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How Far Are We from Income Parity in Agriculture? Evidence from Poland (2004–2019)

Ile dzieli nas od parytetu dochodowego w rolnictwie? Perspektywa historyczna Polski (2004–2019)

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Abstract

The European Union's Common Agricultural Policy (CAP) aims to prevent income insufficiency among farmers, a problem rooted in both natural and economic constraints that determine the allocation of production factors and the sector's depreciation through market mechanisms. Our study examines how changes in policy priorities and instruments have influenced income disparity in the agricultural sector. Since each instrument impacts income differently, we considered all CAP payments and applied the Generalised Propensity Score method to minimise selection bias. Our findings indicate that unsubsidised farms initially outperformed those receiving minimal subsidies. Over time, however, increased financial support became essential to sustaining income parity between agriculture and other economic sectors. Despite recent policy changes and increased support, full income parity has yet to be achieved.

Słowa kluczowe:
dochód, gospodarstwo rolne, polityka rolna, analiza kontrfaktyczna

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Streszczenie

Wspólna polityka rolna Unii Europejskiej (WPR) ma na celu zapobieganie zbyt niskim dochodom wśród rolników oraz problemom spowodowanym okolicznościami naturalnymi i gospodarczymi, które determinują alokację czynników produkcji i osłabienie sektora poprzez mechanizmy rynkowe. Niniejsze badanie pozwoliło sprawdzić, w jaki sposób zmiany w priorytetach i instrumentach polityki wpłynęły na dysproporcje w dochodach w sektorze rolnym. W związku z tym, że każdy instrument ma inny wpływ na dochody, wzięto pod uwagę wszystkie płatności WPR i zastosowano metodę *generalised propensity score*, aby zminimalizować błąd selekcji. Wyniki wskazują, że początkowo gospodarstwa, które nie otrzymywały dopłat, radziły sobie lepiej niż te, które otrzymywały niewielkie dopłaty. Zwiększanie wsparcia finansowego stało się jednak z czasem konieczne, aby osiągnąć parytet między rolnictwem a innymi sektorami gospodarki. Pomimo ostatnich zmian w polityce i zwiększonego wsparcia różnice w dochodach nie zostały jeszcze wyeliminowane.

Introduction

The concept of income parity – or disparity – refers to comparisons between the earnings of different social and occupational groups. Income earned in agriculture is usually lower than in other sectors of the economy. According to Eurostat data [**European Commission, 2023**], the average family farm income in the EU27 was equivalent to 30.6%, 37.3%, and 40.95% of employees' wages in 2005, 2010, and 2020 respectively. In 2021 and 2022, this figure rose to 53.2% and 64.0% respectively, largely due to substantial support provided to agricultural producers during the COVID-19 pandemic and other crises. Various explanations have been given for persistently lower incomes in agriculture. One is the income insufficiency of farming caused by the natural and economic circumstances in which production factors are allocated [**Buckwell et al., 2017**; **OECD-FAO, 2023**]. Another explanation is that farm income does not increase with improved productivity due to non-flexible demand for food, while the prices of agricultural raw materials remain flexible [**Cochrane, 1958**; **Czyżewski et al., 2019**]. Additionally, some argue that market mechanisms devalue the agriculture sector, resulting in trends such as relative deprivation of income [**Stępień et al., 2018**] and the rent gap [**Czyżewski et al., 2024**]. One of the main tools aimed at correcting these market failures is the Common Agricultural Policy (CAP) implemented in EU member states. The question is: to what extent do CAP mechanisms mitigate income disparity in agriculture – and to what extent do they contribute to its persistence?

Ensuring a fair standard of living for the agricultural community was one of the five objectives of the CAP set down in the 1957 Treaty of Rome – goals that remain unchanged to this day.[1] However, neither "fair standard of living" nor "agricultural community" have ever been precisely defined. **The European Court of Auditors** [**2003**] stated that to assess the CAP's effectiveness, it is necessary to define its income target more precisely. A lack of precision in defining goals is not an exception in EU public policies, where political and technical problems are resolved using instruments at the EU's disposal, regardless of whether they are optimal.

CAP instruments for supporting farm income have evolved from intervention price support policies to coupled and decoupled direct payments, and now to targeted direct payments. However, according to **Lascoumes and Le Galès** [**2007**], no instrument is neutral, as it creates specific effects regardless of the goals pursued and thus shapes public policies according to its logic. The more public policy is defined by its instruments, the greater the risk of conflicts among stakeholders – typically resolved in favour of the most powerful actors or institutions. CAP payments come in different forms, each with specific objectives influencing farmers' behaviour. **Lillemets et al.** [**2022**] provide a systematic review of payments impacting farm income. According to **Ciliberti and Frascarelli** [**2018**] and **Severini et al.** [**2016**], direct payments reduce inequalities and stabilise farm income. Other researchers point to the growing polarisation of agricultural incomes and concentration of payments (e.g., **El Benni et al.** [**2012**]). In Poland, **Grochowska et al.** [**2021**] observed increasing inequalities in farm income. Yet most research appears to focus on the impact of CAP payments on farm productivity (see Section 2.2). **Khafagy and Vigani** [**2022**] and **Biagini et al.** [**2023**], who systematically reviewed the literature in this area, show that the results are inconsistent, even within the same group of instruments. **Minviel and Latruffe** [**2017**] provided some explanations to shed light on these discrepancies. Most studies on how agricultural policies affect farmers' incomes, especially in the context of income disparity (comparing agriculture with other economic sectors), have taken a macroeconomic approach, looking at aggregated categories (see **Cai, Pandey** [**2015**]; **Czyżewski, Poczta-Wajda** [**2017**]; **Czyżewski et al.** [**2019**]). Few studies apply a microeconomic approach based on experimental or quasi-experimental methods. Our paper addresses these gaps.

We investigate how CAP support has influenced agricultural income parity in the EU by examining Poland, a member state with among the lowest farm incomes (see Figure A1.). Starting with the CAP's core objective of supporting agricultural income, we ask whether the evolution of CAP priorities and the accom-

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1 Under Article 39 of the Treaty on the Functioning of the European Union, the objectives of the CAP are to increase agricultural productivity; ensure a fair standard of living for the agricultural community; stabilise markets; ensure the availability of supplies; and ensure that supplies reach consumers at reasonable prices.

panying changes in its instruments have yielded a real-term improvement in farm incomes. Unlike previous studies, our metric of progress is not absolute income growth, but income relative to non-agricultural sectors.

The paper is organised as follows. Section 2 traces the evolution of CAP income-support priorities – from a uniform, one-size-fits-all model to a more tailored approach – and outlines the pathways through which CAP payments impact farm income. Section 3 presents the data and estimation strategy. Section 4 describes our results. Section 5 concludes with policy implications.

Background

The evolution of income support for farmers

The almost 70-year history of the CAP shows just how strongly the member states influenced this policy with enough sway to push through instruments that ultimately changed the "common" agricultural policy into an à la carte menu, adjusting them to the needs of their farmers [**Swinnen, 2015**]. The highest number of elements of the one-size-fits-all approach can be found in the beginnings of the CAP when strong support for produce prices was provided through public intervention purchases and export subsidies according to rules that were similar for all the member states of the time. However, this path of CAP implementation triggered the rent-seeking trend when the powerful agricultural lobby caused the policy to be transformed into an instrument of sectoral protectionism, which, particularly in the 1970s and 1980s, brought about the overproduction of certain agricultural products and put excessive pressure on the community budget [**Greer, 2013**]. Upholding income based on price guarantees caused the concentration of the resources earmarked for this at intensive-production farms. In contrast, small and medium-sized farms did not benefit from this support in practice [**Sorrentino et al., 2016**].

The CAP devotes a significant part of its budget to supporting and stabilising EU farmers' incomes through direct payments distributed to agricultural land areas. The introduction of direct payments following the 1992 reform further exacerbated the growing differences in aid provided under the CAP between farms within and between the member States. The payments granted then were meant to compensate farmers for losses from lower price support for the main agricultural products (cereals and beef). The payment amounts were based on yields at individual farms (taking into account criteria such as agricultural land area, productivity and number of livestock) in the reference period. This meant that countries where farms produced crops and meat that had been highly subsidised now received the most significant amount in direct payments. Meanwhile, countries where farms produced or specialised in products previously receiving lower subsidies, such as fruit and vegetables, received much less support. Successive CAP reforms increased these differences even further, reducing funding to aid agricultural markets and instead increasing the amount spent on payments. This historically determined support from public funds for large, intensive-production farms continues to this day. A noticeable path dependency is involved, whereby choices made in the past determine current decisions regarding the form and financing of the EU's agricultural policy [**Kay, 2003**]. Considering that agricultural policy instruments (first pillar) are 100% financed from the EU budget, during negotiations, the member states strive to obtain derogations from the binding law for their farmers or push through specific instruments fitting in with the unique character of their agricultural sectors. The tendency to excessively protect one's agriculture, which is an inherent part of the decision-making mechanisms of this policy, leads to severe problems with appropriately targeting support at groups and sectors that are most in need.

The introduction of the CAP's second pillar in the 1990s [Agenda, 2000] and instruments aimed at fostering structural changes in agriculture and rural development contributed to a further diversification of agricultural policies among member states. Each country was required to draw up its own Rural Development Programme, tailored to national and regional characteristics, within a set of instruments proposed by the European Commission. However, the funding allocated to the second pillar was limited, at approximately 10% of the total CAP budget, and required co-financing from member states.

One example of the CAP's shift towards policy decentralisation was the introduction of a diverse range of direct payment schemes within the policy's first pillar, under Council Regulation (EC) No. 73/2009. The EU15 countries, Malta and Slovenia, implemented a Single Payment Scheme (SPS) based on the historical model, in which farmers received payments calculated from their past agricultural production, hence historical differences between farmers. When the SPS was based on the regional model, the national payment envelope (determined based on historical production) was split among all the eligible farmers. There was also an intermediate, hybrid model that was a combination of the historical and regional models. The new member states that joined the EU in 2004 and 2007 (except Malta and Slovenia) applied the Single Area Payment Scheme (SAPS), which functioned along similar lines to the regional model: depending on the amount in the national envelope, a set amount of payments was assigned per hectare. However, the envelope amount was not based on the historical production level, as was the case in the EU15, but was determined during accession negotiations. Consequently, each EU member state followed its own system of subsidies based on payments received from the EU budget. The resulting substantial differences in direct payment systems in the CAP's first pillar reduced the transparency of public aid provided to agriculture in the EU and made it impossible to create equal conditions of competition between farms with different types of agricultural production as well as between regions and countries. This had a noticeable impact on farmers' incomes.

Successive CAP reforms have not introduced any major changes in the allocation of direct payments between or within member states. The external and internal convergence mechanisms proposed in the 2013 CAP reform remain in place today. Member states largely view direct payments as a straightforward redistribution tool that balances contributions to and receipts from the EU budget. As a result, both net contributors and major CAP beneficiaries have little incentive to support significant convergence of payments, particularly between countries. The evolving range of CAP instruments has substantially affected how payments are distributed, leading to a substantial concentration of support among a small group of farms. This is particularly evident in the transition from a historical model – based on individual farms' production – to a national or regional model that applies a uniform payment per hectare. Consequently, land and payments have become increasingly concentrated: 20% of the largest farms in the EU control 82% of agricultural land and production, and receive 80% of CAP payments [**European Commission, 2023**].

The 2013 CAP reform significantly increased instrument flexibility, impacting farm incomes in varied ways. While instruments regulating the functioning of agricultural markets and food supply chains have been applied relatively uniformly across the EU, the first pillar's flexible direct payment schemes have enabled each country to tailor support based on regional characteristics or types of production. The Strategic Plans for 2023–2027 incorporated into the CAP will intensify this process. As a result, the EU-level path dependency that once shaped the CAP is giving way to national path dependencies, reflecting the unique conditions and policy preferences of individual member states.

Figure A2. presents a timeline of key milestones in the evolution of CAP instruments and successive rounds of EU enlargement.

Evidence on policy impact

CAP instruments designed to support farm income have evolved from intervention price support policies to coupled and decoupled direct payments, and eventually to a system of targeted direct payments. Our study focuses on the period when direct payments served as the primary tool for income support. Since these payments are included in the accounting of farm income, their direct contribution to income levels is clear and unambiguous (see also **European Commission [2011]**). However, CAP payments come in different forms, each with specific objectives that affect farmers' behaviour in different ways. Consequently, although all payments influence farm income to some extent – primarily through their impact on farm productivity – it remains unclear whether this effect is positive or negative.

For direct payments, one view is that these subsidies tend to undermine the motivation of agricultural producers to enhance their production techniques [Hennessy, 1998; Ciaian, Swinnen, 2009]. The negative impact on farm productivity is also attributed to the inefficient allocation of production factors (cf. Bakucs [2010]), soft budget constraints, and subsidising less productive farms, hence facilitating them to stay on the market [Bergström, 2000; Guyomard et al., 2004; Rizov et al., 2013]. Decoupled payments may also decrease the probability of a farm disinvesting [Kazukauskas, 2013] and slow down the technological catching-up process due to the "inefficiency trap," i.e., the possible adoption of technological progress by the most efficient farms [Boussemart et al., 2018]. Ciaian and Swinnen [2006] confirm the negative impact of decoupled direct payments on farm productivity under imperfect competition in the land market. Latruffe et al. [2009] demonstrate the negative effect of direct payments on farm efficiency by investigating farms in France with selected plant and animal specialisations. The negative impact of CAP payments was also confirmed by Latruffe [2010], Sckokai and Moro [2009] and Zhu and Lansink [2010]. According to Bonfiglio et al. [2019], specialised farms receiving higher levels of support show significant effects on technical efficiency through decoupled direct payments. However, the effects are contrasting. Subsidies negatively affect technical efficiency in arable crop farms yet positively influence efficiency in livestock farms. However, Latruffe et al. [2016] note that the impact of subsidies on technical efficiency varies depending on the country and can be positive, negative or null – although the 2003 CAP reform weakened the effect subsidies had on technical efficiency (cf. Mary [2013]). However, a different conclusion was reached by Martinez Cillero et al. [2017], who studied specialist beef farms in Ireland and showed that decoupled payments maintained the positive effect of coupled payments on farm efficiency. In contrast, according to Garrone et al. [2019], direct payments boost labour productivity growth. Still, the positive effect comes from decoupled subsidies, while coupled subsidies have the opposite effect and slow down productivity growth. A positive impact of decoupled direct payments on farm efficiency was confirmed by Ayouba et al. [2017] for crop farms in France.

There has also been considerable interest in the effects of other CAP instruments. Pisulewski and Marzec [2022] found that environmental, LFA and other rural subsidies increase persistent technical inefficiency in dairy farms. Similarly, Quiroga et al. [2017] confirmed a negative impact of both crop subsidies (pillar I) and environmental programmes (pillar II) on productivity. Mennig and Sauer [2019] observed that agri-environmental payments reduce productivity in dairy farms, whereas schemes designed for arable land tend to overcompensate farmers, boosting their income. In contrast, Dudu and Smeets Kristkova [2017] found that agri-environmental payments are essential in stimulating land-augmenting technical change, while rural development payments play an insignificant role.

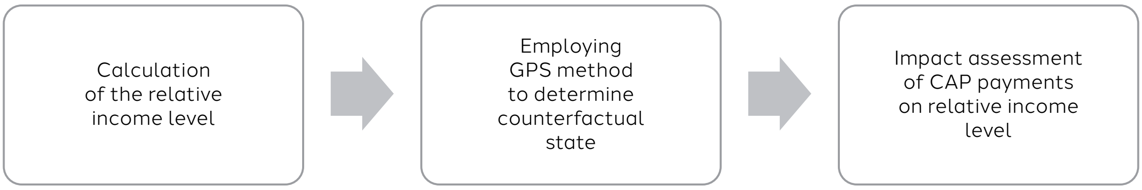
In the case of investment support, subsidies are expected to enhance farm productivity by increasing the capital-to-labour ratio. Ratinger et al. [2013] reported a positive effect of subsidies on labour productivity in medium-sized farms in the Czech Republic. However, according to Nilsson [2017], the positive effect of investment support on productivity is limited to small agricultural firms, while higher levels of support relative to income can negatively impact productivity for all firms.

Materials and methods

Conceptual framework

The usual approach to agricultural income parity is normative, suggesting a need to bring farmers' incomes to the same level as other social and occupational groups [Wąs et al., 2019]. However, determining the relative income level involves several methodological issues that make it difficult to ascertain the relationships between incomes in agriculture and outside it. Adopting the proper income categories is one of the fundamental problems in analyses of income parity [Hill, 2015]. The barriers may include a diversity of economic situations in agriculture and other sectors of the economy, the fact that farmer households may incur unique spending categories connected with a farm's dual function, the existence of different national insurance systems for farmers and non-farmers, and non-agricultural sources of farmers' incomes [Baer-Nawrocka, 2011]. The data used and the level of data aggregation are other essential considerations for operationalising agricultural incomes. Research has so far concentrated on a macroeconomic approach, which also determined the choice of research tools. The methodology in such studies was usually based on the Gini coefficient, the measure dedicated to quantifying the inequality of income distribution (cf. El Benni et al. [2012]; Schmid et al. [2006]). Moreover, in-depth studies on agricultural income parity have used a regression tool (cf. Marino et al. [2023]; Zdeněk et al. [2022]). Marino et al. [2021] applied a fixed-effects regression model, allowing them to control for both observable farm characteristics and unobservable variables that remained constant over time. A similar methodological approach was used in our study. To assess the level of agricultural income parity, we employed a quasi-experimental method based on a counterfactual approach.

Figure 1. Estimation strategy



Source: Authors' own elaboration.

The estimation strategy followed a three-step technique (see Figure 1). First, we calculated the relative income level as the farm income ratio to the household sector's gross disposable income. In the second step, we applied a quasi-experimental evaluation methodology to estimate the impact of the CAP payment on the relative income level. Thus, we employed the generalised propensity score (GPS) method to address the problem of the unavailability of counterfactual non-supported farms. The application of GPS allowed us to estimate how the effects of CAP payments varied with support size.

Data

We used individual farm data from the Polish Farm Accountancy Data Network (FADN) database from 2004 to 2019.[2] Our analysis encompassed all three agricultural policy financial frameworks in which Poland participated as an EU member state. The study was based on commercial farms producing over 90% of standard output (SO) in a given region or country.[3] When sampling farms from the FADN observation field, stratified selection is employed to ensure that the diversity of farms is accurately represented. This procedure involves dividing the sampling frame into strata based on three criteria: regional location, economic size, and type of farming [Goraj, Mańko, 2009]. From 2004 to 2019, the number of Polish FADN farms in the sample ranged between 10,890 and 12,298. Every year, 10% of the farms were replaced with new observations according to a rotation schedule. Hence, the research sample we used in the analysis was a panel of farms that took part in the Polish FADN uninterruptedly throughout the period under consideration. Ultimately, the research sample thus comprised 2,299 observations per year.

2 Only aggregated data is publicly available. Access to the data on an individual level is upon request. In the case of Poland, the database is managed by the Institute of Agricultural and Food Economics – National Research Institute.

3 The value of SO is the five-year average value of crop or livestock production per hectare or per animal in a year under average production conditions for a given region.

Dose response framework

The recognised ideal research method enabling the influence of a selected variable (CAP payments) on the research result (incomes) to be isolated is a randomised controlled experiment. This method ensures that there is no common causation between the state of the treatment (whether a farm received payments or not) and the observable and non-observable characteristics of a given unit (farm). In the social sciences, especially economics, it is usually impossible to conduct an experiment, and the only way to analyse the behaviour of farms is through observational studies. In such a case, it is necessary to use counterfactual methods, i.e., statistical methods allowing a set of data gathered during an observational study to imitate data from a randomised experiment. Forming an appropriate control group enables the reproduction of experimental conditions based on the analysis of counterfactual states. This is a hypothetical value of the outcome that the unit would have achieved if it were in a different state than it is in reality [Rosenbaum, Rubin, 1983]. The key element in such a study is to select a control (comparison) group that is the best possible representative of the counterfactual state for observations receiving the treatment. When a farm from the experimental group (receiving payments) is assigned its counterpart in the control group (a farm that does not receive payments), this requires comparing a set of characteristics. The greater the number of variables in the analysis, the more accurately we can determine the counterfactual state of the experimental group. Rosenbaum and Rubin [1983] proposed a solution to this multidimensional problem: selecting the control group solely based on a propensity score that determines the conditional probability of a unit receiving the treatment based on the observed characteristics.

Methods based on propensity score analysis usually assume that the treatment is binary. However, the treatment often consists of a categorical variable (having more than two levels) or a continuous variable. In such a case, we speak not of the occurrence or absence of the treatment but of its dose. There are three methods for estimating the effect of a continuous treatment in the case of a non-random mechanism of treatment dosage. One is the generalised propensity score introduced by Hirano and Imbens [2004]. Our study considers the continuous treatment (CAP payments) as a random variable Z such that each i-th farm receives a dose of z (a certain payment amount) and for each i-th farm there is a vector of potential values of the outcome $Y_i(z)$ (relative income level). At the level of a single farm, the effect of payments is defined as the expected value of the vector of potential values of the relative income level $\mu(z) = E[Y_i(z)]$, which cannot be estimated directly because only one value z of the vector $Y_i(z)$ is known for each i-th farm. This means that a single farm receives a specific payment amount at a given time, which results in a given relative income level. The other potential values of the relative income level, which the farm could have achieved if it had received payments in a different amount, are unknown.

It is assumed that the payments and the potential value of the relative income level depend on the set of observable confounding variables X and, therefore, to avoid confounding the estimate of the treatment effect, these variables need to be included in the analysis. It is thus required that the potential values of the dose response (relative income level) be independent of the treatment-dosage assignment, for a given vector of observable variables X, i.e. $Y_i(z) \perp Z_i(z) \mid X$. This condition is known as the assumption of weak unconfoundedness [Imbens, 2004]. Hirano and Imbens [2004] proved that the GPS, being a conditional density function of the treatment, allows the bias resulting from the observable variables X to be eliminated if the assumption of weak unconfoundedness is fulfilled. If the relationship between Z and X can be represented by a linear regression model: $Z_i = \beta_0 + \beta X_i + \varepsilon_i$ and $e_i \sim N\left[0, \sigma_i^2\right]$, the GPS is defined by the conditional density function having normal distribution:

$$r(z,x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left[-\frac{1}{2\sigma^2}\left(Z_i - \beta_0 - \beta X_i\right)^2\right]$$

According to Leite [2017], in the case of our study, the method of estimating the continuous treatment effect proposed by Hirano and Imbens [2004] comprises the following stages: (1) checking the distribution normality for the payments received by farms and logarithmically transforming the variable if needed, (2) estimating the linear regression model for payments received *Z* depending on the farms' observable characteristics *X*, (3) determining the GPS value (based on the chosen density function, in this case having normal distribution), (4) estimating the linear regression model for the relative income level *Y* depending on *Z* and the GPS, and (5) estimating the average value of the relative income level for each payment level *Z* and determining the reaction function graph.

Variables

Our objective was to investigate the impact of the CAP on agricultural income parity. Thus, the treatment dose was defined as the total payments received by farms, which, according to the FADN methodology, are classified as CAP payments for a farm's operations (SE605) and investments (SE406). The outcome, referred to as the relative income level, was calculated as the ratio of family farm income per family work unit (SE430) to the nominal gross disposable income per capita in the household sector, based on annual data from Statistics Poland and expressed in 2004 constant prices. The GPS values were determined as the conditional density with a normal distribution, using the fitted values of the treatment dose estimated based on the linear model of regressors: total labour input (SE010), total utilised agricultural area (SE025), rented utilised agricultural area (SE030), total agricultural area out of production (SE074), total livestock units (SE080), total output crops and crop production (SE135), total output livestock and livestock products (SE206), total intermediate consumption (SE275), depreciation (SE360), total external factors (SE365), net worth (SE501), and gross investment in fixed assets (SE516) (see **European Commission** [**2014**]).

On the one hand, the choice of variables for the model was dictated by the need to consider characteristics influencing both the treatment dose (CAP payments) and the outcome (income). On the other hand, it was shaped by the necessity to achieve covariate balance. This assumption was considered met because the standardised regression coefficients calculated for the GPS strata were significantly lower than those in the base model, or lower than 0.1 for each estimated model (see Table A.1).

General characteristics of the farms treated

Table 1 presents the average values of the variables analysed. During the studied 15 years of Poland's EU membership, the relative income level grew slightly. However, its variability (variance) also increased, which suggests growing income inequalities (greater dispersion of incomes) during that time.

Table 1 presents the average values of the analysed variables. During the first 15 years of Poland's EU membership, the relative income level rose slightly. However, its variability (variance) also increased, which suggests growing income inequalities (greater dispersion of incomes) over time. A slight increase in the dose response was accompanied by a substantial increase in the payments obtained from CAP instruments. In the studied period, the proportion of farms receiving CAP support rose from 70% in 2004 to 99% in 2019. Outlays on production factors changed only modestly. Although the average value of crop and livestock production increased, so did intermediate consumption. Notably, while farms' net worth (assets minus liabilities) tripled, investment in fixed assets grew only marginally.

Table 1. Summary statistics of dose response, treatment dose and covariates for GPS estimation in 2004 and 2019 (in 2004 constant prices)

	2004	2019
Dose-response		
Relative income level	1.64 (2.31)	1.98 (3.29)
Treatment dose		
CAP payments [EUR]	1,372.72 (2,601.71)	9,480.56 (10,011.91)

cont. Table 1

	2004	2019
Covariates to estimate GPS		
Total labour input [AWU]	2.03 (1.16)	1.95 (1.15)
Total utilised agricultural area [ha]	29.47 (29.92)	37.52 (38.46)
Rented utilised agricultural area [ha]	8.52 (20.04)	11.3 (21.32)
Total agricultural area out of production [ha]	0.18 (1.5)	0.4 (1.64)
Total livestock units [LU]	27.23 (40.67)	31.41 (62.12)
Total output crops and crop production [EUR]	15,938.74 (24,579.43)	23,781.57 (36,934.53)
Total output livestock and livestock products [EUR]	18,035.22 (29,404.79)	29.941,03 (68,148.30)
Total intermediate consumption [EUR]	19,710.91 (26,086.56)	32,963.48 (49,336.85)
Depreciation [EUR]	4,208.82 (3,679.58)	6,277.05 (8,101.04)
Total external factors [EUR]	1,300.03 (3,458.16)	3,051.38 (6,914.49)
Net worth [EUR]	92,566.14 (72,259.76)	228,046.38 (231,908.80)
Gross investment on fixed assets [EUR]	5,330.71 (12,849.72)	5,226.03 (26,403.65)

Notes: Means are presented and standard deviations are in parentheses.

Source: Authors' own calculation based on Polish FADN database.

Results

Table 2 presents the estimated average potential relative income level for selected percentiles of CAP payments. In the initial period (2004–2005), farms that did not receive CAP payments – approximately 30% of the sample in 2004 and 10% in 2005 – performed significantly better than farms that received relatively small payments. This may reflect the specific context of Poland's EU accession, during which agricultural policy instruments were primarily aimed at economically weaker farms. As a result, farms that were already more efficient prior to accession were better positioned to achieve higher incomes. During these early years, income parity – defined as a relative income level of at least 1 – would have been attainable if all farms had received subsidies of at least EUR 470 in 2004 and EUR 580 in 2005. In 2006 and 2007, the average potential relative income level could have exceeded 1 if farms had received subsidies of at least EUR 1,860 and EUR 1,310 respectively.

This trend continued throughout subsequent CAP programming periods. Despite successive changes in agricultural policy instruments, reaching income parity with the average Polish household required increasingly larger financial transfers to farms. For example, in 2013 and 2014 – at the junction of two CAP financial frameworks – subsidies of approximately EUR 2,580 and EUR 2,280 respectively would have been necessary to match household income levels. By the end of the 2014–2020 framework, subsidies would have had to reach around EUR 3,190 in 2018 and EUR 3,080 in 2019 to achieve parity.

Throughout the analysed period, income inequality persisted among the sample farms. In 2004, the agricultural income (relative to average household income) of farms in the top 10% of subsidy recipients was more than twice that of farms in the bottom 10%. In the following years, this disparity widened significantly. Since 2015, the gap has stabilised, but remains substantial: the income of the top group is nearly six times higher than that of the bottom group. The highest average potential relative income level was consistently observed among large farms (with an economic size of EUR 100,000–500,000 SO), which typically benefited from higher levels of support.

Maintaining income parity over time required increasing levels of financial support. After 2006, higher subsidies generally meant higher average potential relative income levels. However, this relationship was not linear, but logarithmic. As the overlapping confidence intervals indicated, the estimated average treatment effect showed no significant differences between successive treatment doses. The statistical significance of the difference between the treatment effects for two doses can be determined by comparing the confidence intervals (see **Leite [2017]**). Although higher subsidies tended to raise average potential outcomes, increasing the level of support did not always lead to proportionally higher relative incomes.

Table 2. Impact of CAP payments (in EUR thousands 2004 constant prices) on relative income level

	Percentile	10	20	30	40	50	60	70	80	90	100
2004	Treatment dose	0.00	0.00	0.00	0.09	0.21	0.47	1.21	2.2	4.11	25.42
	Dose-response	2.86 (2.06–3.66)	2.86 (2.06–3.66)	2.86 (2.06–3.66)	−0.27 (−0.7–0.17)	0.4 (0.04–0.76)	1.17 (0.89–1.46)	2.2 (1.95–2.46)	2.95 (2.65–3.26)	3.8 (3.41–4.2)	6.7 (5.88–7.53)
2005	Treatment dose	0.00	0.58	1.31	1.80	2.31	2.88	3.72	5.08	7.78	109.36
	Dose-response	5.3 (2.56–8.05)	1.00 (−0.16–2.17)	1.78 (0.57–2.99)	2.12 (0.89–3.36)	2.4 (1.14–3.67)	2.65 (1.36–3.95)	2.96 (1.64–4.29)	3.36 (1.98–4.74)	3.93 (2.46–5.39)	8.26 (5.93–10.58)
2006	Treatment dose	1.08	1.86	2.50	3.05	3.75	4.82	6.28	8.67	13.13	97.54
	Dose-response	0.82 (0.57–1.07)	1.31 (1.11–1.51)	1.6 (1.42–1.77)	1.8 (1.64–1.97)	2.03 (1.87–2.2)	2.32 (2.15–2.5)	2.64 (2.44–2.84)	3.05 (2.81–3.3)	3.62 (3.3–3.95)	6.96 (6.02–7.9)
2007	Treatment dose	0.13	1.31	2.10	2.78	3.50	4.45	5.62	7.45	11.75	134.02
	Dose-response	0.68 (−0.49–1.85)	2.19 (1.04–3.34)	2.76 (1.56–3.95)	3.13 (1.9–4.35)	3.45 (2.19–4.72)	3.81 (2.51–5.12)	4.19 (2.84–5.54)	4.67 (3.25–6.08)	5.5 (3.95–7.05)	11.3 (8.5–14.11)
2008	Treatment dose	1.71	2.68	3.59	4.52	5.77	7.11	9.11	12.19	17.61	111.87
	Dose-response	0.67 (0.49–0.84)	1 (0.87–1.12)	1.24 (1.13–1.35)	1.45 (1.35–1.55)	1.68 (1.57–1.79)	1.9 (1.78–2.02)	2.17 (2.02–2.31)	2.51 (2.33–2.68)	2.97 (2.74–3.19)	5.82 (5.22–6.42)
2009	Treatment dose	1.08	2.05	2.90	3.72	4.66	5.79	7.45	10.08	15.54	89.02
	Dose-response	0.28 (0.02–0.53)	0.77 (0.55–0.99)	1.08 (0.87–1.29)	1.31 (1.1–1.53)	1.54 (1.31–1.76)	1.77 (1.53–2.01)	2.04 (1.78–2.31)	2.4 (2.1–2.69)	2.93 (2.58–3.29)	5.53 (4.8–6.25)
2010	Treatment dose	1.31	2.43	3.45	4.33	5.36	6.71	8.63	11.45	16.90	147.45
	Dose-response	0.51 (0.22–0.8)	1.17 (0.98–1.35)	1.6 (1.46–1.75)	1.91 (1.77–2.05)	2.22 (2.06–2.37)	2.55 (2.37–2.74)	2.95 (2.72–3.18)	3.43 (3.13–3.73)	4.13 (3.72–4.54)	9.04 (7.74–10.35)
2011	Treatment dose	1.30	2.39	3.42	4.32	5.45	6.98	9.12	12.92	19.67	131.86
	Dose-response	0.39 (0.15–0.64)	1.1 (0.93–1.27)	1.58 (1.44–1.73)	1.93 (1.78–2.07)	2.29 (2.13–2.44)	2.7 (2.52–2.88)	3.17 (2.95–3.38)	3.81 (3.54–4.09)	4.66 (4.3–5.02)	9.35 (8.35–10.35)
2012	Treatment dose	0.56	1.71	2.65	3.70	4.63	5.96	7.91	10.90	17.30	149.33
	Dose-response	0.04 (−0.35–0.43)	1.24 (0.97–1.51)	1.81 (1.55–2.07)	2.28 (2.03–2.53)	2.61 (2.35–2.86)	3 (2.73–3.26)	3.45 (3.17–3.74)	4 (3.67–4.33)	4.83 (4.41–5.26)	9.5 (8.18–10.83)
2013	Treatment dose	1.54	2.58	3.52	4.47	5.58	7.11	9.32	12.89	18.87	124.39
	Dose-response	0.65 (0.45–0.85)	1.21 (1.07–1.35)	1.59 (1.47–1.71)	1.9 (1.79–2.02)	2.21 (2.08–2.34)	2.56 (2.41–2.71)	2.98 (2.8–3.16)	3.51 (3.28–3.74)	4.17 (3.88–4.47)	8.13 (7.34–8.92)
2014	Treatment dose	1.19	2.28	3.17	3.99	4.95	6.33	8.35	11.34	17.77	126.84
	Dose-response	0.45 (0.2–0.7)	1.08 (0.92–1.25)	1.46 (1.31–1.61)	1.74 (1.6–1.89)	2.03 (1.87–2.18)	2.36 (2.19–2.54)	2.77 (2.56–2.98)	3.25 (2.98–3.51)	4 (3.65–4.36)	8.09 (7.1–9.08)
2015	Treatment dose	1.26	2.48	3.32	4.21	5.37	7.01	9.27	12.95	19.80	138.45
	Dose-response	0.93 (0.36–1.5)	1.42 (0.8–2.04)	1.66 (1.03–2.3)	1.88 (1.23–2.53)	2.11 (1.45–2.77)	2.38 (1.71–3.04)	2.67 (2–3.34)	3.05 (2.38–3.73)	3.57 (2.88–4.25)	6.43 (5.21–7.65)
2016	Treatment dose	2.78	4.24	5.62	7.13	9.02	11.34	14.35	18.26	25.39	131.80
	Dose-response	0.71 (0.56–0.86)	1.2 (1.08–1.32)	1.55 (1.43–1.67)	1.86 (1.73–1.98)	2.17 (2.04–2.3)	2.48 (2.34–2.63)	2.82 (2.66–2.98)	3.17 (2.99–3.36)	3.67 (3.45–3.9)	6.5 (5.82–7.17)
2017	Treatment dose	2.06	3.10	4.13	5.36	6.54	8.33	10.50	13.72	20.17	86.30
	Dose-response	0.64 (0.47–0.81)	1.15 (1.04–1.27)	1.53 (1.44–1.62)	1.88 (1.79–1.97)	2.16 (2.05–2.26)	2.5 (2.37–2.63)	2.83 (2.67–3)	3.23 (3.03–3.43)	3.82 (3.55–4.09)	6.23 (5.65–6.81)
2018	Treatment dose	2.02	3.19	4.28	5.46	6.68	8.38	10.77	14.23	20.65	116.13
	Dose-response	0.55 (0.39–0.72)	1.01 (0.9–1.12)	1.32 (1.22–1.41)	1.58 (1.49–1.67)	1.8 (1.69–1.9)	2.05 (1.93–2.17)	2.34 (2.19–2.49)	2.67 (2.48–2.86)	3.12 (2.87–3.37)	5.42 (4.84–6)
2019	Treatment dose	1.98	3.08	4.10	5.30	6.50	8.20	10.44	13.85	20.26	178.12
	Dose-response	0.64 (0.48–0.81)	1.08 (0.96–1.21)	1.39 (1.27–1.51)	1.68 (1.55–1.81)	1.92 (1.78–2.05)	2.2 (2.04–2.35)	2.5 (2.32–2.68)	2.87 (2.66–3.08)	3.39 (3.12–3.66)	6.89 (6–7.78)

Notes: 95% confidence interval for dose-response is in parentheses.

Source: Authors' own calculation based on the Polish FADN database.

In the early years of the analysed period, an increase of roughly EUR 1,000 in support would have significantly improved potential relative income levels. By 2019, however, a difference in payments nearly twice as large was required to achieve a comparable effect.

The average potential relative income level could have exceeded 1 if all farms had received subsidies of at least EUR 1,860 in 2006 and EUR 1,310 in 2007. This trend continued in subsequent CAP programming periods. Despite changes in agricultural policy instruments, achieving income parity with the average Polish household would have required increasingly higher financial support for farms. In 2013 and 2014, at the junction of two CAP financial frameworks, Polish farmers would have been able to report income levels similar to households overall if payments had reached approximately EUR 2,580 and EUR 2,280 respectively. Toward the end of the most recent financial framework, i.e., 2014–2020, subsidies would have needed to reach around EUR 3,190 in 2018 and EUR 3,080 in 2019 for farmers to achieve comparable income levels.

Throughout the analysed period, income inequalities persisted among the sample farms. In 2004, agricultural income (in relation to overall household income) for farms in the top 10% of subsidy recipients was more than twice that of farms in the bottom 10%. In subsequent years, income disproportions would increase significantly. Since 2015, the difference has stabilised. The income of the first group was almost six times higher than that of the second. In the analysed period, the highest average potential relative income level was achieved mainly by large farms (economic value of EUR 100,000–500,000 SO), which usually received relatively high support.

Discussion and policy implications

Achieving parity relationships in agriculture is one of the fundamental goals of the CAP. So far, striving for this goal has involved changes in the proportions of applying price and non-price instruments, from supporting agricultural production volume to direct support for farmers. However, despite almost 70 years of the CAP, these measures have proven to be ineffective. This study aimed to assess the impact of support provided under the CAP on agricultural income parity in the EU. The GPS method, based on a counterfactual approach, was used to isolate the direct impact of payments on farmers' income relative to the overall disposable income of households. First, this allowed for the assessment of the net effect of intervention across three financial frameworks during which agricultural policy was modified. Second, it made it possible to determine the amount of support required to achieve income parity for farms.

The study suggests that although changes have been made to CAP instruments and direct payment levels have increased, the goal of eliminating income disparity is yet to be achieved. The growing flexibility of CAP instruments provides more possibilities for adjusting support to the needs of individual countries/regions. However, the historically determined criteria of payment distribution have not changed much, favouring certain types of production or large farms. Our findings indicate that it would be necessary to provide ever-growing support in successive years, in terms of total payment value, for the relationship between agricultural income and other household income to equal at least one.

Although the average farm income is gradually increasing, agricultural production costs are also on the rise. According to **Eurostat [2023]**, there was a significant price peak in almost all the main product categories and key agricultural inputs, especially in 2021–2022. In 2022, a 30% increase was observed compared to 2021. The largest increases concerned fertilisers and soil improvers (87%), energy and lubricants (59%) and feedstuff (30%). These disruptions in global markets have been driven by factors including Russia's invasion of Ukraine, widespread droughts that have reduced crop yields, including crops used for animal feed, and inflationary pressure, primarily related to high increases in energy prices. Forecasts by the European Commission for 2023–2035 indicate that further instability is expected in the coming years due to changes in climate, market conditions and social expectations [**European Commission, 2023**]. This will contribute to energy and input costs remaining higher than before 2021. Despite these constraints, modest gains in agricultural productivity can be achieved from increased mechanisation and automation, which has significant implications for the projected further decline in agricultural labour. Considering these circumstances, it is expected that high support for farm income will continue. However, such a trend raises concerns about growing dependence on agricultural policy. Faultily designed support instruments may prevent farmers from achieving intended income goals.

According to OECD-FAO [2023] forecasts, gradual climate change will be a particularly critical factor influencing global agricultural production and market price instability in the coming years. Agriculture increasingly faces extreme weather events – such as droughts, floods, heatwaves, and storms – which are becoming more frequent and severe. While some regions may benefit from longer growing seasons, production in most parts of the world must adapt urgently to less favourable production conditions. Further action is required to speed up the implementation, monitoring and evaluation of adaptation and mitigation measures.

It could be argued that the reforms of the CAP are heading in the right direction. The policy has shifted from stimulating agricultural production and distorting international trade toward more neutral and environmentally focused support for farmers. Nonetheless, as of 2021, half of the support was still based on historical entitlements, one-third was linked to production volumes, and 17% was tied to input use. While 54% of payments depend on compliance with mandatory environmental restrictions, an additional 14% comes from voluntary agri-environmental schemes that exceed baseline requirements [OECD, 2022]. Despite these changes, the "green" transformation of EU agricultural policy does not necessarily lead to increased agricultural income. A study by Pawłowska and Grochowska [2021] found that the evolution of CAP instruments towards pro-environmental priorities initially had a somewhat negative impact on the income of Polish farms. However, this effect was gradually eliminated in subsequent years. The study also showed that "green" CAP payments did not significantly affect income inequality among commercial farms in Poland. In its current form, support for environmental and climate protection does not fully compensate farmers for income losses incurred due to pro-environmental agricultural practices. The effectiveness of "green" payments needs to be re-evaluated as their environmental objectives are not precisely defined. There is no indication of baseline levels and time frames for measuring achievements, which makes it challenging to monitor and evaluate the environmental effects achieved [European Court of Auditors, 2008, 2011, 2016].

Looking ahead, one solution for future agricultural policy would be to move away from historically conditioned payments aimed at supporting farmers in maintaining specific types of production. Instead, the focus should be on introducing more instruments to enable climate change adaptation and risk mitigation. Although direct support for farmers has increased, the amount of funding allocated to general services such as innovation, biosecurity and infrastructure has fallen in the EU to 12% of total support in 2019–2021, from 16% two decades ago [OECD, 2022]. These services are essential for helping farmers adapt to new and unfavourable climate conditions, where extreme weather events are more likely to occur, and to support sustainable productivity growth. Agricultural policy modifications aimed at creating resilient agriculture should act on three levels: short-term actions to support recovery from unexpected market and climate events; medium-term actions to assist in gradual mitigation and adaptation to changing conditions; and long-term actions to prepare for radical changes in food systems. Increasing investment in agricultural innovations is key to fostering positive changes in agriculture, leading to increased farm income. Digitisation, automation, and animal and plant breeding are some of the factors that can effectively support farmers in adapting to new climatic and market conditions and meeting consumer expectations.

To conclude, only a tangible shift – beyond rhetoric – in how direct payments are allocated to farms can contribute to a more sustainable distribution of support and help bridge the income gap between agriculture and other sectors of the economy. A more targeted approach, based on a broader use of instruments with clearly defined objectives and tailored to specific beneficiaries, could enhance farmers' ability to manage price fluctuations in agricultural markets and improve their capacity to adapt to climate change.

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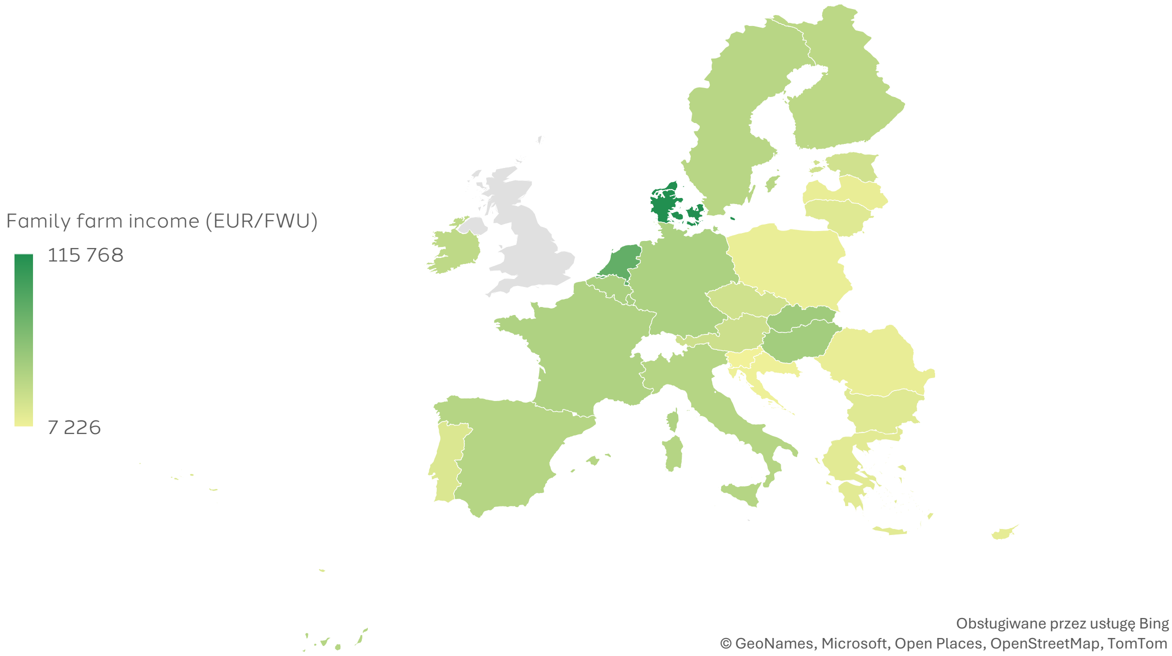
Appendix

Figure A1. Family farm income [EUR/FWU] in EU member states in 2021



Source: FADN public database.

Figure A2. The timeline of key milestones in the evolution of CAP instruments and successive rounds of EU enlargement

1958 BE, FR, IT, DE, NL, LU	**1962 The beginning of the CAP** An economic system of price and market support was put in place. These mechanisms provided farmers with a guaranteed price for their products, introduced tariffs on external products and state intervention in case market prices fell. Farmers received support according to their total levels of production.
1973 DK, IE, GB	**1970 The Mansholt plan** – the first reform of the CAP Market imbalances due to overproduction and price support. Therefore, a wide-scale modernisation of the agricultural sector was proposed to optimise the area of land under cultivation and merge farms to create larger units.
1981 GR; **1986** ES, PT	**1984 Supply management, aligned production with market needs** Agricultural production over-surpluses occurred in the 1970s and early 1980s. The result was that food was either dumped or sold on the world market at much lower prices. To prevent excessive drops in farmers' income, a quota system for milk was introduced in 1984. At the same time, growing pressure from external actors accused the European Communities of over-protectionism and called for the liberalisation of the market.
1995 AU, FI, SE	**1992 The MacSharry reform: from market support to producer support** The aim was to reduce the overall budget and move away from unlimited guaranteed prices. The policy shifted from a market support system to direct income support for farmers and included new obligations to protect the environment and incentives to improve food quality. Direct payments were introduced based on the area of land cultivated or the number of livestock maintained.
2004 CY, CZ, EE, HU, LV, LT, MT, PL SK, SI; **2007** BG, RO	**1999 Adding rural development** The CAP's budget amounted to almost 50% of the total EU budget, while the agricultural sector provided fewer possibilities for creating new jobs. The new Agenda 2000 programme led to the creation of a second pillar of the CAP dedicated to rural development. Agenda 2000 offered a more holistic approach with the aim of improving agricultural competitiveness, providing alternative sources of income in rural areas and strengthening social cohesion in those areas.

one-size-fits-all approach (1962–1984)

tailor-made approach (1992–1999)

cont. Figure A2

2013

HR

2013 New challenges for the CAP
There is a need to ensure a well-fed and thriving society and to respond to new concerns such as climate change, animal welfare, food safety, and the sustainable use of natural resources. New reforms included the greening of payments, making agriculture more sustainable, more equal distribution of support, attempts to limit the budget for big farms, additional support for smaller farms and incentives for young people to embark on a career in farming.

2021 A fairer, greener and more result-oriented policy
The post-2020 reform of the CAP introduced the autonomy for member states to put **strategic plans** based on their needs and in line with EU-wide goals. In the context of growing public concerns about climate change and environmental challenges, the new CAP placed various rewards for greener practices, both as part of direct payments (with a new type of support for green measures – the "eco-schemes") and under rural development.

tailor-made approach

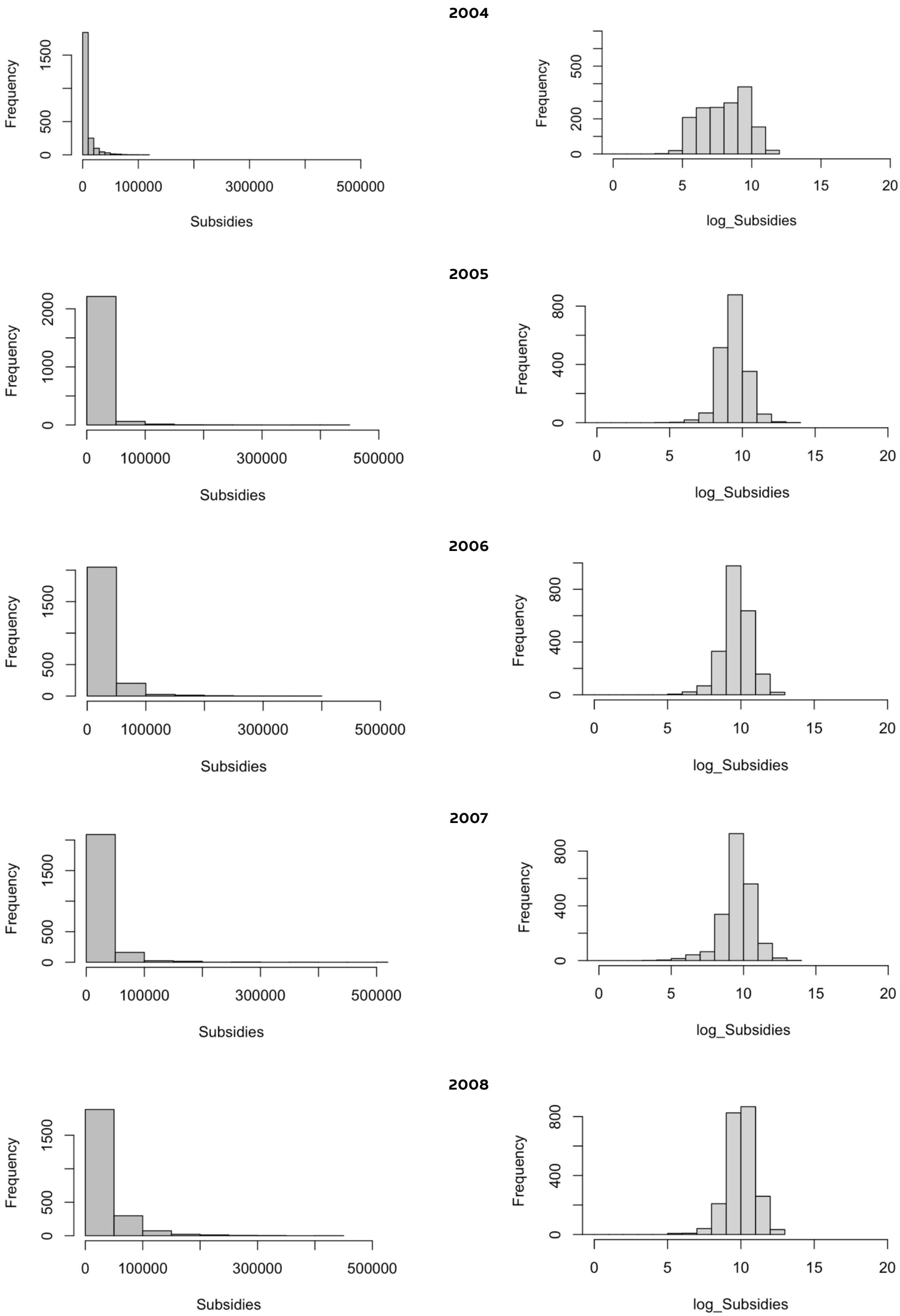
Source: Authors' own elaboration based on Council of the European Union [2023].

Table A1. Standardised coefficients of regression of treatment dose on covariates

Variable	Coefficients	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SE010	Baseline	0.015	0.354	0.329	0.343	0.316	0.228	0.196	0.089	0.248	0.172	0.159	0.127	0.172	0.162	0.191	0.208
	GPS Strata	0.023	0.068	0.037	0.053	0.098	0.006	0.002	0.018	0.021	0.022	0.019	0.024	0.058	0.059	0.081	0.087
SE025	Baseline	1.073	0.449	0.745	0.823	0.810	0.824	0.780	0.808	0.830	0.845	0.771	0.877	0.743	0.762	0.783	0.783
	GPS Strata	0.173	0.189	0.303	0.239	0.379	0.339	0.336	0.351	0.313	0.427	0.352	0.323	0.436	0.443	0.484	0.474
SE030	Baseline	0.699	0.099	0.549	0.495	0.521	0.545	0.480	0.485	0.591	0.539	0.508	0.568	0.462	0.465	0.493	0.478
	GPS Strata	0.090	0.161	0.221	0.173	0.242	0.240	0.218	0.312	0.213	0.263	0.221	0.202	0.269	0.269	0.304	0.281
SE074	Baseline	0.125	0.067	0.084	0.188	0.103	0.068	0.088	0.094	0.179	0.118	0.144	0.167	0.128	0.122	0.131	0.120
	GPS Strata	0.014	0.034	0.045	0.044	0.049	0.036	0.037	0.052	0.065	0.072	0.065	0.064	0.072	0.081	0.079	0.068
SE080	Baseline	0.066	0.416	0.301	0.316	0.213	0.214	0.295	0.236	0.307	0.265	0.260	0.247	0.269	0.250	0.246	0.232
	GPS Strata	0.029	0.048	0.126	0.109	0.115	0.100	0.119	0.105	0.121	0.139	0.121	0.099	0.156	0.144	0.154	0.139
SE135	Baseline	0.218	0.452	0.142	0.039	0.090	0.006	0.078	0.361	0.324	0.281	0.248	0.253	0.126	0.099	0.049	0.076
	GPS Strata	0.021	0.121	0.046	0.138	0.014	0.101	0.128	0.213	0.195	0.215	0.199	0.177	0.127	0.097	0.078	0.098
SE206	Baseline	0.129	0.356	0.183	0.141	0.067	0.115	0.172	0.142	0.203	0.170	0.191	0.120	0.168	0.168	0.171	0.166
	GPS Strata	0.017	0.042	0.089	0.089	0.058	0.078	0.083	0.077	0.099	0.103	0.103	0.074	0.107	0.101	0.111	0.108
SE275	Baseline	0.064	0.046	0.080	0.177	0.096	0.149	0.146	0.268	0.299	0.252	0.274	0.302	0.233	0.204	0.194	0.199
	GPS Strata	0.004	0.091	0.100	0.150	0.094	0.135	0.119	0.159	0.163	0.173	0.171	0.161	0.166	0.143	0.149	0.149
SE360	Baseline	0.364	0.133	0.124	0.250	0.208	0.338	0.335	0.522	0.532	0.501	0.522	0.580	0.460	0.457	0.443	0.437
	GPS Strata	0.038	0.124	0.113	0.166	0.148	0.190	0.199	0.250	0.232	0.284	0.269	0.250	0.295	0.286	0.301	0.292
SE365	Baseline	0.119	0.239	0.163	0.192	0.127	0.029	0.044	0.119	0.082	0.109	0.072	0.186	0.076	0.005	0.007	0.032
	GPS Strata	0.008	0.093	0.014	0.077	0.014	0.065	0.061	0.102	0.117	0.114	0.111	0.139	0.088	0.036	0.046	0.025
SE501	Baseline	0.648	0.168	0.303	0.414	0.353	0.598	0.617	0.705	0.664	0.690	0.646	0.743	0.630	0.644	0.650	0.645
	GPS Strata	0.090	0.122	0.165	0.175	0.205	0.273	0.284	0.317	0.271	0.367	0.323	0.305	0.382	0.382	0.416	0.405
SE516	Baseline	0.676	0.151	0.402	0.152	0.250	0.340	0.375	0.326	0.433	0.335	0.231	0.303	0.111	0.214	0.082	0.144
	GPS Strata	0.074	0.059	0.167	0.081	0.120	0.161	0.173	0.156	0.164	0.184	0.139	0.131	0.070	0.118	0.053	0.083

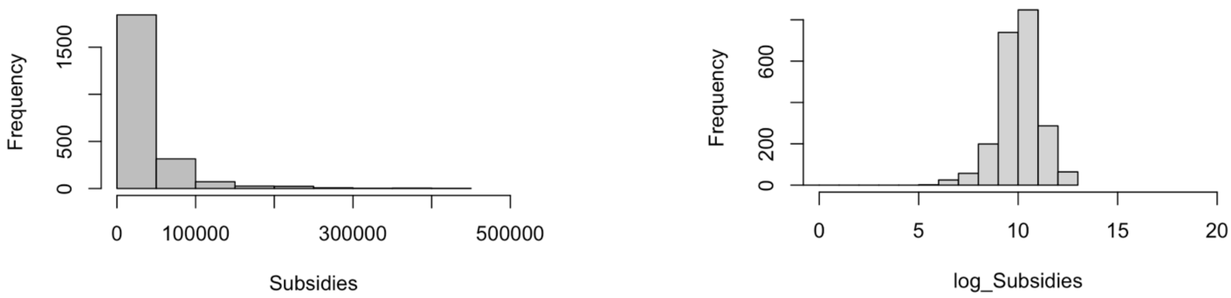
Source: Authors' own elaboration based on the Polish FADN database.

Figure A3. Histograms of CAP payments

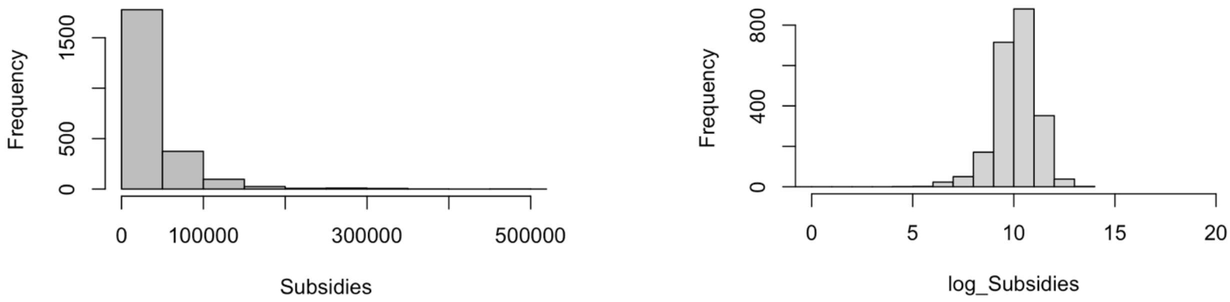


cont. Figure A3

2009



2010



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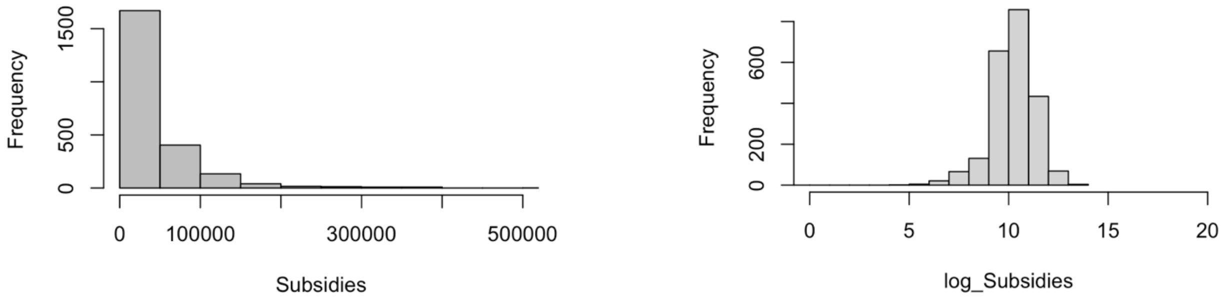
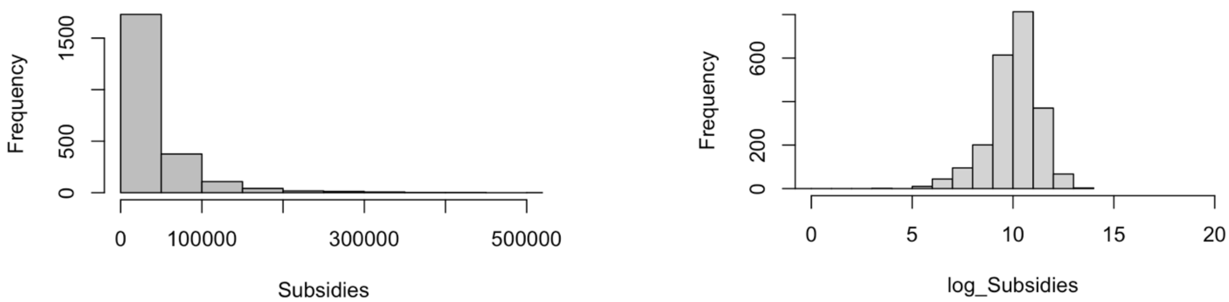
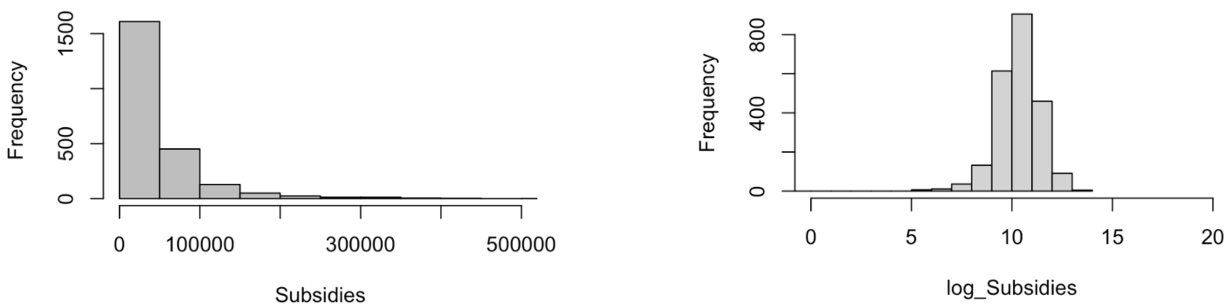


2012

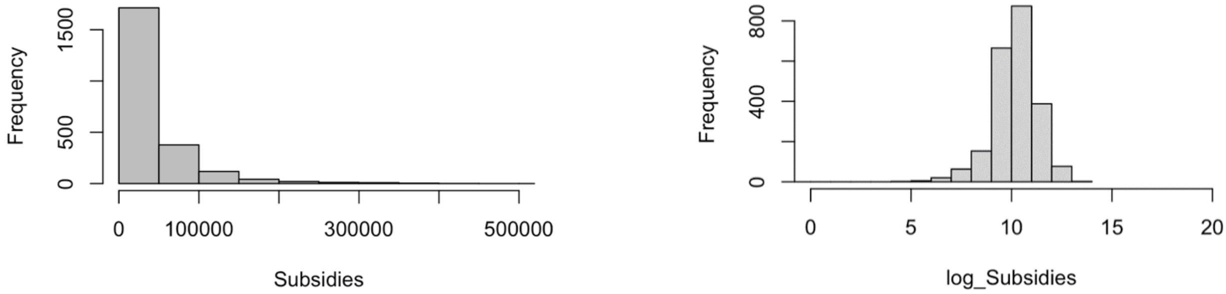


2013



cont. Figure A3

2014



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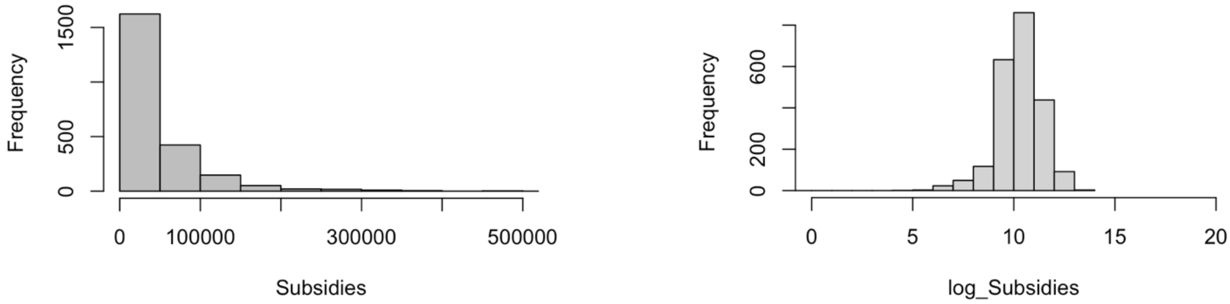
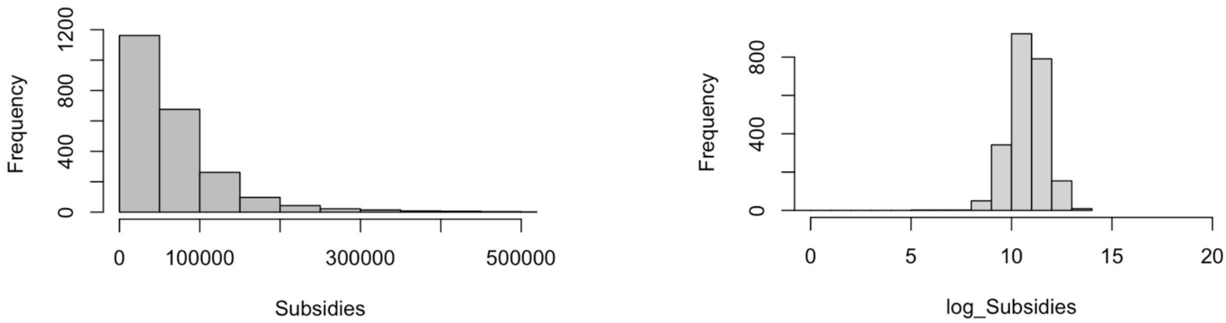
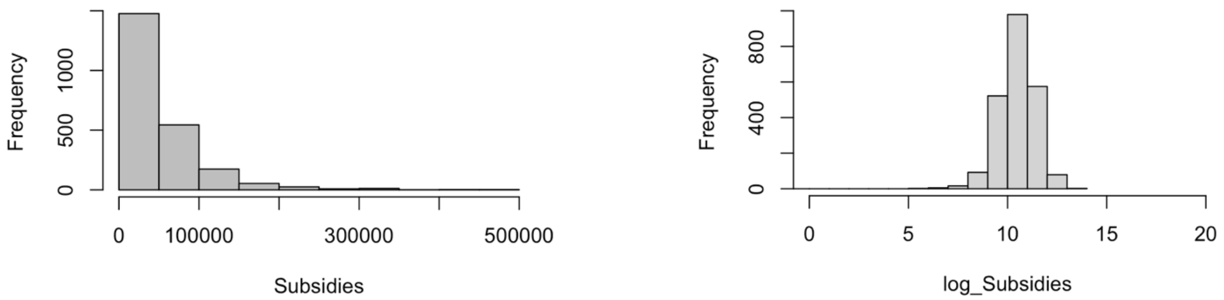


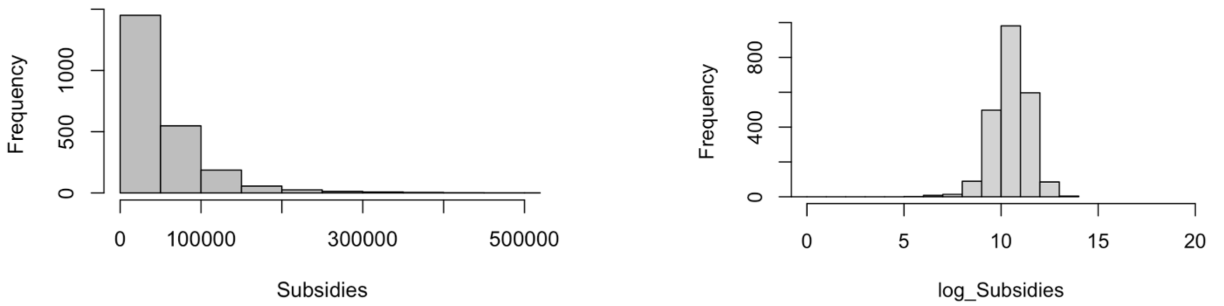
2016



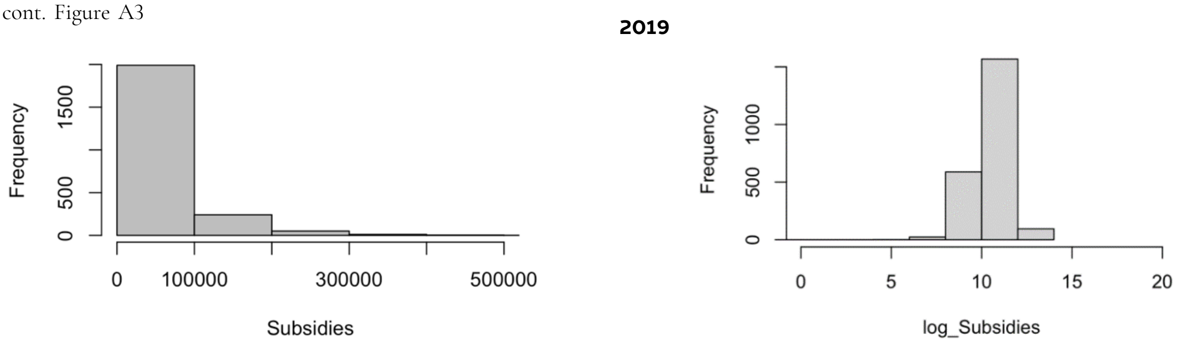
2017



2018



cont. Figure A3



Source: Authors' own elaboration based on the Polish FADN database.