e. ASI) that farmers are using, our database included the following 5 types: i) Direct payments; ii) Capital subsidies; iii) Support for Agri-environmental activities and LFA; iv) Organic farming; v) Other subsidies (e.g. State aid, “Minimis” State aid, etc.).

After several statistical estimation tests, we decided to use only the following types of ASI, as follows:

1. Direct payments (i.e. ASI1), (e.g. payments for production, payments for agricultural area -%);
2. Support for Agri-environmental activities and LFA (i.e. less favourable areas), excluding organic farming (i.e. ASI2);

The estimated market value of the farm (i.e. BEMVF)- The estimated market value of the farm was established by the respondents to the selected questionnaires (i.e., owners of farms). For the assessment, the established criteria considered the following assets: Land (with forest); Capital assets (e.g. building, machinery, equipment), and Livestock. Farmers specified, according to criteria outlined before and the average values in the last 3–5 years, the estimated share of a given form of financial support in total support.

The structure of small farms according to ASI1 is as follows: approximately 83 % of the farms received 100 % financial support in the form of direct payments (i.e., 738 farms), approx. 7 % benefited from financial support less than 79 % (i.e., 62 farms), and approximately 3 % of farms received support between 91 and 97 %.

The structure of farms considering Support for Agri-environmental activities and LFA – ASI2 – needs to be highlighted: approximately 92 % of the total farms (i.e., 820 farms) obtained this type of financial support, and approx. 8 % (i.e., 67 farms) did not benefit from this type of financial support.

The structure of small farms according to the socio-economic variable estimated market value of the farm (i.e. BEMVF) shows that the average value is about 140 thousand lei (i.e. about 31,000 euros in 2020), and the maximum value attributed by farmers is 1,250 thousand lei (i.e. about 278,000)

Table 2. Descriptive statistics of variables

| Variable | Obs. | Mean | Std. Err. | [95 % Conf. Interval] | SD | Variance |
|--|------|-----------|-----------|-----------------------|-----------|------------|
| BEMVF Estimated market value of the farm (Lei) | | | | | | |
| | 887 | 139,178.8 | 4,487.7 | 130,371–147,986 | 133,653.8 | 17.90 mil. |
| SE1 Age of farmer (owner of the farm) | | | | | | |
| | 887 | 46,743 | .4043 | 45,949 – 47,536 | 12,042 | 145,004 |
| SE2 Education (from level 1 to 7) | | | | | | |
| | 887 | 4,688 | .0348 | 4,619 – 4,756 | 1,039 | 1,080 |
| SE3 Number of household members | | | | | | |
| | 887 | 3.103 | .0382 | 3.027 – 3.177 | 1,140 | 1,300 |
| ASI1 Direct payments | | | | | | |
| | 887 | 95,136 | .5077 | 94,139 – 96,132 | 15,121 | 228,634 |
| ASI2 Support for Agri-environmental Activities and LFA | | | | | | |
| | 887 | .0755 | .0088 | .0581 – .0929 | .2644 | .0699 |
| MF1 Distance between the farm and the nearest city | | | | | | |
| | 887 | 27,235 | .7593 | 25,743 – 28,725 | 22.6128 | 511.34 |
| MF2 Difference in sales prices for distribution channels | | | | | | |
| | 887 | .1928 | .0133 | .1668 – .2188 | .3947 | .1558 |
| Log (MC1) Sale on the street markets, marketplace and bazaar | | | | | | |
| | 887 | .5614 | .0167 | .5287 – .5942 | .4965 | .2465 |
| MC2 Sale to processing plants | | | | | | |
| | 887 | .4555 | .0167 | .4226 – .4883 | .4983 | .2483 |
| MC3 Sale directly from the farm to neighbours and tourists by the roadside | | | | | | |
| | 887 | .1939 | .0133 | .1678 – .2199 | .3956 | .1565 |
| MC4 Sale at trade fairs | | | | | | |
| | 887 | .2638 | .0148 | .2348 – .2929 | .4409 | .1944 |

The type of variables presented in Table 2 are based on data provided by farmers in the section of basic information (i.e. MF1) and the relationship between farming and the market (e.g. MF2, MC2, MC3, MC4 – dummy explanatory variable, and MC1 quantitative explanatory variable).

In connection with the structure of farms, MF1 shows that the mean distance between a farm and the nearest city is about 27 km. Most farms (i.e., 238 farms)

are located in the first quantile, and the distance is between 0 and 10 km. The farms included in quantile 4 (i.e., 220 farms) are located at a distance between 37 and 106 km.

Concerning the structure of farms by MF2, the difference in sales prices for distribution channels is highlighted as follows: approximately 81 % of the farms (i.e., 716 farms) did not see any difference in sales prices when they used different distribution channels, and approx. 19 % (i.e., 171 farms) found that there was a difference.

Associated with MC1, most of the farmers (i.e., 442 farmers) registered a difference in price sales between 11 % and 100 %, 65 farmers registered differences between 0.5 % and 10 %, and 380 farmers did not register any differences.

With variable MC2 it can be seen that almost 54 % of small farms (i.e., 483) chose to sell to processing plants but nearly 46 % of them (i.e., 404) did not use this promotion technique.

Related to variable MC3 it is shown that almost 19 % of farms (i.e., 173 in absolute units) chose to sell directly from the farm to neighbours or tourists by the roadside. However, nearly 81 % of farms (i.e., 714) did not use this advertising technique.

Regarding variable MC4 it could be illustrated that just about 26 % of farms (i.e., 234 in absolute units) chose to sell to processing plants, and approximately 74 % (i.e., 653) did not use this promotion technique.

Because some variables show high values for SD compared to the reported mean, logarithm values were used in the regression model for some of them (see equation number 8). In the table below, data were extracted from STATA median values for all variables (except dichotomous variables).

Table 3. Median values of variables

| Variable | Obs. | Percentile | Centile | [95 % Conf. Interval] |
|--|------|------------|---------|-----------------------|
| BEMVF Estimated market value of the farm (Lei) | | | | |
| | 887 | 50 | 88,572 | 82,097–98,674.73 |
| SE1 Age of farmer (owner of the farm) | | | | |
| | 887 | 50 | 47 | 46–48 |
| SE2 Education (from level 1 to 7) | | | | |
| | 887 | 50 | 5 | 4–5 |
| SE3 Number of household members | | | | |
| | 887 | 50 | 3 | 2–3 |
| AS11 Direct payments | | | | |
| | 887 | 50 | 96 | 95–100 |
| MF1 Distance between the farm and the nearest city | | | | |
| | 887 | 50 | 21 | 20–24 |

By using our econometric model, we wanted to highlight the fact that socio-economic factors, agricultural support and investment, marketing forces and marketing channels can increase the market value of small farms in Romania.

The farmer's age (farm owner) was measured on a proportional scale using an open-ended question. According to Amaya and Alwang (2011), older farmers tend to choose nearby markets to sell their products. As they get older, farmers lose interest in long-distance markets, which require greater financial and time resources. There is a positive link between the age of the farmer and the decision to sell through informal markets (Shiimi et al. 2012).

In Romania, according to a study by Mortan et al. (2016), an advanced age of the farmer reduces their concern about developing the farm and implicitly identifying distribution channels for the products derived from it. This finding must be put in the context of the ageing population living in rural areas in Romania.

Education influences the costs and time required to process information (Bywaters/Mlodkowski 2012). Mutura et al. (2015) show that in the case of small dairy farms in Kenya, farmers with a high level of education tend to sell their products through cooperatives because they understand and access market information. Also, according to the results of a study by Farmer and Betz (2016), farmers in West Virginia with a higher level of education choose to sell agri-food products directly to end consumers, which means that they have been informed and they took the risk of choosing direct marketing channels. The influence of the farmer's education level on marketing channel selection represents a major factor since farm operators with higher levels of education commonly show reduced wholesale market participation (Gong et al. 2006; Liao et al. 2017).

In the case of small farms in Romania, a direct link has been identified between the farmer's level of education and the intention to develop the farm (Mortan et al. 2016).

The number of household members was measured on a proportional scale through an open-ended question.

According to various studies, this variable influences the amount of agricultural production for sale. Monson et al. (2008) showed that small farms with more members in their households offer a smaller amount of production for sale through direct marketing channels. Even if a large number of members of the household can provide the labour needed to obtain a larger quantity of production, the products will be distributed directly to the nearest market if there is no possibility of storage or transport.

Distance from the farm to the nearest town was measured on a proportional scale using an open-ended question, representing the number of kilometres to the nearest main market in the neighbouring town.

The depended variable it is represented by the estimated market value of the farm (i.e., BEMVF). Existing literature describes several methods to estimate the value of a farm. The most common method is the “patrimonial” method (Jeanneaux et al. 2017). This method considers the market value of the various assets that the farm has. Nevertheless, it also considers socio-economic factors, for example.

In our study, we tried to adapt economic findings to situations where the socio-economic factors of the farmers influence the value of small farms.

3. Method

Bayesian analysis is common in various areas of interest, but its utilisation in science and engineering is predominant. More precisely, Bayesian statistical inference is practised in econometrics (Poirier 1995; Chernozhukov/Hong 2003; Kim et al. 1998) and several other fields. Additionally, it is a powerful tool for making inferences from data. One of the most significant discoveries was the implementation of the random-walk Metropolis algorithm (Metropolis et al. 1953) to clarify issues in statistical physics, and the Gibbs sampling algorithm (Geman/Geman 1984), which was first used in image processing.

The development of the Markov chain Monte Carlo (i.e., MCMC) method was the result of these ideas. It became an integral part of statistical practice. Various specialised techniques were introduced that utilise MCMC. Some of these include the reversible-jump MCMC (Green 1995) or the perfect sampling algorithm (Propp/ Wilson 1996). Due to the complexity of the task involved in performing Bayesian analysis, finding ways to minimise the number of integrals is often difficult. In most cases, the analysis is performed through simulations. The integrals elaborated in Bayesian inference, for some functions of the random vector (i.e., θ), given the observed data (i.e., y) are as follows:

$$B\{g(\theta)\} = \int g(\theta)p(\theta|y)d\theta \quad (1)$$

In contrast to deterministic algorithms used in frequentist statistics (a.n., treat parameters as fixed values and rely on hypothesis testing and confidence intervals), MCMC methods like the Metropolis-Hastings algorithm (i.e., MH) and Gibbs sampling offer a powerful way to explore complex, high-dimensional parameter spaces (Chib 2001, Luengo et al 2020) and generate samples from the posterior distribution (Spall 2003). This iterative process converges to the true distribution, enabling practitioners to obtain estimates and quantify uncertainty in a wide range of models.

An additional MCMC method that can be considered a special case is the use of the Gibbs sampling method (Gelfand et al. 1990). This is the technique used in

our regression model using STATA17, where the updates are the complete conditional distributions of the various parameters. Consequently, if $\theta = (\theta^1, \dots, \theta^d)$ and, for $j = 1, \dots, d$, q_j is the conditional form of θ^j given the rest $\theta^{(-j)}$; follow by Gibbs update along this way: for $t = 1, \dots, T - 1, T$ (i.e. T represent the size of the MCMC sample – iterations that are retained, in our study $T_0 = 3000$ and $T=30000$) and for $j = 1, \dots, d$:

$$\theta_t^j \sim q_j(\cdot \mid \theta_{t-1}^{(-j)}) \quad (2)$$

The original Gibbs sampling method updates the model parameters one at a time according to the full conditional distribution of the algorithm. This method has various advantages, such as its high efficiency and the ability to accept all proposals. Although the full conditionals are usually not available in most cases, they can be easily obtained through a hybrid MH algorithm that only updates the various blocks of parameters (i.e., the random-walk updates of the Gaussian random-walk method with the Gibbs updates). The combination of the two methods allows the algorithm to improve the mixing of the chains.

At the level of our study, it was assumed that all the data are normally distributed with a known mean, then the algorithm can specify an inverse-gamma before the model parameters, in this way:

$$y \sim N(\mu, Cov\{g(\theta)\}), Cov\{g(\theta)\} \sim InvGamma(\alpha, \beta) \quad (3)$$

where $y = (y_1, y_2, \dots, y_n)$ is a data sample of size n (in our study $n=887$) with a mean μ ; α and β are hyperparameters (i.e. prior shape and prior scale) of an inverse-gamma prior distribution for the variance of a normal distribution of y_n .

In this case, the conditional distribution is an inverse-gamma prior, but with different scale and shape parameters. This allows the algorithm to set up a separate block for the updates:

$$Cov\{g(\theta)\} \sim InvGamma\left(\tilde{\alpha} = \alpha + \frac{n}{2}, \tilde{\beta} = \beta + \frac{1}{2} \sum_{i=1}^n (y_i - \mu)^2\right) \quad (4)$$

The initial MH algorithm updates the model parameters simultaneously. This method may result in poor mixing for high-dimensional models since the chain may remain in the posterior distribution for a long time. This issue can also be caused by the varying scales of the model parameters. An effective solution is to separate the model parameters into two or more subsets (i.e., blocking). This method allows the algorithm to update the model parameters in a separate order.

To confirm the hypotheses of our research, we used the data set on small farms that we examined earlier. We predicted the market value of small farms (i.e.,

log variable) from the farmer's age, farmer's level of education status, farmer's number of household members, whether or not the farmer uses direct payments, whether or not the farmer's benefits support Agri-environmental activities and LFA, the distance between the farms and the nearest city (i.e., log variable), farmer's difference in sales prices for distribution channels, the farmer's sale on the street markets, marketplaces, bazaar (i.e., log variable), farmer's selected sale to processing plants, whether or not the farmer adopted sale directly from the farm to neighbours or tourists by the roadside, and the farmer's choice to sell at trade fairs. We set up the model as follows:

$$\begin{aligned} \text{Log}(B_{EVMF, i}) = & \alpha + \beta_1 x_{SE1, i} + \beta_2 x_{SE2, i} + \beta_3 x_{SE3, i} + \\ & \beta_4 x_{AS1, i} + \beta_5 x_{AS2, i} + \beta_6 \log(x_{MF1, i}) + \beta_7 x_{MF2, i} + \\ & \beta_8 \log(x_{MC1, i}) + \beta_9 x_{MC2, i} + \beta_{10} x_{MC3, i} + \beta_{11} x_{MC4, i} + \epsilon_i \end{aligned} \quad (5)$$

, $i = 1, \dots, n$

All scalar parameters maintained on the entire real line, for example, regression coefficients and log-transformed positive parameters, are allocated a normal distribution with zero mean and variance 2 prior, where prior is given by the option in STATA17. The default priors' value in case of normal prior for coefficients. The standard deviation is 100 (set in STATA17 "Priors" tab section), and thus the default priors for these parameters are $N(0; 10000)$. In our study we set the MCMC number of 33,000 iterations; Burn-in by 3,000 and the sample size $N = 30,000$; maximum block size is set by default at 50; These priors are justly vague for parameters of moderate size but may become revealing for large-scale parameters.

All positive scalar parameters are allocated an inverse-gamma prior to the shape parameter α and scale parameter β , $InvGamma(\alpha; \beta)$. The default values for α and β are 0.01, and thus the default prior for these parameters is $InvGamma(0.01, 0.01)$. Related to adaptive MCMC procedure the default values are as follows: adaptation interval = 100; the maximum number of adaptive iterations = 25; minimum number of adaptive iterations = 5; parameter controlling acceptance rate, $\alpha = 0.75$ parameter controlling proposal covariance, rate, $\beta = 0.8$; tolerance for acceptance rate = 0.01; initial multiplier for the scale factor for all blocks = 2.38

4. Results and discussions

The prior distribution for all the regression parameters is a normal distribution with a mean equal to zero and variance equal to 10,000; prior to sigma2 parameter is presented as follows:

Table 3. Bayesian linear regression-Gibbs sampling statistics

| Parameters | Values |
|-------------------------|----------|
| MCMC iterations | 33,000 |
| Burn-in | 3,000 |
| MCMC sample size | 30,000 |
| Number of obs. | 451 |
| Acceptance rate | 1 |
| Efficiency: min. | .961 |
| avg. | .997 |
| max | 1 |
| Log marginal likelihood | -492,836 |

Source: Authors' processing in STATA17

MCMC iteration is a total of 33,000; the first 3,000 iterations are burn-in and are discarded; the number of iterations retained in the MCMC is 30,000; the number of observations and data sets is 471.

In our model, the acceptance rate is 1 which means that 100 % out of 30,000 proposal parameter values were accepted by the algorithm. The minimum efficiency for the model parameters is .961, the average efficiency is .997, and the maximum efficiency is 1.

After we establish the Bayesian regression model selector (i.e., continuous outcomes / linear regression) and picked, in STATA17, all the criteria and values presented previously we registered the following model:

$$\begin{aligned} \text{Log}(\widehat{B}_{EVMF}) = & 12.396 - .0035x_{SE1} + .0265x_{SE2} + .0717x_{SE3} - \\ & .0079x_{ASI1} + .2047x_{ASI2} + .0523\log(x_{MF1}) + .4533x_{MF2} - \\ & .2367\log(x_{MC1}) + .4046x_{MC2} + .1236x_{MC3} + .3123x_{MC4} \end{aligned} \quad (6)$$

Analysing the sign of beta specific for all independent variables, it is noted that, excepting {Log (BEMVF): Log (MC1)}, {Log (BEMVF): ASI1}, and {Log (BEMVF): SE1}, most parameters positively influence the value of {Log (BEMVF)}. Nonetheless, if we consider the value of intercept and sigma2 (i.e., +.3372) we notice that, in the end, all parameters have a positive influence on {Log (BEMVF)}.

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(i.e., +.3372) we notice that, in the end, all parameters have a positive influence on {Log (BEMVF)}.

Table 4. Posterior summary statistics

| Parameters | Mean | SD | MCSE | Median | [95 % Conf. Interval] | |
|-------------|--------|-------|--------|--------|-----------------------|--------|
| Log (BEMVF) | | | | | | |
| SE1 | -.0035 | .0025 | .00002 | -.0035 | -.0085 | .0014 |
| SE2 | .0265 | .0299 | .00017 | .0262 | -.0319 | .0857 |
| SE3 | .0717 | .0241 | .00014 | .0717 | .0242 | .1191 |
| ASI1 | -.0079 | .0022 | .00001 | -.0078 | -.0121 | -.0034 |
| ASI2 | .2047 | .1232 | .00071 | .2040 | -.0359 | .4471 |
| Log (MF1) | .0523 | .0349 | .00020 | .0523 | -.0156 | .1198 |
| MF2 | .4533 | .0737 | .00043 | .4535 | .3083 | .5976 |
| Log (MC1) | -.2367 | .0373 | .00021 | -.2364 | -.3096 | -.1642 |
| MC2 | .4046 | .0684 | .00039 | .4042 | .2706 | .5392 |
| MC3 | .1236 | .0853 | .00049 | .1233 | -.0425 | .2904 |
| MC4 | .3123 | .0736 | .00043 | .3121 | .1673 | .4569 |
| Intercept | 12,396 | .3675 | .00212 | 12,396 | 11,679 | 13,112 |
| sigma2 | .3372 | .0228 | .00014 | .3361 | .2952 | .3847 |

Source: Authors' processing in STATA17

Generally, the posterior mean estimates of all parameters, except sigma2, are close to the OLS estimate of variables

Posterior standard deviations are between 0.022 (i.e., {Log(BEMVF): ASI1}) and 0.3675 (i.e., {Log(BEMVF): cons}), and they are close to the standard error of the OLS estimate (i.e., Appendix no. 1).

The standard error estimates of the posterior means, MCSEs, are low for all parameters. For instance, MCSE is 0.0043 for {Log(BEMVF): MF2}. This illustrates that the accuracy of our estimate is, up to two decimal points, 0.45 defining that MCMC converged.

The posterior means and medians of {Log(BEMVF)} and all parameters are close, including for sigma2, which suggests that the posterior distribution for {Log(BEMVF)} and all predictor variables may be symmetric.

According to the credible intervals, we are 95 % certain that the posterior mean of all parameters is approximately between equal-tailed 95 % conf. intervals. For example, the posterior mean of {Log(BEMVF): cons} is between 11.7 and 13.11, and the posterior mean of {sigma2} is practically between.30 and.38. We can conclude from this that {Log(BEMVF): cons} is greater than 12 and that {sigma2} is greater than.31, with a very high probability.

A *cumulative sum* (i.e., cusum) plot is used to measure the variation in the mean and the sample values against the iteration number (Yu and Mykland, 1998).

By inspecting cumulative sum plots for all parameters, it can be seen:

1. Socio-economic and ASI variables show (Figure 1) that there is no contrast between the jagged lines of the fast mixing parameters. However, in the case of {Log(BEMVF): SE3} along with {Log(BEMVF): ASI1}, after the first nearly 15,000 iterations, the cusum curve stays in the negative y plane and by the end, it recovers and crosses the x-axis several times. The opposite situation is registered by {Log(BEMVF): Log(ASI2)} during the first nearly 20,000 iterations. The curve stays in the positive y plane and by the end, it recovers and crosses the x-axis several times.

Overall, during the total 30,000 iterations, it seems that all parameters registered a well-mixing chain, and in exceptional ways age and education.

2. In Figure 2, sum plots for market forces variables indicate that there is no dissimilarity among the jagged lines of the fast-combining parameters. However, in the case of {Log(BEMVF): Log(MF1)}, during all iterations, the cusum curve tends to stay more in the positive y plane and by the end crosses the x-axis numerous times. The contradictory situation is registered by {Log(BEMVF): MF2} during the first approximately 20,000 iterations. Here, the curve stays in the negative y plane and by the end, it recovers and crosses the x-axis frequently. Globally, during all iterations, it seems that both parameters recorded a well-mixing chain.

Figure 1. Cusum of socio-economic and ASI variables

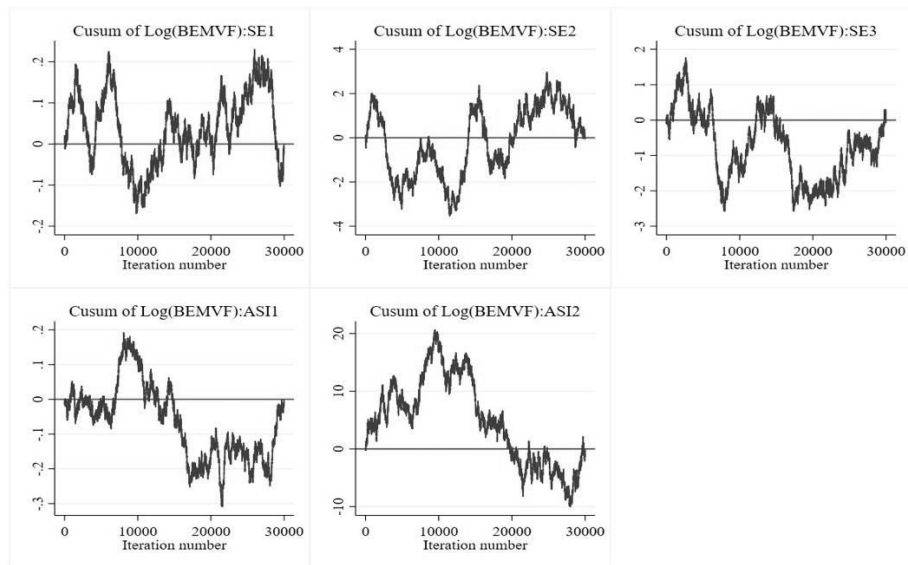
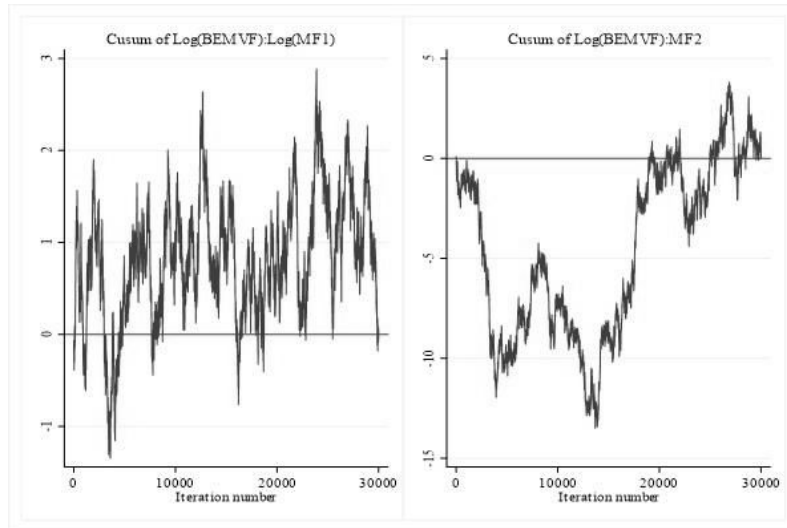
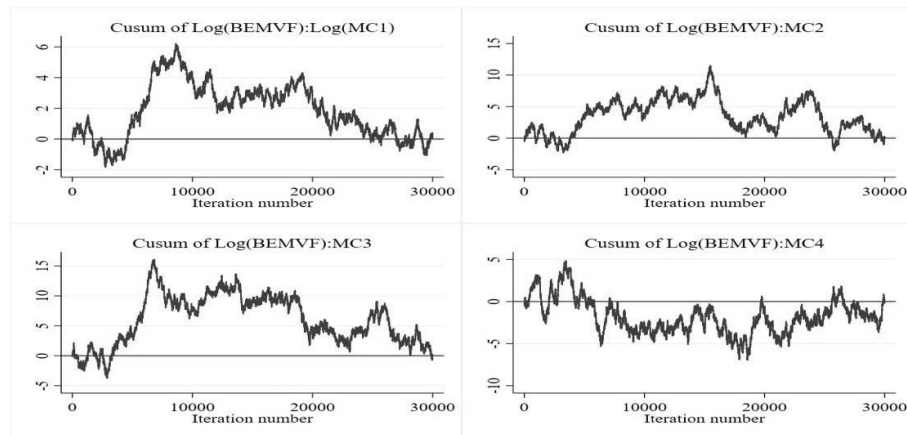


Figure 2. Cusum of market forces variables

3. Complementary, cumulative sum plots for marketing channel variables (Figure 3) illustrated that there are no convergence problems. However, in the case of $\{\text{Log(BEMVF): Log(MC1)}\}$ and $\{\text{Log(BEMVF): MC2}\}$, after the first nearly 5,000 iterations, the cumulative sums (i.e., cusum) curve stays in the positive y plane and by the end it recovers and crosses the x-axis several times. In the case of $\{\text{Log(BEMVF): MC4}\}$ after the first nearly 5,000 iterations, the curve stays more in the negative y plane but still crosses the x-axis numerous times.

Figure 3. Cusum of marketing channels variables

4. By examining cumulative sum plots for intercept term and σ^2 (Figure 4), no contrast between the jagged lines of the fast-mixing parameters can be observed. However, in the case of $\{\sigma^2\}$, the cumulative sums (i.e., csum) curve stays in the negative y plane, after the first half of iterations and in the positive y plane, after the second half of iterations. Comprehensively, during all iterations, it seems that both parameters registered a well-mixing chain, and in an exceptional way intercept term.

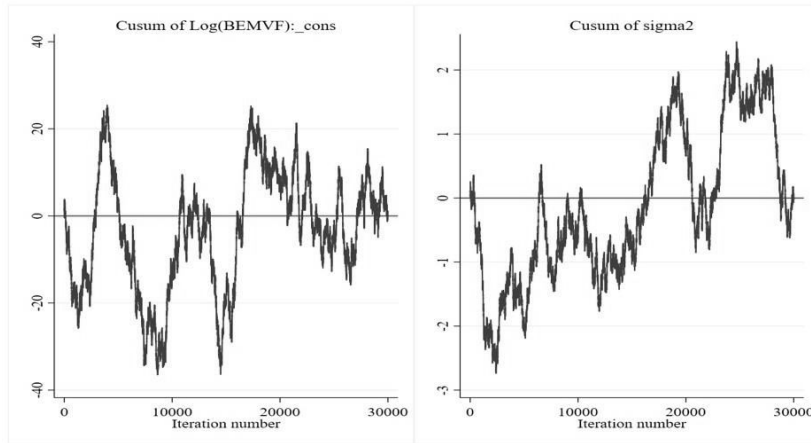


Figure 4. Cusum of constant and σ^2

Efficiency summaries

In our MCMC sample size, we have 30,000 independent observations to obtain estimates (i.e., ESS) for $\{\text{Log (BEMVF): all predictors}\}$ and only about 28,827 independent observations to obtain estimates for $\{\sigma^2\}$ (Table 5. Efficiency summaries).

Table 5. Efficiency summaries

| Terms | ESS | Corr. time | Effcy. |
|-------------|--------|------------|--------|
| Log (BEMVF) | | | |
| SE1 | 30,000 | 1.00 | 1.00 |
| SE2 | 30,000 | 1.00 | 1.00 |
| SE3 | 30,000 | 1.00 | 1.00 |
| ASI1 | 30,000 | 1.00 | 1.00 |
| ASI2 | 30,000 | 1.00 | 1.00 |
| Log (MF1) | 30,000 | 1.00 | 1.00 |
| MF2 | 30,000 | 1.00 | 1.00 |
| Log (MC1) | 30,000 | 1.00 | 1.00 |

| Terms | ESS | Corr. time | Effcy. |
|-----------|-----------|------------|--------|
| MC2 | 30,000 | 1.00 | 1.00 |
| MC3 | 30,000 | 1.00 | 1.00 |
| MC4 | 30,000 | 1.00 | 1.00 |
| Intercept | 30,000 | 1.00 | 1.00 |
| sigma2 | 28,826.62 | 1.04 | 0.96 |

Source: Authors' processing in STATA17

In our example, the estimated lag (i.e., Corr. Time), after which autocorrelation in an MCMC sample remains small, is approximately 1 for all parameters.

Related to efficiency, it can be seen that are 100 % for independent variables, and about 96 % for sigma2, which are good for an MH-Gibbs sampling algorithm.

Bayesian information criteria and model tests

For selecting a model, a set of Bayesian information criteria is used to evaluate the models that are most likely to fit the data. Likelihood-based methods are recognized for overfitting the data, which can be caused by the addition of more parameters in a model (Ghasemian et al., 2019). This is why the use of a penalty is significant to diminish the likelihood of overfitting (i.e. Table 6. Bayesian model tests).

The three most common information criteria used for picking a model are the Akaike information criterion, Bayesian information criterion, and the deviance information criterion (i.e., DIC) (Evans, 2019). These criteria are likelihood-based, and they include a penalty term and a good-of-fit term. Models with smaller values are preferred.

Table 6. Bayesian model tests

| Parameter | DIC | log (ML) | log (BF) | P(M) | P(M y) |
|-----------|---------|----------|----------|--------|--------|
| active | 801,302 | -492,836 | 1.0000 | 1.0000 | 1.0000 |

Source: Authors' processing in STATA17

Marginal likelihood (ML) is computed using Laplace–Metropolis approximation

The Bayes factors (i.e., BF) require that the distribution be completely specified. This is particularly important in MCMC simulations because BF include all information about the specified Bayesian model. In our case, the logarithm of the Bayes Factor (i.e. log (BF)) is 1, which suggests that there is minimal evidence against the model (Kass and Raftery, 1995). Computing posterior probabilities of the model (i.e., P(M|y), it is clear that the model has the highest probability

of 1.00. When computing the posterior probabilities of the model (i.e. $P(M|y)$), it becomes evident that the model has the highest probability, which is 1.00.

Conclusions

This paper estimated the value market of Romanian small farms. Data were collected based on personal interviews with a sample of small farms distributed over the 5 historical geographical areas: Transylvania, Oltenia, Muntenia, Moldova, and Banat. The Gibbs sampling and updates of the Metropolis-Hastings algorithm were applied to investigate farmers' assessment of market value depending on the social and economic characteristics of the small farms.

Results asserted the a priori hypothesis, from the interpretation of (9) overall small farm attributes that those contribute positively and significantly to the estimated market value.

However, socio-economic factors influenced the elasticity of the dependent variable in different ways. Specifically:

1. *Farmer's Age*: The age of the farmer (farm owner) had a relatively low negative influence on the estimated market value of small farms. This is due to the sample predominantly consisting of younger farmers who own small farms (Ahearn et al. 1993).
2. *Education and Household Members*: Education levels (ranging from level 1 to 7) and the number of household members caused a moderately positive increase in the market value (Mishra et al. 2002).
3. *Direct Payments and Support Programs*: Direct payments had a slightly negative impact (Morkunas/Labukas 2020), while support for Agri-environmental activities and Less Favored Areas (LFA) had a positive influence. This suggests that the logarithm of the estimated market value of farms ($\text{Log}(\text{BEMVF})$) is quite responsive to changes in these support measures (Brown et al. 2019).
4. *Marketing Factors*:

Distance to Nearest City: The distance between the farm and the nearest city had a positive influence on the response variable (Migose et al. 2018).

Sales Price Differences: Differences in sales prices across distribution channels also registered a positive influence, with this factor being the most significant among the regressors (Milford et al. 2021).

5. Sales Venues:

- *Street Markets, Marketplaces, and Bazaars*: Sales in these venues positively influenced the output variable (Mejia et al. 2022).

- Processing Plants: Sales to processing plants had a positive effect (Owoo/Lambon-Quayefio 2017).
- Direct Sales: Direct sales from farms to neighbors and tourists by the roadside (Kinoshita 2001; Rajagopal 2012; Anisimova 2022) and sales at trade fairs also positively influenced the market value (Oumlil et al. 2015).

Overall, these socio-economic factors demonstrate varying degrees of impact on the elasticity of the market value of small farms.

Appendix 1

Model summary with OLS estimates

| Parameters | Log (BEMVF) | [95 % Conf. Interval] | |
|---|----------------------------------|-----------------------|--------|
| SE1 Age | -.0035 (.0025) [-1.40] | -.0085 | .0014 |
| SE2 Education | .0266 (.0299) [0.89] | -.0319 | .0857 |
| SE3 Number of household members | .0716 ** (.0241) [2.97] | .0242 | .1191 |
| ASI1 Direct payments | -.0078 *** (.0022) [-3.54] | -.0121 | -.0034 |
| ASI2 Support for Agri-environmental activities and LFA | .2055 * (.1232) [1.67] | -.0359 | .4471 |
| Log (MF1) Distance between farms and the nearest city | .0522 (.0352) [1.48] | -.0156 | .1198 |
| MF2 Difference in sales prices for distribution channels | .4526 *** (.0739) [6.12] | .3083 | .5976 |
| Log (MC1) Sale on the street markets, marketplace, bazaar | -.2369 *** (.0376) [-6.29] | -.3096 | -.1642 |
| MC2 Sale to processing plants | .4046 *** (.0684) [5.92] | .2706 | .5392 |

| Parameters | Log (BEMVF) | [95 % Conf. Interval] | |
|---|---------------------------------|-----------------------|--------|
| MC3 Sale directly from the farm to neighbour's, tourists, by the roadside | .1236 (.0847) [1.46] | -.0425 | .2904 |
| MC4 Sale at trade fairs | .3123 *** (.0735) [4.25] | .1673 | .4569 |
| Intercept | 12,398 *** (.3689) [33.6] | 11,679 | 13,112 |

Note: SE statistics in (), t statistics in [], * p < 0.1, ** p < 0.01, *** p < 0.001

Source: Authors' processing in STATA17

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Exploratory study on the use of CAAT and on the work environments of small and medium audit entities*

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Abstract

This research explored the application of computer-assisted audit techniques (CAAT) and the extent of self-threat that exists in small and medium-sized audit companies due to the applied digital environments. The study used a focus group analysis method based on interviews to explore the types of CAAT applied by small and medium audit companies in Romania. The results of the present research can aid decision makers in small and medium-sized audit firms with respect to the application of CAAT in their audits. Furthermore, the early exploratory study presented here opens up new opportunities for research and a deeper understanding of the application of CAAT by audit companies.

Keywords: digitalisation; CAAT; audit; SME; work life
JEL CLASSIFICATION: M42

Introduction

Digital transformation has or will have a significant impact on the audit system (Tiberius & Hirth, 2019). However, a comprehensive picture of the influence of digital transformation, the stage of digitisation or the potential of digitization in the audit system is not yet available, especially for emerging countries (Guşe & Mangiuc, 2022). Also, here it should be remembered the different historical characteristics and the divergent structures between the responsible bodies and the economic sectors involved in the dual vocational training, but also due to the heterogeneous examination requirements between the professions, it is assumed that the examination system has a high level of diversity in what refers to digital features. In addition, as we also find in the specialised literature, the

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examination system and its digitisation potential encompass much more than the methods and tools for determining even complex analyses and decision-making.

The present research explored the current situation in terms of the application of information technology in the audit field by small and medium-sized entities, particularly considering aspects that could affect the daily activities of affected employees. Therefore, our research contributes to a better understanding of the basic determinants of the adoption of CAAT and its influence on employees. The results of the exploratory study revealed that the perceived usefulness of the new technologies was positive, allowing CAAT were deemed to introduce positive aspects into financial audit activities.

The strategy focusses on making the most of the opportunities presented by digital transformation for small and medium-sized audit companies, especially in emerging markets such as Romania, while minimising possible risks. Central to this are the introduction and optimisation of computer-assisted audit techniques (CAAT), managing digital work environments, promoting employee well-being and reducing self-threats, complemented by continuous feedback and adaptation as well as collaboration. with regulatory authorities and industry. These approaches aim to increase the efficiency and quality of audit work while supporting the well-being and professional development of audit professionals, effectively managing both the challenges and opportunities of digital transformation.

The results of the study can be useful for companies in the field that are reluctant to apply new innovative technologies, as well as for application providers who support auditors and regulatory authorities who can encourage entities to utilise CAAT to increase their efficiency.

To achieve our objectives, the central research question we posed was as follows. How is CAAT used and what are the work environments of small and medium audit entities?

Our research focused on the adoption of CAAT by small and medium-sized entities in Romania through a better understanding of their use by Romanian auditors. Furthermore, this study presented the main problems that affected employees in their daily activities. Thus, the research can be a theoretical basis for future extensive research on the testing of the application of CAAT by audit firms in Romania.

In the framework of this research, the reasons behind the application of new technological innovations in the audit field were examined. In this regard, small and medium companies were the focus, considering the slower adaptation of these companies to new innovative technologies, due to the small number of employees, compared to large companies that are active at the international level.

The present research first addressed the theoretical aspects and the current state of research on the individual components of the research question. In the first step, the dissolution of labour boundaries under the influence of digital media was explained, since this is a basis for potential self-harm and ethical issues. The practical relevance of the research aim was then clarified before a detailed description of the methodological procedure. The research findings were then presented and discussed. Finally, a critical evaluation was presented and a conclusion and possible research perspective were disclosed.

Literature review

Computer-assisted audit techniques (CAAT) are supported by several theoretical approaches that support their understanding and application. Agency theory addresses trust and monitoring between principal and agent, while systems theory views organisations as networked systems that can be effectively analysed through CAAT. Information theory helps to process and analyse large amounts of data to detect anomalies. Contingency theory emphasises the adaptability of CAATs to specific organisational conditions, and behavioural theory examines behavioral patterns to identify risks. Cognitive load theory shows how CAATs reduce auditor cognitive load by automating manual reviews. The Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI) examine the acceptance and diffusion of CAATs, while the Resource-Based View (RBV) views CAATs as valuable resources for an organisation's competitive advantage. Together, these theories provide a comprehensive basis for the implementation and effective use of CAATs in practice.

The diffusion of innovation (DOI) theory, developed by Everett Rogers in the 1960s, describes how, why and at what speed new ideas and technologies spread in a society. According to Rogers, innovations follow an adoption curve process, distinguishing five different categories of adopters: innovators, early adopters, early majority, late majority, and laggards. These categories are based on individuals' willingness and ability to adopt new ideas. The process is influenced by several factors, including the perceived benefits of innovation, compatibility with existing values and practices, complexity of the innovation, testability, and visibility of results. DOI also highlights the role of social media and communication channels in the diffusion of innovations, and opinion leaders playing a crucial role in motivating others to adopt new ideas. This theory has found wide application in fields such as marketing, technology, healthcare, and education, as it provides valuable insight into the dynamics of acceptance and diffusion of new technologies and practices. Furthermore, demographic changes are leading to a shortage of qualified specialists, which also affects Romanian companies that use Computer-Assisted Audit Techniques (CAATs). To counteract this, companies should create attractive working conditions, specifically

promote young talent through cooperation with universities, and invest in the further training of their employees. International recruiting, the use of technology and automation, and the development of a strong employer brand (employer branding) are other important measures. Additionally, alumni networks and partnerships with other companies can help develop recruiting strategies. These measures can help overcome the shortage of skilled workers and ensure competitiveness.

In addition, the reference to the new EU regulations, which increase the workload for auditors, is particularly relevant. In particular, the requirements for auditing and consulting in the field of sustainability reporting are complex and time-consuming. CAATs provide an important solution to more efficiently manage these additional tasks. They allow auditors to analyse large amounts of data quickly and accurately, which not only improves the quality of audits, but also meets increasing regulatory requirements.

There are several regulations and guidelines in the European Union that affect the use of computer-assisted audit techniques (CAAT). These regulations are not specific to CAATs alone, but include general standards and requirements for audit performance, data integrity, information security, and data protection. Here are some of the main EU regulations and guidelines relevant to CAAT:

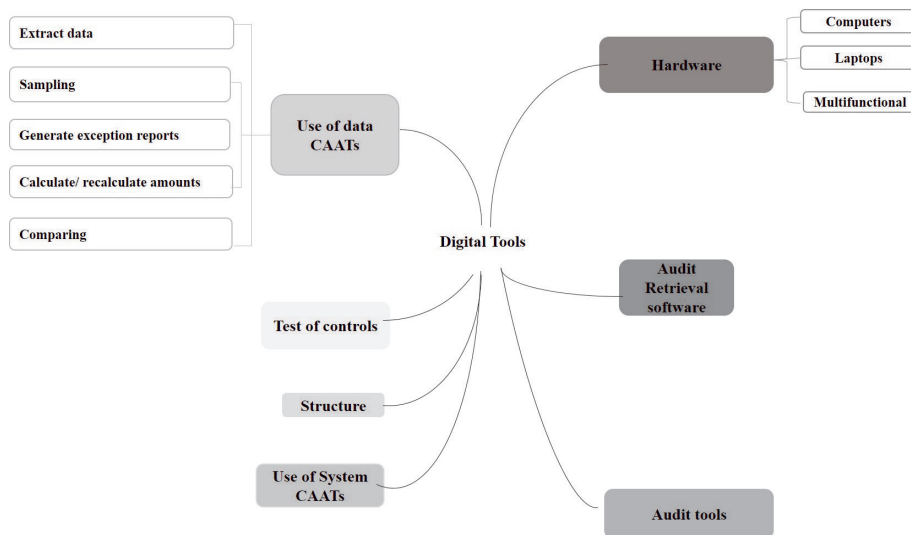
Table 1. Regulatory framework for the use of CAATs in the EU

| Reglementation | Implications |
|---|--|
| EU Directive 2014/56/EU on statutory audits | This policy aims to improve the quality of audits and promote the use of modern technologies, including CAATs. It emphasises the need for auditors to have adequate means and methods to perform their audit duties effectively and efficiently. |
| Regulation (EU) no. 537/2014 regarding the specific requirements for the audit of entities of public interest | This regulation establishes special requirements for the audit of public interest companies. It promotes the use of advanced auditing techniques and emphasises the importance of transparency and independence in auditing practice. |
| General Data Protection Regulation (GDPR) | GDPR is central to all audit processes that involve personal data. CAATs must comply with the provisions of the GDPR, in particular with regard to the processing, storage, and security of personal data. |
| EU Directive 2013/34/EU on annual accounts, consolidated accounts and related reports of certain companies | This policy contains requirements for financial reporting and auditing of financial statements. Supports the use of modern technologies to ensure the accuracy and reliability of financial reports. |

| Reglementation | Implications |
|---|--|
| International Auditing Standards (ISAs), adopted by the EU | ISA standards, which have been adopted into national legislation by the EU, contain guidelines and recommendations for the use of CAATs in audit work. These standards emphasise the importance of technique in testing and provide specific instructions for the application of CAATs |
| Directive (EU) 2016/943 on the protection of confidential know-how and confidential commercial information (trade secrets) against unlawful acquisition, use and disclosure | This policy protects confidential information and trade secrets, which must be taken into account when applying the CAAT, particularly in relation to access and processing of sensitive data. |

These regulations and guidelines provide the regulatory framework for the use of CAATs in the EU and ensure that tests are carried out efficiently, safely, and while maintaining high quality standards, using modern technologies. (see Table 1)

Figure 1. Digital technologies



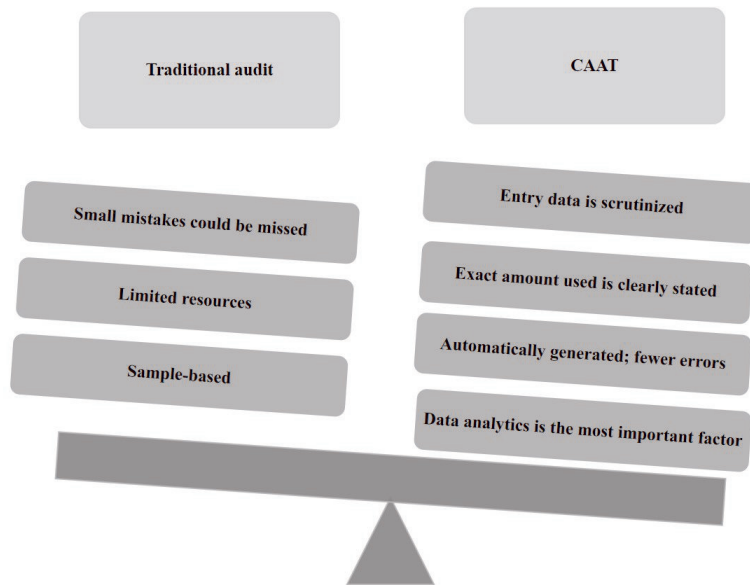
The COVID-19 pandemic has impacted the global business world in terms of remote work, in which the home office became a reality overnight due to mobility restrictions (Appelbaum/Budnik/Vasarhelyi 2020; Boitan / Tefoni, 2023). Consequently, auditors have been forced to adapt to new market requirements and particularly new digital technologies (see Figure 1). Taking into consideration the definition of the Chartered Institute of Internal Auditors, CAATs refers to the use of technology to help you evaluate controls by extracting and examining

relevant data. Sophisticated use of CAATs can be known as ‘data analytics’ and is increasingly being used in the profession.

Technology drives change in society, and various professions are rediscovering their role and aligning themselves with future technological directions. This includes members of the auditing profession. Technologies that can potentially have considerable effects on society have been implemented sooner than expected. Blockchain, robotic process automation, artificial intelligence (AI), and machine learning are no longer just topics discussed in research journals, but processes with practical applications in the auditing world (Fotoh/Lorentzon, 2021; Samagaio/Diogo, 2022; Fotoh/Lorentzon, 2023).

Science and technology surpass the analyses performed by accountants. Robotic process automation has the potential to perform repetitive inspection work more accurately, reliably and tirelessly in a fraction of the time. This technology will enable auditors to perform at a higher level and focus on more meaningful aspects of their work (Pedrosa/Costa/Aparicio 2020; Sujanto/Lindawati/Zulkarnain/Liawatimena 2021).

Figure 2. Traditional audit vs. CAAT

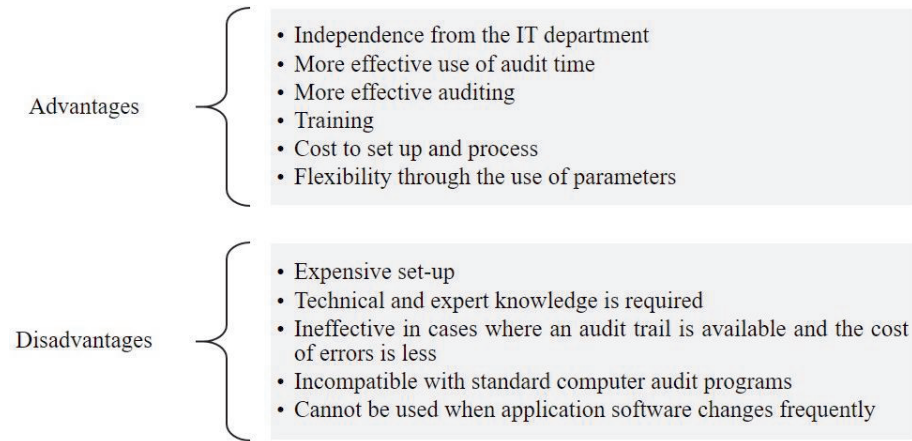


Computer-assisted audit tools or CAAT are commonly used by auditors for simple practices using MS Office to complex software applications for data analysis and sampling (Serpeninova / Matarenko / Litvinova 2020). CAAT represents a growing sector in the audit industry due to the increasing use of innovative new technologies that contribute to the efficiency and effectiveness of audits.

By considering artificial intelligence, which can replace human activity in some instances, we can understand how important CAAT are for audit activities. This is a growing sector in which innovations occur daily (Daoud/Marei/Al-Jabaly/Aldaas 2021). If we compare traditional audit activities with those based on CAAT, we can clearly notice a tilt toward the new digital technologies (see Figure 2).

However, there are limitations to the new CAAT technologies, such as knowledge of the application, which requires a human resource, and methods to save and import data into different software (Chan/Chiu/Vasarhelyi 2018). Figure 3 depicts the main advantages and disadvantages (Marei/Iskandar, 2019; Serpeninova/Makarenko/Litvinova 2019; Mohamed/Muhayyidin/Rozzani2019) of CAAT.

Figure 3. Advantages and disadvantages of CAAT



Future auditors will focus on performance auditing and the creative and intelligent side of auditing. Keeping current with science and technology changes and adapting to future governance models requires that existing skills must be improved, and new skills must be acquired to improve workflows and optimise employment strategies (Thottoli/Ahmed/Thomas 2022; Manurung 2023; Robu/Aevoae/Mardiros/Herghiligi 2023).

According to Ley (2018), ‘digitisation is bringing the biggest change to our world of work since the industrial revolution’. Hence, the current period is described as the “digital age” (Eshet 2012). This evolution has led to a serious change in work structures that has been evident for two decades (Petrillo/De Felice/Petrillo 2021). Due to the increase in flexibility, speed, and entrepreneurial thinking, employees in modern work structures must acquire new skills (Handoko/Thomas, 2022).

Employees must think more economically by understanding the goals of the company, observing competition, and taking economic responsibility for their part in company activities (Pyrrho/Cambraia/de Vasconcelos 2022). This requires considerable ability for self-organisation and self-control. Employees must be attuned to external market influences and make decisions quickly and independently (Eklinder Frick/Fremont/Åge/Osarenkhoe 2020). This coupling of employees with the demands of the market means that entrepreneurial thinking must be integrated into everyday activities. The subjectification of work leads to indirect control and replaces the precise distribution of tasks in classical economic models. Thus, employees approach the aspects of a "limited company" that can trigger increasing pressures to perform. In addition to organisational and control skills, an employee must be aware of his own limitations to cope with pressure (Gawer 2022).

The pressure to perform increases the need for rapid communication with flexible and permanent availability. Digital media such as laptops, tablets, and smartphones play an important role in this aspect (Kossek, 2016), since they can provide employees with company data in an intelligent cluster in real time through a permanent connection to the Internet. This ability to access company information at any time promotes the autonomy of employees with increasing independence from time, place, and people and creates the necessary flexibility potential, coupled with strong self-organisation skills and permanent accessibility. Therefore, employees can be linked to market demands through digital media, as their portability allows permanent access to company, market and customer data, and more flexibility in communication channels. Technological advances in the form of mobile IT are often considered positive and convenient. Some employees consider their mobile devices valuable supports in their daily work. Whether it is the opportunity to scan your emails in the evening, on the weekend or on vacation, or to hold a conference call abroad after work, modern means of communication eliminate the limits to accessibility (Whaibeh/Mahmoud/Naal 2020).

The increasing dissolution of the boundaries between work and private life is the most fundamental change in the organisation of work and the most important feature of modern work structures. In addition to the general societal trend toward continuous availability and the resulting dissolution of work boundaries, this process is a strategy by companies to release more resources and potential of the labour factor (Yavorsky/Qian/Sargent 2022).

The purpose of this study was to discover how modern forms of work are managed, which has been little explored in previous research, and to find the triggers by which working with digital media can lead to self-harm. The influence of possible triggers is especially important in small and medium-sized entities since their structures and forms of work are more strongly shaped by digitalisation

due to high demand orientation and competitive pressures, and therefore they represent possible future trends (Kossek 2016; Ollier-Malaterre/Jacobs/Rothbard 2019; Whaibeh et al., 2020; Novikova/Shamileva/Khandii 2021; Christopher, 2021; Meiryani/Oktavianie/Teresa 2022). These research objectives are incorporated into the following exploratory research question: The use of CAAT and in addition on the work environments of small and medium audit entities?

The current "digital age" requires adaptation to environmental demands through speed, flexibility, and mobility. Since predicting the future and deriving effective strategies has become increasingly difficult, enhanced digital agility is necessary. This agility is characterised by above-average attention, quick decision-making and implementation abilities, and the increased involvement and responsibility of each employee toward the objectives of the company. In addition, many employees desire flexible working hours in digital work environments, which is why these conditions can be a decisive factor in the "war for talent" in the labour market.

Based on these factors, emerging companies that aim to remain competitive cannot evade modern digital forms of work. The demands for different forms of work and digital work environments will continue to increase; therefore, the potential risk of self-harm by employees will also increase and actions need to be in place to manage this potential. Investigations should be conducted to determine whether working in digital environments leads to self-injury and what factors trigger self-harm in employment situations. The results of these evaluations can then be used to manage digital working environments to fully exploit the positive effects of these environments for successful advertising for the company and minimization of potential health-threatening behaviours.

The use of qualitative methods was deliberately chosen for the research question as these methods involve an open approach to the topic.

The methodological approach then presented an applied analysis to answer the research question. First, the scope of the investigation, sampling, and access to informants were described.

The purpose of our research was to investigate subjective opinions and feelings about possible triggers of self-harm behaviours among employees of small and medium company employees in the audit field in Romania. The selection of test participants used a strategy based on the snowball sampling method (Goodman 1961; Naderifar/Goli/Ghaljaie 2017; Köktener/Tunçalp 2021). The focus was based on previously established criteria of small and medium-sized companies' employees in the audit field in Romania because we believe that these businesses must have a high degree of digitisation to compete in a market that is dominated by large audit companies that operate at an international level.

Research methodology

The ability to work from any location at any time of the day has caused digital work environments to obscure the boundary between work and private life. Previous research has indicated that this dissolution of boundaries is strongly connected with health-damaging and life-threatening behaviors (Kossek 2016; Ollier-Malaterre et al., 2019; Whaibeh et al., 2020; Novikova et al. al., 2021).

For the analysis of the interview texts, we applied the thematic analysis method used by Braun and Clarke (2006), which is based on the qualitative content analysis according to Mayring (2015). Qualitative content analysis is a systematic approach that follows explicit rules. She would like to analyze linguistic material *"by dissecting and processing it step by step, developing a theory-guided category system on the material and defining in advance the aspects of analysis"* (O'Kane/Smith/Lerman 2021). Braun and Clarke (2006) present a concrete diagram of the procedure (described in simplified form) within the thematic analysis. Based on the recommendations found in the specialised literature, we chose to conduct 14 interviews.

However, the direct link between time- and location-independent work and the occurrence of self-harm by employees in digital work environments has not been determined. To address this research gap, this study aimed to gain insight into whether self-endangerment occurs when employees are involved in digital work environments.

The target group for the survey included employees of small and medium-sized audit companies. The market requirement to remain competitive along with the increased demands for flexibility translates into an increased use of digital media in the daily lives of employees. Therefore, employees of small and medium companies are particularly affected by the clouding of the distinction between professional and private life, reinforced by the intensive use of digital work environments. Therefore, these workers represent an interesting occupational group for studying possible self-endangerment.

In the specialised literature section, we described a number of possible triggers for self-injury behaviour; however, the use of digital work environments in this context, especially in relation to small and medium-sized companies, has not yet been examined in detail. For this reason, ideas were generated and information was collected as part of a focus group interview with four test persons from small and medium audit entities. Subsequently, based on the results of the group discussion, questions and guidelines were created for the final focus group, which included 14 interviews with individuals from small and medium audit entities in Romania.

The focus on small and medium-sized accounting firms (SMAs) in adopting and using CAATs is due to several factors. SMAs often have limited financial

and human resources, which is why the use of CAATs can significantly increase their efficiency and competitiveness. While large audit firms already have access to advanced technologies, SMAs need more support to implement similar technologies and meet increasing regulatory requirements. CAATs provide scalable solutions that enable SMAs to efficiently process larger amounts of data and therefore serve larger customers without incurring a disproportionate increase in workload. There are also special funding programmes that aim to support the digitalisation and technologization of small and medium companies to ensure that they can also benefit from the advantages of modern technologies. These measures contribute to a more balanced competitive environment and an overall higher quality of audit services.

An overview of the interviewees is shown in Table 2. All interviews were anonymised to obscure the identities of those involved, and this aspect was presented to the interviewees at the beginning of the discussions to ensure unbiased results.

Table 2. Overview of the interviews conducted.

| Interviewee | Date | Managing position | Age of the company |
|-------------|------------|-------------------|--------------------|
| P1 | 07.04.2023 | No | 5 years |
| P2 | 07.04.2023 | Yes | 4 years |
| P3 | 07.04.2023 | No | 5 years |
| P4 | 07.04.2023 | No | 7 years |
| P5 | 15.06.2023 | No | 9 years |
| P6 | 15.06.2023 | No | 3 years |
| P7 | 15.06.2023 | Yes | 7 years |
| P8 | 15.06.2023 | No | 8 years |
| P9 | 15.06.2023 | No | 10 years |
| P10 | 15.06.2023 | No | 6 years |
| P11 | 15.06.2023 | Yes | 4 years |
| P12 | 15.06.2023 | No | 5 years |
| P13 | 15.06.2023 | No | 7 years |
| P14 | 15.06.2023 | No | 2 years |

The test personnel were specifically addressed during the sampling strategy according to previously defined criteria. The sampling strategy proved to be particularly suitable for our research question, as it involved an investigation group that was based on the results of existing research and criteria specific to the study (Naderifar et al. 2017).

The snowball sampling strategy was a useful method since interview partners of small and medium companies recommended other interview partners, which

allowed us easier access to the target group. Although this method could induce network effects (homogeneity) and possible collusion among interviewees, it has proven to be an excellent entry into data collection and focus group acquisition. Since qualitative interviews (focus groups) require a relatively large amount of time and communication, they require a high willingness to participate by test individuals (Misoch 2019).

An interview of the group (focus group) was conducted to determine subjective views toward the possible triggers of self-harm in the digital work environments of small and medium companies in Romania. This was particularly aimed at generating ideas and gathering information for the main research phase (Ritchie, Lewis, Nicholls, and Ormston 2013). Using a realistic discussion, this method is particularly suitable for stimulating and developing statements constructively through provocative discussions. By discussing different collective perspectives, a group dynamic is created that includes authentic attitudes and opinions. With the help of a prior focus group interview, it was possible to capture the underlying attitudes, values, and opinions regarding our research question, which can only occur if the individual is encouraged to provide input to the group. Therefore, the purpose of the group discussion was to collect initial ideas and information to answer the research question and to explore subjective perspectives on possible triggers of self-injurious behaviour in digital work environments.

After conducting the focus group interview, a transcript was created based on the recordings using the simple rules of transcription according to Morgan (1996) and the qualitative content analysis procedure of Krueger (1997).

The results were presented after processing of the information obtained from the group made up of employees from small and medium-sized audit companies in Romania.

Results and discussion

The global volume of electronic data is growing at an almost incomprehensible rate. Filtering and selecting crucial information while avoiding redundancies to avoid inflating the volume of data further is a major challenge for companies. This large volume of information creates issues regarding cybercrime and industrial espionage within companies, which have become more common in recent years; therefore, data security is an increasingly important matter. In addition to the increasing volume of data, the possibilities for manipulation and misuse of data and fraudulent activities within companies are on the rise. These additional concerns affect audit procedures, as more emphasis on IT-supported audit procedures and data analytics, especially for mass data, in conjunction with classical audit procedures. Mass data (Big Data) characterises databases that have become large and complex and are difficult to verify effectively and efficiently with conventional testing methods. The requirement for digital data

analysis through computer-aided audit tools and techniques (CAAT) is evident; therefore, the influence of these tools on employees in terms of their efficiency and effectiveness must be analysed.

The diffusion theory presented by the communication scientist Everett Rogers (2003) explains the development of innovations and their expansion into the market. Diffusion occurs because innovations such as new services or products are usually adopted over a period of time. The potential of an innovation generally changes by the following gradual stages:

- Open potential: the innovation is still unknown to potential buyers/users.
- Takeover potential: takeover unit's familiar with the innovation hesitate or anticipate a decision to take over the innovation
- Existing potential: Acquisition units have adopted innovation.
- Both companies and households or individuals can assume the role of a takeover unit. Consumers can be divided into types according to their willingness to innovate based on their social status, income level, and age.

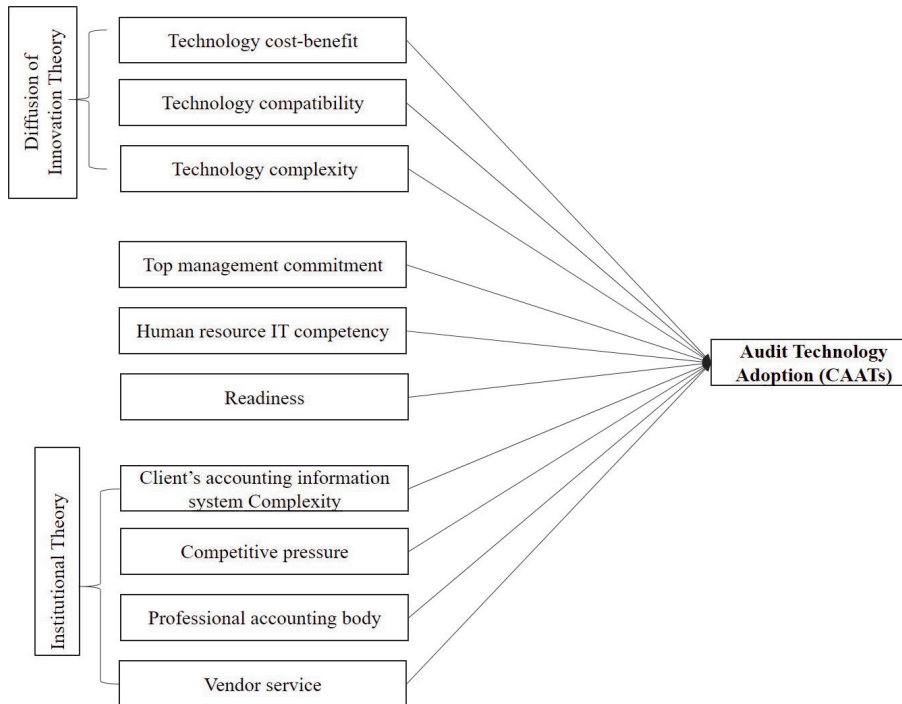
The fundamental ideas, terms, and concepts of neo-institutional organisational research were developed in key texts by Meyer and Rowan (1977), DiMaggio and Powell (1983), and Weick (1976), which subsequently stimulated a large number of theoretical and empirical works.

An example is the technology-organisation-environment (TOE) framework which Awa, et al. (2017) reiterated can be used for organizational-level analysis. This framework focusses on high-level attributes (ie, technological, organizational, and environmental contexts) rather than detailed behaviours of individuals within the organisation when addressing the adoption of technologies at the individual level. To understand this, behavioural models such as the theory of reasoned action, the theory of planned behaviour, and the technology acceptance model should be applied.

Figure 4 depicts the contextual framework of this study, which was developed based on the TOE framework by Tornatzky and Fleischer (1990). This research framework provided the technological, organisational and environmental factors that affect the adoption of audit technologies; thus, it addressed the research question about the adoption of these technologies. The framework was strengthened by the diffusion of innovation (DOI) (Rogers 2003) and institutional (DiMaggio and Powell 1983) theories to better explain the technological and environmental influence on the adoption of audit technology by audit firms. The TOE framework may only provide a general technological aspect without specifically addressing the characteristics of the technology (Rosli/Yeow/Siew 2012). The gap in this technological aspect could be supported by factors explained by DOI theory.

According to DOI theory, the adoption of technology is influenced by its perceived benefits or relative advantage. According to Rogers (2003), a relative advantage exists when a technology is "perceived to be better than the idea it replaces", or "offers improvements over currently available tools". As expected, a positive cost-benefit ratio is required for small and medium enterprises to be encouraged to adopt new innovative technologies. However, it also plays an important role in the adoption and use of new technologies that are compatible with existing systems. Thus, we assumed that the cost-benefit ratio can also positively influence the adoption of new CAAT technologies in the audit profession.

Figure 4. Contextual framework



DOI theory defines complexity as the degree of difficulty in understanding and using a specific system (in this case, CAAT). If entities and auditors perceive that the use of CAAT is excessively complicated, they will be reluctant to adopt these digital technologies (see Figure 4). Therefore, the complexity of CAAT could have a negative effect on their adoption and application; therefore, a method is needed to increase their allure. This is where management has an essential role, whereby, through proactive involvement, they can support the adoption of new CAAT and encourage their use. This participation and commitment of managers can positively influence the adoption of the new CAAT.

In addition to instilling the desire and motivation for the application of CAAT, the company must have the financial resources and be prepared for the investment required. Previous literature on the adoption of computer-assisted auditing tools has emphasized that the physical facilities and technological infrastructure influence the motivation to adopt computer-assisted audit tools (Krieger/Drews/Velte 2021). Therefore, the financial resources and preparations of society could positively influence the adoption of CAAT.

As argued by the TOE framework, a knowledgeable and competent workforce is necessary for a firm to successfully adopt new technologies (Tornatzky & Fleischer 1990). For this reason, we believe that the IT competence of human resources will positively influence the adoption of audit technology. Furthermore, the application of new technology by the client can induce the auditor to use new technologies to remain competitive in the market. As the TOE framework and previous studies have indicated, firms are more likely to adopt an IT when competitors in its industry are using similar technologies (Tornatzky & Fleischer 1990; Daoud et al. 2021).

Furthermore, the literature implies that there is a relationship between professional association and technology adoption (Rosli/Yeow/Eu-Gené 2013; Siew/Rosli/Yeow 2020). The normative view of institutional theory states that a firm will follow the norms of its professional groups and react to its environment (DiMaggio & Powell, 1983). Services offered by professional bodies and society in the adaptation of new technologies must also be considered.

Table 3. Descriptive statistics.

| Attribute | Mean | Standard deviation | Factor Loading | Cronbach's Alpha |
|-----------|------|--------------------|----------------|------------------|
| CB1 | 3.73 | 0.95 | 0.85 | 0.932 |
| CB2 | 4.07 | 0.92 | 0.91 | |
| CB3 | 3.93 | 1.07 | 0.83 | |
| TC1 | 3.68 | 0.94 | 0.91 | 0.823 |
| TC2 | 3.92 | 0.72 | 0.86 | |
| TC3 | 3.29 | 0.84 | 0.81 | |
| TComp1 | 3.39 | 0.93 | 0.85 | 0.853 |
| TComp2 | 3.83 | 0.72 | 0.87 | |
| TComp3 | 3.62 | 0.91 | 0.88 | |
| TMC1 | 3.01 | 0.96 | 0.78 | 0.902 |
| TMC2 | 2.89 | 0.97 | 0.91 | |
| TMC3 | 2.92 | 1.12 | 0.85 | |
| HR1 | 3.25 | 1.10 | 0.89 | 0.887 |
| HR2 | 3.28 | 1.01 | 0.90 | |
| HR3 | 3.31 | 0.98 | 0.92 | |

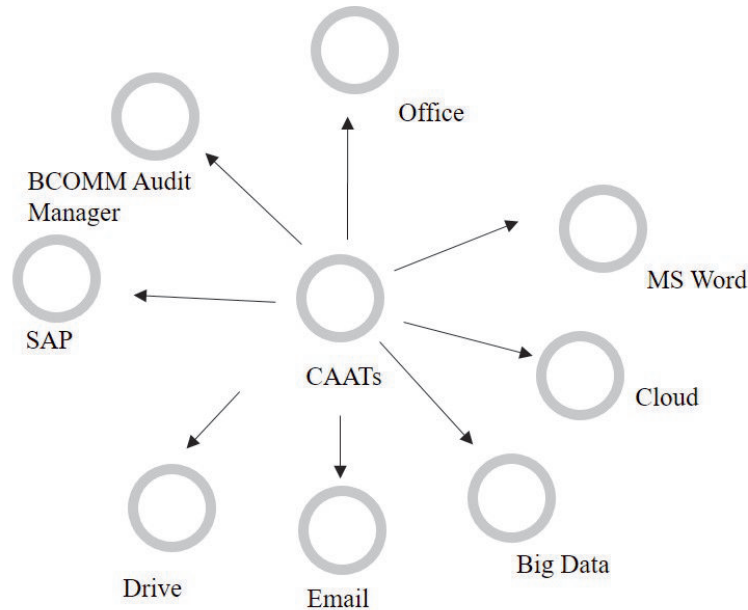
| Attribute | Mean | Standard deviation | Factor Loading | Cronbach's Alpha |
|-----------|------|--------------------|----------------|------------------|
| OR1 | 3.38 | 1.13 | 0.89 | 0.889 |
| OR2 | 3.72 | 1.02 | 0.86 | |
| OR3 | 3.26 | 0.98 | 0.82 | |
| AIS 1 | 3.53 | 0.97 | 0.81 | 0.798 |
| AIS 2 | 3.42 | 1.02 | 0.79 | |
| AIS 3 | 3.62 | 0.99 | 0.83 | |
| CP1 | 3.12 | 0.97 | 0.71 | 0.735 |
| CP2 | 3.15 | 0.99 | 0.82 | |
| CP3 | 2.98 | 0.83 | 0.80 | |
| PAB1 | 3.07 | 0.93 | 0.79 | 0.769 |
| PAB2 | 3.24 | 0.83 | 0.82 | |
| PAB3 | 3.44 | 0.85 | 0.69 | |
| V1 | 3.65 | 0.83 | 0.76 | 0.934 |
| V2 | 3.43 | 0.85 | 0.93 | |
| V3 | 3.24 | 0.81 | 0.85 | |

The factors included in our model had an influence on the results, as expected (see table 3). To extract further details, we continue with the focus group to learn more from the auditors involved. The results obtained from the focus group were consistent with those of the questionnaire carried out at the beginning of the study.

Seven people in the group stated that they had positive and negative feelings about being constantly available in a digital work environment. Their perceptions were controlled by three factors in particular: the time period, the type of environment and contact person. For example, on the first factor, most people tested in the group discussion said that they were often disturbed during breaks or contacted by colleagues on sick days when working in a digital environment.

In our research, we transitioned from a general approach to a particular one. In the first step, we tried to identify the types of CAAT adopted by small and medium-sized audit entities (see Figure 5), we then analysed the reasons for the adoption of these innovative technologies, and finally we assessed the positive and negative implications of this adoption on employment.

The results related to the first secondary objective regarding the different types of CAAT adopted by small and medium entities showed that medium-sized entities tended to apply SAP, internal, or commercial software such as BCOMM Audit Manager. In contrast, small entities worked mainly with Microsoft Office for data analysis and sampling. These firms generally had predefined worksheets that were linked to MS Word for automatic report creation.

Figure 5. Use of CAAT

In addition, cost was a central element for medium-sized entities. One of the respondents was passionate about using SAP because of its complexity and efficiency, but also emphasised the importance of understanding this software. Another respondent used in-house software to analyse and sampling data. The respondent mentioned that the software used by the client in the preparation of financial statements and the ability to export the files and reimport them after the audit were important components of a specific technology.

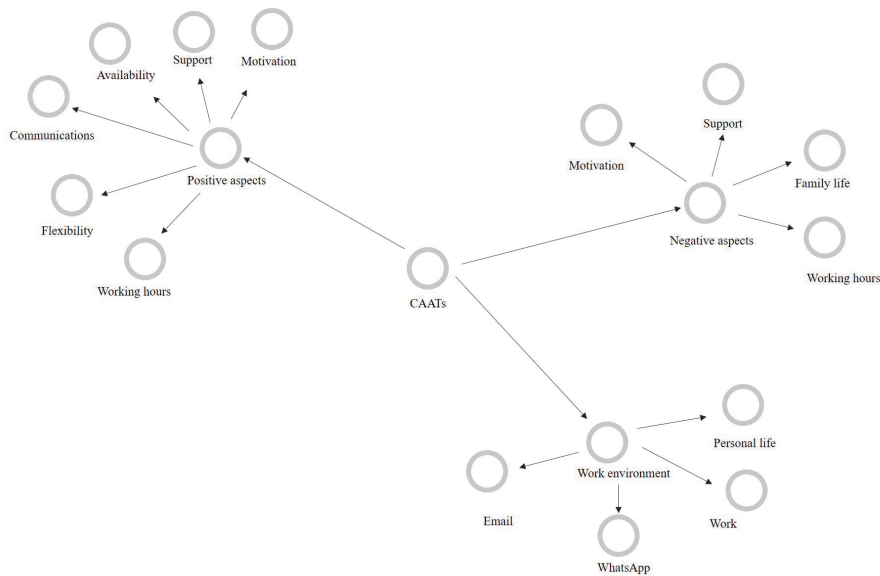
If the client does not use software to prepare their financial statements, which is an uncommon occurrence, the situation becomes complicated. In this case, the results for small audit firms are similar to those of medium-sized firms. Smaller firms tend to use MS Office for data analysis and sampling because they find it accessible, relatively inexpensive, and reliable over a long period. The Microsoft Excel software is sufficient for data analyses of smaller databases, and a small audit firm is unlikely to conduct an audit for a large firm as it does not have the required capacity. The essential problems of small audit firms are the financial ability to purchase and use advanced software for data analysis and sampling, and the drive to apply new technologies to remain competitive. For small audit entities, the cost-benefit ratio for the technology is negative, but over time this may change. Respondents considered that currently, CAAT require a series of expenses that cannot provide them with commensurate benefits. In addition to the costs of purchasing the software, there are expenses relating to

staff training and considerations regarding the reluctance and unresponsiveness of these employees to new activities.

We then focused on the perception of those who enjoy using digital media. Positive and negative perceptions of the influence of the digital workplace were observed. Based on the statements made by the interviewees, a trend should be evident with respect to the development of self-injurious behaviour through digital work environments and the associated personal feelings.

A first overview of the positive and negative aspects and related external factors (that is, environmental aspects) was determined for the behaviour of the employees based on the responses from the respondents (see Figure 6).

Figure 6. Positive and negative aspects in relation to the work environment



Regarding the type of digital environment, the group discussion participants stated that it was more difficult to respond to an email over the weekend because they had to consider wording, sentence structure, and other grammatical issues than just writing a short WhatsApp message.

The results of the contact person discussion indicated that the focus group participants did not find it stressful if a team member contacted them on the weekend. They quickly responded by saying that they liked being there for their team. The situation differed in terms of customer concerns, which they indicated that they would prefer to answer during regular business hours.

All respondents identified positive aspects regarding the use of CAAT in their audit activities and believed that digital environments could increase their efficiency. Those surveyed saw the use of digital work environments as an opportunity to learn about upcoming tasks before the workday began and plan accordingly. The ability to make initial preparations, when necessary, was perceived by the respondents as a positive aspect. Thus, respondents believed that deadline pressures would be reduced by having the ability to obtain details in advance. According to one respondent: *"Although sometimes I feel pressure on myself due to a busy week, when I notice ahead of time the activities that are due to me, and especially when I can prepare them the night before, my stress level drops considerably. From a mental point of view and the delimitation of the activity from work and personal life, it suffers due to the fact that I allocate personal time for work, however, I feel calmer."*

Moreover, activities conducted outside of working hours had a positive influence on productivity: *"We certainly have the feeling that we work more due to the fact that we work in our free time, but we are more efficient at work due to the fact that some activities already I prepared them."*

The flexibility to work at any time and place was also a considerable advantage, as one participant: *"I appreciate that I can work from anywhere and anytime so I can manage my time best."*

Despite these positive aspects, negative statements were also provided about the use of digital work environments. Several respondents admitted that it was difficult to work outside of regular hours as a result of the digital environments. *"Normally and without realising that I'm outside of working hours or even on vacation, I check my email and if necessary, I complete my tasks even though I shouldn't. Yes, this aspect can be considered negative, but here our culture and how we educate ourselves also come into play. We must impose ourselves and realise that a delimitation must be made between work and personal life, especially for our mental health. Rest is vital to dealing with everyday challenges and if we cannot detach from work, we don't have time for rest."*

Regarding their active work environments, respondents believed that there should be a delimitation of work from family life because families are often disturbed by work activities occurring during their free time. *"The family feels neglected because I always occupy it with work, this aspect became more visible with the pandemic when I started working a lot remotely, that is, from home because I no longer had a structured schedule but was on the option whenever and sometimes where I work. I am often told: Man, work hours are over, now put your cell phone away."*

Thus, we note that digital environments and special CAAT can bring both benefits and impediments to audit work.

The respondents mentioned the following possible factors that could influence their behaviour or lead to self-harm: communication, availability, support, and motivation.

Different communication channels are used in organisations for various purposes, and respondents perceived their effects differently. In general, emails, WhatsApp messages, and telephone calls were reported the most. *"There are so many different channels through which you can be contacted that sometimes it is already hard for me to keep track of them all, so I unconsciously access them all in my spare time."*

Respondents say that they will read emails outside of work hours but do not feel obligated to respond. However, they stated that they would not expect others to respond if they emailed them outside of office hours. Receiving e-mails outside of work hours created no pressure and was perceived as a minimal annoyance because the sender was not notified when the employee reads the email.

Other results were found regarding WhatsApp messages. This communication channel, which was generally described as more private, was used in all the organisations studied. WhatsApp messages were received primarily from peers or supervisors and often created pressure on respondents to respond immediately or promptly. This is partly due to the assumption that unimportant questions will not be answered using WhatsApp, but rather via email. It is obvious that a prompt response was usually expected to increase the efficiency of the activity. *'I would say that if I have a problem now, I would immediately write a WhatsApp or even call my direct colleagues. I generally prefer calls like that, because I think then it will clear up immediately and I don't have to wait forever for someone to answer me.'*

Respondents viewed telephone calls as the most urgent means of communication and are only used when an immediate response is required. Since the only options are to accept or ignore the call, they create considerable pressure and are perceived as inconvenient.

In terms of culture, respondents identified influencing factors that can promote self-injurious behavior. As discussed in previous sections, the line between work and leisure is increasingly indistinct, favored by flexible working times and the possibility of working from home. Furthermore, there are time pressures in the companies under audit, whereby working hours often have to be extended and break times are not respected.

In addition, the respondents identified that a high level of work motivation among the other employees of their company pressures them to maintain high performance.

In terms of motivation and work structures, two key points were identified that encouraged self-expert behaviour. All companies surveyed had flexible working

time models that did not include any control. This lack of control generally resulted in work being performed after agreed working hours. This is further discussed in the second point, which is meeting deadlines. Employees were given considerable responsibility and projects that could be accomplished independently. This resulted in increased pressure and a desire to complete the work successfully within a given time frame; therefore, the employees used their free time to meet this goal.

Leisure use is generally considered critically. Constant availability led to negative feelings in all test participants and included feelings of constant pressure and a lack of recovery time. These results were similar to those of Hilty (2016) and Singh et al. (2022), who discussed an always-on mindset that prevents periods of rest and can result in detrimental health effects.

Conclusions

The present research proposed two main objectives. First, an investigation was performed on the adoption of digital media, especially CAAT, in small and medium-sized audit entities in Romania, and second, the self-harm of employees due to the use of new digital media was explored.

The purpose of this research was to qualitatively analyse the working methods in small and medium audit companies in Romania in terms of adaptation to new digital technologies and the influence of these technologies on engagements. As no concrete research has been identified on the application of CAAT and employee self-harm in small companies and audit environments in Romania, the selected sample was approached openly. A focus group interview was conducted to collect initial ideas and the research team conducted information, and outcome assessments and individual factor analyses together. All passages retrieved from the interviews were discussed among the team, which allowed for a more objective assessment than would occur with individual evaluations. The anonymity of the respondents was ensured throughout the study.

The development of the audit market requires that the audit process be optimized. Therefore, IT-supported audit procedures are increasingly important. CAAT are expected to be the buzzword and auditing revolution over the next few years, and audit firms are urged to focus on digital data analysis and mass data processing tools. In the long term, the examination process will move further toward digital examinations and mass data analytics will be used on a greater scale than in previous audits.

Many CAAT-based audit tools and techniques are currently in use, but a continuous evolution of these tools and techniques is required in the field of data analysis, as many questions remain unanswered.

The findings of this study reveal that small and medium-sized entities generally try to stay abreast of trends in the market and test different CAAT programmes within their financial limits. Small audit firms tend not to use complicated software but remain with commonly used programmes such as MS Office. In addition, this study examined the reasons for small and medium-sized entities to choose CAAT software or rely on existing applications. The findings indicated that the financial aspect or cost-benefit analysis was the main determinant for the purchase of complex software for analysis and sampling in the audit. In conclusion, the adoption of CAAT software among audit firms likely depends on the availability of financial resources, the expertise of the partners, and the nature of the operations of their clients.

This study showed that small and medium companies in the audit field have a high degree of digitisation and that the use of digital work environments in free time is a common method of extending the work schedule. This extended accessibility was used by all tested people and often led to negative feelings; therefore, there was a potential for self-endangerment. This self-threat through extended accessibility was considerably influenced by digital work environments, but, as is evident from previous research, digital work environments were not the trigger for the participants in this study, but rather a means to an end.

The representativeness of this study should be viewed critically. Due to the small number of respondents, qualitative studies can only show aspects that are limited in scope. However, this study provides a focused qualitative perspective, and the results obtained may be helpful in designing further studies.

When examining potential triggers, the use of digital work environments in leisure time resulted from a high workload, but it could not be clarified whether complex market demands or career aspirations influenced this workload. The indirect pressure from the social environment had an effect, in small and medium-sized companies, a high level of social ties with the company and colleagues appeared to create expectations that resulted in the indirect pressure to be constantly available. We believe that our research results can incite new research and discussions in the field that can bring positive changes to the accounting profession to the extent that the relationship between the cost and benefit of advanced audit software is identified. Moreover, we believe that the results can be useful both to practitioners and to academics. Like any research, face-to-face studies present a series of limitations. The current study was exploratory and utilised a focus group and the results of those surveyed could confirm or deny our results. Furthermore, the scope was limited to audit firms in a specific regional area. We believe that the results obtained could be a guide for small and medium-sized entities that have not yet considered digital media. Furthermore, we determined that close social relationships could be a reason why private media are used for professional purposes and that the boundaries between work-

ing hours and free time are becoming increasingly indistinct. This development must be viewed critically, especially in the case of availability during vacation and sick time. Furthermore, more studies should address the lack of rest periods during the regular work week and weekends.

Declarations

Disclosure statement

The authors declare that they have any competing financial, professional, or personal interests of other parties.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

Author Contributions

All authors made the same contribution to the article. All authors have read and agreed to the published version of the manuscript.

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