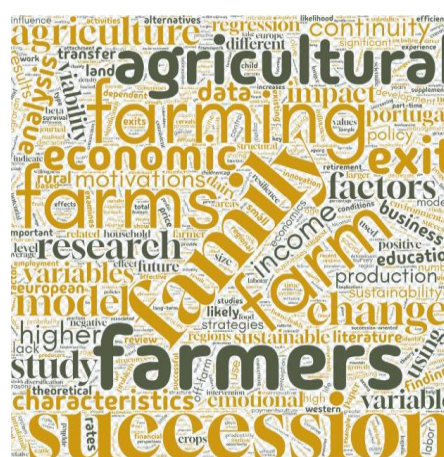


INFLUENCE OF AGE, GENDER, AND OTHER INTRINSIC FACTORS ON PORTUGUESE FAMILY FARMERS' MOTIVATIONS FOR SHORT-TERM CONTINUITY

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Abstract: This study investigates the intrinsic factors influencing Portuguese family farmers' motivations for short-term continuity, utilizing data from the Agricultural Censuses. The research, based on five Beta regression models, highlights the significance of socio-demographic characteristics, such as age, gender, and education, alongside farm structures and agricultural practices in shaping decisions to sustain farming. Results reveal diverse motivational frameworks, including economic viability, supplementary income, emotional attachment, and the lack of professional alternatives. The findings offer valuable insights for policymakers aiming to balance economic incentives with cultural preservation in agricultural policy.

Keywords: family farming, farm continuity, motivations, resilience, Portugal

Resumo: Este estudo investiga os fatores intrínsecos que influenciam as motivações dos agricultores familiares portugueses para darem continuidade às suas explorações a curto prazo, utilizando dados do Recenseamento Agrícola. O estudo, baseado em cinco modelos de regressão Beta, realça a importância das características sociodemográficas, como a idade, o género e a educação, juntamente com as estruturas das explorações e as práticas agrícolas, na decisão de manter a atividade agrícola. Os resultados revelam diversos quadros motivacionais, incluindo viabilidade económica, complemento de rendimento, ligação emocional e falta de alternativas profissionais. Os resultados são relevantes para os decisores políticos que pretendam equilibrar os incentivos económicos com a preservação cultural na definição de políticas agrícola.

Palavras-chave: Agricultura familiar; continuidade da exploração; motivações; resiliência; Portugal

Highlights

- Farm continuity stems from diverse motivations, often acting in conflicting directions.
 - Diverse motivations drive Portuguese family farmers' short-term continuity.
 - Older farmers prioritize emotional ties; younger farmers focus on economic viability.
 - Gender differences reveal female farmers often farm out of necessity, not choice.
 - High-value crops align with economic motivations; traditional crops evoke cultural ties.
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1. Introduction

The number of farms in the European Union (EU) has been in decline for a long time in every member state (Eurostat, 2023). Often it is not just the individual entrepreneur who quits, but as it is difficult for many to find a successor within the family, the whole family business comes to an end. Based on the historical data from Statistics Portugal (n.d.), the Agricultural Census reveals that the number of family farms in Portugal experienced a consistent decline at an average annual rate of 2.4% from 1989 to 2019. Nevertheless, they still represent around 95% of all farms.

The literature reveals that the resilience of family farmers is driven by a complex combination of motivational factors, ranging from tangible economic aspects to more abstract emotional and contextual considerations, reflecting a dynamic interaction between individual, economic, social and cultural variables (Brookfield, 2008; Calus & Van Huylenbroeck, 2010; Darnhofer et al., 2010; Davidova & Thomson, 2014; Dinis, 2019; Špička & Berg, 2022; Van der Ploeg, 2016a).

Farming continuity research usually takes a long-term approach, analysing the problem primarily from the perspectives of succession (Calus et al., 2008)(Elder et al., 1996; Potter & Lobley, 1996)(Lobley, 2010)

and retirement (Conway et al., 2016) (Bragg & Dalton, 2004) (Breustedt & Glauben, 2007), while ignoring why some farmers stay engaged in agriculture even in situations of low rentability. This study uses the Portuguese agricultural context to gain a more comprehensive understanding of the motivations of family farmers to remain in their farms and the various intrinsic factors that underlie these motivations, contributing to the current understanding of family farms and their decision-making processes. By examining and quantifying the complex interaction between the direct and indirect factors that influence family farmers' choice to sustain their businesses, the study provides empirical evidence to inform the definition of public policies and strategies tailored to different types of family farmers.

Further sections of this paper are structured as follows. The subsequent section provides the literature that establishes the fundamental theoretical foundation of the research. The methodology used in this study is then described in detail, including the data collection techniques and analytical approaches used. In the next section, an analysis and discussion of the investigation results are presented, focusing on the main findings and their relationship with prior evidence. To conclude, we outline the main contributions of the research, address any possible constraints of the study, and suggest avenues for future research.

2. Theoretical Background

Following the orthodox Marxist tradition, both neoclassical economists and classical sociologists predicted that family farms would disappear or be marginalized as a consequence of capitalist forces (Davis, 1980; De Janvry, 1980; Marsden et al., 1989; Whatmore et al., 1987; Whatmore & Munton, 1987). Surprisingly, two centuries later, family farms continue to account for more than 90% of worldwide farms, occupying 70–80 percent of acreage and generating around 80 percent of the world's food in value terms (Lowder et al., 2019). Several authors (Brookfield & Parsons, 2007; Brookfield, 2008; Calus & Van Huylenbroeck, 2010; Chayanov, 1966; Friedmann, 1978, 1980; Schmitt, 1991; Shanin, 1971) have theorized around the durability of family farms in a capitalist framework, finding as main explanations the particular rationale of the family farm and the utilization of family labor.

Since the late 1980s, the focus on family farming studies has changed from the long-held assumption that family farms must inevitably give way to industrial farms to focusing on the active strategies developed by farmers to achieve their goals (Barbieri et al., 2008; Barbieri & Valdivia, 2010; Davidova & Thomson, 2014; Knutson et al., 1998; Moran et al., 1996; Van der Ploeg, 1993, 2016b; Weltin et al., 2017; Wilson, 2008). Intensification and specialization, diversification into agricultural and/or non-agricultural activities (e.g., value-added production and rural tourism), as well as pluri-activity and pluri-income, have been identified as important adaptation strategies for dealing with market pressures and changing political framework conditions, as well as reducing economic risk. Thus, from an economic standpoint, continuity in agriculture is supported by the farmers' perception that farming provides viable income opportunities, either as a primary or secondary activity, offering a consistent source of family income in a volatile economic environment.

According to Hu & Gill (2021), family farms can be less sensitive to economic trends compared with other businesses. In addition to economic aspects, it is important to consider that family farming is frequently crossed by deep affective and cultural values (Špička & Berg, 2022). Many family farmers have a strong emotional connection to the land, family traditions, and the community, which influences their decision to continue farming. These emotional aspects can be more influential than purely economic considerations, as they provide a deeper understanding of why farmers may be hesitant to retire or transfer their farms to the next generation (Holloway et al., 2021; Hu & Gill, 2021).

In other cases, the scarcity of viable professional alternatives outside of agriculture explains the importance of farm continuity. In rural areas where employment opportunities are scarce and traditional industries are declining, agriculture is frequently the only viable option for individual and family livelihoods (Sergaki et al., 2015). The same is true when farmers' profiles are unsuitable for the labor market due to age or lack of academic and professional training. In this situation farmers may be more

inclined to invest additional time and effort into their farming activities without considering alternative uses of their time that could potentially generate higher returns (Brookfield, 2008).

As stated by Darnhofer et al. (2010), farmers' motivations for ensuring the farm's continuity are influenced by both intrinsic and extrinsic factors. Among intrinsic factors, farmers' sociodemographic characteristics like age, gender, and education level play a crucial role.

The influence of farmer's age on farming exit does not appear to follow a linear pattern. Most research has shown that the likeliness of farming exit increases with age since succession and retirement considerations are closely related to exit decisions (Bragg & Dalton, 2004; Kimhi & Nachlieli, 2001; Mishra et al., 2010). Older farmers often pass management of their business to a successor or leave farming due to poor health or death. Other authors, however, argue that the likelihood of a voluntary exit and business closure decreases with farmer age because younger farmers may leave farming voluntarily due to a career or lifestyle change, or a financial decision (Breustedt & Glauben, 2007). According to the authors, it is often easier for younger, more skilled farmers to find jobs outside the farm. Besides, farmers in the early or middle stages of their careers are more likely to experience financial stress, as they often use debt to expand their businesses (Gale, 2003). Pietola et al. (2003) observed that the likelihood of a voluntary exit via an EU early retirement program, to which farmers aged 55 to 65 could apply, decreases with age. This is likely due to the fact that if farmers postpone succession for too long, they may face difficulties in finding an appropriate successor because their daughters and sons may have found employment elsewhere (Suess-Reyes & Fuetsch, 2016).

In terms of gender, while several studies have looked at its effect on the likelihood of becoming a farmer successor (Cassidy & Mcgrath, 2014; Chiswell, 2018; Špička & Berg, 2022) or on intrafamily succession (Cavicchioli et al., 2015), there is limited research on the role of gender in the decision of farmers to either continue or leave farming voluntarily. If the intra-family succession probability is higher when the farm operator is female (Cavicchioli et al., 2015), it is expectable that when the farmer is a woman, the probability of exit would be higher, *ceteris paribus*.

Regarding education level, one might expect that a higher level of education involves greater skills, which, if employed for farming, imply greater farm profitability, making farming more appealing relative to off-farm jobs (Suess-Reyes & Fuetsch, 2016), thereby lowering the likelihood of exit. However, as highlighted by Bragg & Dalton (2004) in their study of dairy farms in the United States, higher levels of education can be positively or negatively correlated with the likelihood of exiting the farm by either creating the opportunity for off-farm employment or increasing the willingness to adopt management intensive systems in order to improve efficiency. Other previous findings on this topic, while primarily focused on succession rather than the desire of the farmer to continue farming, were effectively inconsistent. Kimhi & Nachlieli (2001) found that a higher level of education among farmers increases the likelihood of succession, because the higher the educational level of the farm owner, the more likely there will be a succession plan (Suess-Reyes & Fuetsch, 2016). Conversely, Aldanondo Ochoa et al. (2007) demonstrated that the educational level of the farmer can have a detrimental impact on the success of intergenerational transmission of family farms. The rationale is that children of farmers with lower educational levels are more inclined to persist in farming compared to children of farmers with higher educational qualifications.

Other relevant intrinsic factors are related to the farm. The literature focuses on aspects such as farm size, tenure, economic performance, diversification and off-farm income. Breustedt & Glauben (2007) found a negative correlation between farm size and the rate of net exit from farming. One explanation is that larger farms are more likely to provide farmers and their families with a sufficient and long-term income. As a result, the opportunity costs of leaving are higher on larger farms (Kimhi & Bollman, 1999). However, as highlighted by Breustedt & Glauben (2007), the value of own land and farm assets can also enhance the market value of the farm, hence increasing the post-retirement income and the probability of exit. Besides, larger farmers provide better prospects for potential successors and are more likely to be passed down within the same family (Aldanondo Ochoa et al., 2007; Glauben et al., 2009; Suess-Reyes & Fuetsch, 2016). Nevertheless, other authors argue that in regions where farmers own a larger proportion of land, farm exit rates are lower (Breustedt & Glauben, 2007; Goetz & Debertin, 2001). This is because a large

share of owned land may suggest a strong emotional connection between the family and their business, and it may also enhance the credit capacity, so improving the financial stability of the business.

The existing research suggests that the likelihood of exit is positively correlated with the farm's economic performance, because it influences the motivation of both heirs and external entrepreneurs to take over the farm, as good current performance improves the farm's prospects of success (Cavicchioli et al., 2015; Mishra et al., 2010).

Regarding farm diversification, the literature is conflicting and mostly concentrated on the probability of succession. While Glauben et al. (2004) argue that specialized, often larger family farms are more likely to have a designated successor and be passed on within the family due to their higher production efficiency, other researchers have found that on-farm diversification is positively associated with the likelihood of having a successor (Sottomayor et al., 2011), as additional activities reduce risks, increase farm revenues, and make succession more appealing.

Assessing the influence of off-farm employment on farm sustainability is a complex matter. While expanding into sectors other than the core agricultural business or engaging in employment outside the farm may provide extra revenue, these approaches may jeopardize the long-term sustainability of the family farm (Suess-Reyes & Fuetsch, 2016). More precisely, to participate in off-farm employment, it may be necessary to reduce the production capacity of the farm, so increasing the probability of eventual farm closure. Moreover, engaging in off-farm work could result in the family becoming emotionally detached from the farm which, in turn, could lead to a reduced motivation to persist in farming. Goetz & Debertin (2001) show that, in the United States, off-farm employment lowers the probability that a region faces a net loss of farmers, but on the other hand leads to higher exit rates in regions that are already experiencing farm losses. The study by Breustedt & Glauben (2007) suggests that a higher share of part-time farm operators is significantly and negatively related to net farm exit rates in the EU. The authors also found that regions with a relatively high number of family members working on the farm have lower exit rates, not only due to succession concerns, but also because the costs of closing the business are higher when there are more family members depending on the farm.

In addition to internal factors, several external factors can impact the decision to either exit or continue operating the farm. For example, Breustedt & Glauben (2007) and Suess-Reyes & Fuetsch (2016) emphasize that regions with a higher population density have notably higher exit rates, probably due to the possibility to convert farmland to building land, so increasing the opportunity costs associated with using the land for farming purposes. The impact of regional differences in agricultural production structures as well as the impact of agricultural policy (Buitenhuis et al., 2020; Kazukauskas et al., 2013; Žičkienė, 2020) and retirement policies (Calus et al., 2008) has also been the subject of considerable interest among researchers.

3. Methodology

3.1 Data

The data set used in this study was derived from the 2019 Agricultural Census (AC), broken down by communes, the smallest unit in Portugal's administrative division. The commune was chosen as the unit of analysis primarily for the benefit of using territorial data at the lowest possible aggregation level. Portugal has a total of 3,091 communes, with 2,882 on the mainland, 155 in the Autonomous Region of the Azores, and 54 in the autonomous region of Madeira. The study included only 2,858 communes due to missing values and the exclusion of communes with less than ten farms.

The AC covers the entire national territory, and it's an exhaustive statistical survey, binding on EU and Council Regulation 2018/1091, which gathers data on all national farms, generating results at detailed geographical levels. The data is collected by a face-to-face interview through duly accredited interviewers and seeks to meet national and international statistical needs (Statistics Portugal, 2019), including farm structure, agricultural production systems, agricultural production methods, family farming population and agricultural labor force, farmers' source of income and gainful activities not directly related to

the agricultural holding. During the previous two Agricultural Censuses, held in 2009 and 2019, farmers were asked if they planned to continue farming for the following two years. A closed question concerning the motivations for continuity was presented to the enquiries, contingent upon an affirmative response to the previous question, offering five options: 1) Economic viability of the activity; 2) Supplement to family income; 3) Affective value; 4) Lack of other professional alternatives; and 5) Other(s). The response to this inquiry will serve as the foundation for the development of the dependent variables in the current study.

3.2 Models and variables

The estimation process occurred in two phases. A Beta regression model was initially estimated with the proportion of farmers expressing willingness to continue farming in the short term, specifically over the next two years, as the dependent variable (*Maintain*). Subsequently, four additional Beta regressions were applied to identify the predominant factors influencing four distinct motivations for sustaining farming in the short term: i) Economic viability; ii) Income supplement; iii) Affective value; iv) Lack of professional alternatives. All dependent variables reflecting these motivations (*Viability*; *Supplement*; *Affective*; *Noalternative*) were quantified by the percentage of farmers selecting each motivation relative to the total number of farmers who expressed a willingness to sustain the farm in the short term. The model was fitted employing a logit link function for the mean and a log link function for the scale and was estimated using beta regression because it has advantages over the linear model when the dependent variable is expressed in percentages, as predictions are guaranteed to be in (0, 1) (Janicki, 2020). Beta regression models have been extensively employed in agricultural research worldwide (Archontoulis & Miguez, 2015; Barnes et al., 2021; Endalew et al., 2023; Sahoo et al., 2025). For estimation purposes, the dependent variables were transformed into proportions constrained between 0 and 1 to make them suitable for Beta regression modelling. All statistical analyses were conducted using Stata 18.0 software.

Based on the literature review, three groups of independent variables were included in the model to represent three types of intrinsic factors: i) farmer socio-demographic characteristics, ii) farm structure, and iii) agricultural activities. Two control variables were incorporated into the model to account for extrinsic factors. Table 1 provides a brief description of all the model's independent and control variables.

Regarding socio-demographic characteristics, age was assessed by incorporating the variable *Elderly*, which denotes the percentage of farmers aged 65 years or older, indicating those in retirement age who are likely less inclined to sustain the farm in the foreseeable future. Gender was represented by the proportion of female farmers (*Women*). The education level of farmers was quantified as the proportion of farmers who have achieved a higher level of education (*Higheeducation*), regardless of whether they have received agricultural training. The variable *Notraining* represents the proportion of farmers without formal agricultural training who predominantly depend on their practical agricultural experience. The average agricultural population, denoting the number of family members residing on the farm (*Household*), was also incorporated as an explanatory variable.

Concerning farms' structure, five continuous variables were included in the model: the percentage of Utilized Agricultural Area (UAA) owned by the farmers (*Landownership*) to capture the effect of tenure on farmers' motivations to continuity; farms average UAA (*Acreage*) to assess whether size is a significant structural component in addressing the motivations for continuity; the percentage of farmers working full-time in the farm (*Fulltime*) to analyze the impact of income diversification; the average value of total standard production by annual work unit (*Lproductivity*) to measure the influence of the farm's economic performance; and the percentage of farmers receiving Common Agricultural Policy (CAP) income support (*Subsidies*) as this may be an important source of income for farmers.

To analyze the impact of agricultural production specialization, two variable groups were evaluated: crops and livestock. The objective is to incorporate the principal crops of the country according to the classification established by Commission Regulation (EC) No. 1242 of 2008. Excluding animal fodder, cereals (5.9%) and horticulture (1.3%) constitute the principal temporary crops in Portugal regarding UAA composition. Permanent crops, including fruit plantations, olive groves, and vineyards, are of considerable

significance, representing 2.0%, 9.5%, and 4.4% of the UAA, respectively. The UAA encompasses more than 60% of grasslands and fodder (Statistics Portugal, 2021). The model did not consider the area allocated for animal feed, as grazing livestock (i.e., cattle, sheep, and goats) were incorporated as variables. Five crops were selected to exemplify the diversity of agricultural systems nationwide, comprising three permanent crops (fruits, olive groves, and vineyards) and two temporary crops (cereals and vegetables). The crop variables were quantified by their proportion of Utilized Agricultural Area (UAA), while the livestock variables were quantified by the density of animals per hectare of UAA.

To assess the impact of agricultural production specialization, two variable groups were examined: crops and livestock. The goal is to incorporate the country's main crops according to the classification established by Commission Regulation (EC) No. 1242 of 2008. Excluding animal fodder, cereals (5.9%) and horticulture (1.3%) are Portugal's main temporary crops in terms of UAA composition. The most important permanent crops, such as fruit plantations, olive groves, and vineyards, account for 2.0%, 9.5%, and 4.4% of the total UAA. Grasslands and fodder covers more than 60% of the UAA (Statistics Portugal, 2021). The model did not consider the area allocated for animal feed because grazing livestock (*Cattle*, *Sheep*, and *Goats*) were included as variables. Five crops were chosen to represent the diversity of agricultural systems across the country: three permanent crops (*Fruits*, *Olivegroves*, and *Vineyards*), and two temporary crops (*Cereals* and *Vegetables*). Crop variables were quantified as a percentage of UAA, while livestock variables were quantified as the number of animals per hectare of UAA. For improved data visualization, Appendix 1 displays the histograms of the variables that represent intrinsic factors.

Tab 1. Independent and control variables description. Source: own elaboration

Variable	Description
Socio-demographic characteristics of farmers	
<i>Elderly</i>	Farmers aged 65 and above (%)
<i>Women</i>	Female farmers (%)
<i>Higheducation</i>	Farmers possessing higher education (%)
<i>Notraining</i>	Farmers without formal agricultural training (%)
<i>Family</i>	Average familiar agricultural population (nr. /farm)
Farms' structure	
<i>Landownership</i>	Owned land in UAA (%)
<i>Acreage</i>	Average UAA (ha)
<i>Fulltime</i>	Farmers working on the farm full-time (%)
<i>Lproductivity</i>	Average value of total standard production by annual work unit (€/ AWU)
<i>Subsidies</i>	Farmers that receive subsidies, grants on income (%)
Agricultural activities	
<i>Fruit</i>	Fruit area in UAA (%)
<i>Olive</i>	Olive groves area in UAA (%)
<i>Vineyard</i>	Vineyard area in UAA (%)
<i>Cereals</i>	Cereals area in UAA (%)
<i>Vegetables</i>	Vegetables area in UAA (%)
<i>Cattle</i>	Number of cows per ha of UAA
<i>Sheep</i>	Number of sheep per ha of UAA
<i>Goat</i>	Number of goats per ha of UAA
Population density	
<i>Popdensity</i>	population density (inhabitants / km ²)
Location	
<i>LocEDM</i>	=1 if the commune is in <i>Entre Douro e Minho</i> and =0 otherwise
<i>LocTM</i>	=1 if the commune is in <i>Trás-os-Montes</i> and =0 otherwise
<i>LocBL</i>	=1 if the commune is in <i>Beira Litoral</i> and =0 otherwise
<i>LocBI</i>	=1 if the commune is in <i>Beira Interior</i> and =0 otherwise
<i>LocRO</i>	=1 if the commune is in <i>Ribatejo e Oeste</i> and =0 otherwise
<i>LocALT</i>	=1 if the commune is in <i>Alentejo</i> and =0 otherwise
<i>LocALG</i>	=1 if the commune is in <i>Algarve</i> and =0 otherwise
<i>LocMD</i>	=1 if the commune is in <i>Madeira</i> and =0 otherwise
<i>LocAZ</i>	=1 if the commune is in <i>Azores</i> and =0 otherwise

Two extrinsic factors, population density and location, were used as control variables. The location variable includes several categories that represent the Portuguese Agrarian Regions, allowing for indirect measurement of the impact of differences in environmental conditions and resource availability. Population density is related to a variety of factors, including land availability, labor dynamics, economic opportunities, and cultural shifts. Population density (*Popdensity*) is measured by the number of people per square kilometre. The parameter *Location* is a categorical variable with nine distinct categories, each representing a Portuguese agricultural region. Each category variable was assigned a value of 1 if the commune is located in that region, and 0 otherwise. The *Entre Douro e Minho* region served as the baseline and was thus excluded from the model.

4. Results

4.1 Descriptive statistics

Table 2 displays the main descriptive statistics for the study's variables. The high mean for *Maintain* (96.5%), combined with minimal variability (4.0%), indicates that the majority of farmers demonstrate significant consistency in farm maintenance. Nonetheless, it indicates that in the subsequent two years, around 3.5% of farmers anticipated exiting the agricultural sector, consistent with the abandonment rate recorded over the past twenty years. More recent data (Statistics Portugal, 2024), indicated that the abandonment rate was, in fact, higher, with a reduction of family farms of approximately 11% from the 2019 Agricultural Census to 2023, reflecting an average annual decline of 2.9%.

Nearly half of farmers cite emotional reasons for staying on the farm, emphasizing a strong attachment to their work or lifestyle. Supplementary income motivates a sizable proportion (33.8%), while viability motivations are much less common (9.0%), raising concerns about farming's financial sustainability. A small subset of farmers (5.5%) is primarily motivated by a lack of professional and income alternatives.

Concerning socio-demographic characteristics, an average of 50.9% of farmers are aged 65 or older, suggesting an ageing agricultural demographic, albeit with significant variability among communes. Women constitute, on average, 32.7% of farmers, indicating a moderate level of female representation in agriculture. Approximately 20% of farmers possessed higher education, whereas over half lacked formal agricultural training, relying solely on their practical experience for decision-making. The average number of family members residing on the farm is 2.4, with minimal variability (Standard Deviation (SD) = 0.5).

With respect to the structure of farms, an average of 80.9% of the UAA is managed by owner-operated farming; however, the substantial variation (6.7–100%) indicates significant disparities among communes. Farms, with an average size of 12.9 hectares, exhibit notable differences in size, as evidenced by a high SD (28.5) and a maximum of 402.5 ha. The low average of *Fulltime* (15.7%) shows that a small proportion of farmers work on the farm on a full-time basis. Labor productivity, averaging 18,740.7 euros per AWU, demonstrates considerable variability, highlighting marked geographical disparities in economic output. Approximately 60% of farmers obtain CAP subsidies, signifying moderate reliance on financial support. It is significant that in some communes no farmers obtain subsidies while in others almost all do.

Permanent crops hold significant importance. Approximately 27% of UAA is allocated to fruits, olive groves, and vineyards. Cereals constitute the predominant temporary crop in the country, averaging 7.0% of the UAA in each commune, though this varies significantly across the territory, ranging from a minimum of 0% to a maximum of 91.4%.

The mean population density of 217.9 inhabitants/km² is distorted by outliers (maximum: 11,822.62), and the elevated standard deviation of 555.1 suggests that the majority of regions are probably sparsely populated. The descriptive statistics indicate that 46.5% of family farms are located in the northern region of the country, specifically in the agricultural areas of *Entre Douro e Minho* and *Trás-os-Montes*.

Tab 2. Descriptive statistics. Source: created by the author based on the original data from Statistics Portugal (n.d.)

Variable	Mean	Std. dev. (SD)	Min.	Max.
Dependent variables				
<i>Maintain (%)</i>	96.5	4.0	68.0	100.0
<i>Viability (%)</i>	9.0	10.1	0	71.4
<i>Supplement (%)</i>	33.8	20.6	0	100.0
<i>Affective (%)</i>	49.4	22.5	0	100.0
<i>Noalternative (%)</i>	5.5	7.8	0	90.9
Socio-demographic characteristics of farmers				
<i>Elderly (%)</i>	50.9	12.2	0	87.5
<i>Women (%)</i>	32.7	12.4	3.4	84.0
<i>Higheducation (%)</i>	19.3	10.0	0	77.0
<i>Notraining (%)</i>	51.3	18.3	0	100.0
<i>Household (nr/farm)</i>	2.4	0.5	0.4	11.5
Farms' structure				
<i>Landownership (%)</i>	80.9	18.8	6.7	100.0
<i>Acreage (ha)</i>	12.9	28.5	0.1	402.5
<i>Fulltime (%)</i>	15.7	17.0	0	89.0
<i>Lproductivity (euros)</i>	18,740.7	20,453.3	1,120.1	236,110.5
<i>Subsidies (%)</i>	60.2	23.5	0	99.2
Agricultural activities				
<i>Fruit (%)</i>	5.6	11.8	0	100.0
<i>Olive (%)</i>	10.2	16.3	0	89.7
<i>Vineyard (%)</i>	11.8	18.0	0	97.2
<i>Cereals (%)</i>	7.7	10.4	0	91.4
<i>Vegetables (%)</i>	3.2	8.0	0	87.5
<i>Cattle (nr/UAA)</i>	0.7	1.2	0	9.3
<i>Sheep (nr/UAA)</i>	0.8	1.0	0	32.2
<i>Goat (nr/UAA)</i>	0.3	0.5	0	5.6
Population density				
<i>Popdensity (inhabit. /Km²)</i>	217.9	555.1	1.55	11,822.62
Location (*)				
<i>LocEDM (0,1)</i>	0.299		0	1
<i>LocTM (0,1)</i>	0.166		0	1
<i>LocBL (0,1)</i>	0.170		0	1
<i>LocBI (0,1)</i>	0.109		0	1
<i>LocRO (0,1)</i>	0.096		0	1
<i>LocALT (0,1)</i>	0.078		0	1
<i>LocALG (0,1)</i>	0.022		0	1
<i>LocMD (0,1)</i>	0.018		0	1
<i>LocAZ (0,1)</i>	0.051		0	1

(*) For binary variables the mean corresponds to relative frequency; Standard Deviations are omitted.

4.2 Determinants of farm continuity

Table 3 presents the results of the Beta regression analysis with *Maintain_b* as the dependent variable. The model fits the data strongly, supported by high log-likelihood (7849.5772), significant LR χ^2 (220.91, $p < 0.0001$), and a favorable AIC (-15643.15). The results reveal significant relationships between the dependent variable and farm structure, demographic factors and agricultural activities, with most independent variables showing statistically significant coefficients for p-values below 0.05. To compress the scale and simplify the relationship with the dependent variable, the variables *Lproductivity* and *Popdensity* were log transformed in all estimations due to their extensive range of values. As previously stated, the dependent variables were transformed into proportions, hence the addition of a 'b' to their designations in tables 3 and 4 to distinguish them from the earlier percentage variables.

Tab 3. Estimation results for the dependent variable *Maintain_b*. Source: own elaboration

Variable	Coefficient	Std. error	z	P> z
<i>Elderly</i>	-0.0041	0.0019	-2.19	0.029
<i>Women</i>	-0.0036	0.0018	-1.99	0.046
<i>Higheeducation</i>	0.0030	0.0020	1.49	0.135
<i>Notraining</i>	0.0041	0.0011	3.88	0.000
<i>Household</i>	-0.0698	0.0335	-2.08	0.037
<i>Landownership</i>	0.0044	0.0012	3.54	0.000
<i>Acreage</i>	0.0039	0.0010	3.80	0.000
<i>Fulltime</i>	-0.0037	0.0012	-3.18	0.001
<i>InLproductivity</i>	-0.0720	0.0335	-2.15	0.032
<i>Subsidies</i>	0.0006	0.0012	0.52	0.604
<i>Fruit</i>	-0.0024	0.0018	-1.32	0.186
<i>Olive</i>	-0.0002	0.0014	-0.11	0.913
<i>Vineyard</i>	-0.0051	0.0013	-4.07	0.000
<i>Cereals</i>	0.0013	0.0020	0.64	0.520
<i>Vegetables</i>	0.0033	0.0025	1.30	0.193
<i>Cattle</i>	0.0034	0.0227	0.15	0.883
<i>Sheep</i>	0.0249	0.0217	1.15	0.251
<i>Goat</i>	0.0741	0.0398	1.86	0.062
<i>InPopdensity</i>	0.0377	0.0177	2.13	0.033
<i>LocTM</i>	-0.0601	0.0776	-0.77	0.439
<i>LocBL</i>	-0.1897	0.0698	-2.72	0.007
<i>LocBI</i>	-0.1849	0.0852	-2.17	0.030
<i>LocRO</i>	-0.6901	0.0898	-7.68	0.000
<i>LocALT</i>	-0.7139	0.1172	-6.09	0.000
<i>LocALG</i>	-0.4127	0.1410	-2.93	0.003
<i>LocMD</i>	0.0512	0.1706	0.30	0.764
<i>LocAZ</i>	-0.2562	0.1117	-2.29	0.022
<i>Constant</i>	3.9561	0.4147	9.54	0.000

Significant socio-demographic characteristics include age ($\beta = -0.0041$, $p < 0.05$) and gender ($\beta = -0.0036$, $p < 0.05$). The coefficients' negative signs indicate that in communes with a higher percentage of older and female farmers, the willingness to continue agricultural activities decreases. The same is true for *Household*, indicating that the greater the average number of family members living on the farm, the lower the percentage of farmers who intend to keep their farms in the short term. Surprisingly, *Notraining* presents a small but highly significant positive effect ($\beta = 0.0041$; $p < 0.001$), showing that in communes with a higher prevalence of farmers with no formal training, the percentage of those planning to maintain their farm is higher.

In terms of farm structures, *Landownership* ($\beta = 0.0044$, $p < 0.01$) and *Acreage* ($\beta = 0.0039$, $p < 0.01$) have a significant positive effect, indicating an increase in the percentage of farmers who expect to keep their farms in communes with larger farms and owned land. Unexpectedly, in communes with a greater percentage of full-time farmers and higher labor productivity, fewer proportions of farmers declare that they plan to persist in farming.

Agricultural practices do not significantly influence the continuity of farms, except for vineyards that have a negative effect ($\beta = 0.0051$, $p < 0.01$).

The results reveal a significant influence of control variables on the dependent variable. Increased population densities have a strong positive effect on the proportion of farmers persisting in agriculture ($\beta = 0.0377$, $p < 0.05$). The influence of regional heterogeneity is also evident. The most pronounced negative effects, when compared to the baseline region (*Entre Douro e Minho*) are concentrated in the southern regions of the country (*Ribatejo e Oeste*, *Alentejo* and *Algarve*).

It is worth noting that the impact of each variable on farm continuity is most likely the result of a combination of influences from various underlying farmers' motivations, which could explain some

unexpected results, such as *Notraining's* positive influence or *Lproductivity's* negative impact. The same variable may influence motivations to varying degrees and even in opposite directions. For example, while *lnLproductivity* correlates negatively with farm continuity, it may have a positive impact on some motivations for keeping the farm, such as farm viability, while negatively impacting others, such as emotional reasons. To deepen the analysis, we will investigate how the early identified variables shape the key motivations that drive farmers to persist, because motivations such as viability, income supplementation, affective attachment, and a lack of alternatives are likely to mediate the relationship between the independent variables and farm continuity.

4.3 Determinants of farmers motivations to persist farming

Table 4 presents the findings from the estimated four Beta regressions, which included each of the previously mentioned motivations as dependent variables: *Viability*, *Supplement*, *Affective* and *Noalternative*.

The high significance of the LR Chi-Square test for all models confirms that the predictors collectively contribute to explaining the dependent variables. Higher log-likelihood values and lower AIC for the models *Viability* and *Noalternative* suggest better fit than the *Supplement* and *Affective* model, which have lower log-likelihoods and higher AIC, reflecting slightly weaker fits compared to the other models. Many independent variables show significant effects at $p < 0.01$, $p < 0.05$ and $p < 0.1$ levels, suggesting that the predictors are generally relevant for explaining the dependent variables.

The results reveal intricate relationships among socio-demographics, farm structures, and agricultural methods concerning farmers' motivations to persist in farming. Starting with socio-demographic variables, the continuity of farmers based on economic motivations (viability and supplementary income) is less important in communes with higher percentages of older farmers. The lack of alternatives is also less relevant as a reason for continuing farming where older farmers are more prevalent. It seems that older farmers mainly associate farming continuity with emotional attachment. Women are also less motivated by economic viability. They are more likely to consider supplementary income and the lack of professional alternatives as reasons to keep the farm. Higher education enhances economic viability and affective reasons as motivations to stay farming. On the contrary, educated farmers are less likely to keep farming as a way to obtain supplementary income or due to the lack of professional alternatives. In communes where farmers without formal training are more significant, the economic viability motivation as well as emotional attachment and lack of alternatives are reduced. The number of family members living on the farm mainly impacts on the emotional attachment. No significant effect on economic viability or lack of alternatives can be inferred while a slightly negative impact can be observed in farming as supplementary income.

Concerning farm structures, landownership negatively affects maintenance due to economic viability, emotional reasons and lack of alternatives but positively influences the plan to stay on the farm due to supplementary income. Surprisingly farm size presents very low coefficients, with statistically significant impact only for the supplementary income motivation, to which it is negatively associated. Full-time farming significantly increases motivation related to economic viability and lack of alternatives. It has no significant effect on income supplement motivation and negatively influences affective motivations. The percentage of farmers that receive CAP subsidies is positively associated with the economic motivations, namely farm economic viability and supplementary income, as well as with the lack of alternatives. On the contrary, it negatively impacts emotional attachment motivations.

Regarding agricultural activities, the results suggest that crops and livestock production shape motivations differently, with economic viability strongly tied to certain high-value crops (e.g., fruit, vegetables, vineyards) and cattle farming, while emotional attachment is more prominent in traditional systems like olive farming. Supplementary income is notable for goats, cereals and vegetables producers, whereas lack of alternatives is prominent for cattle and vegetable producers.

Tab 4. Model coefficients for the dependent variables *Viability_b*; *Supplement_b*; *Affective_b*; *Noalternative_b*. Source: own elaboration

Variable	<i>Viability_b</i>	<i>Supplement_b</i>	<i>Affective_b</i>	<i>Noalternative_b</i>
<i>Elderly</i>	-0.0037*	-0.0092***	0.0180***	-0.1117***
<i>Women</i>	-0.0038**	0.0065***	-0.0027	0.0065***
<i>Higheeducation</i>	0.0104***	-0.0086***	0.0142***	-0.0105***
<i>Notraining</i>	-0.0023*	0.0009	-0.0018*	-0.0030***
<i>Household</i>	-0.0177	-0.0672*	0.1562***	-0.0244
<i>Landownership</i>	-0.0026**	0.0052***	-0.0034***	-0.0038***
<i>Acreage</i>	0.0001	-0.0021**	0.0007	-0.0011
<i>Fulltime</i>	0.0068***	-0.0004	-0.0089***	0.0085***
<i>lnLproductivity</i>	0.2148***	0.0137	-0.0260	0.0137
<i>Subsidies</i>	0.0090***	0.0071***	-0.0097***	0.0043***
<i>Fruit</i>	0.0129***	-0.0019	-0.0040**	0.0015
<i>Olive</i>	-0.0013	-0.0005	0.0044***	-0.0047***
<i>Vineyard</i>	0.0075***	-0.0023*	0.0018	0.0021
<i>Cereals</i>	-0.0054**	0.0048***	-0.0050***	-0.0023
<i>Vegetables</i>	0.0152***	0.0078***	-0.01423***	0.0099***
<i>Cattle</i>	0.0779***	0.0084	-0.0201	0.0844***
<i>Sheep</i>	-0.0066	-0.0067	0.0150	0.0183
<i>Goat</i>	-0.0960**	0.1681***	-0.1365***	-0.1028**
<i>lnPopdensity</i>	-0.0975***	-0.0363**	0.0431***	-0.0337*
<i>LocTM</i>	0.0333	0.2804***	-0.3180***	0.6972***
<i>LocBL</i>	0.2255***	0.1818***	-0.0968	0.5107***
<i>LocBI</i>	-0.0904	-0.0598	0.0955	0.6141***
<i>LocRO</i>	0.4596***	-0.0147	-0.0974	0.5799***
<i>LocALT</i>	0.7910***	0.2399**	-0.2746**	0.2850**
<i>LocALG</i>	0.8282***	0.2912**	-0.2416*	0.6871***
<i>LocMD</i>	-0.1300	0.3195**	0.0304	0.3675**
<i>LocAZ</i>	0.5764***	0.0771	-0.2346**	0.4631***
<i>Constant</i>	-4.6524***	-1.0990***	-0.1901	-22.6167***
	LR χ^2 = 1021.35 (p= 0.0000) log-likelihood = 6034.5408 AIC=-12001.08	LR χ^2 = 474.50 (p= 0.0000) log-likelihood = 869.08373 AIC=-1680.167	LR χ^2 = 853.41 (p= 0.0000) log-likelihood = 627.69138 AIC=-1197.383	LR χ^2 = 464.13 (p= 0.0000) log-likelihood = 7128.2667 AIC=-14198.53
***p-value<0.01; **p-value<0.05 *p-value<0.1				

Control variables also seem to have a strong impact on farmers' motivations to keep on farming. In densely populated areas, these motivations seem to shift away from practical (*Noalternative*) and economic reasons (*Viability* and *Supplement*) toward affective reasons. Location variables show strong regional differences. For example, the locations in *Alentejo* and *Algarve*, when compared to the baseline location, *Entre Douro e Minho*, strongly increase the economic viability motivation while the location in *Trás-os-Montes* and *Beira Litoral* significantly boost supplementary income motivation. Locations like *Trás-os-Montes*, *Alentejo* and *Azores* negatively affect emotional attachment while almost every location enhance lack of alternatives motivation, when compared to *Entre Douro e Minho*.

5. Discussion

Table 5 illustrates the direction of the effect and the significance of the coefficients for the intrinsic factors included in the previous models as dependent variables. The analysis confirms the intricate interaction of factors, revealing diverse patterns across different motivating frameworks.

Tab 5. Intrinsic factors on family farmers' motivations for short-term continuity. Source: own elaboration

Variable	Maintain	Viability	Supplement	Affective	Noalternative
Elderly	-	-	-	+	--
Women	-	-	+	-	+
Higheeducation	+	+	-	+	-
Notraining	+	-	+	-	-
Household	-	-	-	++	-
Landownership	+	-	+	-	-
Acreage	+	+	-	+	-
Fulltime	-	+	-	-	+
Lproductivity	-	++	+	-	+
Subsidies	+	+	+	-	+
Fruit	-	+	-	-	+
Olive	-	-	-	+	-
Vineyard	-	+	-	+	+
Cereals	+	-	+	-	-
Vegetables	+	+	+	-	+
Cattle	+	+	+	-	+
Goat	+	-	+	-	-

Caption:

+ Positive impact

++ Strong positive impact

- Negative impact

-- Strong negative impact



Positive (p<0.01)

Positive (p<0.05)

Positive (p<0.10)



Negative (p<0.01)

Negative (p<0.05)

Negative (p<0.10)

One of the key features of the economic “viability” model is the significant positive effect of labor productivity, which is not evident in the other models. Another element is the notable positive association, in contrast to other models, with fruit and vineyard, underscoring the influence of these crops on the profitability and economic sustainability of Portuguese farmers.

In comparison with alternative models, the “supplement” income model is distinguished by the positive effects of land ownership, cereal cultivation, and goat rearing. This reveals that landowners and farmers engaged in extensive agriculture perceive farming mostly as a supplementary source of income rather than a primary economic initiative.

The “affective” model is perhaps the most revealing as it depicts a distinct aspect of farm continuity. In contrast to the previous models, this model demonstrates a positive correlation with age, indicating that elderly farmers may see agriculture as an emotional endeavor rather than an economic one. It is the only model exhibiting a negative association with vegetables and a positive correlation with olives, revealing the cultural importance of this crop beyond simple economic factors. The little significance of economic and practical reasoning is seen in the fact that this is the only model where the effect of subsidies is detrimental, indicating that financial support systems may exhibit differing efficacy in sustaining farms according to their fundamental motivations.

The “no alternative” model is characterized by the pronounced negative impact of age, suggesting that older farmers are less likely to continue farming due to the lack of alternatives.

Cross-model comparisons reveal interesting tendencies as well. Age has a significant negative relationship with farming continuity, economic viability, income supplementation, and a lack of professional

alternatives, indicating that older farmers are less likely to continue farming for economic and practical reasons, whereas affective reasons encourage them to do so. As showed by other authors (Duesberg et al., 2017; Joosse & Grubbström, 2017), farmers possess a profound identification with their agricultural labor, workplace, land, and livestock, hampering their ability to depart from the farm as they age. These results align with the conclusion of Rogers et al. (2013) that ageing on the farm is a viable option for many farmers, if their health, personal safety, security, and independence are preserved.

The general adverse effect of the proportion of female farmers in farm continuity is primarily influenced by the perception of insufficient farm economic viability, whereas the positive correlation with supplement and the absence of alternative motivations indicates that women frequently engage in farming out of practicality or necessity rather than as a principal economic endeavor. This result is consistent with various investigations reported by Hoang et al. (2021) which suggest that women-owned businesses tend to be smaller and less profitable, due to household responsibilities, restricted management experience, and gender-related capital disparities.

Higher education has a positive effect on the overall model due to viability and affective motivations, implying that higher education levels may engage farmers for both economic and emotional reasons. Positive significant effects of the variable *Notraining* on the general and supplement models suggest that individuals without formal training often persist in farming as a means of generating supplementary income. Negative associations with viability, affective, and no alternative motivations show that formal training can help farmers achieve economic success, strengthen their connection to farming as a tradition or emotional pursuit, and reduce their dependence on farming. Similar conclusions were achieved by Evenson (2001), Fu (2009) and Mugeru et al. (2012) regarding the ability of more educated and trained farmers to achieve success.

The negative effect of household size in the viability, supplement, and no alternative models, as well as in the general model, suggests that larger families may face pressures that reduce the likelihood of agricultural continuity because of necessity-driven or economic factors. These findings contradict those reported by other authors (Aldanondo Ochoa et al., 2007; Glauben et al., 2004; Špička & Berg, 2022), which indicate that household size positively influences the probability of farming continuity. The discrepancy may be due to the authors' focus on succession and long-term continuity analysis rather than short-term analysis. Short-term effects could be the opposite due to competing family demands, budgetary constraints, or a greater reliance on non-agricultural income sources to support larger families. A positive correlation with affective motives suggests that larger households are more inclined to sustain farming for emotional or traditional reasons.

The anticipated positive impact of landownership on maintenance conceals an unexpected negative correlation with both viability and affective motivations, implying that land is not primarily viewed as an economic or emotional asset. Land is most likely viewed as a static, underutilized resource, or even a burden, especially when land ownership is not associated with economic stability or viability. Furthermore, farmers who have inherited land may regard farming as an obligation rather than a choice. Other authors (Crockett, 2004; Fischer & Burton, 2014) have suggested this type of relationship with land, emphasizing that farmers have strong feelings about carrying on the family tradition of farming, coupled with a sense of duty to maintain the farm's continuity and functionality for future generations.

The positive effect of acreage on maintain is difficult to explain on the basis of farmers' motivations since the only significant coefficient is associated with supplement which exhibits a little influence and a negative sign.

Full-time employment and labor productivity surprisingly exhibit negative coefficients in the overall model. The adverse effects of full-time employment are influenced by emotional motives, although the relationship with labor productivity remains ambiguous. Moreover, the positive coefficients of both variables regarding viability and the absence of alternative motivations indicate that both full-time and high-labor productivity farmers are motivated by viability and necessity, as they depend on their labor as the main source of income.

The lack of statistically significant influence of subsidies on maintenance is due to complex implications of farmers' motives for continuity, which produce paradoxical outcomes. The positive associations with viability, supplement and no alternative motivations indicate that subsidies reinforce the viability of farms and the maintenance of farmers that have no other professional alternative and reduce the perception of farming as an emotional or tradition-driven activity. The impact of direct payments on farm income and its contribution for the survival of many European farms is widely recognized (Hejnowicz et al., 2016; Hennessy, 2014)). Nonetheless, the allocation of subsidies in Portugal predominantly favored agricultural systems reliant on larger farms operated by younger farmers (Dinis, 2024), which do not correspond to the affective motivated farmer profile.

Farm activities significantly influence motivational patterns. In the general model, only vineyard and goat productions exhibit a statistically significant impact on farmers' decisions to maintain their farms. However, this reflects a varied and conflicting relationship between production and farmers' motivations to continue. For instance, farmers motivated by economic viability are inclined to cultivate high-value crops such as fruits, wine, and vegetables while farmers driven by income supplement tend to concentrate on a limited number of lower-risk and lower-effort activities, such as cereals and goats.

6. Conclusion

This study contributes to the understanding of the motivations driving short-term continuity among family farmers in Portugal, emphasizing the intricate interplay between intrinsic factors such as age, gender, education, farm structure, and agricultural practices. The findings reveal that while the majority of farmers demonstrate a strong intent to maintain their farms, this decision is often shaped by diverse motivational frameworks, including economic viability, supplementary income, affective attachment, and the lack of professional alternatives.

A critical insight is the significant influence of socio-demographic factors on farmers' motivations. Older farmers are more likely to view farming through an emotional lens, whereas younger farmers focus on economic viability or supplementary income. Gender dynamics highlight that female farmers often remain engaged in agriculture due to practicality or necessity rather than primary economic motivations. Higher education emerges as a dual motivator, enhancing both economic and emotional reasons for continuity.

Farm structures and activities also shape these motivations in distinct ways. Larger farms and owner-operated land promote supplementary income but can undermine the perception of emotional or economic viability. Crops like fruits and vineyards align with economic motivations, while traditional systems like olive farming evoke emotional attachment. Full-time farming and CAP subsidies strengthen economic motivations but reduce emotional ties, indicating that financial dependence and operational intensity might erode farming's cultural significance.

This study highlights the necessity for policymakers to implement targeted measures that meet the diversity of motivation among family farmers. To ensure that farmers can persist in providing essential commodities and services that benefit society, support for small farmers and redistributive payments must acknowledge the many factors that motivate farmers to remain on their farms, as well as the variables that influence those decisions. Policies that promote environmental sustainability should be combined with programs that improve the economic viability of family farms while also preserving farming's cultural and emotional relevance, especially among ageing populations. Furthermore, education and training initiatives should strive to bridge the gap between practical farming expertise and contemporary agricultural methods, enabling farmers to preserve their livelihoods while strengthening their emotional connection with the land.

Important extrinsic factors such as land price, accessibility, natural resource endowment, and environmental constraints were excluded from the models due to a lack of data at the commune level. Nevertheless, the control variables incorporated into the models to address this limitation, pertaining to population density and location, revealed that external factors are essential in elucidating why individuals opt to persist in farming and the fundamental motivations behind this choice. Future studies might build

on these results by looking at the influence of external variables, notably land market and land pricing, which are currently some of the most pressing challenges in farm entrance and continuity. Longitudinal research may also give more detailed insights into how motives change over time, especially in response to changing socioeconomic and environmental contexts. Addressing these characteristics would deepen the knowledge of family farming's resilience and continuity, assuring its long-term contribution to rural economies and communities.

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Appendix 1: Main variables histograms

