Eesti Maaülikool
Estonian University of Life Sciences

STRUCTURAL ADJUSTMENT OF ESTONIAN AGRICULTURE – THE ROLE OF INSTITUTIONAL CHANGES AND SOCIOECONOMIC FACTORS OF FARM GROWTH, DECLINE AND EXIT

EESTI PÕLLUMAJANDUSE STRUKTURAALNE KOHANEMINE – INSTITUTSIONAALSETE MUUTUSTE JA PÕLLUMAJANDUSETTEVÕTETE KASVU, KAHANEMIST NING TEGEVUSE LÕPETAMIST MÕJUTAVATE SOTSIAAL-MAJANDUSLIKE TEGURITE OSA

ANTS-HANNES VIIRA

A Thesis
for applying for the degree of Doctor of Philosophy
in Agricultural Economics and Management

Väitekiri
filosoofiadoktori kraadi taotlemiseks
maamajanduse ökonoomika erialal

Tartu 2014

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II **Viira, A.-H.**, Põder, A., Värnik, R. 2009. The factors affecting the motivation to exit farming – evidence from Estonia. Food Economics – Acta Agriculturae Scandinavica, Section C, 6 (3), 156–172.

III **Viira, A.-H.**, Põder, A., Värnik, R. 2013. The Determinants of Farm Growth, Decline and Exit in Estonia. German Journal of Agricultural Economics, 62 (1), 52–64.

IV **Viira, A.-H.**, Põder, A., Värnik, R. 2014. Discrepancies between the Intentions and Behaviour of Farm Operators in the Contexts of Farm Growth, Decline, Continuation and Exit – Evidence from Estonia. German Journal of Agricultural Economics, 63 (1), 46–62.

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The contributions from the authors to the papers are as follows:

Paper	Original idea and structure	Data collection	Data analysis	Manuscript preparation
I	All	AHV, AP	AHV, AP	All
II	All	All	AHV, AP	All
III	All	AHV, AP	AHV, AP	All
IV	All	AHV, AP	AHV, AP	All

AHV – Ants-Hannes Viira; AP – Anne Põder; RV – Rando Värnik; All – all authors of the paper.

ABBREVIATIONS

ARIB	Estonian Agricultural Registers and Information Board – Estonian paying agency of agricultural subsidies
CEEC	Central and Eastern European Countries
CA	Cluster analysis
CAP	Common Agricultural Policy of the European Union
ESU	Economic size unit defined for the purpose of the Farm Accountancy Data Network (FADN).
FADN	Farm Accountancy Data Network
FAOSTAT	The Statistics Division of the Food and Agriculture Organization of the United Nations (FAO)
LFA	Less favoured areas
OECD	The Organisation for Economic Co-operation and Development
PCA	Principal component analysis
PSE	Producer support estimate
SAPARD	Special Accession Programme for Agriculture and Rural Development
SO	Standard output of the farm as defined in the Commission Regulation (EC) No. 1242/2008
TPB	Theory of planned behaviour
TRA	Theory of reasoned action

1. INTRODUCTION

In Western countries, changes in farm structures have been of interest for agricultural economists, rural sociologists, policy makers and society at large for decades. One of the key issues in these debates has been the livelihood and survival of family farms, which, in Western Europe, have been the prevailing form of agricultural producers. A characteristic feature of the farming sector, as opposed to most sectors of the economy, is that enterprises are traditionally passed on within families. Families own the land and capital of farms, manage farms, provide and reproduce farm labour, and consume part of the farm's production (Gasson and Errington, 1993; Boehlje, 1999; Glauben *et al.*, 2004; Johnsen, 2004).

Technological development has dramatically reduced labour requirements in modern agriculture, and the development of other economic sectors has provided jobs for employees released from agriculture. While the terms of trade for agricultural products has been deteriorating for decades, and income levels in non-agricultural employment relative to agricultural employment have increased, family farms, in order to sustain livelihood for the family, have increased in size (Levins and Cochrane, 1996). Due to the limited availability of agricultural land, these processes have implied a decrease in the number of farms and an increase in average farm size. At the same time, the trend of increasing farm size and capital requirements have increased the barriers for new entrants (Boehlje, 1973; Huffmann and Evenson, 2001).

Since the Second World War, European agriculture has been strongly influenced by agricultural policies. The integration of Europe into the EU has increased the role of the Common Agricultural Policy (CAP) in the agricultural development of the EU member states, and also their trade partners. Since the MacSharry reform in 1992, the CAP has become less and less distortive to agricultural markets (Ritson and Harvey, 1997; Burrell and Oskam, 2000; Greer, 2005; Garzon, 2006). In general, less market distortions should lead to quicker structural changes and more market orientated, competitive agricultural producers. Huffmann and Evenson (2001) found that structural changes have positively affected total factor productivity growth in the USA.

In the EU, the structural changes have been promoted by the rural development policy of the CAP via schemes of early retirement, aid schemes for young farmers, investment subsidies and subsidies for non-agricultural diversification. However, transformation of farm structures has pressured the viability of smaller family farms, which are characteristic of many rural regions across the EU. Therefore, while the main part of the CAP aims to enhance structural changes, measure for semi-subsistence farms, aid for smaller farms and payment schemes targeted for farms situated in disadvantaged areas aim to ensure the viability of smaller and/or vulnerable farms, and at the same time decelerate the process of structural adjustment.

In Estonia, the trend of the decreasing number of farms and increasing average farm size, similar to the trend of structural changes in Western countries, can be observed. However, during the last 100 years Estonian society, agriculture and farm structures have been influenced by three major structural breaks – foundation of the Republic of Estonia in 1918 (distribution of previous manorial lands of non-Estonian nobility into numerous small-scale farms in 1920s); Soviet occupation in 1940 (collectivisation of all private farms after the Second World War); regaining of independence in 1991 (restitution of farmlands based on the pre-Second World War ownership and privatisation of collective farms) (**III**). Each of those structural breaks implied a complete reform of property relations that overturned the previous developments in agriculture (Rosenberg, 2014).

The ownership, agricultural and land reforms initiated at the end of the 1980s and the beginning of the 1990s, together with societal and economic changes, implied a transition in agriculture that resulted in the establishment of large-scale agricultural enterprises via privatisation of previous collective farms and establishment of new private farms based on restituted or privatised land. These processes formed the basis for the dualistic farm structure in Estonia (**I**). In the first ten years of regaining independence, the number of farms in Estonia increased from 7.4 thousand in 1991 to 55.7 thousand in 2001. However, by 2010, the number of agricultural households had decreased to 19.6 thousand (Statistics Estonia, 2014).

According to the farm life cycle approach, a farm passes stages of entry, growth, maturity, decline and exit, and the farm life cycle is closely related to the farm family life cycle (Boehjle, 1973; Potter and Lobley, 1996). Generational change is an acute topic in Estonian agriculture due to the fact that approximately one generation has passed since the beginning of transition. The farms that were established in the beginning of transition could be regarded as first-genereation private farms (**II**). The substantial decrease in farm numbers implies that numerous farm exits could be observed; while the increase in agricultural land use and production implies that remaining farms have increased in size. It is likely that changes in farm structures during the last 25 years in Estonia have simultaneously been influenced by the processes of transition from command to market economy, by the CAP since EU accession, and the normal process of structural changes induced by general economic development, and they have also been affected by the decisions taken by farm operators in different stages of their farm and family life cycles.

Therefore, the thesis explores the role of institutional changes, and the farm-specific socioeconomic factors of farm growth, decline, continuation and exit, in the structural adjustment of Estonian agriculture. For that, the main institutional changes in Estonian agriculture in last 25 years are reviewed and compared with the adjustment of agricultural production and farm structure (**I**). Factors that affect farm growth, decline, continuation and exit are studied on the basis of the intentions of farm operators (**II, IV**), and also on the basis of actual farm growth, decline, and continuation and exit measures (**III, IV**) collected with two farm surveys and complemented with registry data from Estonian paying agency the Agricultural Registers and Information Board (ARIB). Several studies (Thomson and Tansey, 1982; Calus *et al.*, 2008; Väre *et al.*, 2010; Lefebvre *et al.*, 2013) have argued that the intentions stated by the farm operators are of dubious quality in explaining their actual behaviour. Therefore, the discrepancies between intention and actual behaviour of farm operators in the contexts of farm growth, decline, continuation and exit are studied (**IV**).

2. REVIEW OF THE LITERATURE

2.1. Studies of structural changes in agriculture

The structure of an economic sector has many dimensions (size, financial characteristics, resource ownership, characterisation of labour, technology, inter-sector and intra-sector linkages, etc.). Therefore, structural changes may be observed and studied from different perspectives (Boehlje, 1990; Boehlje, 1999; Huffman and Evenson, 2001).

Boehlje (1990) has categorised five models of structural change in agriculture: technology, human capital, financial, institutional and sociological model. In the studies that apply the technology model, the focus has mainly been on the long run cost curve in agriculture and determinants that shape and shift that curve; and on the adoption and diffusion of new technology (e.g. Huffman and Evenson, 2001; Rungsuriyawiboon and Lissitsa, 2006; Rasmussen, 2010). The human capital model deals with human capital, household labour allocation and relative labour incomes in agricultural and non-agricultural employment (e.g. Rodgers, 1994; Kimhi, 2000; Huffman and Evenson, 2001; Hennessy and Rehman, 2007; Lien *et al.*, 2010; Berlinschi *et al.*, 2013). The financial model combines production and financial theories in explaining the firm behaviour regarding maximising income from production and capital gains (e.g. Ahituv and Kimhi, 2002; Calus *et al.*, 2008). The institutional model deals with industrial organisation in the framework of the structure-conduct-performance paradigm, according to which the structure, management and performance of an industry are interrelated (e.g. Morrison, 1997; Rizov, 2008; Dong *et al.*, 2010; Wegren, 2012). The sociological model captures the behaviour of individuals in a family context, and the development and sustenance of family farms (e.g. Aubert and Perrier-Cornet, 2009; Mäkinen *et al.*, 2009; Berlinschi *et al.*, 2013).

Schmitt (1991) suggests that the theory of farm households is more appropriate than the theory of farms as firms, in explaining the resource use in family farms. This implies that in studies of structural changes it is also important to consider the socioeconomic characteristics of farms. Exit from farming, farm transfer and succession, and farm growth have

been subject to many researchers of different disciplines, and many quantitative (e.g. Kimhi, 1994; Kimhi and Bollmann, 1999; Foltz, 2004; Glauben *et al.*, 2004; Breustedt and Glauben, 2007; Väre, 2007) and qualitative studies (e.g. Mann and Mante, 2004; Mann, 2007; Forbord *et al.*, 2014; Pinter and Kirner, 2014).

In studies of farm exits and transfers as well as farm growth, a variety of different methodological approaches have been used. Several studies have used theoretical and descriptive approaches (Burton and Wilson, 2006; Williams and Farrington, 2006; Mann, 2007; Calus *et al.*, 2008), econometric analyses (Weiss, 1997; Kimhi and Bollmann, 1999; Glauben *et al.*, 2004; Breustedt and Glauben, 2007; Väre, 2007), as well as simulation modelling (Britz *et al.*, 2006; Happe *et al.*, 2008; Sahrbacher *et al.*, 2008; Schnicke *et al.*, 2008). Due to the complexity of the problem of the changes in farm structures, and interrelations of the driving forces, several studies have employed structural equations modelling (e.g. Huffmann and Evenson, 2001; Pietola *et al.*, 2003; Dong *et al.*, 2010; Lien *et al.*, 2010; Bergfjord *et al.*, 2011).

Various data sources have been used in the studies of structural changes. Several studies have used census and farm structure survey data (e.g. Huffman, 1980; Kimhi, 2000; Ahituv and Kimhi, 2002; Foltz, 2004; Aubert and Perrier-Cornet, 2009). Farm accounts data have been used by Calus and Van Huylenbroeck (2008), Bakucs and Fertö (2009), Bjørnsen and Biørn (2010), Lien *et al.* (2010), for example. Numerous studies have used farm surveys to obtain information about farm-specific variables that are related to structural changes (e.g. Kimhi and Lopez, 1999; Kimhi and Nachlieli, 2001; Rizov and Mathijs, 2003; Glauben *et al.*, 2004; Loureiro, 2009; Mäkinen *et al.*, 2009; Lobley and Butler, 2010; Lobley *et al.*, 2010; Bergfjord *et al.*, 2011; Lefebvre *et al.*, 2013). There are also studies that have linked survey data with the farm accounts data (e.g. Glauben *et al.*, 2004; Mäkinen *et al.*, 2009), or data from the tax authorities (e.g. Loureiro, 2009; Bergfjord *et al.*, 2011).

As previously reviewed, the studies on farm exit, succession and growth are often based on surveys carried out in the sample of farms that have exited or have been transferred, or they utilise survey data regarding farmers' intentions regarding farm exit or succession. The problem with the intention surveys is that plans that farmers make are often found time-inconsistent (Thomson and Tansey, 1982; Calus *et al.*, 2008; Väre,

2010; Lefebvre *et al.*, 2013). However, much of the research on the farm is often based on the opinions and evaluations of the farmer (Morris and Evans, 2004). Farm surveys derive an advantage from the fact that detailed and direct information can be obtained from the respondents' subjective evaluation of the situation (Glauben *et al.*, 2004). The usefulness of ex-post data in predicting future structural changes has also been questioned, as the causes of structural changes may lie outside the boundaries of historic data, especially in environments where great structural changes are occurring. In such cases, primary data collection, in the form of interviews with stakeholders, experiments, surveys about intentions, etc. is required to augment the historical data series with information about decision making processes (Boehlje, 1999).

2.2. The role of institutional changes in the agricultural transition

Several conferences and journal issues were dedicated on discussing the agricultural development of transition countries 20 years after the beginning of transition (e.g. Csáki, 2008; Buchenrieder *et al.*, 2009; Schaft and Balmann, 2009; Maaelu ja elu maal …, 2014). The study **I** focuses on the adaptation of Estonian agriculture in response to institutional changes and the transition of the previous 20 years. The same approach was extended until 2010 by Viira (2011).

The beginning of transition in the former states of the Soviet Union and Central and Eastern European Countries (CEEC) could be associated with different events: for example, 'Perestroika' initiated after the elections of the Soviet Parliament in 1985, or the fall of the Berlin Wall in 1990. The transition countries faced many challenges that caused economic distortions: absence of private and public market-orientated institutions; interruption of historic trading paths; collapse of many state-owned enterprises; underdeveloped private sector; insufficient knowledge about the rules of the "market" game (Buchenrieder *et al.*, 2009).

Institutions were one of the most important reform areas in CEEC transition countries (Rozelle and Swinnen, 2004; Rizov, 2008). Institutions can be described as a set of informal (sanctions, taboos, customs, traditions, and codes of conduct) and formal (constitutions, laws and

property rights) rules, which constrain political, economic and social interactions, therefore creating order and reducing uncertainty (North, 1991). Institutions as formal rules are human-made and therefore can be changed by humans. Therefore, institutions could be regarded as necessary pre-conditions of the policy change (Slangen *et al.*, 2004).

Csáki (2008) identifies five crucial reform areas in the agri-food sectors of the transition economies of the CEECs: 1) macroeconomic and institutional reforms, notably price liberalisation and subsidy cuts; 2) land privatisation; 3) privatisation and upgrade of the value chain; 4) implementation of operational organisations; 5) rural financial market. According to Heath (2003), Estonia, along with Czech Republic, Hungary, Slovenia and Latvia, was one of the most advanced reformers of the agri-food sectors in the 1990s.

Agricultural production systems in post-communist transition countries could be divided into three groups according to the farm size structures: 1) large-scale-farming-dominated structures (e.g. Czech Republic), in which large-scale farms produce most of the agricultural output; 2) mixed farming structures (e.g. Hungary); and 3) predominantly small-scale farming (e.g. Romania) (Buchenrieder *et al.*, 2009). Based on this categorisation, Estonian (dualistic) farming structure belongs to the 1st group.

The process of structural changes in Estonian agriculture and in many other transition economies in the 1990s is different from that of more stable Western countries from as early as farm entry. While in stable Western economies, new entrants traditionally took the farm over from parents or entered via the "agricultural ladder" (Boehlje, 1973), in Estonia, most of the new entrants entered farming in a relatively short time period and mainly via restitution or privatisation. This suggests that generational change in Estonian farming sector could be less smooth compared to Western economies, and many of the farm transfers are about to occur in the current decade, i.e. approximately one generation after the beginning of transition (**II**).

Calus *et al.* (2008) point out that uncertainty, which may be exogenous or endogenous, may affect farm transfers and exits. Changes in legislation and environmental conditions are exogenous factors that affect the

transfer possibilities of a farm. In a clear and good policy and economic environment, transfer will be more likely than in opposite conditions. However, due to the growing capital requirements of viable farms and changes in the ownership structure of agricultural producers, the "agricultural ladder" has become irrelevant as the facilitator of new entrants (Boehlje, 1973; Huffmann and Evenson, 2001).

Buchenrieder *et al.* (2009) point out that the lack of financing opportunities continues to be one of the most serious constraints to growth in the CEEC agricultural sector. Access to capital is a particularly serious problem for smaller scale and family farms. Rizov *et al.* (2001) conclude that environmental factors such as general social and economic conditions, how conductive the local culture is for entrepreneurship, existing infrastructure and the distance from markets also affect the relative costs and profitability of the starting up and transfer of an individual farm.

Changes in Estonian agriculture during the transition have been investigated in several studies. Valdes *et al.* (1998) studied the options for Estonian integration with the EU. Brandt (1998) studied the situation and outlook of Estonian agriculture in 1998. Alanen (1999) studied the outcomes of the decollectivisation of previous collective farms. Hedin (2005) has studied the consequences of land restitution. Sepp and Ohvril (2007) have studied the structural development of agriculture in Estonia and other new member states of the EU. Alanen (2009) has comparatively studied the property rights in Russia and Baltic countries. Saar and Unt (2010) have studied the career paths of workers that left the agricultural sector. Annist (2011) investigated the community development in post-socialist Estonian villages. Grubbström and Sooväli-Sepping (2012) studied farm succession in family farms.

2.3. Factors affecting farm growth, decline, continuation and exit

While the changes in Estonian agriculture during transition have been studied by several authors, the farm development and exit patterns related to its life-cycle are undetermined and not extensively researched in Estonia (**II**). While from 2001 to 2010 the number of agricultural households decreased by 64.8%, in recent years, the decline has slowed down. Hence, one generation after the beginning of the transition, it is

intriguing to study if the process of structural changes is driven by similar factors as in other Western countries or still exhibits the characteristics of post-communist transition (**III**). Thus, the studies **II** and **III** focused on investigating the effects of farm-specific socioeconomic factors on farm growth, decline, continuation and exit.

The analysis in papers **II** and **III** mainly draws on the sociological and human capital models of structural change (Boehlje, 1990) because these are closely related to the family farm life cycle and farm family characteristics. Farm growth and exit are often associated with the family-farm life cycle, which itself is related to the life cycle of the farm owner-operator. According to this approach, the first stage in farm life cycle is the entry or establishment stage, in the second stage farm growth and survival are the key problems for the farmer, and in the third stage, decisions about disinvestment or exit have to be made (Boehjle, 1973; Boehlje and Eidman, 1984; Potter and Lobley, 1996; Glauben *et al.*, 2004).

In the studies of farm adjustment, the age of the farm operator, his or her spouse, and potential successors, is frequently considered as a factor that affects farm growth and survival (Weiss, 1999; Väre, 2006; Peerlings and Ooms, 2008; Schnicke *et al.*, 2008). Farm growth is less likely in the younger and older age groups of farm operators. In the entry stage, a farm operator needs time to acquire the "critical mass" of managerial ability and capital necessary for growth. In the exit stage, the farm operator is interested in reducing his/her commitment (Boehlje, 1990).

The effect of age is interrelated with the availability of successors. The succession effect plays a role from the age of 45. Early designation of the successor motivates the farmer to invest and improve the management of the farm; if exit is foreseen, liquidation value is optimised (Glauben *et al.*, 2002; Väre, 2006; Calus and Van Huylenbroeck, 2008; Calus *et al.*, 2008). Farm transfers to new entrants, in general, take place somewhat earlier than farm closures (Väre, 2006). Exit is a large disinvestment that takes some time and therefore can only lead to actual exit a few years after the decision is made (Peerlings and Ooms, 2008). Calus *et al.* (2008) found that the negative growth of farms starts at the age of 57 of a farmer without a successor. Therefore, farm development at the end of the farm life cycle is strongly affected by the succession prospects. A

farm may not be transferred to a successor because no successor exists, or there is a potential successor who is not interested in agricultural production (Schnicke *et al.*, 2008).

Human capital, i.e. level of education, managerial ability, experience and skills, as well as social capital are important factors of farm growth (Boehlje, 1990; Breustedt and Glauben, 2007; Schnicke *et al.*, 2008). Huffmann and Evenson (2001) suggest that as farmers spend more time on planning, analysing and managing their business, the importance of higher level formal education along with analytical and decision making skills has increased, as these enhance information acquisition and decision making. Rizov (2005) suggests that the level of human capital affected the selection of farm type in transition, and a higher level of human capital can be associated with the more effective management of individual farms and better opportunities in the off-farm labour market.

Off-farm employment may have dual effects on the farm survival: negative if the farm operator chooses to dedicate 100% of his/her labour input outside the farm (Weiss, 1999; Goetz and Debertin, 2001); or positive if only part of the labour-input is applied off-farm, and off-farm income complements earnings from agricultural production (Boehlje, 1990; Bojnec *et al.*, 2003; Buchenrieder, 2005; Breustedt and Glauben, 2007). The effects of the off-farm labour market are more significant in the proximity of an urban labour market (Boehlje, 1990; Huffmann and Evenson, 2001); in the case of younger farmers who can benefit more from the career change due to a longer time horizon (Rizov and Mathijs, 2003; Gullstrand and Tezic, 2008); and in the case of smaller farms, where off-farm employment could be considered a strategy to retain farm viability (Schmitt, 1991). At the same time, better economic conditions outside of agriculture might be an incentive for potential successors to leave farming (Gale, 2003; Williams and Farrington, 2006; Schnicke *et al.*, 2008).

While Gibrat's Law state that farm growth is independent of initial farm size (Sutton, 1997), Weiss (1999) has shown that smaller farms grow relatively faster than larger farms. Nevertheless, several studies have found that larger farms are less likely to exit from farming. More land helps to reduce borrowing constraints, therefore reducing development restrictions and increasing succession probability (Glauben *et al.*, 2004a; Breustedt and Glauben, 2007). According to the financial model of

structural changes, agricultural land is one of the main production factors determining farm income. If capital gains from land are foreseen, the farmer is expected to obtain more agricultural land to increase the farm's future value (Boehlje, 1990). In the period 2004–2013, Estonian average level of direct payments per ha of agricultural land was one of the lowest in the EU. Nevertheless, the payments have been increasing and are expected to increase in the future (European Commission, 2011). Therefore, in Estonia, the expected future capital gains from agricultural land have been and will continue to be a strong motivator for farm expansions (**III**). Increased capital requirements and low expected rates of return are among the reasons that explain the decline of entry of new farmers (Gale, 2003; Williams and Farrington, 2006; Schnicke *et al.*, 2008). Farm exits due to financial stress are more likely among farmers in the early or middle phases of their careers, when many use debt financing to expand their businesses (Gale, 2003). In the CEEC, a shift to individual farming was limited by capital constraints, which reduced the ability to make investments in new technology, thereby decreasing the present value of expected earnings from individual farming. Access to non-farm capital sources, such as income from off-farm employment, pensions or movable assets contribute to reducing capital constraints, and in a transition period they could be more effective in securing external finance than farm building or land (Rizov *et al.*, 2001).

It has been found that medium-sized farms are most likely to disappear in the future, leading to more dualistic farm size structure (Schmitt, 1991; Weiss, 1999; Dannenberg and Kuemmerle, 2010). Also, the nature of production affects the size development of farms: the narrow time span for the planting and harvesting of crops sets limitation to the size of specialised crop farms, while livestock production becomes similar to the production of industrial goods as it is relatively free of seasonal and special constraints (Huffmann and Evenson, 2001). A high share of animal production is related to high sunk costs in closing down the farm. Breustedt and Glauben (2007) found that the rate of farm exits was lower in regions that were specialised in livestock production.

The technology model of structural changes mainly deals with the adaptation of technology and scale economies. Primarily, the interest lies in the long-run cost curve and factors that affect the curve, among which agricultural policy is often of interest (Boehlje, 1990). In this study, three measures of agricultural policy were analysed as determinants of farm

growth, decline and exit: participation in investment subsidy schemes (**II**), participation in the less favoured area (LFA) payment scheme (**II, IV**), and participation in the semi-subsistence farming payment scheme (**III, IV**). Investment subsidy schemes, implemented in the framework of Rural Development Programmes of the CAP, provide farmers with a subsidy, which may amount to 50% of the value of investment, and aim to facilitate the adaptation of modern technology, therefore shifting the long-run cost curve right. The effects of investment subsidies have been analysed by Buchta and Buchta (2009) and Ciaian *et al.* (2011), among others. The aim of the LFA payment scheme is to maintain the countryside in less favoured areas through the continual use of agricultural land. The LFA payment rate in Estonia has been 25 Euros/ha since 2004 (Estonian Ministry of Agriculture, 2005). Structural changes in the agriculture of disadvantaged areas have been studied by Hermann *et al.* (2004) and Kuyvenhoven (2004), among others. The semi-subsistence farming scheme provided farmers with an annual flat rate payment of 1,000 euros for five years, and it was one of the payment schemes in the 2004–2006 Estonian Rural Development Plan. The aim of the scheme was to maintain smaller agricultural holdings and enhance their survival (Estonian Ministry of Agriculture, 2005). The role of semi-subsistence farming payments in the development of small farms has been discussed in Davidova *et al.* (2009) and Davidova (2011).

2.4. Discrepancies between stated intentions and actual behaviour

Few studies have questioned the usefulness of farm surveys in predicting the future behaviour of farmers due to discrepancies between the stated intentions and actual behaviour. Väre *et al.* (2010) found that in the context of planned and actual succession, Finnish farm operators acted according to intentions in 63% of the cases. Calus *et al.* (2008) found that on average 8% of farms indicate a change in their succession perspectives each year. Thomson and Tansey (1982) found that 33–50% of farmers acted according to their intentions regarding the enlargement of dairy herds. Lefebvre *et al.* (2013) found that 74% of the farms behaved according to their intentions regarding investments in land. Study **IV** supplements the findings of previous studies and raises some study questions for the future regarding the dependence of intention-behaviour discrepancies on the context of the issue.

The behavioural approaches used in the studies of individual decision-makers employ largely quantitative methodologies to measure psychological constructs such as motives, values and attitudes that determine the decision-making process (Morris and Potter, 1995; Burton, 2004). Theories from social psychology, such as the theory of reasoned action (TRA) and the theory of planned behaviour (TPB), are examples of behavioural approaches that could be used in studying farmers' behaviour. Intentions as predictors of behaviour and gaps between behavioural intention and actual behaviour are extensively studied in social psychology, especially in the studies of consumer and health behaviour (Sheppard *et al.*, 1988). Väre *et al.* (2010) and Lefebvre *et al.* (2013) have studied the discrepancies between farm operators' intentions and behaviour in the framework of TPB.

According to Fishbein and Ajzen (1975), behavioural intention refers to a person's subjective probability of performing some behaviour. It is regarded as an index of a person's mental readiness for action in several social psychological theories of behaviour, including the TRA and its extension – the TPB (Sheeran, 2002). According to the TRA, the behavioural intention is a function of two factors: a person's attitude towards the behaviour and subjective norm concerning the behaviour. The TRA assumes that a person's behaviour is under volitional control, but this is often not the case. To address the possibility of incomplete volitional control, Ajzen (1991) introduced TPB, which complements the TRA with the additional construct of perceived behavioural control. According to the TPB, the probability that the behaviour will occur depends on the intention of an individual to engage in that behaviour; and intentions are a function of three determinants: attitude towards the behaviour, subjective norm and perceived behavioural control (Ajzen and Fishbein, 1980; Ajzen, 1987; Ajzen, 1991).

The attitude towards the behaviour refers to the degree to which a person has a favourable or unfavourable judgement of the behaviour in question. It is influenced by beliefs about the consequences of the behaviour and the evaluation of those consequences. It is found that people tend to favour behaviours they believe have desirable results, and form negative attitudes towards behaviour that is associated with undesirable consequences. Subjective norm is associated to the perceived social pressure to perform or not perform certain behaviour. It is based on the person's beliefs about what certain people will think about the

person performing that behaviour, and a person's motivation to comply with or defy social pressure. The perceived behavioural control is based on the beliefs on how much control one has over the outcome as opposed to how much the outcome is controlled by external factors like other people, economic development and other factors. The perception of control is assumed to be a reasonably accurate reflection of actual control. The more favourable the attitude, subjective norm towards the behaviour, and the greater the perceived behavioural control, the stronger an individual's intention should be to perform the behaviour under consideration (Fishbein and Ajzen, 1975; Ajzen, 1991; Ajzen, 2005).

In the studies of intention-behaviour inconsistencies, it is vital that the intention and behaviour are measured at the same level of specificity. The more similar the time, target, action, and context of one indicator are to those of the other, the stronger the intention-behaviour relation (Ajzen, 2005). The discrepancy between planned and actual behaviour may be induced by the lack of scale of correspondence, if different magnitudes, frequencies and response formats are applied for studying the intentions and behaviour (Courneya, 1994). The importance of this is also noted by Väre *et al.* (2005; 2010), who propose that inappropriate survey design and quality of responses can be the reasons for the occurrence of discrepancies between farmers' intentions and behaviour.

Sheeran (2002) suggests that properties such as certainty of intentions, accessibility of intentions and degree of intentions' formation should be taken into account. The degree of intention formation indicates how thoroughly a person has considered the consequences of his or her decision to perform particular behaviour. Persons who have well-formed intentions should be more likely to anticipate problems and obstacles and try to enact the intentions. Sharma *et al.* (2003) found that firms with clear intentions to pursue succession tend to engage in succession-planning activities more often than firms whose intentions are less clear. The persons who have not thoroughly considered their plans should be more likely to encounter unforeseen obstacles in performing the intended behaviour, and they should therefore be more likely to change their intention (Sheeran, 2002).

The stability of the intention is affected by the time interval between the measurement of intention and observation of behaviour (Sheeran, 2002).

Accuracy of prediction will usually decline with the amount of time that intervenes between the measurement of intention and observation of the behaviour. The longer the time interval, the greater the probability that the individual may obtain new information or that certain events will occur that will have an impact on the intention (Fishbein and Ajzen, 1975; Ajzen, 2005). Therefore, as farmers constantly review new information, it is likely that their intentions will change over time and, therefore, the occurrence of inconsistency between the original intention and actual behaviour is more likely. Glauben *et al.* (2002) show that there is a time-inconsistency in the farm operator's retirement plans. As time passes from the stated plans, the farm operator will revise his/her plans repeatedly and will postpone retirement. Therefore, the reported succession time will be biased downwards.

Öhlmer *et al.* (1998) note that while the traditional approach suggests that the decision process is a linear sequence of steps, it should be regarded as a non-linear process, where different steps are intertwined in the different phases. Sheeran (2002) points out that if behaviour is predicted on the basis of intentions, it should be taken into account whether the behaviour predicted is a single action or a goal that is achieved by performing a variety of single actions. Intentions are likely to predict single actions more correctly. If the behaviour can only occur following some other sequence of behaviours, or if the behaviour is dependent on other people, events or requires abilities or resources the individual does not possess, then the volitional control the person has is lower; hence, intentions are less stable (Fishbein and Ajzen, 1975). Väre *et al.* (2005; 2010) point out that the surveys are typically addressed to one respondent (farm operator), while actual succession decisions involve the actions of different family members. Therefore, one of the limitations of such survey is that the intentions and behaviour of the farm operators are usually studied, but in most cases there is no information on the intentions of the other actors whose actions will have considerable influence on the behaviour of the operator.

Another point made by Sutton (1998) about predicting behaviour on the basis of intentions is that the intentions stated in the surveys may be provisional, because while some participants in a survey may have already formed intentions, it is likely that for others the intentions expressed are merely hypothetical or provisional.

3. AIMS OF THE STUDY

Given the recent history of Estonia as a transition economy, the structural adjustment of agricultural production and farm structures should be discussed in the context of adaptation to institutional changes. However, in-depth knowledge about the farm-specific socioeconomic factors that affect farm growth, decline, continuation and exit is needed in order to understand better the process of structural changes in Estonian agriculture. The studies of behaviour of farm operators, including the studies of farm growth and exit, are often based on the intentions revealed in farm surveys. Several studies (Thomson and Tansey, 1982; Calus et al., 2008; Väre et al., 2010; Lefebvre *et al.*, 2013) have shown that considerable discrepancies exist between farmers' intentions and actual behaviour; however, the literature on the intention-behaviour discrepancies of farmers is not extensive. Knowledge about the factors that cause discrepancies between farm operators' intentions and behaviour may help to reduce the potential biases in farm surveys that study the intentions of farm operators.

Based on this, the hypotheses of the study are:

1. Institutional changes stemming from the transition from planned to market economy have strongly influenced the adjustment of Estonian agricultural production and farm structures in the past 25 years.
2. Operators of the farms that were established based on restituted land or farmsteads are more inclined to maintain the farm that was established by their forefathers.
3. Farm growth, decline and exit processes in Estonia follow the farm life cycle pattern, and are affected by farm-specific socioeconomic characteristics similar to Western countries.
4. Farm operators' intentions regarding exiting from farming and the shrinkage of farm size are less useful in predicting actual exits and contraction, compared to the intentions regarding continuation of farming and farm growth in predicting actual continuation on farm growth.

Therefore, the thesis aims to study:

1. The structural adjustment of Estonian agriculture in the last 25 years in the context of institutional changes (**I**);
2. The farm-specific socioeconomic factors that affect actual farm

growth, decline, continuation and exit in Estonia (**III**);

3. The farm-specific socioeconomic factors that affect the intentions of Estonian farm operators about exiting from or continuation of farming, farm decline and growth (**II**, **IV**);
4. The determinants of intention-behaviour discrepancies in Estonia in the contexts of farm exit and continuation, and farm growth and decline (**IV**).

4. MATERIAL AND METHODS

4.1. Data

4.1.1. Data collection

Various public statistical databases and yearbooks were used in order to compile the time series data necessary for the descriptive analysis in paper **I**. In studies **II**, **III** and **IV**, data from two farm surveys and the registry data of ARIB were used. Table 1 presents an overview of the nature and sources of the data used in the study.

Table 1. Nature and source of the data used in the study.

Paper	Nature of the data	Source of the data
I	Public statistics, time series of agricultural production, productivity and trade figures.	Statistics Estonia, FAOSTAT, Estonian Ministry of Agriculture, Animal Recording Centre.
II	Farm operators' intentions regarding exiting from farming in 2008–2010; farm-specific socioeconomic variables.	Farm survey of 2007.
III	Information about farm exits, farm growth and shrinkage in 2008–2010; farm-specific socioeconomic variables.	Farm surveys of 2007 and 2011; and registry data of ARIB.
IV	Farm operators' intentions regarding exiting from or continuation of farming, and growth or shrinkage of farm's agricultural area in 2008–2010; information about continuation of farming, farm exits, farm growth and shrinkage in 2008–2010; farm-specific socioeconomic variables.	Farm surveys of 2007 and 2011; and registry data of ARIB.

Paper **I** provides an overview of the structural adjustment of Estonian agriculture in relation to the institutional changes from 1988–2008; this overview was extended until 2010 by Viira (2011). The interrelations and changes of institutional reforms, farm structures, production volumes, productivity, and trade patterns in the Estonian agricultural sector were comparatively followed. The descriptive analysis was based on previous literature and time-series data from public databases and statistical yearbooks.

In December 2007 and January 2008, a postal survey was carried out that asked Estonian agricultural producers about their plans and outlook for

the upcoming years (2008–2010), and it investigated their preferences on the possible agricultural policy developments discussed in the mid-term review of the CAP 2003 reform, known as "Health Check". The questionnaire was comprised of six sections. In the first section, general information about the farm was requested; the second section dealt with farm labour, the third concentrated on farm income and the fourth section was related to land use. In the fifth section, the respondents were asked to evaluate the prospects of their farm and their weaknesses and strengths as farmers. In the sixth section, farmers were requested to give opinions on the main CAP developments discussed in the "Health Check" context. The questionnaire was posted to a random sample of 1,000 farmers among the population of agricultural holdings[1] whose economic size exceeded 2 ESU[2] in 2005. This was also the minimum size of agricultural holdings that were considered as professional agricultural producers in Estonian FADN sample. In total, 290 questionnaires were returned (response rate 29.0%) (**II**).

As discussed in section 2.3, the age of the farmer and farm size are factors that significantly affect farm exits and growth. The structure of responded farms with regard to their size and farm operator's age was representative of the structure of Estonian farms as of 2007. The farms were classified into three size groups: 2–≤8 ESU, 8–≤16 ESU and >16 ESU. The farms of economic size 2–≤8 ESU constituted 70% of the sample farms and 64.1% of respondents. Farms of 8–≤16 ESU formed 12.3% of the sample and 16.9% of respondents. The group of farms of >16 ESU constituted 17.7% of the sample and 19.0% of the responded farms. Therefore, the structure of the sample and responded farms with respect to their economic size remained relatively uniform (**II**). The age distribution of the farm operators who responded was similar to the age distribution of farm operators in the farm structure survey of 2007 (Annex II of paper **IV**).

In order to gather data about actual farm-level developments from 2008–2010, the survey was repeated among the respondents of the first survey in March and April of 2011. Again, regular mail was used. The questionnaires were sent to the 290 respondents of the previous survey. The response rate of the second survey was 78.6%. In addition

[1] In the following, agricultural holdings, agricultural producers and farms are used as synonyms.

[2] ESU refers to the economic size unit defined for the purpose of FADN. 1 ESU equalled standard gross margin of 1,200 euros in 2005.

to collecting data similar to the previous study, the farmers were asked if they had quit agricultural production in 2008–2010.

The data from the two surveys was complemented with data from the registries of ARIB regarding land use, crops, agricultural animals and farm payments. Based on the registry data of 2006 and 2010, standard output (SO) was calculated for each farm, based on the Estonian SO coefficients used in 2011 (Rural Economy Research Centre, 2012). The derived SO of 2006 and 2010 were used in order to measure the economic size of the farms in 2006, and estimate changes in farm's economic size between 2006 and 2010 (**III**). Based on the registry data of 2006, farm type was determined for each respondent (**III**, **IV**).

4.1.2. Definitions of variables

In Table 2, an overview is given about the definitions of variables used in papers **II**, **III** and **IV**, and their respective scales or measurements. The definitions of dependent variables used in various models are explained in more detail in section 4.2. In Table 2, the explanatory variables are grouped according to their belonging to specific sub-categories of farm-specific socioeconomic factors discussed in section 2.3.

Explanatory variables include age of the farm operator, which was measured in years (**II**, **IV**), or indicated by dummy variables of the age group to which the farm operators belonged (**III**). Since the farms typically employ members of the farm family, three variables provided information about the involvement of family members in farm work: share of family labour in total farm labour (**II**), farm operator's evaluation on the support from family members (**II**), and farm operator's evaluation on the availability of successors (**II**, **III**, **IV**). The farm operator's evaluation on his or her condition of health was included in papers **II** and **IV**. Four proxies were used to measure the farm operator's human and social capital: farm operator's evaluation on his or her knowledge (**II**), the average of the farm operator's evaluations on his or her knowledge and experience (**IV**), farm operator's level of education (**III**), and a dummy variable that indicated if the farm operator belonged to farming associations (**IV**).

Farm size was measured in hectares of agricultural land (**II**, **IV**), or indicated by dummy variables of farm size quartiles (**III**). The

distribution of farms to size quartiles was based on the SO of these farms in 2006. The farms in the 1st quartile had on average 17.4 ha of agricultural land and 4.4 thousand euros of SO. In the 2nd size quartile, the average area was 35.3 ha and average SO 10.0 thousand euros. In the 3rd quartile, the average area was 64.2 ha and average SO 21.0 thousand euros. In the 4th quartile, the average agricultural area was 350.2 ha and average SO 210.1 thousand euros. Four variables were related to farm income sources: shares of agricultural and non-agricultural income in farm total income (**II**), off-farm labour status of the farm operator (**II**, **III**, **IV**), and indication of renting out part of the farm's agricultural land (**II**). The farm operator's intention regarding contraction or expansion of farm's agricultural land was considered, together with the farm operator's evaluation on the availability of capital in paper **II**. The share of rented land in total agricultural land of the farm was used as an explanatory variable in papers **II** and **IV**.

Three payment schemes that are related to structural adjustments in the farming sector were indicated as dummy variables: the LFA payment scheme (**II**, **IV**), investment subsidies (**II**), and the semi-subsistence farming scheme (**III**, **IV**). Farm specialisation was indicated by three variables. The dummy variable *animals* indicated if agricultural animals were kept in the farm (**II**). Based on the ARIBs registry data and the typology used by the FADN (Commission Regulation (EC) No. 1242/2008) the farm specialisation (grazing livestock (**III**) or arable (**IV**)) was determined for each sample farm. In paper **III**, a dummy variable indicated if the farm was established on the basis of restituted land. This variable related the farm exit and size developments to the institutional changes of the early 1990s.

The selection of explanatory variables was based on theoretical considerations and the experience of other authors as reviewed in chapter 2; the selection was limited by the availability of necessary questions in the survey and by the number of respondents who answered the specific questions. As is often the case in postal surveys, not all the respondents answered all the questions (Miller and Salkind, 2002). Therefore, the number of observations used in analyses **II**, **III** and **IV** varies from 196 to 251. The number of observations used in different models and estimations are reported in section 5.3. Descriptive statistics of the variables used in the analyses are provided in Table I of paper **II**, in Table 2 of paper **III** and in Table 1 of paper **IV**.

Table 2. Dependent and explanatory variables used in the studies about the role of socioeconomic factors of farm growth, decline, continuation and exit (**II**, **III**, **IV**).

Groups of factors	Variable	Definition	Scale/measurement	Papers
Dependent variables				
Intended exit	*exit*	Intention to give up agricultural production in 2008–2010	Cluster analysis: 1 = yes; 0.5 = not certain; 0 = no Logistic regression: 1 = yes; 0 = not certain; 0 = no Ordered logistic regression: 3 = yes; 2 = not certain; 1 = no	**II**
Actual farm exit, growth and shrinkage	*development*	Exit or change in farm standard output (SO) in 2006–2010	0 = stable (2010 SO 85–115% of 2006 SO) 1 = exit from farming 2 = decreasing (2010 SO <85% of 2006 SO) 3 = increasing (2010 SO >115% of 2006 SO)	**III**
Discrepancies between intentions and behaviour in the context of farm growth, decline, continuation and exit	*exit_int*	Intention to exit from farming in 2008–2010 as stated in 2007	1 = yes; 0 = no	**IV**
	exit_real	Realised exit from farming in 2008–2010	1 = yes; 0 = no	**IV**
	cont_int	Intention to continue farming in 2008–2010 as stated in 2007	1 = yes; 0 = no	**IV**
	cont_real	Farm is operating in 2011	1 = yes; 0 = no	**IV**
	decl_int	Intention to reduce agricultural area in 2008–2010 as stated in 2007	1 = yes; 0 = no	**IV**
	decl_real	Agricultural area in 2010 ≤85% of agricultural area in 2007	1 = yes; 0 = no	**IV**
	grow_int	Intention to increase agricultural area in 2008–2010 as stated in 2007	1 = yes; 0 = no	**IV**
	grow_real	Agricultural area in 2010 ≥115% of agricultural area in 2007	1 = yes; 0 = no	**IV**
Explanatory variables				
Age	*age*	Age of the farm operator as stated in the survey of 2007	**II**, **IV**: Years; **III**: dummy variables <40 years; 40–49 years; 50–59 years	**II**, **III**, **IV**

Table 2. *Cont.*

Groups of factors	Variable	Definition	Scale/measurement	Papers
Family involvement	*flabour*	Share of family labour in farm labour	100% = 1	**II**
	family	Evaluation on family support	1 = very poor; 2 = poor; 3 = adequate; 4 = good; 5 = very good	**II**
	successors	Evaluation on availability of successors	1 = very poor; 2 = poor; 3 = adequate; 4 = good; 5 = very good	**II, III, IV**
Health	*health*	Evaluation on health	**II**: 1 = very poor; 2 = poor; 3 = adequate; 4 = good; 5 = very good **IV**: 1 = very good; 2 = good; 3 = adequate; 4 = poor; 5 = very poor	**II, IV**
Human and social capital	*knowledge*	Evaluation on farm operator's knowledge and skills in agricultural production	1 = very poor; 2 = poor; 3 = adequate; 4 = good; 5 = very good	**II**
	know_ exper	Average of farm operator's evaluation on his/her agricultural knowledge and experience	1 = very poor; 2 = poor; 3 = adequate; 4 = good; 5 = very good	**IV**
	education	Farm operator's level of education	1 = basic education; 2 = secondary education; 3 = vocational education; 4 = higher education	**III**
	associations	Farm operator was a member of farming associations in 2007	1 = yes; 0 = no	**IV**
Farm size	*area*	Farm's utilised agricultural area	Ha	**II, IV**
	size	Farm's size measured in 2006 standard output	Dummy variables 1st quartile; 2nd quartile; 3rd quartile; 4th quartile	**III**

Table 2. *Cont.*

Groups of factors	Variable	Definition	Scale/measurement	Papers
Income	*agrev*	Share of agricultural output produce in total farm revenues (including subsidies)	100% = 1	**II**
	othrev	Share of non-agricultural activities in total farm revenues (including subsidies)	100% = 1	**II**
	off_farm	Farm operator had off-farm job in 2007	1 = yes; 0 = no	**II, III, IV**
	rentout	Part of farm's agricultural land is rented to other producers	1 = yes; 0 = no	**II**
Capital	*capital*	Evaluation on availability of capital	1 = very poor; 2 = poor; 3 = adequate; 4 = good; 5 = very good	**II**
Land tenure	*rental*	Share of rented land in total utilised agricultural area	100% = 1	**II, IV**
Intention to expand	*areachange*	Estimation of change in agricultural area in 2008–2010	1 = decrease significantly; 2 = decrease; 3 = no changes; 4 = increases; 5 = increases significantly	**II**
Participation in payment schemes	*lfa*	Participation in the LFA payment scheme in 2007	1 = yes; 0 = no	**II, IV**
	invest	Farm has received investment subsidies	1 = yes; 0 = no	**II**
	semisubs	The farm is participating in the semi-subsistence farming scheme	1 = yes; 0 = no	**III, IV**
Farm type	*animals*	Animal production in the farm	1 = yes, 0 = no	**II**
	gr_livestock	Farm is specialised in grazing livestock	1 = yes; 0 = no	**III**
	arable	Farm was specialised in field crops in 2007	1 = yes; 0 = no	**IV**
Relation to reforms in 1990s	*restituted*	The farm was established on the basis of restituted land	1 = yes; 0 = no	**III**

4.2. Methods

4.2.1. Cluster analysis

In the analysis of intended farm exits, cluster analysis (CA) was used to derive groups of farms based on 18 variables described in Table 2 (**II**). Clustering is a multivariate statistical procedure that reorganises a sample so that entities within each cluster would be relatively homogeneous and as distinct as possible from entities in other clusters (Aldenderfer and Blashfield, 1984). In several studies, CA has been used for creating farm typologies. For example, Eboli and Turri (1988) created a typology of farm families according to the diversity of their job holding; Iraizos *et al.* (2007) segmented farms based on their attributes of structural change; Guillem *et al.* (2012) studied farmers' decision making processes by creating farmer typologies based on farmers' perceptions about their environment.

The higher the ratio of observations to variables, the better the CA performs. In order to reduce the number of variables and avoid problems with multicollinearity amongst variables, principal component analysis (PCA) was carried out first as suggested by Arfini *et al.* (2001) and Iraizoz *et al.* (2007). PCA is often used to reduce the dimensionality of large multivariate datasets. It replaces original variables by a smaller number of derived variables (principal components), which are linear combinations of the original variables (Jolliffe, 2005). The factors derived from the PCA could be used and interpreted as exogenous variables in further analyses (e.g. CA or logistic regression) (Lawson *et al.*, 2009).

It was assumed that studying the between-group differences of farms may reveal some underlying factors or combination of factors that can be associated with farmers' attitudes towards exiting from farming, and farm decline or growth. CA was performed using 10 factors derived from PCA. The non-hierarchical *k*-means clustering algorithm was used to derive 10 clusters. The clusters were divided into three main categories – firstly, clusters that have significantly lower than sample average evaluations on the probability of exit; secondly, groups of farms whose evaluations on the probability of exit do not differ significantly from the sample average; and thirdly, clusters that have significantly higher than sample average exit probability. In each farm group, the averages of all variables were compared with the sample means. The results of the clustering are provided in Table II of paper **II**.

The software package STATISTICA 8.0 was used for PCA and CA (Statsoft, Inc., 2008). T-tests were used to test the significance of differences between cluster and sample means. The levels of significance $p<0.1$, $p<0.05$ and $p<0.01$ were used (**II**).

4.2.2. Binary logistic and ordered logistic regression

The second approach used in paper **II** was econometric analysis. In essence, the question of whether the farmer has the intention of giving up agricultural production in the coming 3 years could have binary options for answering: 'yes' and 'no'. Therefore, since the main interest lies in the probability of the response, a binary response model was considered appropriate for the analysis (Wooldridge, 2009). However, in the survey of 2007, the farm operators could select from 3 answers: 'yes', 'not certain' and 'no'. Therefore, the response was multinomial and could be considered as inherently ordered (Greene, 2008). Therefore, both binary logistic and ordered logistic regressions were applied.

In the binary logistic regression, answer 'yes' to the exit was scaled as 1 and 'not certain' and 'no' as 0. The model for the underlying latent variable ($exit_{M1*}$) was, as follows (**II**):

$$exit_{M1*} = \beta_0 + \beta_1 flabour + \beta_2 othrev + \beta_3 area + \beta_4 rentout + \beta_5 rental + \beta_6 health + e \quad (1)$$

Where *exit* is a function of continuous unmeasured latent variable $exit_{M1*}$, whose values determine the value of observed binary variable *exit*.

$$exit = 0, \ [exit_{M1*} \leq 0]$$
$$exit = 1, \ [exit_{M1*} > 0]$$

In the ordered logistic regression, the answers to the questions of whether the farmer intends to exit from farming in the coming years were ranked as follows: 'no' as 1, 'not certain' as 2 and 'yes' as 3. The underlying latent variable model ($exit_{M2*}$) is, as follows (**II**):

$$exit_{M2*} = \delta_0 + \delta_1 + \delta_2 flabour + \delta_3 othrev + \delta_4 area + \delta_5 rentout + \delta_6 rental + \delta_7 health + e \quad (2)$$

In the ordered logistic model, *exit* was a function of continuous unmeasured latent variable $exit_{M2*}$, the values of which determine what the observed ordinal variable *exit* equals. The continuous latent variable $exit_{M1*}$ has various threshold points (κ_i) that are estimated together with the model. The value of the observed variable *exit* depends on whether the particular threshold is crossed.

$$exit = 1, \ [exit_{M2*} \leq \kappa_1]$$
$$exit = 2, \ [\kappa_1 \leq exit_{M2*} \leq \kappa_2]$$
$$exit = 3, \ [exit_{M2*} \geq \kappa_2]$$

In models (1) and (2), at first the same 17 exogenous variables were used in the case of unrestricted models (reported in Appendix I of paper **II**). However, the restricted models (1) and (2) include only those explanatory variables that, based on the likelihood ratio tests, were significant in explaining the variation in *exit* variable in unrestricted models. In models (1) and (2), the parameters to be estimated are denoted respectively by β and δ and e denotes respective residual terms. The estimates of models (1) and (2) are given in Table 5 of section 5.3.

The binary logistic and ordered logistic regressions were carried out with the STATISTICA 8.0 software (Statsoft, Inc., 2008). The levels of significance $p<0.1$, $p<0.05$ and $p<0.01$ were used (**II**).

4.2.3. Multinomial logistic regression

Multinomial logistic regression helps estimate the probabilities of more than two outcome variables. One variable is treated as a base situation against which the probabilities of other variables are estimated (Greene, 2008). Multinomial logistic regression has been previously used in, for example, the study of the adaptation of farms in response to economic crisis (Schulman and Cotten, 1993) and the study of agricultural land use changes (Corbelle-Rico *et al.*, 2012).

Multinomial logistic regression was used to estimate the effects of the explanatory variables on the probability of realised farm exit, decline and growth relative to the base situation, which was retaining the farm's economic size in the range of 85–115% of the respective figure in 2006. The multinomial logit regression was specified as:

$$Logit(development_{jlstable}) = \alpha_0 + \alpha_{1jk} age + \alpha_{2jl} size \quad (3)$$
$$+\alpha_{3j} off\_farm + \alpha_{4j} semisubs + \alpha_{5j} education + \alpha_{6j} successors$$
$$+\alpha_{7j} restituted + \alpha_{8j} gr\_livestock + \varepsilon_j$$

In the model (3), $development_j$ are the probabilities of realised farm exit, decline and growth relative to retaining the farm's economic size (stable). If the farm SO in 2010 remained within the boundaries of 85–115% of its respective value in 2006, the farm size was considered as stable. If, in 2010, the farm's SO was less than 85% of its SO in 2006, the farm size was considered as decreased. If the farm SO in 2010 exceeded 115% of the SO in 2006, the farm size was considered as increased. The farms for which, in the survey of 2011, the farm operator reported that the farm has finished agricultural production, or for which SO, according to the ARIBs registry data, in 2010 was zero were considered to be those that have exited from farming. The α_j are the parameters to be estimated simultaneously for the three regression equations represented by equation (3), and ε_j are the corresponding residual terms (**III**).

Multinomial logistic regression was performed in STATISTICA 11.0 software (Statsoft, Inc., 2011). The levels of significance $p<0.1$, $p<0.05$ and $p<0.01$ were used (**III**).

4.2.4. Recursive bivariate probit regression

Recursive bivariate probit regression was employed in paper **IV**. It was assumed that both intentions and behaviour may be influenced by similar farm and farmer specific factors accounted for in the model, as well as similar unobserved factors, implying that the error terms of models describing intentions and behaviour may be correlated. As suggested in Maddala (1983), the recursive bivariate probit model simultaneously facilitates controlling for unobserved heterogeneity, and considers the structural features of the problem by using the predicted values of intentions as regressors in the equations that describe the actual behaviour. Previously, the recursive bivariate regression has been used by, amongst others, Väre *et al.* (2010) in explaining the irrelevance of stated plans in predicting farm successions and Dong *et al.* (2010) in the study of relevance of production contracts with regard to exit decisions in pig production.

The effects of stated intentions on actual behaviour were estimated in four models (**IV**):

(a) *Farm exit*. In 2007, the farm operators had three options for answering the question about exiting from farming in 2008–2010: 'yes', 'do not know', and 'no'. In model (a), the answer 'yes' is considered as an intention to exit from farming (variable *exit_int* in Table 2). Information about the actual exit (*exit_real*) was collected in the survey of 2011 and from the registries of ARIB.

(b) *Continuation of farming*. The answer 'no' for the previous question was considered as an intention to continue farming (*cont_int*). Information about the actual continuation of farming (*cont_real*) was collected in the survey of 2011 and ARIB's registries.

(c) *Farm shrinkage*. In 2007, the farmers were asked if they intended to increase or decrease the agricultural area of their farms in 2008–2010. The answer could be given in the scale of five ranging from 1 = decrease significantly to 5 = increase significantly. The change in a farm's agricultural area is considered as a proxy of farm size change. The answers 'decrease significantly' and 'decrease somewhat' were considered as an intention to reduce the farm's agricultural area, and therefore formed the basis for binary variable *decl_int*. Information about the actual changes in the farm's agricultural area was collected from the comparison of survey data of 2007 and 2011, and ARIB's registry data of 2007 and 2010. Farm size was considered as decreased (*decl_real*) if its agricultural area in 2010 was <85% of the respective figure in 2007.

(d) *Farm growth*. The answers 'increase somewhat' and 'increase significantly' were considered as an intention to expand the farm's agricultural area. Based on these responses, the binary variable *grow_int* was formed. The farm size was considered as increased (*grow_real*) if its agricultural area in 2010 was ≥ 115% of its respective figure in 2007.

In general, the recursive bivariate probit model employed in the case of models (a), (b), (c) and (d) had the following recursive structure (**IV**):

$$y_1^* = \beta_1' X_1 + \varepsilon_1 \tag{4}$$

$$y_2^* = \gamma y_1 + \beta_2' X_2 + \varepsilon_2 \tag{5}$$

Unobservable variables y_1^* and y_2^* in equations (4) and (5) are related to binary observable variables as follows:

$y_1 = 1$ if $y_1^* > 0$, and 0 otherwise;
$y_2 = 1$ if $y_2^* > 0$, and 0 otherwise.

X_1 and X_2 indicate sets of explanatory variables (*age, area, rental, off_farm, semisubs, lfa, arable, associations, know_exper, successors, poor_health*), β_1 and β_2 are respective parameters to be estimated, γ is a parameter that indicates the effects of stated intentions on realised behaviour and ε_1 and ε_2 denote errors that may or may not be correlated. The error $\varepsilon = (\varepsilon_1, \varepsilon_2)$ is assumed to be normally distributed with mean zero. The correlation between errors ε_1 and ε_2 is given by ρ. If ρ is significantly different from zero, the errors of the two models are significantly correlated, implying dependency between intentions and actual behaviour through the unobservable variables.

Recursive bivariate probit regression was performed in R version 3.0.1 (R-Project, 2013), using the package SemiParBIVProbit version 3.2-7 (Marra, 2013). Marginal effects were calculated in SAS software version 9.1 (SAS Institute, 2004). The levels of significance $p<0.1$, $p<0.05$ and $p<0.01$ were used.

5. RESULTS AND DISCUSSION

5.1. Adaptation and development of Estonian agriculture in response to institutional, market and policy changes from 1988–2012

Table 3 summarises the main institutional changes and driving forces that have influenced the structural adjustment and development of Estonian agriculture from 1988–2012 as reviewed in study **I** and by Viira (2011).

Table 3. Summary of the main determinants of adjustment and development of Estonian agriculture in 1988–1995, 1996–2001, 2002–2008 and since 2009.

"Structural break" 1988–1995	"Adaptation" 1996–2001	"EU accession" 2002–2008	"Crises and uncertainty" 2009–…
• Farm Law • Ownership, land and agricultural reforms • Disappearance of former markets • Disappearance of former subsidies (Soviet agricultural policy) • Free trade • First national agricultural and rural support measures	• Action plan for the EU accession • Subsidised imports • Increasing scope and budget of national agricultural policy • Import tariffs and licences • Food quality control • Russian crisis in 1998–1999	• Preparations for the EU accession • SAPARD programme • EU accession • Application of the CAP • Access to the EU common market • Improved access to credit • Increasing prices of agricultural products • Rapid economic growth	• "Food crisis" • Deteriorated access to credit • Economic crisis • Volatility of commodity prices • More attention to cooperation • More public attention to food • Generational change in farming • General uncertainty (macroeconomic situation, CAP reform)

Source: composed on the basis of paper **I** and Viira (2011)

This period is divided into four sub-periods: the first sub-period of structural adjustment, "Structural break", started in 1988, when regulations were adopted for the allocation of marginal land of collective farms to private farms, as well as the selling of agricultural machinery to private farms (**I**; Viira, 2011). The Farm Law of 1989,

principles of Ownership Reform Act of 1991, Land Reform Act of 1991, and Agricultural Reform Act of 1992 were the main regulations that determined the development path of farm structure – restitution of land to its lawful owners or their heirs, privatisation of land, privatisation of collective farms (Maide, 1995; Alanen, 1999; Estonian Ministry of Agriculture, 2002). The choices made during the reforms in the beginning of the 1990s affected the structural changes, agricultural policy debates and choices in the following periods, and have effects also today, therefore creating a certain amount of path dependence (North, 1994; Kyriazis and Zouboulakis, 2005) in agricultural development in Estonia. For this reason, in order to understand the potential future developments in Estonian agrarian structures, the development path, starting from the "structural break", should be considered.

As a result of these reforms, the number of agricultural holdings increased rapidly in the 1990s (Figure 1). The establishment of private farms started in 1989. By the end of the year, 828 private farms were established with an average area of 25 ha. At the same time, 326 collective farms existed with an average area of 7,628 ha[3] (Virma, 2004; **I**). From 1989–2000, the number of private farms increased rapidly. The privatisation and break up of collective farms were the main reasons behind the increase in the number of agricultural enterprises from 396 to 1,013 in 1990–1993. However, from 1993–1999, the number of agricultural enterprises declined from 1,013 to 680, reflecting the deficit of competitiveness of many agricultural enterprises in new market conditions. As a result of restitution and the privatisation of land, by 1999, the number of private farms increased to 51,081. Farms established from 1989–1992 received support, in the form of subsidised inputs and services, from the government and collective farms (OECD, 1996; Alanen, 2004). This encouraged the establishment of private farms and stimulated naïve expectations about the viability of small farms in the market economy (Tamm, 2001). The main motives for establishing private farms were the possibility of working according to one's desire and the wish to return to a traditional, family-farming lifestyle (Kelam, 1993).

[3] This figure includes all area of collective farms, not just agricultural area.

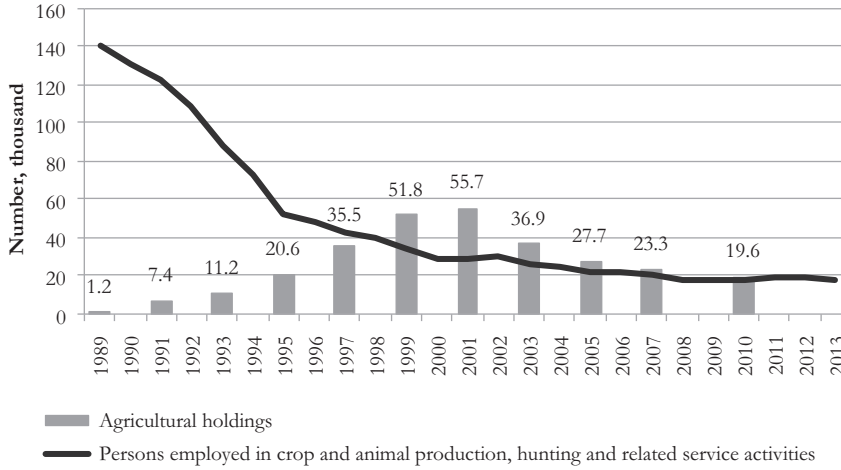

Figure 1. Number of agricultural holdings and agricultural employment in Estonia in 1989–2013 (Statistics Estonia, 2014).

However, market conditions for agricultural producers deteriorated at the same time: a seemingly unlimited market for agricultural output disappeared with the collapse of the USSR, the terms of trade of agricultural producers deteriorated and liberal trade policy provided a competitive advantage for subsidised imports, which in turn caused a decline in agricultural prices during 1992–1994 by an average of 1/3rd compared with the world markets (Estonian Ministry of Agriculture, 1993; OECD, 1996; Alanen, 1999; Reiljan, 2000). According to the Organisation for Economic Co-operation and Development (OECD) (1996; 2002), the producer support estimate (PSE) of Estonian agricultural producers declined from 70% in 1990 to –89% in 1992, while the average PSE in the EU during 1990–1994 ranged from 47–49%. While the first support schemes (income tax exemptions, compensation of interest payments) for agricultural producers were introduced in 1993 (Estonian Ministry of Agriculture, 1999; Jurjev, 2003), their effects were moderate. By 1994, the PSE of Estonian agricultural producers had increased to –10%, and by 1995 to 0% (OECD, 2002).

This period is characterised by the rapid decline in volume of agricultural production. From Figure 2, it appears that from 1990–1995 cereal production decreased by 42%, milk production by 54% and meat production by 64%. From 1989–1995, the number of persons employed

in agriculture, hunting and related service activities decreased by 88.8 thousand (63.2%). The magnitude of the negative effect on Estonian agricultural output was also influenced by the fact that, before the "structural break", Estonia was the highest per capita milk and meat producer in the Soviet Union, also exceeding the respective figures in the EU and USA. The rapid decline in agricultural output led to a situation, whereby, in 1995, Estonia became a net importer of agricultural products (**I**).

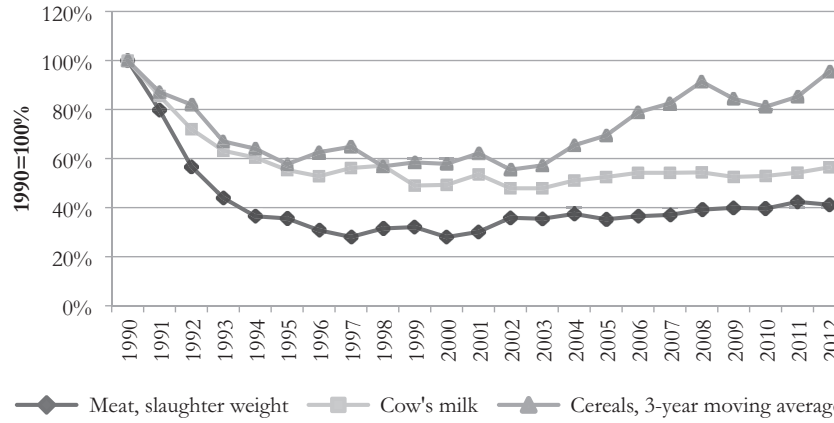

Figure 2. Changes in meat, milk and cereal production in 1990–2012, 1990=100% Source: Statistics Estonia (2014).

In 1996–2001, which could be considered as a period of adaptation to new economic circumstances, the volume of agricultural output stabilised. Compared to 1995, meat production by 2001 had declined by 15%, milk production had declined by 3%, and the production of cereals had increased by 8% (Figure 2). Since Estonia had become a net importer of agricultural products, subsidised imports continued to pressure domestic agricultural prices. General economic development helped to broaden the scope of agricultural policy: in 1996–1997, fuel excise tax exemption and capital (investment) support schemes were adopted, and in 1998, direct payments were introduced. Import tariffs, import licencing, improved border and food quality controls were established in 1999. From 1996–2001, the PSE in Estonia ranged from 6–13%, with an exception of 20% in 1998 (OECD, 2002), when compensation for loss of income due to unfavourable natural conditions was paid for the first time (**I**). In 1996–2001, the EU average PSE ranged from 32–38%

(OECD, 2014). In 1997, the pre-accession negotiations began with the EU that subsequently led to the harmonisation of Estonian agricultural legislation and policy with those of the EU (Estonian Ministry of Agriculture, 1999).

The approaching EU accession had already affected Estonian agricultural policy some years before the actual accession in 2004. Therefore, the period from 2002–2008 was marked with the positive effects of the EU accession (**I**). From 2001–2004, the pre-accession Special Accession Programme for Agriculture and Rural Development (SAPARD) granted Estonian agricultural producers, food industry and rural enterprises 67.9 million euros of investment subsidies (Estonian Ministry of Agriculture, 2007). Under the SAPARD programme, agricultural producers, processing industry and rural entrepreneurs, as well as administration of agricultural policy (e.g. Ministry of Agriculture and ARIB) gained first-hand experience with measures similar to those provided under the CAP (**I**, Buchenrieder *et al.*, 2009). After the EU accession, market regulation, direct payments and rural development measures were adopted. Although the PSE estimates for Estonia have not been estimated after Estonia's EU accession, it is likely that the PSE of agricultural producers increased. In 2002–2008, the EU average PSE declined from 34% to 24% (OECD, 2014). However, 24% in 2008 is significantly higher compared to Estonia's PSE of 13% in 2001 (OECD, 2002). Convergence of food prices towards the EU level (Sepp *et al.*, 2009; Lindenblatt and Feuerstein, 2012) together with favourable macroeconomic conditions and good access to credit implied and increase in Estonian agricultural output in 2002–2008. Compared to 2001, meat production by 2008 had increased by 30%, milk production by 1%, and the production of cereals by 47% (Figure 2).

Since 2009, agriculture has been influenced by crises and uncertainty, which in part have been related to the volatility of the prices of agricultural commodities (Prakash, 2011; Wright, 2011), and in part by the world financial crisis (Headey *et al.*, 2010; Lin and Martin, 2010). However, during this period, in Estonia, significantly more attention has been paid to the development of cooperation between farmers (Leetsar *et al.*, 2013), and compared to the 1990s agriculture has received more positive public reflection in the media. Also, the prices of agricultural products have been at higher levels compared to the previous decade

(FAO, 2014), stimulating the growth of agricultural output. Compared to 2008, meat production in 2012 had increased by 5%, milk and cereals production both by 4% (Figure 2).

In 2010–2012, the EU average PSE has ranged from 18% to 20% (OECD, 2013). When the PSE estimates and the trends in volumes of agricultural production are compared in outlined sub-periods, it is evident that in addition to institutional changes and reforms, agricultural prices and support has had a significant role in the variation of agricultural output. In the early 1990s, when the PSE in Estonia was negative, the production declined significantly; from 1996–2001 when the PSE was moderate compared to the EU, the production volumes stabilised; and since the EU accession, increasing prices and PSE has been accompanied by an increase in production.

If Figures 1 and 2 are compared, one can notice that from 1990–2001, while Estonian agricultural output decreased significantly, the number of agricultural holdings significantly increased equivalently. After 2001, when agricultural output started to increase, the number of agricultural holdings started to decline. These opposing trends imply that the increase in the number of agricultural holdings in the 1990s, and decline in 2000s had less to do with market conditions for agricultural producers, and were mainly influenced by the ownership, land and agricultural reforms initiated in the beginning of the 1990s. From Figure 2, one can notice that, since 1999, the number of agricultural holdings has exceeded the number of persons employed in agriculture. This suggests that many of the agricultural households established in the 1990s were unable to provide full-time employment for at least one household member (**I**).

A number of transition-specific factors that induced rapid decline in a number of agricultural households in 2000s can be outlined. Farms that were established in the 1990s faced many problems: lack of the necessary equipment and financial capital; machinery privatised from collective farms was designed for 1,200–1,500 hectare farms, and therefore was unsuitable for small holdings; new landowners did not have prior experience and knowledge of farm management; property relations were not well-defined and secure (Jullinen, 1997; Tamm, 2001; Estonian Ministry of Agriculture, 2003; Uint *et al.*, 2005; Jörgensen and Stjernström, 2008; Sirendi, 2009). Glauben *et al.* (2004) suggest that

farm-specific human capital, acquired in childhood as a by-product of growing up, increases the likelihood of intra-family farm transfers. In transition countries, this farm-specific human capital might be a scarce factor in first-generation family farms. This is another reason why a significant share of farms established in the 1990s have exited from farming (**I**).

Considering the preceding discussion, the first hypothesis of the current thesis, that agricultural, land and ownership reforms initiated in the beginning of 1990s together with institutional changes stemming from transition from planned to market economy have strongly influenced the development of Estonian agriculture in past 25 years, could be regarded as accepted.

While the transition from planned to market economy can be considered as completed (Lauristin and Vihalemm, 2008; Schaft and Balmann, 2009; Wandel *et al.*, 2011), the further harmonisation and integration of Estonian agricultural markets, organisation of the agri-food industry, and agricultural policy with equivalent policies in neighbouring countries and the EU can be observed. In the CAP context, the adaptation to the EU average direct payment levels continues at least until 2020 (Regulation (EU) No 1307/2013). One can also argue that the EU is adapting to its enlargement of the 2004, and it takes time before the CAP adjusts to the changed situation (**I**).

The crucial factor in the next developmental phase is the emergence of the next generation of farmers and leaders of agricultural enterprises, who could be less involved with the ideological contradictions of the 1990s (**I**). It is also likely that the next generation of farmers are not constrained by high personal specialisation levels (Rizov *et al.*, 2001), and they have acquired more farm-specific human capital (Glauben *et al.*, 2004) before taking over the management of farms. The next generation of farmers might also have more social capital, and therefore the societal enforcement mechanisms (e.g., peer or community pressure, a sense of mutual obligation, and overall sense of trust) (Buchenrieder *et al.*, 2009) might strengthen over time. Therefore, the next generation of farmers could find ways how, such as through cooperation, to make a step forward in the agri-food value chains and start adding value to the agricultural primary goods.

5.2. Dualistic farm structure

In Estonia, as in several other post-communist CEECs, a dualistic farm structure already emerged in the early phases of transition (Schnicke *et al.*, 2008). Table 4 gives an overview of the changes in the number of agricultural holdings and their agricultural land from 2001–2010 by size classes of agricultural land. As already illustrated in Figure 1, from 2001–2010 the number of agricultural holdings decreased by 64.8%. From Table 4, it occurs (with an exception of holdings of <1 ha) that the smaller the size class of agricultural holdings, the larger the relative decline in number of agricultural holdings. From 2001–2010, the number of agricultural holdings of 1–<2 ha of agricultural land decreased by 86.1%. The only size classes in which the number of agricultural holdings and area of agricultural land have increased are those of 50–<100 ha and ≥100 ha. This suggests that in the period of 2001–2010, the reduction in the number of agricultural holdings has mainly occurred on the account of smaller holdings.

While the number of small-sized agricultural holdings has decreased markedly, the farm structure in Estonia could still be regarded as dualistic. In 2010, the SO was less than 2,000 euros in 43.8% of the agricultural holdings. These holdings held 8.0% of agricultural land and produced 0.8% of the total SO (Figure 3). At the same time, 1.1% of the holdings produced more than 500 thousand euros of SO. These holdings managed 27.5% of agricultural land and produced 51.6% of total SO. From Figure 3, it follows that 8.2% of agricultural holdings produced 82.9% of the total SO.

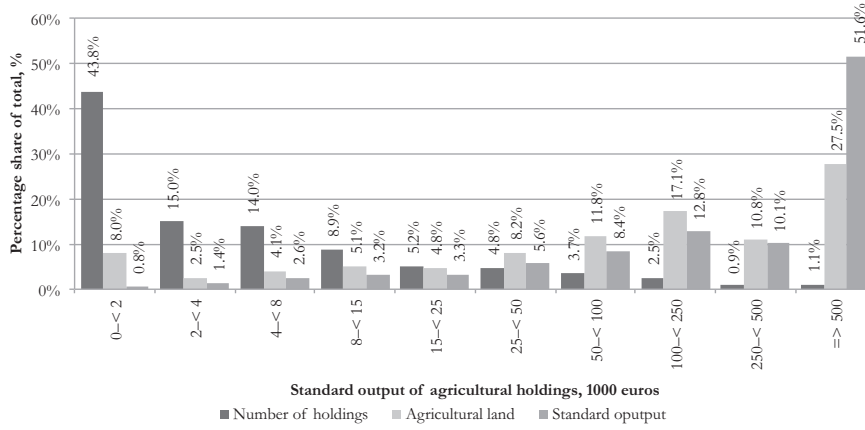

Figure 3. Distribution of agricultural holdings, agricultural land and standard output in Estonia in 2010 by size class of standard output (Statistics Estonia, 2014).

In 2010, in Estonia, the average annual gross wage in agriculture, forestry and fishing was 8,016 euros (Statistics Estonia, 2014). Therefore, in 2010 the value of SO of 72.8% of agricultural holdings was smaller than the average annual gross wage of one agricultural worker. This suggests that from the family income earning perspective these agricultural holdings are incapable of providing income for even one family member; therefore, in the medium and long-term perspective, such agricultural holdings are probably not viable as market orientated agricultural producers.

Table 4. Number of agricultural holdings and agricultural land from 2001–2010 by size class of agricultural land.

Year	Figure		0–<1 ha	1–<2 ha	2–<5 ha	5–<10 ha	10–<20 ha	20–<30 ha	30–<50 ha	50–<100 ha	≥100 ha	Total
2001	Holdings	Number	472	14,047	16,516	10,791	7,715	2,512	1,687	962	1,000	55,702
		%	0.8	25.2	29.7	19.4	13.9	4.5	3.0	1.7	1.8	100.0
	Agricultural land	1000 ha	0.2	19.6	52.6	76.2	107.2	60.5	64.1	65.7	425.3	871.2
		%	0.0	2.3	6.0	8.7	12.3	6.9	7.4	7.5	48.8	100.0
2003	Holdings	Number	409	7,104	11,158	7,264	5,347	1,889	1,482	1,051	1,090	36,792
		%	1.1	19.3	30.3	19.7	14.5	5.1	4.0	2.9	3.0	100.0
	Agricultural land	1000 ha	0.2	9.9	35.8	50.5	74.0	45.5	56.4	71.7	451.5	795.6
		%	0.0	1.2	4.5	6.4	9.3	5.7	7.1	9.0	56.8	100.0
2005	Holdings	Number	377	4,429	7,700	5,572	4,390	1,653	1,303	946	1,317	27,688
		%	1.4	16.0	27.8	20.1	15.9	6.0	4.7	3.4	4.8	100.0
	Agricultural land	1000 ha	0.2	6.3	24.8	39.7	61.0	40.1	49.8	65.0	542.0	828.9
		%	0.0	0.8	3.0	4.8	7.4	4.8	6.0	7.8	65.4	100.0
2007	Holdings	Number	347	2,636	5,439	5,118	4,178	1,704	1,323	1,042	1,549	23,336
		%	1.5	11.3	23.3	21.9	17.9	7.3	5.7	4.5	6.6	100.0
	Agricultural land	1000 ha	0.1	3.8	18.0	36.4	58.7	41.1	50.3	71.4	627.0	906.8
		%	0.0	0.4	2.0	4.0	6.5	4.5	5.5	7.9	69.1	100.0
2010	Holdings	Number	416	1,946	4,251	4,074	3,465	1,477	1,169	1,091	1,724	19,613
		%	2.1	9.9	21.7	20.8	17.7	7.5	6.0	5.6	8.8	100.0
	Agricultural land	1000 ha	0.1	2.8	14.1	29.3	48.7	36.0	45.0	76.2	688.7	940.9
		%	0.0	0.3	1.5	3.1	5.2	3.8	4.8	8.1	73.2	100.0
	Change in % from 2001–2010	Holdings	-11,9	-86.1	-74.3	-62.2	-55.1	-41.2	-30.7	13.4	72.4	-64.8
		Agricultural land	-48,9	-85.7	-73.2	-61.5	-54.6	-40.5	-29.7	16.0	61.9	8.0

Source: Statistics Estonia (2014)

5.3. Factors affecting continuation or exit from farming, and farm decline or growth

Paper **I** concludes that one of the key questions in the next decade is whether a new generation of farmers will emerge to take over the farms established in the beginning of the 1990s, as the founders of these farms will reach retirement age. Therefore, papers **II**, **III** and **IV** study the role of farm-specific socioeconomic factors in farm growth, decline, continuation of farming and exit. Data collection for the studies **II**, **III** and **IV** was conducted in 2007 and 2011. Considering the less rapid decline in the number of agricultural holdings between 2007 and 2010, compared to the beginning of the 2000s (Figure 1 and Table 4), it is assumed that the institutional changes of the 1990s had a minor role in the adjustment of farm structure in the study period, compared to the role of farm-specific socioeconomic factors.

The factors that affect intentions regarding exiting from farming were studied in paper **II**. The respective regression estimates of models (1) and (2) are presented in Table 5.

Table 5. Coefficients of ordered and ordered logistic regressions regarding intentions of exiting from farming (models (1) and (2)) (**II**)

Variables	Logistic regression Model (1)	Ordered logistic regression Model (2)
intercept/intercept 1	–0.7696 (0.9099)	0.5172 (0.6807)
intercept 2		2.0146*** (0.6936)
flabour	–1.2645** (0.5809)	–1.0383** (0.4473)
othrev	–5.4618** (2.1362)	–0.9896 (0.7847)
area	–0.0026** (0.0013)	–0.0022*** (0.0008)
rentout	0.6689 (0.4628)	0.8651** (0.3603)
rental	1.3695** (0.6436)	0.2015 (0.4873)
health	0.1431 (0.2360)	–0.3504** (0.1745)
	Pseudo R^2=0.1134 Log likelihood=92.71 n=202	Pseudo R^2=0.0515 Log likelihood=200.05 n=202

Figures in parentheses are standard errors; *Significant at 0.1 level; **Significant at 0.05 level; ***Significant at 0.01 level.

The determinants of probabilities of farm growth, decline and exit relative to retaining farm size were studied in paper **III**, and the regression estimates of model (3) are reported in Table 6. While paper

IV focused on the discrepancies between intentions and behaviour of farm operators in the contexts of farm growth, decline, continuation of farming and farm exit, it also provides information about farm-specific socioeconomic factors that affect intended and realised farm growth, decline, continuation of farming and exit. The respective recursive bivariate probit estimates of the models (a), (b), (c) and (d) that employ the general model structure given by equations (4) and (5) are provided in Table 7. Table 8 summarises the results of papers **II**, **III** and **IV** regarding the effects of various factors on the realised and intended exits, continuation of farming, farm shrinkage and growth.

Table 6. The results of multinomial logit estimates of model (3) regarding exiting from farming, farm shrinkage and growth (**III**)

Variable	1 = exit from farming	2 = decrease of SO >15%	3 = growth of SO >15%
intercept	1.076 (1.865)	0.284 (1.129)	–2.273* (1.319)
age <40	–1.222 (1.406)	–1.001 (0.828)	0.464 (0.804)
age 40–49	–1.521 (0.951)	–0.929 (0.635)	1.238* (0.644)
age 50–59	–1.274* (0.691)	–0.759 (0.487)	0.441 (0.589)
successors	–1.095*** (0.350)	–0.236 (0.199)	0.263 (0.207)
farm size 1st quartile	2.936** (1.265)	1.562** (0.697)	1.039 (0.734)
farm size 2nd quartile	1.881 (1.278)	1.119* (0.644)	0.250 (0.664)
farm size 3rd quartile	1.239 (1.382)	1.579** (0.630)	0.903 (0.600)
off_farm	1.568** (0.698)	0.293 (0.523)	–0.287 (0.566)
semisubs	–1.862*** (0.658)	–0.321 (0.431)	–0.562 (0.469)
education	–0.056 (0.293)	–0.019 (0.215)	0.471* (0.263)
restituted	0.364 (0.625)	–0.700* (0.422)	–1.052** (0.440)
gr_livestock	–1.160* (0.642)	0.364 (0.420)	–0.367 (0.448)
McFadden pseudo R^2=0.223			
Log likelihood=–207.044			
Number of observations=196			

Figures in parentheses are standard errors; *Significant at 0.1 level; **Significant at 0.05 level; ***Significant at 0.01 level.

From the results in Tables 6 and 7, it follows that the farm operator's age has a positive effect on the probabilities of farm exit and shrinkage (**III**, **IV**). From Table 7 it stems, that a 10-year increase in the farm operator's age increases the probability of farm exit by 4.0% ($p<0.1$), and the probability of farm shrinkage by 4.9% ($p<0.05$). From Table 7, it appears that in models (b) and (d), the age of the farm operator significantly and negatively affects the probabilities of intended continuation of

farming ($p<0.1$) and intended farm growth ($p<0.01$). In both models, the intentions had a significant positive effect on the realised behaviour ($p<0.01$). Therefore, the farm operator's age also had an indirect negative effect on the probabilities of continuation of farming and farm growth (**IV**). The probability of farm growth is highest when the farm operator is aged 40–49 years ($p<0.1$) (Table 6, **III**). These results comply with the farm life cycle argument in that the probability of farm growth is highest in the group of middle-aged farmers, and that elderly farmers are more likely to exit, less likely to continue farming, and more likely to disinvest if the farm transfer probability is low (Boehlje, 1990; Calus *et al.*, 2008; Peerlings and Ooms, 2008; Schnicke *et al.*, 2008).

This is further asserted by the fact that the good availability of successors significantly reduces the probability of farm exits (Tables 6 and 7, **III**, **IV**). From Table 7, it appears that if the farm operator's evaluation on the availability of successors was 'good' rather than 'adequate', the probability of realised farm exit was 4.4% lower ($p<0.1$). While the effect of *successors* on the probability of realised continuation of farming, farm shrinkage and farm growth was statistically insignificant, the results indicate that the better availability of successors has a significant positive effect ($p<0.05$) on the formation of the respective intentions in terms of continuation of farming and farm growth. In cases of farm shrinkage, the better availability of successors decreased the probability of respective intentions ($p<0.01$). These results are in accordance with the succession effect, according to which the nomination of successor motivates the farmer to invest and improve the management of the farm, while the liquidation value is optimised if farm exit is foreseen (Glauben *et al.*, 2002; Väre, 2006; Calus and Van Huylenbroeck, 2008; Calus *et al.*, 2008).

It was found that a higher proportion of family labour in total farm labour reduces the likelihood of intended farm exits ($p<0.05$) (**II**). This suggests that the viability of family farms may be positively affected by the higher availability, flexibility and efficiency of family labour (Martikainen *et al.*, 2009; Cabrera *et al.*, 2010). A higher proportion of family labour may also be associated with low opportunity costs of family labour, either because family members are not seeking off-farm labour opportunities, are not qualified for available off-farm jobs or such opportunities do not exist in this region (**II**).

Table 7. The coefficients of the recursive bivariate probit regressions regarding intended and realised farm exits, continuation of farming, farm shrinkage and farm growth (models (a), (b), (c) and (d) of the model structure (4) and (5)) (**IV**)

	Model			
	(a) Farm exit		(b) Continuation of farming	
Dependent variable	*exit_int*		*cont_int*	
	Coefficient	Marginal effect	Coefficient	Marginal effect
intercept	0.1823 (1.8069)		0.6205 (0.9527)	
age	0.0149 (0.0143)	0.0013	−0.0142 (0.0079)*	−0.0045
area	−0.0013 (0.0015)	−0.0001	0.0008 (0.0004)**	0.0003
rental				
off_farm	0.3844 (0.4592)	0.0334	−0.4908 (0.2085)**	−0.1552
semisubs	−0.1081 (0.3640)	−0.0094	0.2601 (0.1797)	0.0822
lfa	−1.0338 (0.3954)***	−0.0897	0.1540 (0.1779)	0.0487
arable	−0.3596 (0.3558)	−0.0312	0.2289 (0.1927)	0.0724
associations	1.0387 (0.3917)***	0.0901	−0.1386 (0.1915)	−0.0438
know_exper	−0.8225 (0.3448)**	−0.0714	0.2513 (0.1592)	0.0795
successors	−0.2030 (0.1842)	−0.0176	0.2193 (0.0906)**	0.0693
poor_health	0.1906 (0.2476)	0.0165	−0.3204 (0.1319)**	−0.1013
Dependent variable	*exit_real*		*cont_real*	
intercept	−0.1956 (1.2045)		−0.9005 (1.0240)	
exit_int	0.9632 (1.6040)	0.1950		
cont_int			1.5968 (0.2773)***	0.3346
decl_int				
grow_int				
age	0.0196 (0.0108)*	0.0040	−0.0079 (0.0091)	−0.0016
area	−0.0039 (0.0018)**	−0.0008	0.0037 (0.0016)**	0.0008
rental				
off_farm	0.6630 (0.2622)**	0.1342	−0.3091 (0.2356)	−0.0648
semisubs	−0.5234 (0.2360)**	−0.1060	0.2933 (0.2006)	0.0615
lfa	−0.5174 (0.2911)*	−0.1047	0.3726 (0.2026)*	0.0781
arable	0.2132 (0.2254)	0.0432	−0.2939 (0.1958)	−0.0616
associations	−0.0812 (0.2606)	−0.0164	0.0581 (0.2114)	0.0122
know_exper	−0.3072 (0.2041)	−0.0622	0.0917 (0.1769)	0.0192
successors	−0.2169 (0.1229)*	−0.0439	0.0448 (0.1141)	0.0094
poor_health	−0.0277 (0.1682)	−0.0056	0.1131 (0.1378)	0.0237
Disturbance correlation ρ	−0.5199 (0.7862)		−0.9174 (0.1230)***	
Log likelihood	−131.75		−227.17	
N	251		251	

Figures in parentheses are standard errors; *Significant at 0.1 level; **Significant at 0.05 level; ***Significant at 0.01 level.

Table 7. *Cont.*

	Model			
	(c) Farm shrinkage		(d) Farm growth	
Dependent variable	*decl_int*		*grow_int*	
	Coefficient	Marginal effect	Coefficient	Marginal effect
intercept	−1.0314 (1.4101)		2.1433 (1.1654)*	
age	0.0121 (0.0113)	0.0023	−0.0467 (0.0103)***	−0.0109
area				
rental	2.0529 (0.5086)***	0.3966	0.7863 (0.3883)**	0.1841
off_farm	−0.2523 (0.3336)	−0.0487	−0.6224 (0.2929)**	−0.1457
semisubs	−0.0790 (0.2506)	−0.0153	−0.1226 (0.2296)	−0.0287
lfa	0.1742 (0.2505)	0.0337	0.0243 (0.2331)	0.0057
arable	−0.3746 (0.2897)	−0.0724	0.2505 (0.2393)	0.0586
associations	−0.4512 (0.2901)	−0.0872	0.0139 (0.2544)	0.0032
know_exper	−0.1299 (0.2444)	−0.0251	−0.2474 (0.2187)	−0.0579
successors	−0.4584 (0.1440)***	−0.0886	0.2965 (0.1113)***	0.0694
poor_health	0.1587 (0.1801)	0.0307	−0.1696 (0.1591)	−0.0397
Dependent variable	*decl_real*		*grow_real*	
intercept	−0.3178 (1.2662)		−0.4490 (1.3588)	
exit_int				
cont_int				
decl_int	1.3214 (0.7824)*	0.2809		
grow_int			2.4174 (0.3620)***	0.3700
age	0.0231 (0.0102)**	0.0049	−0.0131 (0.0129)	−0.0020
area				
rental	−0.5810 (0.5020)	−0.1235	−0.1915 (0.4366)	−0.0293
off_farm	0.2967 (0.2875)	0.0631	0.1556 (0.3026)	0.0238
semisubs	0.1291 (0.2346)	0.0274	0.1165 (0.2420)	0.0178
lfa	−0.0942 (0.2383)	−0.0201	0.1765 (0.2468)	0.0270
arable	−0.3492 (0.2903)	−0.0742	−0.0316 (0.2596)	−0.0048
associations	0.2986 (0.2546)	0.0635	−0.4388 (0.2919)	−0.0672
know_exper	−0.0416 (0.2183)	−0.0088	−0.0512 (0.2283)	−0.0078
successors	−0.1018 (0.1383)	−0.0216	−0.0189 (0.1157)	−0.0029
poor_health	−0.5882 (0.1907)***	−0.1250	−0.0789 (0.1766)	−0.0121
Disturbance correlation ρ	−0.2683 (0.4364)		−0.8635 (0.1999)***	
Log likelihood	−147.38		−145.43	
N	198		198	

Figures in parentheses are standard errors; *Significant at 0.1 level; **Significant at 0.05 level; ***Significant at 0.01 level.

Table 8. Summary of effects of various factors on probability of realised and intended farm exits, continuation of farming, farm shrinkage and growth (**II**, **III**, **IV**)

Variables	Actual behaviour							
	Exit		Continuation of farming		Farm shrinkage		Farm growth	
	Realised	Intended	Realised	Intended	Realised	Intended	Realised	Intended
age	+			–	+			–
age 40–49							+	
age 50–59	–							
successors	–			+		–		+
area	–	–	+	+				
farm size 1st quartile	+				+			
farm size 2nd quartile					+			
farm size 3rd quartile					+			
rental		+				+		+
rentout		+						
off_farm	+			–				–
flabour		–						
othrev		–						
semisubs	–							
lfa	–	–	+					
gr_livestock	–							
restituted					–		–	
education							+	
know_exper		–						
associations		+						
poor_health		+		–	–			

+ indicates positive effect, and – indicates negative effect on the probability; only the effects that are significant at 0.1, 0.05 or 0.01 levels are reported

Farm size, which is closely related to the income earning potential of the farm, has significant effects on continuation of farming, farm shrinkage and exits (**III**, **IV**). As shown in Table 4, from 2001–2010, the number of agricultural holdings has decreased in all farm size classes of less than 50 ha. From Table 5, it occurs that larger farms are less likely to intend exit from farming ($p<0.05$), and from Table 7 it appears that larger farms are more likely ($p<0.05$) to intend continuation of farming. From Table 6, it appears that the farms in the 1st size quartile were significantly more likely to exit from farming ($p<0.05$) compared to the farms in the 4th size quartile; and farms in the first three size quartiles were significantly more likely to decrease in size compared to the farms in the 4th size quartile ($p<0.1$). From Table 7, it follows that larger farms were less likely to exit and more likely to continue agricultural production: every 10 ha of additional agricultural area decreased the farm exit probability by 0.8% ($p<0.05$) and increased the probability of continuation of farming by 0.8% ($p<0.05$).

A higher survival probability of larger farms has also been found by Glauben *et al.* (2004), and Breustedt and Glauben (2007). The CA revealed that large-scale farms were characterised by higher market orientation, higher specialisation on agricultural production and more frequent utilisation of investment subsidies (**II**). This suggests that larger agricultural producers in Estonia have been more successful in adapting with the new technology and in utilising scale economies, which are the factors that affect structural changes according to the technology model of structural change (Boehlje, 1990).

A higher proportion of other revenues in total farm revenues, i.e. diversification of farm business with non-agricultural activities, reduced the probability of intended farm exits ($p<0.05$) (Table 5, **II**). Buchenrieder *et al.* (2009) suggest that small farms might benefit from their ability to respond quickly to the dynamic environment, while large farms are likely to benefit from economies of scale and positive effects from innovations. Viira (2011) concludes that it is unlikely that smaller farms are able to compete with larger agricultural holdings in the mass production of cereals and milk, and should therefore find niches where they have advantages compared with large-scale producers, or specialise in products that large-scale farms do not produce. However, the results of studies **II**, **III** and **IV** assert that the trend of decreasing farm

numbers via the exits of smaller agricultural producers and increasing average farm size will probably persist in Estonia.

A higher proportion of rented land in the utilised agricultural area increases the likelihood of intended exits ($p<0.05$) (Table 5), shrinkage ($p<0.01$) and farm growth ($p<0.05$) (Table 7). This result is somewhat counterintuitive. From the CA, it appeared that the share of rented land is higher (**II**) in larger farms. Considering the previous discussion about the effects of farm size on the probabilities of farm exit and continuation with farming, one would expect that a higher share of rented land reduces the likelihood of farm exits. However, the CA revealed that there is a group of medium-sized farms that use a high proportion of rented land and are uncertain about the prospects of continuation of farming (**II**). This suggest that the positive effect of higher share of rented land on the probability of farm exit may be associated with the medium-sized farms, which are insecure in terms of their survival prospects. It has been also suggested by Schmitt (1991) that medium-sized farms are most likely to disappear in the future. However, Calus *et al.* (2008) have also suggested that there might be more discrepancies between intentions and behaviour in medium-sized farms.

Previous studies have found that a farm operator's participation in the off-farm labour market may have either positive (Boehlje, 1990; Bojnec *et al.*, 2003; Buchenrieder, 2005; Breustedt and Glauben, 2007) or negative effects on the probability of farm survival (Weiss, 1999; Goetz and Debertin, 2001). According to study **IV**, farm operators with an off-farm job were less likely to intend continuation of farming ($p<0.05$) and farm growth ($p<0.05$), while having an off-farm job increased the likelihood of farm exits by 13.4% ($p<0.05$) (Table 7). The positive effect of having on an off-farm job on the probability of farm exit ($p<0.05$) was also found in paper **III** (Table 6). This implies that the income derived from off-farm work in Estonia substitutes rather than complements earnings derived from agricultural production, therefore reducing the farm's survival probability and supporting the findings of Weiss (1999), and Goetz and Debertin (2001).

Renting out part of owned agricultural land increases the probability of intended farm exits ($p<0.05$) (Table 5). In the CA, two groups of farms emerged, in which 80–85% of farms rented out part of their land to

other produces. In these groups, 69–80% of the farm operators also had an off-farm job. On average, these farms were smaller compared to the sample mean (**II**). This suggests that renting out agricultural land could be associated with the farm operator's participation in the off-farm labour market, and these two phenomena could be associated with insufficient income derived from the agricultural production in the small-scaled farms.

It appeared that semi-subsistence and LFA payment schemes reduce the likelihood of farm exits among the participating farms, and increase the likelihood of continuation of farming in the case of LFA payments. Farms participating in a semi-subsistence farming scheme had a 10.6% ($p<0.05$) and farms participating in the LFA payment scheme a 10.5% ($p<0.1$) lower probability to exit from farming (Table 7). The negative effect of participating in a semi-subsistence farming scheme on the probability of farm exit ($p<0.01$) was also revealed in paper **III** (Table 6). Farms participating in the LFA payment scheme were by 7.8% ($p<0.1$) more likely to continue farming. This result may be related to the obligation taken by the farm operators who participate in the LFA and semi-subsistence payment schemes to continue agricultural production for at least five years (Estonian Ministry of Agriculture, 2005). At the time when the survey of 2007 was carried out, these farms were in the middle of the period of 5-year obligation. Therefore, it is expected that these farm operators were less likely to intend exiting from farming.

Davidova (2011) suggested that the CAP has to help semi-subsistence farms to commercialise or exit. However, the effects of participating in LFA and semi-subsistence payments schemes on farm growth (which could be considered as a proxy for commercialisation) and decline were insignificant. This implies that while such payment schemes may slow down farm exits, they do not have a significant effect on the growth (development) of participating farms. These results confirm the suggestion of Davidova *et al.* (2009) that subsistence production could be favoured by households with non-farm income or retired households who wish to satisfy lifestyle and consumption preferences (**III**).

The results in Table 6 indicate that farms that were specialised in grazing livestock were less likely to exit from farming ($p<0.1$) (**III**). This finding corresponds to the results of Breustedt and Glauben (2007), who found

that, the rate of farm exits was lower in regions specialised in livestock production. From Table 7, it follows that specialising in arable crops did not significantly affect the probabilities of farm exit, continuation of farming, farm shrinkage and farm growth (**IV**).

It also appeared that a higher level of education has a positive effect on the probability of farm growth ($p<0.1$) (Table 6, **III**), confirming the positive effect of human capital on the farm growth (Boehlje, 1990; Breustedt and Glauben, 2007; Schnicke *et al.*, 2008). From Table 7, it appears that a farm operator's evaluation on his or her knowledge and experience had a significant ($p<0.05$) negative effect on the probability of intended farm exits and a positive ($p<0.12$) effect on the probability of intended continuation of farming (**IV**). Therefore, it is important that the next generation of farmers has access to agricultural professional and higher education. This would increase the future performance and viability of farms.

Farms for which operators evaluated their condition of health as poor were more likely to intend exit and less likely to intend continuation of farming ($p<0.05$) (Table 7, **IV**). This result was expected and could be explained by the uncertainty that is caused by the poor health. Also, Bentley and Saupe (1990), and Gale (2003) found that older farm operators pass the management of their business to a successor or leave farming because of poor health or death in most of the farm exit cases. At the same time, farms for which operators evaluated their condition of health as poor were less likely ($p<0.01$) to actually decrease in size (Table 7). The last result is somewhat counterintuitive, and it suggests that if the condition of health permits and farmers who evaluated their health as poor keep on farming, they are not likely to reduce the agricultural area of their farms (**IV**).

From paper **III**, it occurred that farms established based on the restituted land or farmsteads had a lower probability of farm shrinkage ($p<0.1$) and farm growth ($p<0.05$). However, the farm establishment via restitution did not have a significant effect on the probability of exiting from farming. On average, the farms that were based on restituted land or farmsteads were smaller (64 ha compared to 192 ha in cases of farms established via privatisation or bought). It appeared that the operators of the restituted farms value farming as a lifestyle

more highly than other farmers. These results support the second hypothesis of the study, that operators of the farms established based on restituted land or farmsteads are more inclined to maintain the farm that was established by their forefathers. The importance of lifestyle preferences and the emotional connection to forefathers' land has also been suggested by Kelam (1993), Hedin (2005), and Grubbström and Sooväli-Sepping (2012). Therefore, the decisions regarding agricultural, land and ownership reforms (restitution) have an effect on the process of structural changes almost 20 years later.

Having regard the adjustment of agricultural sector in response to institutional changes, as discussed in sections 5.1 and 5.2, farm growth, decline and exit processes in Estonia follow the farm life cycle pattern, and are affected by farm-specific socioeconomic characteristics similar to Western countries. Therefore, the third hypothesis of the study could be accepted.

Based on the data stemming from the survey that investigated the intentions of farm operators, and the analysis in papers **II**, **III** and **IV**, three groups of farms can be outlined that are more likely to intend continuation of farming:

1) Large-scale agricultural producers who are characterised by higher market orientation and specialisation on agricultural production; relatively high share of rented land; relying mainly on hired labour; and utilisation of investment subsidies.
2) Small-scale livestock farms that rely mainly on family labour; are more specialised in agricultural production and less diversified; and are willing to expand their agricultural area but report capital constraints.
3) Small-scale farms with farm operators whose average age is above pension age; have strong support from other family members; good knowledge in agricultural production; rely mainly on owned agricultural land, and do not state serious capital constraints; continue farming as part of their everyday life and acquire additional income from pensions.

The three groups of farms that more likely express intention to exit from farming (**II**, **III**, **IV**):

1) Small-scale livestock farms with farm operators who are beyond pension age; relying mainly on family labour; are less market

orientated; express intention to decrease their agricultural area; have poor availability of potential successors, poor health, are facing capital constraints and evaluate their knowledge as poor.

2) Small-scale farms with operators of average age, many of whom are also working off-farm; rent out a significant part of their agricultural land; evaluate their knowledge in agricultural production as good; and whose condition of health is good.
3) Medium-scaled farms with operators who are younger than average, who use less than average proportion of family labour; are not employed off-farm; use a relatively high proportion of rented land; and express intentions to expand their agricultural area; have good availability of successors; good level of knowledge, less than average capital constraints, good condition of health and a high level of support from family members.

The previous findings imply that the dualistic farm structure will probably persist in Estonia: large-scale farms continue as market orientated agricultural producers, while many small-scale farms continue farming as part of their everyday life, and derive additional income from pensions or off-farm work. This is in line with the suggestion by Mardsen *et al.* (2002) that modern farms will have various development patterns: lifestyle producers, professionally managed agricultural enterprises, and multifunctional businesses that benefit from economies of scope and synergies.

The growth of large farms may occur in the process of consolidation of large farms into large groups or holdings. This implies towards the tendency for the creation of large, professionally managed groups of agricultural producers. Such agri-holdings are rarely found in the former Western Bloc countries (Buchenrieder *et al.*, 2009). Therefore, it is likely that the large and small farms also have a more and more diverting set of values related to agricultural production. This leaves an open question about how well the family and farm life cycle approach explains the exit and growth of large, commercialised, investor-owned agri-holdings.

5.4. Discrepancies between stated intentions and actual behaviour of Estonian farm operators in the context of farm growth, decline, continuation and exit

Several studies (Thomson and Tansey, 1982; Glauben, 2002; Väre *et al.*, 2010; Lefebvre *et al.*, 2013) have questioned the usefulness of farmers' intentions as predictors of actual behaviour. This research problem was addressed in paper **IV**. The results of the recursive bivariate probit estimates of the models (a), (b), (c) and (d), all having the model structure as described by equations (4) and (5), and that accounted for intentions and actual behaviour regarding farm exit, continuation of farming, farm shrinkage and farm growth, are presented in Table 7.

The results confirmed the 4th hypothesis of the study, in that the farm operators' intentions regarding exiting from farming and shrinkage of farm size are less useful in predicting actual exits and contraction compared to the intentions regarding continuation of farming and farm growth in predicting actual continuation or growth. Only 9.3% of exits and 32.4% of farm size shrinkages coincided with the respective intentions, while actual behaviour was compatible with intentions in 68.8% of the cases in relation to continuation of farming and farm growth. Väre *et al.* (2010) found that farmers' behaviour corresponded to their earlier intentions with regard to retirement decisions in 63% of the cases (**IV**).

Intention to continue with farming increased the probability of actual continuation by 33.4% ($p<0.01$), and intention to expand agricultural area increased the probability of agricultural area growth by 37.0% ($p<0.01$). In the case of farm exits, revealed intentions were not statistically significant in predicting actual exits. The effect of intended farm shrinkage on actual farm size decline was positive and statistically significant ($p<0.1$). Intention to decrease agricultural area increased the probability of shrinkage of agricultural area by 28.1%. In the models of farm exits (a) and shrinkage (c), the correlation (ρ) between error terms of equations that explain intention and actual behaviour was statistically insignificant, implying that there are no unobserved explanatory variables left that would explain both intended and actual behaviour in a statistically significantly way. In the models of continuation of farming (b) and farm growth (d), the ρ was statistically significant ($p<0.01$), indicating correlation between the unobserved variables of both models, and

the dependency between intended and actual behaviour. These results imply that if the behaviour under consideration could be regarded as negative (shrinkage of farm size, farm exit), the intentions are poorer predictors of actual behaviour compared to the more positive behaviour like continuation of farming and farm growth (**IV**).

With regard to the effects of the farm-specific socioeconomic variables on the probability of intention-behaviour discrepancies, it appeared that older farm operators were more likely to diverge from their intentions in the contexts of continuation of farming and farm growth, while the farm operator's age did not have a significant effect on the intention-behaviour discrepancy with regard to intentions of farm exit and farm shrinkage (Table 7). This implies that while the age of the farm operator is a significant determinant of farm development, the intentions revealed by elderly farmers regarding continuation of farming and farm growth may be misleading (**IV**). Glauben *et al.* (2002) and Väre *et al.* (2010) also found that the farm operator's age is a significant determinant of intention-behaviour discrepancies. Relying on the TPB, the positive effect of age on the probability of intention-behaviour discrepancy could be explained by the more positive attitudes of younger farmers about continuation of farming and farm growth; pressure from family members towards elderly farmers, encouraging exiting or downsizing farming, which the elderly farmers may or may not agree with; and lower level of perceived behavioural control of elderly farmers, since their decisions regarding the future of the farm are more dependent on other family members (**IV**). This implies that timely succession of farm management is crucial if the positive future outlook of the farm is wanted. This is only possible in cases where the suitable farm successor is available and willing to take over the farm.

It also appeared that smaller farms had a higher probability of intention-behaviour discrepancy in the context of continuation of farming. This finding is opposite to the conclusions of Lefebvre *et al.* (2013). This indicates, that uncertainty about the future viability of their farms is larger among the operators of smaller farms. The operators of larger farms may have more positive attitudes regarding continuation of farming due to the higher income earning potential of larger farms. This could also affect positively the attitudes of other family members regarding continuation of farming (**IV**). Therefore, in order to increase the sustainability of smaller farms, the agricultural policy should pay

more attention to increasing the income earning potential of smaller farms. This could be done either through the change of the specialisation in small farms towards agricultural activities that provide higher revenue per hectare of agricultural land, enhancing the opportunities for off-farm work, or the growth of small-scaled farms in terms of agricultural land and/or animals.

In the contexts of farm decline and growth, farms where the proportion of rented land in total agricultural land use was higher were more likely to behave according to their stated intentions (Table 7). From another perspective, this indicates that farms that do not rent or rent a small proportion of their agricultural area are more likely to deviate from the intentions regarding farm shrinkage or growth. This could be explained by the better awareness of the operators of the farms that rent agricultural land about the expiry of the existing rental agreements and the opportunities to conclude new rental agreements. Also, it is likely that farmers who participate in rental market of agricultural land are better able to anticipate the future growth in land prices. Better awareness about the situation in the land market may increase the perceived behavioural control of farm operators over the short- and medium-term changes in their agricultural area, and thereby decrease the likelihood of intention-behaviour discrepancies (**IV**).

In the case of farm operators who had an off-farm job, intention-behaviour discrepancies were more likely in the contexts of continuation of farming and farm growth. If the income derived from the off-farm job is higher than the income earning potential of the farm, the farm operator may have a more negative attitude towards the continuation of farming or farm growth. In such cases, the farm operator may perceive pressure from family members to reduce his or her on-farm workload. These considerations may cause the respective discrepancies between intended and actual behaviour (**IV**).

It also appeared that farms that participated in the LFA payments scheme were less likely to deviate from their stated exit intentions. This is probably related to their obligation taken in the payment scheme to continue with farming for 5 years. It is likely that before taking the obligation to continue farming for 5 years the farm operator has thoroughly considered if he is able and willing to comply with this

obligation. Therefore, such farm operators have probably more positive attitudes towards the continuation of farming and also have better formed intentions (**IV**).

Farm operators with higher level of knowledge and experience were less likely to diverge from their intentions (**IV**). This could be related to the more thoroughly considered plans of such farm operators. It has been suggested by Sheeran (2002) and Sharma *et al.* (2003) that persons with better formed intentions are less likely to change their intentions and more likely to enact the intentions. Huffmann and Evenson (2001) concluded that the importance of higher level formal education will increase as the farmers need to spend more time in planning, analysing and managing their business, and therefore need information acquisition, analytical and decision making skills. This implies that the well-functioning and accessible professional and higher education, as well as training and advisory systems are crucial elements in modern agriculture.

Farm operators who were members of farming associations were more likely to intend exiting from the sector (**IV**). This result is unexpected as one would assume that members of farming associations are better informed, have higher level of human and social capital, and therefore, are more likely to continue farming and utilise opportunities to develop their farms. This result may be related to the fact that the survey of 2007 also investigated the farmers' opinions about the possible policy developments discussed in the CAP "Health Check". Bergés and Chambolle (2009) demonstrated that "threat to exit" can be used as a bargaining power under different market structures or contract types. Therefore, the result may be influenced by farmers' intention to pressure policy and decision makers by using the "threat to exit". It is likely that the members of farming associations are more aware about the possible relations between such surveys and policy decisions, and therefore might provide answers that are motivated by their policy-related interests rather than true intentions.

It is argued that the succession effect plays a role in the development of the farm from age 45 of the farm operator (Glauben *et al.*, 2002; Calus *et al.*, 2008). Farm operators' better evaluation on the availability of successors reduced the intention-behaviour discrepancy in the contexts of continuation of farming and farm growth, but increased the intention-

behaviour discrepancy in the context of farm shrinkage. The latter result may be related to the circumstances in which the farm operator, while evaluating the availability of successors as good, is unaware of the actual plans of the successors. This confirms the suggestion of Taylor *et al.* (1998) and Väre *et al.* (2010) that, in the studies of farm successions, it is crucial to investigate both the intentions of the current farm operators and intentions of the potential successors, since their plans might not necessarily coincide, therefore creating a discrepancy between intentions and actual behaviour (**IV**).

It occurred that a poor condition of health increases the likelihood of intention-behaviour discrepancy in the context of continuation of farming. While it significantly decreased the probability of intended continuation of farming, it did not have a significant effect on the actual continuation of farming (Table 7). It also occurred that the poorer the farm operator evaluated his condition of health, the lower the probability of actual farm shrinkage. These results suggest that poor condition of health increases uncertainty about the future development of the farm. Poor condition of health may be associated with a lower level of perceived behavioural control over the continuation of farming, which in turn increases the likelihood of intention-behaviour discrepancy (**IV**).

6. CONCLUSIONS

The following conclusions can be drawn from this study about the role of institutional changes and farm-specific socioeconomic factors in the process of the structural adjustment of Estonian agriculture:

- The change in the number of agricultural holdings and volume of agricultural production in the 1990s and 2000s are negatively interrelated. In the 1990s, the volume of agricultural production decreased markedly while the number of agricultural holdings increased. This was the result of agricultural, land and ownership reforms that aimed to restitute the land of previous family farms to the heirs of the pre-war owners and privatise previous collective farms. However, agricultural policy was very liberal with a minimal amount of direct subsidies, import tariffs, and non-tariff import barriers, and most of the newly established farms turned out to be unviable in the market conditions. Therefore, the policy that aimed to create a family farm based agricultural structure was not supported by the appropriate agricultural policy that would have helped these new farms to survive. However, since 2001, the number of agricultural holdings has declined and the volume of agricultural production has increased. Accession to the EU in 2004 clearly increased the prices of agricultural products in the Estonian market, increased direct payments and investment subsidies, and thereby the volume of agricultural production has increased significantly (**I**).

- The choices made in the agricultural, land and ownership reform processes have long-term effects on the structural development of the Estonian farming sector. Almost 25 years after the reforms, the farms that were established based on returned land or farmsteads are on average smaller and have significantly lower growth and decline probabilities, but their exit probability is similar to other farms. The operators of restituted farms value farming as a lifestyle more highly than other farmers. This implies that continuity of the ownership and respect for forefathers' work is a factor that affects the process of structural changes (**III**).

- Provided that the historical context and institutional reforms of the 1990s have effects on the structural adjustment of the farming sector, the role of various farm-specific socioeconomic factors of farm growth, decline, continuation and exit is substantial. Farms with operators aged 60 and above are more likely to exit; and farms that have operators aged between 40 and 49 are more likely to increase in size. The likelihood of farm exit is strongly affected by the availability of successors. A more positive evaluation by the farm operator on the availability of successors significantly reduced the farm exit probability. Large-scale farms are more likely to persist in Estonia. Farms in the 1st size quartile were significantly more likely to exit; and farms in the first three size quartiles were more likely to decline in size compared to farms in the 4th size quartile. It appeared that semi-subsistence farming and less favoured areas payment schemes reduce exits among the farms that participate in the scheme. However, the semi-subsistence farming payments were applied as a transitional measure for 5 years after the EU accession in 2004. Farm exits are also affected by the farm type: farms specialised in livestock were less likely to exit. The farm operator's level of education has a multifaceted role in the structural adjustment of the farming sector. Farm operators with a higher level of education were more likely to have an off-farm job; and farm operators with an off-farm job were more likely to exit farming. At the same time, the level of education of the farm operator had positive effects on the probability of farm growth (**III**).

- The value of the intentions regarding continuation of farming or farm exit and farm decline or growth as stated by the farm operators in surveys is limited, as considerable discrepancies exist between intentions and actual behaviour. Intentions are better predictors of actual behaviour when the considered event could be regarded as positive (continuation of farming and farm growth) rather than negative (exit from farming, farm shrinkage). It appeared that the actual behaviour was more likely to diverge from intentions in the case of older farmers, smaller farms, farm operators with an off-farm job, poorer level of knowledge and experience. The availability of successors and condition of the farm operator's health have more complex effects on the intention-behaviour discrepancy. A farm operator's good evaluation on

the availability of successors may both reduce and increase the probability of intention-behaviour discrepancy. This depends on the cohesion between the intentions of the farm operator and successors. A poor condition of health increased the probability of an intention-behaviour mismatch in cases of continuation and exit from farming. At the same time, farmers with poor health, when they continued farming, maintained the size of their agricultural area (**II, IV**).

Issues requiring further research:

- Farm structures in Estonia are dualistic with small farms existing together with large-scale agricultural producers. Several of the large agricultural producers have been united in larger groups of agricultural holdings. It is reasonable to assume that life cycle patterns in smaller or family farms differ from large investor-owned agricultural producers. Therefore, the farm growth, decline and exit patterns probably differ as well in these two groups.

- There is a large amount of information in ARIB's registers that covers the period from 2004. This is annual data about farms that received farm payments, their agricultural areas, crops and animals. Based on this data and using Markov chain approach, it is possible to determine the development patterns of different farm types and size groups, and also to assess the role of various farm policies in these structural adjustments.

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SUMMARY IN ESTONIAN

EESTI PÕLLUMAJANDUSE STRUKTURAALNE KOHANEMINE – INSTITUTSIONAALSETE MUUTUSTE JA PÕLLUMAJANDUSETTEVÕTETE KASVU, KAHANEMIST NING TEGEVUSE LÕPETAMIST MÕJUTAVATE SOTSIAAL-MAJANDUSLIKE TEGURITE OSA

Sissejuhatus

Muutused põllumajandusettevõtete struktuuris on huvitanud lääneriikide põllumajandusökonomiste, maasotsiolooge, poliitikakujundajaid ja ka ühiskonda tervikuna juba aastakümneid. Seejuures on üheks oluliseks uurimis- ja aruteluteemaks olnud peretalude toimetulek ning püsimajäämine. Peretalud on lääneriikides peamised põllumajandustootjad[4]. Seetõttu on põllumajandussektorile iseloomulik, et ettevõtete omaniku- ja juhivahetused toimuvad perekonnaringis, pered on maa ja kapitali omanikud, juhivad ettevõtteid, pakuvad ja ühtlasi taastoodavad ettevõttele tööjõudu ning tarbivad ka osa ettevõtte toodangust (Gasson ja Errington, 1993; Boehlje, 1999; Glauben jt, 2004; Johnsen, 2004).

Tehnoloogiline areng on suurel määral vähendanud põllumajandussektori tööjõuvajadust. Samas on teiste majandusharude areng pakkunud töökohti põllumajandussektorist lahkunud töötajatele. Kuna põllumajandustoodete kauplemistingimused on aastakümneid halvenenud, kuid teistes majandusharudes on sissetulekud kasvanud, on põllumajandustootjad pidanud perele elatise tagamiseks laienema ja suurendama tootmismahte (Levins ja Cochrane, 1996). Põllumajandusmaa kui ressursi piiratuse tõttu on kirjeldatud protsesside tulemuseks põllumajandustootjate arvu vähenemine ja alles jäävate tootjate keskmise suuruse kasv. Koos põllumajandustootjate keskmise suuruse ja kapitalivajaduse kasvuga on kasvanud ka sisenemisbarjäärid uutele tootjatele (Boehlje, 1973; Huffmann ja Evenson, 2001).

Pärast teist maailmasõda on Euroopa Liidu (EL) ja selle kaubanduspartnerite põllumajanduse arengut oluliselt mõjutanud EL-i ühine

[4] Alljärgnevalt on kasutatud termineid talu, põllumajandustootja, tootja, põllumajandusettevõte, ettevõte ning põllumajanduslik majapidamine sünonüümidena.

põllumajanduspoliitika (ÜPP). Alates MacSharry reformist 1992. aastal on ÜPP turge moonutav mõju järk-järgult vähenenud (Ritson ja Harvey, 1997; Burrell ja Oskam, 2000; Garzon, 2006; Greer, 2006). Üldiselt peaks turumoonutuste vähenemine tooma kaasa strukturaalse kohanemise kiirenemise, mistõttu jäävad püsima rohkem turule orienteeritud ja konkurentsivõimelisemad põllumajandustootjad. ÜPP stimuleerib põllumajanduse strukturaalseid muutusi erinevate meetmete kaudu: põllumajandustootjate varem pensionile siirdumise toetused, noortele põllumajandustootjatele suunatud toetused, investeeringutoetused põllumajandustootjate tegevuse arendamiseks ja mitmekesistamiseks. Kuivõrd strukturaalsed muutused põllumajanduses survestavad peamiselt väiketootjatest peretalusid, mis on iseloomulikud paljudele EL-i maapiirkondadele, siis pöörab ÜPP lisaks strukturaalseid muutusi stimuleerivatele abinõudele tähelepanu ka väiksemate ja haavatavamate tootjate elujõulisuse tagamisele. Selliste meetmete hulka kuuluvad näiteks elatustalude kohanemise toetus ning väiksematele ja ebasoodsamates piirkondades asuvatele tootjatele suunatud toetused. Taolised abinõud aga aeglustavad strukturaalse kohanemise protsessi.

2000. aastate algusest saadik on Eestis põllumajanduslike majapidamiste arv vähenenud ja tegutsevate tootjate keskmine põllumajandusmaa pindala suurenenud. Selline tendents on sarnane eelkirjeldatud, läänеriikides toimuva protsessiga. Siiski tuleb Eesti puhul arvesse võtta, et viimase 100 aasta jooksul on Eesti ühiskonda, aga ka põllumajandust ja põllumajandustootjate struktuuri suurel määral mõjutanud kolm struktuurikatkestust: Eesti Vabariigi asutamine 1918. aastal (varasemate mitte-eestlastest aadlile kuulunud mõisamaade jagamine suurele arvule väiketaludele 1920. aastatel), nõukogude okupatsioon 1940. aastal (talude kollektiviseerimine pärast teist maailmasõda) ja iseseisvuse taastamine 1991. aastal (talumaade tagastamine lähtuvalt enne teist maailmasõda kehtinud omandist, ühismajandite erastamine) (**III**). Kõik mainitud struktuurikatkestused tõid kaasa omandisuhete täieliku muutumise ja pöörasid ümber eelnevad arengud põllumajanduses.

Ühiskondlikud ja majanduslikud muutused ning põllumajandus-, omandi- ja maareformid, mis algatati 1980. aastate lõpus ning 1990. aastate alguses, tõid ka põllumajanduses kaasa siirdeperioodi. Selle käigus erastati varasemad ühismajandid ja asutati uued, eraomandis olevad põllumajanduslikud majapidamised, mis baseerusid kas

tagastatud talumaadel ja -kohtadel või erastatud põllumajandusmaal (**I**). Esimesel kümnel aastal pärast iseseisvumist kasvas põllumajanduslike majapidamiste arv Eestis 7400-lt 1991. aastal 55 700-ni 2001. aastal. Aastaks 2010 vähenes põllumajanduslike majapidamiste arv 19 600-ni (Statistics Estonia, 2014). Põlvkonnavahetus on Eesti põllumajanduses päevakajaline teema, sest siirdeperioodi alguses eraomandil baseeruvate põllumajanduslike majapidamiste asutamisest on möödunud ligikaudu üks inimpõlv ning võib eeldada, et paljude, ettevõtte asutamise ajal nooremas keskeas olnud põllumajanduslike majapidamiste juhid on praeguseks eas, kus tuleb langetada otsuseid oma ettevõtte tuleviku kohta. Märkimisväärne põllumajanduslike majapidamiste arvu vähenemine viitab sellele, et paljud neist on põllumajandustootmisega tegelemise lõpetanud. Kuna samal ajal on põllumajandustoodangu maht ja kasutatava põllumajandusmaa pindala suurenenud, siis järelikult on tegutsevate põllumajandustootjate suurus kasvanud. Seega on viimase 25 aasta jooksul Eestis põllumajanduse strukturaalseid muutusi mõjutanud samal ajal nii käsumajandusest turumajandusse siirdumise protsess, EL-iga liitumine ja ÜPP rakendamine kui ka lääneriikidega sarnane, n-ö normaalne strukturaalse kohanemise protsess, mis kaasneb majanduse üldise arenguga.

Põllumajanduse strukturaalse kohanemise protsessi paremaks mõistmiseks on vaja põhjalikke teadmisi põllumajandustootjate tootmismahu kasvu ja kahanemist ning tegevuse jätkamist ja lõpetamist mõjutavate tegurite kohta. Põllumajandustootjate tootmismahu kasvu ja tegevuse lõpetamist käsitlevad uuringud baseeruvad tihti küsitlustel, milles ettevõtete juhtidel palutakse väljendada oma kavatsusi. Kuigi paljudel juhtudel on kavatsused osutunud tootjate tulevase tootmismahu kasvu või tegevuse lõpetamise osas usaldusväärseks teabeallikaks, on mitmed uuringud (Thomson and Tansey, 1982; Calus *et al.*, 2008; Väre *et al.*, 2010; Lefebvre *et al.*, 2013) näidanud, et põllumajandusettevõtete juhtide kavatsused ja tegelik käitumine võivad märkimisväärselt lahkneda. Teadmised ettevõtete juhtide kavatsuste ja tegeliku käitumise vahel esineda võivate lahknevuste ning neid põhjustavate tegurite kohta aitavad ettevõtjate kavatsusi uurivate küsitluste puhul vähendada järelduste võimalikku kallutatust. Eesti lähiajalugu arvestades tuleb põllumajanduse strukturaalse kohanemise käsitlemisel arvesse võtta ka läbitud institutsionaalsete muutuste mõju.

Eelnevale toetudes on töö hüpoteesid järgmised.

1. Eesti põllumajanduse arengut on viimase 25 aasta jooksul suurel määral mõjutanud 1990. aastate alguse põllumajandus-, maa- ja omandireformid ning plaanimajanduselt turumajandusele siirdumisega kaasnenud institutsionaalsed muutused.
2. Tagastatud talukohtade ja/või põllumajandusmaa baasil asutatud põllumajanduslike majapidamiste juhid on võrreldes muul viisil asutatud põllumajanduslike majapidamiste juhtidega rohkem orienteeritud nende esivanemate talude säilitamisele.
3. Võttes arvesse institutsionaalsete muutuste osa põllumajandussektori kohanemisel, lähtuvad põllumajandustootjate tegevusmahu kasvu, kahanemise ning tegevuse jätkamise ja lõpetamise protsessid Eestis nagu teisteski lääneriikides ettevõtte elutsüklist tulenevast loogikast.
4. Põllumajanduslike majapidamiste juhtide kavatsused, mis puudutavad tootmise lõpetamist ja põllumajandusmaa pindala vähenemist, on tegeliku käitumise prognoosimiseks vähem usaldusväärsed kui kavatsused, mis puudutavad põllumajandustootmise jätkamist ning põllumajandusmaa laiendamist.

Hüpoteesidest tulenevalt on töö eesmärkideks uurida:

1. Eesti põllumajanduse strukturaalset kohanemist viimase 25 aasta jooksul, võttes arvesse institutsionaalsete muutuste konteksti (**I**);
2. ettevõttespetsiifiliste sotsiaal-majanduslike tegurite mõju Eesti põllumajanduslike majapidamiste juhtide kavatsustele, mis puudutavad tootmise jätkamist ja lõpetamist ning ettevõtte suuruse kahanemist ja kasvu (**II**, **IV**);
3. ettevõttespetsiifiliste sotsiaal-majanduslike tegurite mõju Eesti põllumajanduslike majapidamiste tootmise jätkamisele ja lõpetamisele ning ettevõtte suuruse kahanemisele ja kasvule (**III, IV**);
4. põllumajanduslike majapidamiste juhtide tootmise jätkamist ja lõpetamist ning põllumajandusmaa suuruse kahanemist ja kasvu puudutavate kavatsuste ning tegeliku käitumise lahknevusi ja neid mõjutavaid tegureid (**IV**).

Andmed ja metoodika

Põllumajandustootmise ja põllumajanduslike majapidamiste strukturaalset kohanemist analüüsiti võrdlevalt samal ajal toimunud tähtsamate institutsionaalsete muutuste ning põllumajanduspoliitika arenguga. Analüüsimisel kasutati avaliku statistika aegridu (**I**). Põllumajanduslike majapidamiste tegevuse jätkamist ja lõpetamist ning tegevusmahu vähenemist ja suurenemist uuriti kahe, põllumajanduslike majapidamiste juhtide seas posti teel läbi viidud ankeetküsitluse andmete alusel (**II**, **III**, **IV**). Esimene ankeetküsitlus toimus 2007. aasta detsembrist 2008. aasta jaanuarini. Küsitletavate valimisse kuulus 1000 Eesti põllumajanduslikku majapidamist majandusliku suurusega vähemalt kaks Euroopa suurusühikut (ESU) ehk standardkogutuluga üle 2400 euro. Küsitluses uuriti, millised on ettevõtjate plaanid aastateks 2008–2010 põllumajandusmaa kasvu ja kahanemise ning tootmise jätkamise ja lõpetamise osas. Küsitlusele vastas 290 põllumajandustootjat. 2011. aasta märtsis ja aprillis viidi eelmisele küsitlusele vastanute hulgas läbi jätku-uuring, milles hinnati, kuidas on 2007. aasta küsitluses väljendatud kavatsused tegelikkuses realiseerunud. 2011. aasta küsitluse puhul oli vastanute määr 78,6%. Lisaks kasutati Põllumajanduse Registrite ja Informatsiooni Ameti (PRIA) registrite andmeid, mis puudutasid taotletud toetusi, põllukultuuride kasvupinda ja põllumajandusloomade arvu toetusi saanud põllumajanduslike majapidamiste lõikes. PRIA andmete alusel arvutati igale tootjale tema standardtoodang (SO) 2006. ja 2010. aastal, samuti tootmistüüp lähtuvalt Euroopa Komisjoni määruses 1242/2008 (millega kehtestatakse ühenduse põllumajandusettevõtete liigitus) toodud eeskirjadest.

Kuivõrd tootmise jätkamist ja lõpetamist ning põllumajanduslike majapidamiste suuruse kahanemist ja kasvu mõjutavate tegurite puhul uuriti nende mõju nimetatud sündmuste kavatsemise ja toimumise tõenäosusele, siis kasutati analüüsimiseks erinevaid regressioonianalüüsi meetodeid: binaarne logistiline ja järjestatud logistiline regressioon (**II**), multinomiaalne logistiline regressioon (**III**) ja rekursiivne kahe muutujaga *probit*-regressioon (*recursive bivariate probit regression*) (**IV**). Veel kasutati kombineerituna peakomponentide meetodit ja klasteranalüüsi (**II**).

Viimased 25 aastat saab põllumajandussektori strukturaalse kohanemise ja arengu seisukohast jagada tinglikult neljaks etapiks (**I**; Viira, 2011). Muutuste alguseks võib pidada 1988. aastat, kui võeti vastu õigusaktid, mis lubasid anda ühismajandite ääremaad erakasutusse ja eraomanikele müüa põllumajandusmasinaid. 1989. aastal vastu võetud taluseadus, 1991. aasta omandireformi aluste seadus ja maareformi seadus ning 1992. aasta põllumajandusreformi seadus panid aluse uuele, eraomandil baseeruvale põllumajandusettevõtete struktuurile ja määrasid ära selle edasise arengusuuna: varade tagastamine õigusjärgsetele omanikele või nende pärijatele, maade erastamine, ühismajandite erastamine (Maide, 1995; Alanen, 1999; Estonian Ministry of Agriculture, 1999). 1990. aastate alguses langetatud valikud on mõjutanud strukturaalseid muutusi, põllumajanduspoliitika alaseid arutelusid ja otsuseid ka järgnevatel perioodidel, luues Eesti põllumajanduse arengu seisukohalt teatud rajasõltuvuse (North, 1994; Kyriazis ja Zouboulakis, 2005).

Eesti põllumajanduse strukturaalse kohanemise esimene alaperiood – struktuurikatkestus – kestis 1995. aastani. Peale oluliste reformide iseloomustavad seda perioodi ka varasemate turgude ning toetuste kadumine, üleminek vabakaubandusele, aga ka esimeste riiklike põllumajandus- ja maaelu arengu toetuste kehtestamine (**I**). Põllumajanduslike majapidamiste arv kasvas 1989. aasta 1200-lt 1995. aastaks 20 600-ni (Statistics Estonia, 2014). Põllumajandustootjate jaoks halvenesid oluliselt kauplemistingimused. Põllumajandustootja subsideerimise ekvivalent (PSE) langes 1990. aasta 70%-lt 1992. aastaks –89%-ni (OECD, 1996; 2002). Aastatel 1990–1995 vähenes teraviljatoodang 42% (teraviljatoodangut iseloomustavad näitajad põhinevad kolme aasta libiseval keskmisel), piimatoodang 54% ja lihatoodang 64% võrra (Statistics Estonia, 2014).

Aastaid 1996–2001 iseloomustab kohanemine uute majandusoludega. Tähtsad põllumajandussektorit mõjutavad arengud olid EL-iga liitumise kava vastuvõtmine, subsideeritud import teistest riikidest, riikliku põllumajanduspoliitika eelarve ja haarde laienemine, seaduste vastuvõtmine impordimaksude ja -litsentside ning rangemate toidu kvaliteedikontrollide kehtestamiseks ja nn Vene kriis aastatel 1998–1999 (**I**). Sel perioodil jätkus põllumajanduslike majapidamiste arvu kasv. 2001. aastaks oli Eestis 55 700 põllumajanduslikku majapidamist (Statistics Estonia, 2014). Eestis oli PSE vahemikus 6–13%, samal ajal kui EL-i

riikides oli see 32–38% (OECD, 2002; 2014). Põllumajandustootmise mahud stabiliseerusid: võrreldes 1995. aastaga toodeti 2001. aastal liha 15% vähem, piima 3% vähem ja teravilja 8% rohkem (Statistics Estonia, 2014).

Liitumine EL-iga oli nii Eesti majanduse kui ka põllumajanduse seisukohast aastatel 2002–2008 tähtis märksõna. Sellesse perioodi jäävad EL-iga liitumise ettevalmistamine, SAPARD-i programmi elluviimine ja EL-iga liitumise järel ka ÜPP rakendumine täies mahus, samuti põllumajandustoetuste suurenemine Eestis. Kiire majanduskasv, põllumajandustootjate paranenud laenutingimused ja ka põllumajandus-toodete hindade tõus lõid põllumajanduse arenguks soodsa majanduskeskkonna (**I**). Samal ajal vähenes põllumajanduslike majapidamiste arv (2007. aastaks 23 300-ni), kuid põllumajandus-toodangu maht hakkas suurenema. Võrreldes 2001. aastaga oli 2008. aastal lihatoodang 30% suurem, piimatoodang 1% suurem ja teraviljatoodang 47% suurem (Statistics Estonia, 2014).

Alates 2009. aastast on põllumajanduse arengut mõjutanud majanduskriis ja üldine suurenenud ebakindlus. Majanduskriisi ajal halvenesid põllumajandustootjate laenuvõimalused ja kuigi põllumajandustoodangu hinnad on püsinud kõrged (FAO, 2014), on nende volatiilsus kasvanud (Prakash, 2011). Samal ajal on avalikkuses hakatud enam tähelepanu pöörama toidu ja toitumisega seonduvale. Rohkem on hakatud väärtustama ja ka realiseerima ühistegevusest tulenevaid võimalusi (Leetsaar jt., 2013) ning enam on kõneainet pälvinud ka põlvkonnavahetuse temaatika (Viira, 2011; Grubbström and Sooväli-Sepping, 2012). Põllumajandustoodangu maht on kasvanud: võrreldes 2008. aastaga oli 2012. aastal lihatoodang 5% suurem, piimatoodang 4% suurem ja teraviljatoodang samuti 4% suurem (Statistics Estonia, 2014).

Tuginedes eelnevale arutelule, leiab kinnitust esimene hüpotees 1990. aastate alguses alanud põllumajandus-, maa- ja omandireformide ning plaanimajanduselt turumajandusele üleminekuga kaasnenud institutsionaalsete muutuste suurest mõjust Eesti põllumajanduse arengule viimase 25 aasta jooksul.

Eestis tekkis reformivalikute tagajärjel duaalne põllumajandustootjate struktuur, mida iseloomustab suhteliselt suur väiksemate põllumajandustootjate osakaal, kes annavad väikese osa põllumajandus-toodangust, ja väike suuremate tootjate osakaal, kes annavad enamiku

toodangust. 2010. aastal andis 8,2% põllumajandustootjatest 82,9% Eesti põllumajanduse standardtoodangust[5] (Statistics Estonia, 2014). Kuna 2001. aastal oli Eestis põllumajanduslikke majapidamisi rohkem kui põllumajanduses, jahinduses ja nendega seotud valdkondades töötajaid (vastavalt 55 700 ja 28 800), on ilmne, et suur osa põllumajanduslikest majapidamistest ei suutnud pakkuda täistööajaga hõivet isegi ühele pere liikmele. Seetõttu on loomulik, et aastatel 2001–2010 vähenes põllumajanduslike majapidamiste arv 64,8%. Vähenemine toimus kõigis majapidamiste suurusklassides, kus põllumajandusmaa pind oli väiksem kui 50 ha (Statistics Estonia, 2014).

Kahe küsitluse andmete analüüsimisel selgus, et põllumajanduslike majapidamiste tegevuse jätkamist, lõpetamist, tootmismahu kahanemist ja kasvamist mõjutavad oluliselt ettevõtte ning selle juhi ja tema pere elutsükliga seotud tegurid: ettevõtte juhi vanus, ettevõtte üleandmiseks sobivate järeltulijate olemasolu, pere liikmete osatähtsus ettevõtte tööjõukasutusest ja ettevõtte juhi tervis (**II**, **III**, **IV**). Kui põllumajandusliku majapidamise juhi vanus suureneb 10 aasta võrra, siis ettevõtte tegevuse lõpetamise ja kasutatava põllumajandusmaa kahanemise tõenäosus kasvab vastavalt 4,0% ning 4,9% võrra. Juhi vanuse kasvades vähenes ka põllumajandustootmisega jätkamise ja tegevusmahu laienemise tõenäosus (**IV**). Ettevõtte tootmismahu kasvamise tõenäosus oli kõige suurem vanuserühmas 40–49 aastat (**III**). Need tulemused on vastavuses talu elutsükli teooriast tuleneva väitega, mille kohaselt on tootmismahu kasv kõige tõenäolisem keskealiste ettevõtjate hulgas ja vanemad ettevõtjad kas lõpetavad suurema tõenäosusega tootmise või – juhul kui talu üleandmise tõenäosus on väike – hakkavad deinvesteerima (Boehlje, 1990; Calus jt, 2008; Peerlings ja Ooms, 2008; Schnicke jt, 2008).

Põllumajandustootmise lõpetamise tõenäosust mõjutas statistiliselt oluliselt ka põllumajandusliku majapidamise üleandmiseks sobivate järeltulijate olemasolule antud hinnang. Kui ettevõtte juhi antud hinnang ülevõtja olemasolule kasvas 5-pallisel skaalal ühe ühiku võrra, siis ettevõtte tegevuse lõpetamise tõenäosus vähenes 4,4%. Positiivne hinnang ettevõtte üleandmiseks sobilike järeltulijate olemasolule suurendas ka põllumajandustootmise jätkamise ja tootmismahu

5 „Standardtoodang on põllumajandustoodangu rahaline väärtus põllumajandustootja hinnaga, mis vastab keskmisele olukorrale iga põllumajandusliku tegevusala puhul ja mis arvutatakse põllumajanduskultuuride kasvupinna, loomade arvu ning standardtoodangu koefitsientide alusel. Standardtoodang ei sisalda käibemaksu, muid toodetelt makstavaid makse ega otsetoetusi." (Statistics Estonia, 2014)

kasvamise tõenäosust (**IV**). See tulemus on kooskõlas ettevõtte üleandmise efekti põhimõttega, mille järgi ettevõtte ülevõtja nimetamine tugevdab praeguse juhi motivatsiooni investeeringute tegemiseks ja ettevõtte tulemuslikumaks juhtimiseks. Samas, kui nähakse ette tegevuse lõpetamist, siis optimeeritakse ettevõtte likvideerimisväärtust (Glauben jt, 2002; Väre, 2006; Calus ja Van Huylenbroeck, 2008; Calus jt, 2008). Lisaks sellele ilmnes, et nendes põllumajanduslikes majapidamistes, kus pereliikmete osatähtsus tööjõukasutusest oli suurem, oli tootmisest loobumise kavatsuste esinemise tõenäosus väiksem (**II**). Seega on peresuhetel oluline osa ka Eesti põllumajanduslike majapidamiste arengu ja jätkusuutlikkuse tagamisel.

Juhi tervis, mis on samuti seotud tema elutsükliga, mõjutab põllumajanduslike majapidamiste tegevuse lõpetamise tõenäosust. Juhid, kes hindasid oma tervislikku seisundit kehvemaks, väljendasid suurema tõenäosusega põllumajandustootmise lõpetamise kavatsust ja väiksema tõenäosusega tootmise jätkamise kavatsust. Samas ilmnes ka, et halb hinnang tervislikule seisundile suurendas ettevõtjate kavatsuste ja tegeliku käitumise lahknevust (**IV**).

Põllumajandustootmise lõpetamist või jätkamist mõjutab suurel määral põllumajandusliku majapidamise ja sealt saadava sissetuleku suurus. Suuremad põllumajanduslikud majapidamised kavatsesid ja ka tegelikult lõpetasid põllumajandustootmisega tegelemise väiksema tõenäosusega (**II**, **III, IV**). Esimesse kolme suuruskvartiili kuuluvate tootjate puhul oli ka tootmismahu vähenemise tõenäosus suurem kui neljandasse kvartiili kuuluvatel ettevõtetel (**III**). Iga 10 ha täiendavat põllumajandusmaad vähendas põllumajandustootmisega tegelemise tõenäosust 0,8% ja suurendas samavõrra tootmisega jätkamise tõenäosust (**IV**). Seda, et suuremad põllumajandusettevõtted jäävad suurema tõenäosusega püsima, on leidnud ka Glauben jt (2004) ning Breustedt ja Glauben (2007). Klasteranalüüsi tulemuste järgi iseloomustas suuremaid põllumajandustootjaid ka suurem orienteeritus turule, suurem spetsialiseerumine põllumajandustootmisele ja sagedasem investeeringutoetuste võimaluste kasutamine (**II**). Seega võib eeldada, et Eestis on suuremad põllumajanduslikud majapidamised olnud edukamad uute tehnoloogiate juurutamisel ja mastaabiefekti ärakasutamisel. Need kaks tegurit mõjutavad ettevõtete kohanemist strukturaalsete muutuste tehnoloogia mudeli järgi (Boehlje, 1990). Kuigi Buchenrieder jt (2009) leidsid, et väiketalude eeliseks võiks olla nende kiirem reageerimisvõime dünaamilises keskkonnas, ja Viira (2011) arvas, et on ebatõenäoline, et

väiketalud suudaksid konkureerida suurte põllumajandusettevõtetega piima ning teravilja masstootmises ja peaksid seetõttu spetsialiseeruma sellisele toodangule, mida suurtootjad ei paku, viitavad eespool toodud tulemused siiski sellele, et Eestis jätkub tõenäoliselt väiksemate põllumajanduslike majapidamiste tegevuse lõpetamise tendents ning tegutsema jäävate põllumajandustootjate keskmine suurus kasvab ka edaspidi.

Varasemates uuringutes on leitud, et põllumajandusliku majapidamise juhi töötamine lisaks oma ettevõttele ka väljaspool seda võib ettevõtte püsimajäämisele mõjuda nii soodsalt (Boehlje, 1990; Breustedt ja Glauben, 2007) kui ka ebasoodsalt (Weiss, 1999). Bojnec jt (2003) ja Buchenrieder (2005) leidsid, et osalise ajaga talupidamine võiks olla mudel, mis aitab säilitada väikseid peretalusid. Käesoleva töö tulemused näitasid, et ettevõtte juhi palgatööl käimine väljaspool ettevõtet suurendas põllumajandustootmisega tegelemise lõpetamise tõenäosust 13,4% (**III**, **IV**). Need tulemused on kooskõlas Weissi (1999) järeldustega ja viitavad sellele, et väljaspool ettevõtet palgatööst saadav sissetulek Eestis pigem asendab kui täiendab põllumajandustootmisest saadavat sissetulekut.

Oma põllumajandusmaa osaline väljarentimine suurendas põllumajandustootmise lõpetamise kavatsuste esinemise tõenäosust (**II**). Klasteranalüüsi tulemusena saadi kaks põllumajanduslike majapidamiste rühma, milles olevatest tootjatest 80–85% rentis osa oma põllumajandusmaast teistele tootjatele. Neis rühmades oli 69–80%-l tootjatest ka palgaline töökoht väljaspool oma ettevõtet. Võrreldes vastanute keskmisega olid need põllumajanduslikud majapidamised väiksemad. Seega võib põllumajandusmaa osalist väljarentimist seostada palgatööl käimisega ja need kaks nähtust omakorda on seotud väiketalude ebapiisava sissetulekuga põllumajandustootmisest.

Rendimaa suurem osakaal ettevõtte põllumajandusmaast suurendas nii põllumajandusmaa vähendamise kui laiendamise kavatsuste tõenäosust (**IV**). See tulemus võib olla põhjustatud asjaolust, et maad rentivad tootjad on hästi kursis oma rendilepingute peatse lõppemisega ja oskavad seetõttu ette näha maakasutuse vähenemist. Samuti on sellised tootjad ilmselt paremini kursis põllumajandusmaa renditurul toimuvaga ja neil on kogemusi maade rendile võtmisega. Seetõttu on neil suhteliselt parem positsioon maakasutuse laiendamiseks lisamaa rendile võtmise kaudu.

Elatustalude kohanemise toetus ja ebasoodsamates piirkondades asuvate põllumajandustootjate toetus, mis mõlemad nõuavad viieaastase tootmise jätkamise kohustuse võtmist (Estonian Ministry of Agriculture, 2005), vähendavad põllumajandustootmise lõpetamise ning suurendavad tootmise jätkamise tõenäosust (**III**, **IV**). Elatustalude kohanemise toetust saanud põllumajanduslike majapidamiste puhul oli tootmise lõpetamise tõenäosus 10,6% väiksem kui tootjatel, mis seda toetust ei saanud. Ebasoodsamatel aladel asuvate põllumajandustootjate toetus vähendas toetuse saajate tegevuse lõpetamise tõenäosust 10,5% ja suurendas tootmise jätkamise tõenäosust 7,8% võrreldes nendega, kes seda toetust ei saanud. Samal ajal ei olnud nende toetuste saajate puhul tootmismahu vähenemise ja suurenemise tõenäosus statistiliselt oluliselt erinev võrreldes tootjatega, kes neid toetusi ei saanud (**IV**). Seega, kuigi need toetused vähendavad (toetusega kaasneva kohustuse kehtimise ajaks) ettevõtete tegevuse lõpetamise tõenäosust, ei ole neil märkimisväärset mõju nende ettevõtete tootmismahu suurenemisele.

Haridustasemel on positiivne mõju põllumajandusliku majapidamise tootmismahu kasvamise tõenäosusele (**III**). See tulemus kinnitab inimkapitali positiivset mõju põllumajandusettevõtete tootmismahu kasvule, mis on kooskõlas ka varasemate uuringute tulemustega (Boehlje, 1990; Breustedt ja Glauben, 2007; Schnicke jt, 2008). Kui põllumajanduslike majapidamiste juhid hindasid oma teadmisi ja kogemusi kõrgemalt, siis vähenes tõenäosus, et nad kavatsesid põllumajandustootmise lõpetada, ja suurenes tõenäosus, et nad kavatsesid tootmist jätkata (**IV**). Seega on oluline, et järgmisel põllumajandustootjate põlvkonnal oleks hea ligipääs kvaliteetsele põllumajanduslikule kutse- ja kõrgharidusele ning teabe- ja nõuandeteenustele. Kõrgem teadmiste ja hariduse tase suurendab põllumajandusettevõtete tulemuslikkust ning elujõulisust.

Kariloomade kasvatamisele spetsialiseerunud põllumajanduslike majapidamiste[6] puhul oli põllumajandustootmise lõpetamise tõenäosus väiksem võrreldes teistesse tootmistüüpidesse kuuluvate tootjatega (**III**). See tulemus on kooskõlas Breustedti ja Glaubeni (2007) järeldusega, mille kohaselt loomakasvatusele spetsialiseerunud piirkondades oli ettevõtete põllumajandustootmise lõpetamise määr madalam. Loomakasvatusele spetsialiseerunud ettevõtete madalam lõpetamise määr võib olla

6 Antud määratlus lähtub Euroopa Komisjoni määrusest 1242/2008 (Commission Regulation (EC) No. 1242/2008), millega on kehtestatud EL põllumajandusettevõtete liigitus. Kariloomadele spersialiseerunud ettevõteteks peetakse piimatootmisele, veisekasvatusele, lamba- ja kitsekasvatusele spetsialiseerunud põllumajandustootjaid.

seotud loomakasvatushoonete ja -tehnoloogia immobiilsusega ning ka sellega, et ettevõtjatel on loomade kui elusolenditega suurem emotsionaalne side kui näiteks põllukultuuridega. Samas ilmnes, et taimekasvatusele spetsialiseerumine ei avaldanud statistiliselt olulist mõju põllumajandustootmisega jätkamisele või selle lõpetamisele ega tootmismahu kahanemisele või kasvule (**IV**).

Nendel põllumajandustootjatel, kes asusid tegutsema tagastatud põllumajandusmaa või talukoha baasil, oli tootmismahu kahanemise ja kasvamise tõenäosus väiksem kui neil tootjatel, kes hakkasid tegutsema teistel alustel (**III**). See toetab töö teist hüpoteesi: tagastatud talude ja/või põllumajandusmaa baasil asutatud ettevõtete juhid on võrreldes muul viisil asutatud ettevõtete juhtidega rohkem orienteeritud nende esivanemate loodud talude säilitamisele. Emotsionaalse sideme olemasolu esivanemate talumaadega on kinnitanud ka Hedin (2005) ning Grubbström ja Sooväli-Sepping (2012). Seega saab väita, et põllumajandus- ja maareformi valik tagastada põllumajandusmaad mõjutab põllumajanduslike majapidamiste strukturaalset kohanemist.

Võttes arvesse arutelu institutsionaalsete muutuste ja põllumajandussektori strukturaalse kohanemise seoste kohta, mõjutavad eespool käsitletud ettevõttespetsiifilised sotsiaal-majanduslikud tegurid põllumajandustootmisega jätkamise või lõpetamise ja põllumajandusliku majapidamise tootmismahu kahanemise või kasvu tõenäosust samamoodi nagu teistes lääneriikides. See kinnitab kolmanda hüpoteesi kehtivust.

Ka töö neljas hüpotees – põllumajanduslike majapidamiste juhtide kavatsused, mis puudutavad tootmise lõpetamist ja ettevõtte põllumajandusmaa pindala vähenemist, on tegeliku käitumise prognoosimiseks vähem usaldusväärsed kui kavatsused, mis puudutavad põllumajandustootmisega jätkamist ning põllumajandusmaa laiendamist – leidis kinnitust. Põllumajandustootmise jätkamise kavatsus suurendas tegeliku tootmisega jätkamise tõenäosust 33,4% ja põllumajandusmaa laiendamise kavatsus suurendas põllumajandusmaa pindala tegeliku kasvu tõenäosust 37,0%. Põllumajandustootmise lõpetamise kavatsused ei avaldanud statistiliselt olulist mõju tootmise tegeliku lõpetamise tõenäosusele. Põllumajandusmaa vähendamise kavatsus suurendas põllumajandusmaa tegeliku kahanemise tõenäosust 28,1%. Tootmise lõpetamist ja põllumajandusmaa vähendamist puudutavates mudelites (a) ning (c) oli kahe võrrandi vealiikmete vahelist korreleeritust näitav tegur ρ statistiliselt ebaoluline, samal ajal kui tootmise jätkamist ja

põllumajandusmaa laiendamist puudutavate mudelite (b) ja (d) puhul oli ρ statistiliselt oluline. Viimane asjaolu viitab aga sellele, et nende mudelite puhul on kavatsused ja tegelik käitumine mõjutatud samadest arvesse võtmata teguritest. See kinnitab omakorda kavatsuste ja tegeliku käitumise omavahelist positiivset seost tootmise jätkamise ning põllumajandusmaa laiendamise otsuste puhul. Need tulemused kinnitavad, et kui vaadeldaval otsusel on negatiivne kontekst (ettevõtte tegevuse lõpetamine, tootmismahu vähendamine), siis on kavatsused tegeliku käitumise prognoosimisel nõrgema ennustusjõuga kui positiivse kontekstiga otsuste puhul (tegevuse jätkamine, tootmismahu kasv) (**IV**).

Ka põllumajandusliku majapidamise sotsiaal-majanduslikud tegurid mõjutavad kavatsuste ja tegeliku käitumise lahknemist. Põllumajandustootmise jätkamise ning põllumajandusmaa laiendamise osas oli vanemate ettevõtte juhtide puhul kavatsuste ja tegeliku käitumise vahelised lahknevused suuremad. Ka Glauben jt (2002) ning Väre jt (2010) jõudsid järeldusele, et vanemate ettevõtjate puhul on kavatsuste ja tegeliku käitumise vahel suurem lahknevus. Põllumajandustootmise lõpetamist ja põllumajandusmaa vähenemist puudutavate otsuste puhul aga ettevõtja vanus kavatsuste ning tegeliku käitumise lahknevust ei mõjutanud. Ka kehv tervislik seisund suurendas põllumajandustootmise jätkamist puudutava küsimuse puhul kavatsuste ja tegeliku käitumise lahknemise tõenäosust (**IV**).

Glauben jt (2002) ning Calus jt (2008) leidsid, et ettevõtte üleandmise efekt hakkab mõjutama põllumajanduslike majapidamiste arengut siis, kui ettevõtte juht saab 45-aastaseks. Tööst selgus, et tootmise üleandmiseks sobivate järeltulijate olemasolule antud positiivsem hinnang vähendas tootmise jätkamise ning põllumajandusmaa laiendamise küsimuste puhul kavatsuste ja tegeliku käitumise lahknemist. Põllumajandusmaa vähenemise küsimuse osas aga kaasnes positiivse hinnanguga kavatsuste ja tegeliku käitumise suurem lahknemine. Viimane asjaolu võib olla seotud sellega, et põllumajandusliku majapidamise juht ei pruukinud oma kavatsuste väljendamise ajal olla teadlik võimaliku ülevõtja tegelikest kavatsustest. See aga kinnitab Väre jt (2010) järeldust, et tootmise üleandmisega seotud küsimuste puhul on oluline uurida nii põllumajandusliku majapidamise juhi kui ka tema järeltulijate ja teiste pere liikmete kavatsusi (**IV**).

Põllumajandustootmise jätkamise küsimuse puhul oli väiksemate põllumajanduslike majapidamiste juhtide puhul kavatsuste ja tegeliku

käitumise lahknemine suurem. See viitab asjaolule, et väiksemate tootjate hulgas on ebakindlus oma ettevõtte tulevikuperspektiivi osas suurem (**IV**). Seega, väiksemate põllumajanduslike majapidamiste jätkusuutlikkuse tugevdamiseks peaks põllumajanduspoliitika pöörama enam tähelepanu sellistele meetmetele, mis aitavad suurendada väiketootjate sissetulekut. Seda saab teha kas väiketootjate tootmissuundade muutmise, ettevõtteväliste palgatööl käimise võimaluste parandamise, või väiketootjate tootmismahu kasvatamise teel. Samas tuleks aga arvesse võtta ka seda, et palgatööl käimine suurendas käesoleva töö tulemuste järgi põllumajandustootmise lõpetamise tõenäosust. Ka palgatööl käivate ettevõtjate põllumajandustootmisega jätkamise ning põllumajandusmaa laiendamise kavatsused ja tegelik käitumine lahknes enam kui neil tootjatel, kes palgatööl ei käinud (**IV**).

Nende põllumajanduslike majapidamiste juhtide puhul, kes hindasid oma teadmisi ja kogemusi paremaks, lahknes tegelik käitumine kavatsustest vähem (**IV**). Sellest võib järeldada, et ka hästitoimival ning kättesaadaval õppe- ja nõuandesüsteemil on kindel osa põllumajandussektori arengus. Tootjaorganisatsioonide liikmeks olevad põllumajanduslike majapidamiste juhid kavatsesid teistest suurema tõenäosusega põllumajandustootmist lõpetada (**IV**). See tulemus ei vastanud ootustele, mille järgi suurem inim- ja sotsiaalne kapital peaks kaasa aitama põllumajandusettevõtete arengule, mitte nende tegevuse lõpetamisele. Antud tulemus võib olla mõjutatud sellest, et 2007. aastal läbiviidud küsitlusega uuriti ka ettevõtjate arvamust ÜPP võimalike edasiste reformivalikute osas. Bergés ja Chambolle (2009) leidsid, et põllumajandustootjad võivad kasutada „ähvardust tootmine lõpetada" selleks, et suurendada enda mõjuvõimu erinevatel läbirääkimistel. Kuna tootjaorganisatsioonidesse kuulumine ei mõjutanud oluliselt tegelikku põllumajandustootmise lõpetamise tõenäosust (**IV**), siis võib antud tulemuste puhul oletada, et need tootjad võisid niimoodi vastates püüda mõjutada ÜPP edasiste arengute alast arutelu.

Ebasoodsamates piirkondades asuvate põllumajandustootjate toetuse saamine vähendas põllumajandustootmise lõpetamise küsimuse puhul kavatsuste ja tegeliku käitumise lahknemise tõenäosust. See on arvatavasti seotud selle toetuse raames võetud 5-aastase tootmise jätkamise kohustusega. Võib eeldada, et kohustust võttes on põllumajanduslike majapidamiste juhid tegeliku jätkamise või lõpetamise võimalused põhjalikult läbi kaalunud, mistõttu on tegelik käitumine kavatsustega suuremas kooskõlas (**IV**).

Samuti selgus, et põllumajandusmaa vähenemise ja suurenemise küsimustes oli nende põllumajanduslike majapidamiste puhul, kelle maakasutusest moodustasid suurema osa rendimaad, kavatsuste ja tegeliku käitumise vaheline kooskõla suurem. Seda tulemust ümber pöörates saab väita, et nende tootjate puhul, kelle maakasutusest moodustavad rendimaad väikese osa, oli maakasutuse muutust puudutavate kavatsuste ja tegeliku käitumise vahel lahknemine tõenäolisem. Mõlemal juhul saab teha järelduse, et tootjad, kes rendivad suurema osa oma maast, on maaturul toimuvaga paremini kursis, mistõttu nad oskavad ka paremini prognoosida oma ettevõtte maakasutuse muutumist (**IV**).

Edasist uurimist vajavad probleemid

Eestis on välja kujunenud duaalne põllumajandustootjate struktuur, kus väiketootjad eksisteerivad kõrvuti suurtootjatega. Paljud suuremad põllumajandusettevõtted on ühendatud suurematesse ettevõtete rühmadesse, mille omanikeks on ka põllumajandusega mitteseotud investorid. Võib eeldada, et põllumajanduslike majapidamiste juhtide põlvkonnavahetuse käigus see nähtus süveneb. Seega saab oletada, et põllumajandusettevõtte juhtimine ning sotsiaal-majanduslikud tegurid hakkavad väike- ja suurtootjate puhul üha enam erinema. Seega hakkavad väikeste ja suurte ettevõtete vahel üha enam erinema ka ettevõtete kasvu, kahanemise ja tegevuse lõpetamise mustrid. Need muutused vajaksid edasist uurimist.

PRIA andmebaasid sisaldavad alates 2004. aastast kõigi toetust saanud põllumajandusettevõtete maakasutust, loomade arvu, viljeldavate põllukultuuride pindalasid jms. Selle ulatusliku andmestiku põhjal on põllumajandusettevõtete strukturaalsete muutuste uurimiseks võimalik kasutada ka teisi meetodeid. Üheks võimaluseks on Markovi ahela kasutamine, mille abil on võimalik leida, millise tõenäosusega teatud tootmistüüpi või suurusjärku kuuluv ettevõtte areneb teatud suundades. Antud lähenemine võimaldaks uurida ka erinevate toetuste osa põllumajandusettevõtete strukturaalse kohanemise protsessis.

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I

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20 years of transition – institutional reforms and the adaptation of production in Estonian agriculture

20 Jahre Transformation – institutionelle Reformen und Anpassung der landwirtschaftlichen Produktion in Estland

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Abstract

This article provides an overview of the most important reforms, their background, and corresponding changes in Estonian agriculture during the transition period from 1988-2008. The past two decades have been divided into three sub-periods to outline differences in dynamics and the direction of changes in agriculture. From 1988-1995, the main reforms were implemented and agricultural production decreased rapidly. From 1995-2001, the decline stabilised and nonviable farms exited the sector. From 2001 onwards, the positive effects of the EU pre-accession period and EU membership can be observed.

Key words

transition; institutional reforms; EU enlargement; Estonian agriculture

Zusammenfassung

Das Ziel des vorliegenden Artikels ist es, einen Überblick über die wichtigsten Veränderungen in der estnischen Landwirtschaft im Transformationszeitraum 1988-2008 zu geben. In den letzten zwei Jahrzehnten gab es drei Entwicklungsperioden. 1988-1995 wurden die wichtigsten Reformen durchgeführt, und die landwirtschaftliche Produktion ist stark gesunken. 1995-2001 hat sich der Rückgang stabilisiert, der Sektor war teilweise nicht lebensfähig, und private Betriebe haben den Sektor verlassen. Seit 2001 kann man die positiven Auswirkungen des EU-Beitritts auf die Landwirtschaft beobachten.

Schlüsselwörter

Transformation; institutionelle Reformen; EU-Erweiterung; estnische Landwirtschaft

1. Introduction

Since the Republic of Estonia regained its independence in 1991, major reforms have been implemented in all spheres of governance and economy. Reforms in the agricultural sector, however, began at the end of 1980s when the start-up of private farms was legalised. From 1990-1992 land, proprietorship, and agricultural reforms were initiated. These reforms were aimed at reorganising the agricultural sector into private farms and restituting land that was nationalised during the Soviet era. In the 1990s, Estonia applied an extremely liberal economic policy without trade barriers on food and agricultural commodities. In 1996, the decision to attain European Union (EU) membership was taken. Since then, Estonian legislation, together with agricultural policy, has been consistently harmonised with EU laws and policies. The pace of harmonisation accelerated from 2001-2004 and from 1 May 2004, together with nine other CEECs (EU-10), Estonia became a member of the EU. However, the harmonisation of agricultural policy within the current EU-27 is ongoing. The main differences in Common Agricultural Policy (CAP) application between the old and new member states are related to direct payment schemes, and notable differences in subsidy levels. Therefore, the transition of agricultural sectors of the EU-12 will continue during the upcoming EU budget period of 2014-2020, i.e., for 10 more years.

Therefore, the aim of this paper is to present an overview of the institutional reforms since the end of 1980s, whilst comparatively following the changes in structures, production volumes, productivity, and trade patterns in the Estonian agricultural sector. Interrelations of the reforms and performance of the agricultural sector are discussed. The period of 1988-2008 is divided into three sub-periods to display the differences in dynamics and the direction of changes in these sub-periods. The first phase of transition was from 1988-1995, when major reforms were initiated and previous production relationships collapsed. From 1995-2001, a reorganised and privatised agricultural sector adapted to the new institutions and markets. From 2001 onwards, the impact of the impending EU accession could be detected. This article is organised as follows – major reforms and developments in agriculture are reviewed in the second section. Changes in the performance of agriculture are examined in the third section. The causal relationships between the reforms and the development of agriculture are discussed throughout the article. In the fourth section, principal conclusions are drawn.

2. Institutional reforms and agricultural policy

2.1 Pre-transition period

At the end of 1980s, Estonian agriculture was one of the most developed in the Soviet Union (USSR) (UINT et al., 2005). The agricultural sector specialised in livestock and dairy production, which was mainly exported to the cities of the Russian SSR, notably Leningrad (St. Petersburg) only some 300 km away from Estonia (WALTER-JORGENSEN and LUND, 1997; TOMSON, 1999; SILBERG, 2001; UNWIN, 1997: 97). Estonia was the highest per capita producer of milk and meat in the USSR, exceeding even EU and USA averages (see table 1). In the USSR, the average Estonian milk yield was the highest and cereal yields were second after the Moldavian SSR. While milk yield was comparable to the EU level in 1985, cereal yields lagged behind both EU and USA averages. High productivity and increasing production resulted in a rising level of wages. Estonian collective farm workers had higher average wages than workers in other USSR states (74% higher than the USSR average).

Table 1. Agricultural productivity characteristics in selected states of the USSR, EU and USA in 1985

	Average milk yield, kg/cow	Milk production per capita, kg	Meat production per capita, kg	Weighted average yield of cereals in 1981-1985, hkg/ha	Average monthly wage in kolkhozes in 1986, rubles
Estonian SSR	3 966	817.1	140.1	26.1	284
Latvian SSR	3 362	746.4	123.6	21.5	223
Lithuanian SSR	3 444	825.1	139.9	23.6	197
Ukrainian SSR	2 601	451.8	76.8	24.3	148
Russian SSR	2 347	348.2	59.1	14.0	180
USSR in total	2 451	353.7	61.4	14.9	163
EU*	3 986	402.3	89.6	47.7	-
USA*	5 913	267.1	106.3	42.9	-

* Data for EU and USA was obtained from FAOSTAT (2009).

Source: STATISTICAL YEARBOOK (1986)

A remarkable part of the infrastructure in rural areas was funded from agricultural income (EMA, 2005: 32). Also, collective farms provided a variety of agricultural and non-agricultural services to rural residents (SILBERG, 2001; RAAGMAA, 2002; KALMI, 2003).

2.2 Changes from 1988-1995

Reforms in Estonian agriculture began in 1988, when regulations were adopted for the allocation of the marginal land of collective farms to private farms, as well as the selling of agricultural machinery to private farms (EMA, 2002). The Farm Law of 1989 envisaged the establishment of hereditary (based on the pre-collectivisation farms) and new tenant farms (on rented land) (MAIDE, 1995).

In 1991, the principles of the Ownership Reform Act were adopted. The main goals were the reorganisation of pecuniary circumstances in order to guarantee intact proprietorship and free business activity, the redemption of injustice, and the foundation of preconditions for the restitution or compensation of former proprietors or their heirs.

Land and agricultural reforms were the two major reforms that aimed to transform Estonian agriculture and society from a planned economy to a capitalist market economy (ALANEN, 1999; SARRIS et al., 1999). The Estonian Land Reform Act was adopted in 1991. In the CEECs, land reform involved two separate issues: the legal demands of pre-collectivisation landowners ('historical justice'), and social equity concerns (SWINNEN, 1999: 638). In order to address those issues, the goal of the land reform was to return land to its lawful owners. The reform also enacted the privatisation of land by pre-emptive rights (for people whose buildings were located on land subject to privatisation) or on general grounds (for rural inhabitants in the vicinity of their homes) (EMA, 2002).

Initially, the main focus of land reform was on restitution, and the first returned cadastral units were registered in 1993. The land reform process intensified from 1996 onward, and the privatisation of free agricultural and forestlands began in 1999 (EMA, 2005). The process progressed slowly because of complex legal and administrative issues. By the end of 1996, around 12% of land had been registered in the land cadastre; this number rose to 51% by the end of 1999, 78% by the end of 2004, and by March 2009, 84% of land had been registered (ELB, 2009). About 40% of that land is restituted; 35% is state-owned with 0.7% in municipal ownership; 19% is privatised or bought; and around 6% is free agricultural or forestland.

The Land Reform Act was amended more than 30 times in the 10 years following its adoption. Slow land reform hindered the development of agriculture due to uncertain property relations. Part of the problem was that neither the complexity of the land reform nor the conflicts had been foreseen (ULAS, 2006). Another issue arose from the restitution of land according to the pre-war farm boundaries. The average size of a farm was 22.7 hectares in 1939, of which only 7.9 hectares were arable land (VIRMA, 2004: 188). Restitution resulted in even more fragmented land ownership, since land was typically apportioned to several heirs (ALANEN, 1999: 440). Hence, the resulting farmland units were usually too small to be economically viable. The fragmentation of agricultural land was also a problem in Latvia and Lithuania (DAVIS, 1997).

The Agricultural Reform Act of 1992 formed the basis for the liquidation of collective farms and the establishment of new farms and agricultural enterprises (EMA, 2002). The aims of agricultural reform were to return assets and compensation to the lawful pre-World War II owners, but also to privatise the assets of collective farms (production plants, livestock, machinery, etc.). For both land and ownership reforms, agricultural reform became a complicated and contradictory process that led to much dispute.

The implementation of agricultural reform was decentralised. Reform plans were made at the local level and required the approval of both the members and employees of collective farms (ALANEN 1999: 441-442). Each collective farm established a local reform committee with an equal number of representatives from the collective farm, the local municipality and private farms. The committee formulated the content of a reform plan (MAIDE, 1995). The plan was approved by the municipal council and the legitimacy of transfers of various assets was confirmed by a lawyer. In the majority of cases, however, power remained firmly in the hands of the collective farm leadership (ALANEN, 1999).

All workers and members of the collective farms were entitled to ownership of its assets. Privatisation was usually performed through an auction, where one could pay with either privatisation vouchers, which had been distributed to collective farm members according to individual 'work shares' (based on workdays and salary), or with compensation vouchers, which were issued for the compensation of

property that had not been returned to former owners or heirs (ALANEN, 1999: 442).

The reform did not insist upon the liquidation of collective farms, but rather their liquidation as legal entities and reorganisation as market economy enterprises. The exact nature of the reorganisation and privatisation, and whether technological units remained intact and functional depended on the local reform plan and the committee. Usually the local reform committee and public opinion was inclined towards liquidation (KAUBI, 1999). TAMM (2001: 434) assesses that 2-3% of large-scale farms remained undivided. Several of Central Estonia's richest and largest collective farms were reorganised into partnerships which today remain among the largest agricultural enterprises in Estonia.

By the deadline of agricultural reform at the end of 1996, 361 former collective farms had been transformed into 710 cooperatives, 600 partnerships, 1,411 joint-stock companies and 13,513 private farms (TAMM, 2001: 435). While property reform, restitution and privatisation were nearly completed (EMA, 2003) by 1996, land reform was still progressing slowly.

The privatisation of land has been considered the least successful part of the reforms (JEFFRIES, 2004); the lack of connection between land and agricultural reforms is identified as one of the largest problems (IVASK, 1997; ALANEN, 1999; TAMM, 2001). The procedure of returning land was so complicated that it remained far behind the separation of assets (ALANEN, 1999: 442). Reforms created conflicts of interest between the owners of the production assets of limited companies, farms and the applicants for land restitution who had the right to restore their land to its previous boundaries (EMA, 2003: 51). The problem was that privatised producers could no longer continue the tenure of former collective farmland (TAMM, 2001). Uncertainties about land use rights hindered the development of agriculture by increasing the risk of investments and complicating credit opportunities, as agricultural enterprises lacked collateral in the form of land property (EMA, 2003).

New farms lacked the necessary equipment and financial capital (TAMM, 2001; SIRENDI, 2009; JULLINEN, 1997). The farmers who had privatised machinery from former collective farms had technology that had been designed for 1,200-1,500 hectare farms, and therefore was unsuitable for small farms (EMA, 2003). Many entrepreneurial, rural people migrated to towns and the adaption to the new economic situation in the agricultural sector during the 1990s was slow (IVASK, 1997). Quite often, new owners of land or production means did not have prior experience in or knowledge of farm management (UINT et al., 2005; SIRENDI, 2009), nor did they have an interest in continuing production; therefore, they sold the assets. JÖRGENSEN and STJERNSTRÖM (2008: 96) have pointed out that well-defined and secure property relations were not established at the same pace, as new owners began exploiting their land and forests. It is estimated that ¾ of returned and compensated assets left the agricultural sector in 1990s (EMA, 2003).

In 1991, the seemingly unlimited market for agricultural output disappeared with the collapse of the USSR (ALANEN, 1999; REILJAN, 2000). The inflation caused by the rapid deregulation of the market and the subsequent decline in consumer demand reduced demand for domestic foodstuff (ALANEN, 1999). From 1991-1994, the prices of inputs increased 17.5 times, while producer prices of agricultural products increased 11.5 times. Food retail prices increased 28.9 times after USSR consumer subsidies were terminated (OECD, 1996: 47). Therefore, the terms of trade for agricultural producers deteriorated and consumers were faced with much higher food prices. In 1992, all subsidies were terminated and prices liberalised. The OECD (1996) calculations on the percentage of producer support estimates (PSE) illustrate the drastic change from 1991-1992 (see table 2).

Table 2. PSE estimates in Estonia, EU, USA, Finland, Sweden in 1986-1994

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Estonia	75	76	77	77	70	58	-76	-24	-4
EU-12	50	49	46	41	47	48	47	49	49
USA	35	32	23	20	23	22	22	23	20
Finland	65	69	70	68	71	72	66	64	69
Sweden	57	57	52	51	58	63	58	54	51

Source: OECD (1996)

The determination to follow a liberal economic policy resulted in a considerable inflow of foreign direct investment and a rapid transformation of the economy, but it had painful costs for the agrarian sector and, subsequently, rural development (UNWIN, 1998: 293). A liberal trade regime provided a competitive advantage to subsidised imports, which in turn caused a decline in agricultural prices during 1992-1994 by an average of ⅓ compared with the world markets (EMA, 2003). Agricultural producers had to compete with cheap foreign imports, yet foreign markets were protected with high trade barriers (LEETSAR, 1996; UNWIN, 1997; MAIDE, 1995).

The economic situation for farms and agricultural enterprises had not notably improved by the time the first aid schemes (income tax exemptions, and compensation of loan interest payments) were introduced in 1993. Also, the first programmes for agricultural and rural development were initiated in 1993 (EMA, 1999; JURJEV, 2003).

2.3 Changes from 1995-2001

In 1995, Estonia became a net importer of agricultural products. Although farmers demanded restrictions on imports, more subsidies, and solutions to the lagging land reform, their calls were not answered. Restrictions on food imports set by the Agricultural Market Regulation Act in 1995 were largely declarative and had no regulative effects (EMA, 2003). Many farms were not viable due to uneven conditions stemming from the competitive advantage of imported produce (MARRANDI, 2002).

However, together with Estonia's general development, the focus on agricultural policy increased. In 1996 and 1997, a fuel excise tax exemption and capital (investment) support were adopted. In 1998, compensation for loss of income due to unfavourable natural conditions was paid for the first time and direct payments for cereal and dairy producers were also implemented (EMA, 1999). In 1999, the scope

of direct payments was extended to raising calves, sheep, small-scale livestock and swine breeding herds. Aid schemes for young farmers, the start-up of mutual loan associations and crop insurance were also established. After establishing the legal framework from 1996-1998, import duties were established for the first time in 1999, together with the import licensing of agricultural and food products. At the same time, the border control for agricultural and food products was improved and programmes for monitoring food quality were initiated (EMA, 1999). Another setback for Estonian agriculture was the fallout from the 1998 financial and economic crisis in the world, and particularly in Russia.

At the end of the 1990s, Estonian agricultural policy began to be shaped by the goal of EU accession. In 1995, Estonia ratified the Europe Agreement and accepted the politics, purposes and measures of the Community. In 1997, pre-accession negotiations began. The first action plan towards joining the EU was adopted in 1996. A more profound "third" action plan for EU accession was approved in 1998. That plan also covered the need to harmonise legislation and policies, as well as establish administrative capabilities. In 1999, the Phare Special Preparatory Programme was launched, which laid the groundwork for the implementation of the Special Accession Programme for Agriculture and Rural Development (SAPARD) (EMA, 1999).

2.4 Changes from 2001-2008

The third phase of transition and developments in agricultural policy encompasses the characterised processes and impacts of EU pre-accession and EU membership. From 2001-2004, SAPARD payments amounted to 67.9 million EUR and ¾ of all the programme funds were used for investments in agricultural holdings, as well as processing agricultural and fishery products. The programme had a considerable impact on the establishment of the administration for the implementation of the CAP. The programme also contributed to the reduction of several bottlenecks in Estonian agriculture and the food industry through investments (EMA, 2007).

In 2003, a national milk quota was established as a transition instrument prior to EU accession. Since accession in 2004, Estonia has applied the CAP with exceptions that were made for new member states. The main differences from the EU-15 were that direct payments were implemented under the simplified area payments scheme (with gradually increasing subsidy levels) and the Rural Development Programme was only established for three years, i.e., 2004-2006. Market regulation mechanisms were implemented as in the EU-15. In 2007, the 2007-2013 Rural Development Programme was launched and by 2013 direct payment levels in EU-12 should reach the levels that the EU-15 member states had on 30th April 2004.

Since 2001, the upheaval in agricultural development can be associated with the implementation effects of programmes preceding EU accession (LÕO, 2005: 125). The opening of the EU market increased trade in all sectors of the economy. The growth of exports increased the demand for domestic raw materials, which had positive effects on producer prices and sales volume. However, the rising cost of agricultural raw materials and means of production resulted in increased production costs (UINT et al., 2005).

3. The performance of the agricultural sector during transition

3.1 Land use and arable production

During the reforms, agricultural land use declined significantly. From 1990-2008 the sown area of field crops declined by 322.9 thousand hectares (28.9%) (see table 3). The steepest decline occurred during the first sub-period (1990-1995). Of a total decrease in sown areas, the first 5-year period accounts for 82.3%. This period corresponds with the fundamental land, proprietorship and agricultural reforms and the disbandment of collective farms. As discussed in Section 2, the main reasons for excluding land from agricultural use relate to unclear landed property relations and the incapability and unwillingness of new landowners to begin agricultural production. At the same time, the steep decline in consumer demand, the loss of the export market to former USSR states and deteriorated terms of trade constituted a shock that led to a drastic decline in agricultural supply. From 1995-2001, the sown area declined by 12.8 thousand ha (1.5%) compared with 1995 and from 2001-2008 by 44.5 thousand ha (5.3%) compared to

Table 3. Sown area of field crops in 1990, 1995, 2001 and 2008

	1990, thousand ha	1995, thousand ha	Average annual change 1990-1995	2001, thousand ha	Average annual change 1995-2001	2008*, thousand ha	Average annual change 2001-2008
Cereals and legumes	397.1	308.0	-4.3%	277.8	-2.1%	313.9	1.8%
.. Barley	263.7	186.5	-5.9%	134.3	-6.8%	136.7	0.3%
.. Wheat	26.0	38.6	6.8%	59.6	9.1%	107.1	8.7%
.. Oats	33.4	38.5	2.4%	48.1	4.6%	34.3	-4.9%
.. Rye	65.9	32.0	-12.8%	20.9	-8.9%	21.4	0.3%
Industrial crops	3.2	7.3	14.7%	28.3	31.1%	78.5	15.7%
Vegetables and greens	5.2	4.6	-2.1%	3.3	-6.9%	2.4	-4.7%
Potatoes	45.5	36.9	-3.6%	22.1	-10.8%	8.7	-14.2%
Forage crops	665.3	493.9	-5.1%	506.4	0.5%	389.9	-3.8%
Total	1 116.3	850.7	-4.6%	837.9	-0.3%	793.4	-0.8%

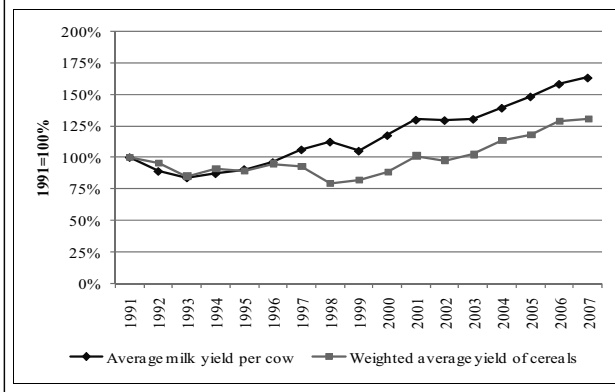
* Data from 2008 is preliminary.

Source: SOE (1998, 2002, 2006)

2001. However, the decline in agricultural land use should not only be associated with reforms. The abandonment of agricultural land has been more extensive in regions with low fertility soils (ASTOVER et al., 2006). Consequently, agricultural production from the lower fertility of previous collective farm soils was not competitive in the newly-introduced free market economy conditions.

During transition there have been changes in crop preferences, with potatoes declining the most (80.9%) (see table 3). A large decline has also taken place in vegetables and greens (53.8%), and forage crop production (41.4%). The decline in the area of cereals and legumes has been smaller than the average (21.0%). From 1990-2008, rapeseed has gained significant importance. The area of sown land for rapeseed has increased to 77.7 thousand ha, accounting for 9.8% of the total sown area (up from 0% in 1990).

Figure 1. Milk and cereals yield dynamics in 1991-2007



Source: SOE (2009)

The relative importance of certain cereal crops has also changed. The proportion of barley in the total sown area has decreased from 66.3% to 35.3% and the share of wheat has increased from 6.5% to 27.7%. An increase in the share of wheat can be explained by the average 14% premium in producer prices and 16% higher yields in comparison to barley (SOE, various issues). A decline in the relative importance of barley can also be explained by a decline in animal herds. Demand for barley as a feed grain has decreased significantly. Considering the transition from planned to market economy, we can also assume that the crop preferences prior to transition were not decided purely by economic reasoning.

A reduction in cereal production due to a decline in sown areas has been partly offset by increasing yields. The three-year weighted moving average yield of cereal crops was 2,633 hkg/ha in 2007, which is 30.7% higher than the corresponding figure in 1991 (see figure 1). However, the average yield from 1981-1985 was 26.1 kg/ha (see table 1), indicating a strong decline in cereal yields during transition. The three-year average cereal production in 2007 accounted for 94.6% of the 1991 level, suggesting that cereal production is approaching its pre-transition volume. Production figures were lowest in 1998, accounting for 65.3% of 1991 production levels. From 1998 onwards, yields have been increasing at a 5.7% per annum average. Improving productivity can partly be associated with direct payments introduced from 1998. Farmers had more funds to buy inputs (fertilisers and pesticides) for arable production. After EU accession (2003-2007), average yields have increased by 27.6% (6.3% per annum). A higher rate of yield increases since EU accession could be associated yet again with higher direct payments, which have enabled farmers to use more and better quality inputs. Also, land use relations are more defined, with 84% of the land registered in cadastre. Investment aid schemes applied since 2001 have allowed farmers to invest significantly (compared to 1990-2001) in up-to-date technology.

3.2 Animal production

In the USSR, Estonia was specialised in animal and dairy production. After the collapse of the USSR, animal production fell proportionately more than arable production (see table 4). From 1990-1995 the number of sheep and goats declined by 64.4%. The decline in dairy herds has been more steady compared to other herd classes. From 1990-1995 the number of dairy cows decreased by 34.0% (8.6% per annum). The average annual decline was steepest from 1990-1995. Between 2001 and 2008 one can see signs of recovery in pig, sheep and goat herds. The size of the pig herd increased by 5.5% (0.8% per annum), while sheep and goat herds have increased by 159.3% (12.7% per annum). An increase in sheep and goat herds could partly be explained by the establishment of direct payments for raising sheep and goats from 1999, but also by the low starting point in 1998.

Table 4. Size of animal herds in 1990, 1995, 2001 and 2008

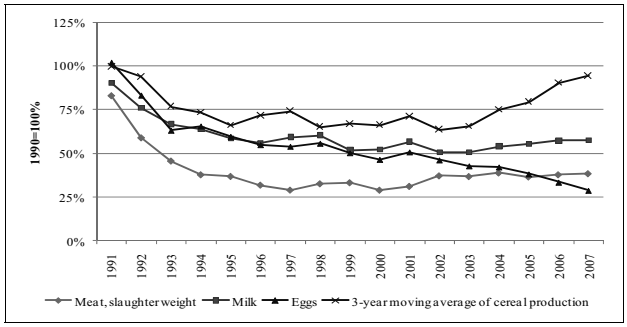
	1990, thousands	1995, thousands	Average annual change, 1990-1995	2001, thousands	Average annual change, 1995-2001	2008*, thousands	Average annual change, 2001-2008
Cattle	757.8	370.4	-15.4%	260.5	-6.0%	238.2	-1.3%
Dairy cows	280.7	185.4	-8.6%	128.6	-6.3%	100.5	-3.6%
Pigs	859.9	448.8	-13.9%	345	-4.5%	364.0	0.8%
Sheep and goats	139.8	49.8	-22.9%	32.4	-7.4%	84.0	12.7%
Poultry	6 536.5	2 911.3	-17.6%	2 294.9	-4.0%	1 743.3	-4.0%

* Data from 2008 is preliminary.

Source: SOE (1998, 2002, 2006)

In livestock production, there has not been a recovery similar in volume to that of cereal production (see figure 2). In 1991, 1,092.8 thousand tonnes of milk were produced. In 2007, the production volume accounted for just 57.3% of 1991 levels. There has been a slight increase in meat production since 2000 but in 2007 meat production accounted for 38.6% of the 1991 level. Egg production is still declining, and 2007 production accounted for 28.8% of the 1991 production level.

Figure 2. Changes in animal and cereal production in 1990-2007, 1990=100%



Source: SOE (2009)

On the other hand, productivity has increased more in livestock than in crop production. The average yield of dairy cows has steadily increased since 1993 (see figure 1). From 1991-1993 there was a 16.3% decline in average milk yield. From 1993-2007, the average yield of dairy cows increased by 95.2% at an average annual rate of 4.9%. In 2007, the average milk yield was 6,484 kg/cow (SOE), while the EU average was 6,013 kg/cow (FAOSTAT, 2009).

3.3 Structural changes

Breaking up the collective farms caused a shock in Estonian farming structures. Resources and production facilities that had been previously concentrated in large holdings were now scattered among relatively small private farms. The establishment of private farms began in 1989. By the end of 1989, 828 private farms were established with an average area of 25 ha (see table 5) (VIRMA, 2004).

From 1989-2000 the number of private farms increased rapidly. The number of agricultural enterprises increased from 1990-1993 mainly due to privatisation and the break up of collective farms. From 1993-1999, the number of agricultural enterprises was declining due to the liquidation of non-competitive agricultural enterprises (former collective farms). From 2000-2007, the number of legal persons in the agricultural sector increased. These were mainly private farms reorganised as private limited companies (limited liability instead of full liability of the owner in the case of natural persons). From 2000-2007 there was a sharp decline in the number of farms owned by natural persons, but this is mainly due to how farms are registered. Natural persons initially registered as farms have unregistered themselves because they are not selling agricultural produce. According to SOE, there were 7,302 agricultural producer holdings whose economic size was at least 2 ESU (European Size Units) in 2007. With reservations, these holdings could be counted as acting commercial farmers in Estonia.

Farms established from 1989-1992 received support from the government and collective farms in the form of subsidised inputs and services (ALANEN, 2004; OECD, 1996). This encouraged people to establish small family farms and also stimulated naïve expectations about the viability of small farms in the market economy (TAMM, 2001: 415). KELAM (1993: 39) shows that the main motives for establishing farms were the possibility of working according to one's desire and the wish to return to a traditional lifestyle. New farmers were optimistic about the future and considered the economic situation favourable. However, by 1992, the economic situation of farmers had considerably worsened (KELAM, 1993: 44).

Table 5. Number of collective farms, agricultural enterprises, private farms, natural persons and legal persons*

	Collective farms		Agricultural enterprises	Private farms		Natural persons		Legal persons	
Year	Number	Average area, ha	Number	Number	Average area, ha	Number	Average area, ha	Number	Average area, ha
1985	302	8 369		17	0				
1989	326	7 628		828	25				
1991			396	7 029	25				
1993			1 013	10 153	25				
1995			873	19 767	21				
1997			803	34 671	22				
1999			680	51 081	21				
2001						54 895	9.9	853	384.3
2003						36 076	12.9	783	419.8
2005						26 868	17.2	879	418.0
2007						21 889	21.5	1 447	302.1

* Until 2001, the official statistical units were agricultural enterprises and private farms. Since 2001, the official statistics use concepts of agricultural holdings, which are classified into natural persons and legal persons.

Sources: VIRMA (2004); SOE (1999); SOE (2009)

Table 6. The structure of dairy herds 1990-2008

	Herd size classes, number of dairy cows per heard							
	1…10	11...50	51...100	101...300	301...600	601...900	901...1,200	>1,200
1990				24	107	114	54	34
1992				99	158	83	27	16
1993	2 815	291	161	342	120	27	6	5
1995	2 128	291	127	278	74	14	5	3
1999	1 832	682	116	188	60	12	4	3
2003	1 727	637	103	164	60	13	4	4
2007	489	465	100	135	63	17	4	3

Source: EARC (2009)

The structural break in the dairy sector is perhaps more pronounced than in farming in general. Until 1993, there were no farms with less than 101 cows and production was concentrated in large holdings (see table 6). In 1993 the situation changed drastically – there were 2,815 herds with less than 11 cows and there was a large decline in the number of larger dairy herds. However, since 1995, the number of herds in size classes 601-900, 901-1200, and over 1200 cows has been relatively stable, indicating that these are mainly former collective farms that were privatised and did not collapse during transition. On the other hand, since 2000 there has been a rapid decline in herds with between 1-10 and 11-50 dairy cows. Therefore, it is evident that the structural break at the beginning of the 1990s created a number of small farms, and during transition a vast majority of the small dairy farms were not viable.

Table 7. Income of farms by size classes and farm types in 2007

	Farm size class, ha			
	0-40	40.01-100	100.01-400	400.01-…
Farm net value added per AWU				
.. arable holdings	5 012	6 865	30 173	46 775
.. dairy holdings	3 366	7 762	13 509	15 066
.. mixed holdings	3 302	5 541	17 214	20 395
Farm net value added per ha				
.. arable holdings	261	183	284	314
.. dairy holdings	188	207	322	412
.. mixed holdings	240	144	228	372
Family farm income				
.. arable holdings	6 466	9 410	49 922	177 654
.. dairy holdings	5 200	11 858	41 625	140 485
.. mixed holdings	4 515	8 116	34 265	227 137

Source: EMA (2008)

The average annual wage in Estonia was 8,700 Euros in 2007. In the agricultural sector, the average annual wage was 6,600 Euros (SOE, 2009). If average wages are compared to family farm incomes in 2007 (see table 7), it is evident that farms of less than 40 ha do not provide sufficient income for farm families. There is a positive correlation between farm size and farm net value added per hectare and per annual working unit.

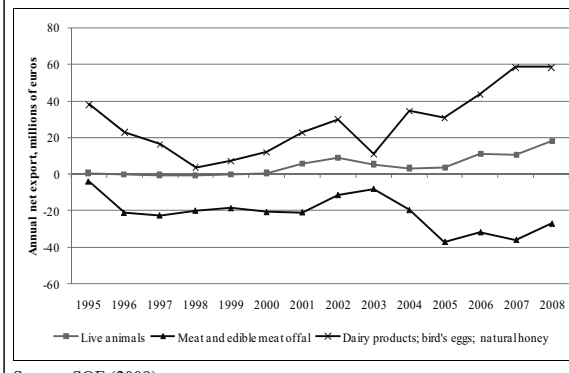
3.4 Trade patterns

During transition, Estonia maintained its position as a net exporter of dairy products and live animals (see figure 3). At the same time, Estonia has become a net importer of meat products. Since EU accession, the net export of dairy products and live animals has increased, indicating the positive effects of accession. At the same time, the net import of meat has also increased, indicating lower competitiveness in the meat sector compared to the dairy sector.

With regard to plant products, Estonia has been a net importer of fruits and vegetables. As purchasing power has increased, the net import balance has also increased steadily (see figure 4). An increase in cereals and oilseed production since EU accession has led Estonia to become a net exporter of cereals and oilseeds from 2005-2008.

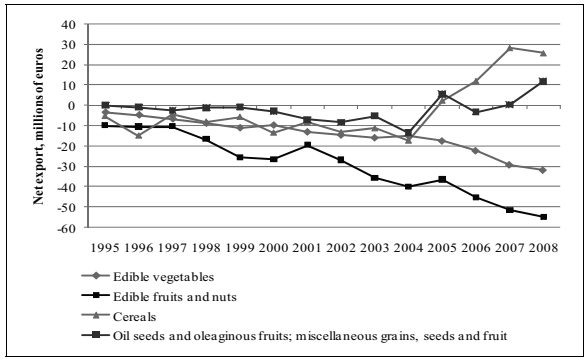
During transition, Estonia's main trading partners for agricultural produce have also changed. At the beginning of the 1990s, the Russian Federation continued to be an important export market. However, trade between Estonia and the Russian Federation has always been strongly influenced by political tensions. Therefore, the importance of the Russian Federation as an export market fell dramatically between 1995-2003, and trading with the EU increased markedly,

Figure 3. Net export of animal products (Section I of HS), 1995-2008, millions of Euros



Source: SOE (2009)

Figure 4. Net export of plant products (Section II of HS), 1995-2008, millions of Euros



Source: SOE (2009)

with The Netherlands leading the way. EU accession re-opened the Russian Federation as a market for Estonian producers. Since accession, exports have been directed away from The Netherlands and towards the Russian Federation (see table 8). There has also been a visible increase in the importance of the Scandinavian and Baltic countries as export markets. Indeed, almost ⅔ of Estonian agricultural produce exports go to neighbouring countries' markets.

The importance of the Russian Federation for the import of agricultural produce has also decreased significantly. With regard to imports, integration with the Baltic and Scandinavian markets is evident. Germany and the Netherlands have been significant import countries throughout transition.

Table 8. The main trading partners of agricultural commodities (HS Sections I and II) in 1995, 1999, 2003 and 2008, % of trade volumes

	1995	1999	2003	2008
Share in exports, %				
The Netherlands	27.2	19.0	21.7	5.8
Russian Federation	23.4	9.6	4.8	12.2
Baltic countries	7.4	25.3	25.3	25.8
Scandinavian countries	11.4	15.3	14.3	26.3
Germany	3.3	5.6	11.7	8.0
Share in imports, %				
The Netherlands	15.2	15.0	15.3	12.5
Russian Federation	9.0	6.6	5.2	1.1
Baltic countries	7.5	9.3	16.9	21.8
Scandinavian countries	36.9	36.6	24.8	32.3
Germany	7.3	8.5	4.9	7.8

Source: SOE (2009)

4. Conclusion

Based on the information regarding institutional reforms and production statistics, three sub-periods can be outlined within the 20 years of Estonian transition. From 1988-1995 land, property, and agricultural reforms were implemented to form the new structure of agricultural production based on private farms and privatised agricultural enterprises. The ideological goal of these reforms was to return to the structure of small family farms that prevailed before World War II. In reality, the majority of re-established farms proved to be nonviable and ill-equipped for the realities of the liberal market economy. In addition, the liberal trade policy gave a competitive advantage to subsidised imports from the EU. The fundamental changes were accompanied by a dramatic decline in the sown area of field crops and the volume of agricultural production.

The idealisation of family farming could be cited as a hindrance that led to the separation of most of the collective farms (IVASK, 1997). The primary carrier of the ideologically rigid family farm project was the narrow stratum of nationalist intellectuals and new government functionaries with an urban background. The ideology had a great effect on the policies of the government, although the prospects of agricultural production itself took a drastic turn for the worse immediately after the Baltic republics had reinstated their independence in 1991 (ALANEN, 1999: 433).

The Estonian agricultural decline in the 1990s manifested itself in the widespread neglect of arable land; the great problems faced by post-reform agricultural enterprises, including numerous closures and bankruptcies; and the impoverishment of farmers and the rural population (ALANEN, 1999; ALANEN et al., 2001; ALANEN, 2004; UNWIN, 1998; SIRENDI, 2009). Slow land reform and incoherent property relations, the unwillingness and incapability of new farmers to manage farms, and the uneconomic land use of previous collective farms were the main reasons behind the neglect of arable land. Agriculture could not offer enough employment or primary income to the majority of producers (LÕO, 2005).

From 1995-2001, the decline in production began to level out, the number of privatised agricultural enterprises declined and the number of private farms increased. However, many of the private farms are just households where some production for family purposes is maintained. During this period, agricultural policy became more relevant to the political agenda and the first support schemes for agricultural producers were implemented. Due to limited resources in the governmental budget, these mechanisms did not have particularly significant effects on agricultural growth. In 1996, Estonia set the goal of attaining EU membership. Therefore, the harmonisation of Estonia's institutional basis with EU institutions was initiated.

In 2001, the first positive effects of the impending EU accession could be detected. The harmonisation of institutions and law with the CAP has contributed to more systemic agricultural policy in Estonia. Implementing the SAPARD pre-accession programme considerably improved the deficit of investments that emerged in the 1990s. Since EU accession, trading activity has significantly increased. Cereal production has increased since 2005 and is approaching the level of 1990. This has led to the net export of cereals and oilseeds in 2005-2008.

As the application of the CAP in the EU-12 and EU-15 is somewhat different and will remain so until 2013, it is evident that the transition and harmonisation of institutional settings in agriculture and the adaptation of EU-12 agricultural sectors with the EU common market will continue during the next EU budget period of 2014-2020. In the EU-12, one of the key questions is whether a new generation of farmers will emerge to take over the farms established in the beginning of 1990s, as the founders of these farms will reach retirement age in the coming decade.

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ORIGINAL ARTICLE

The factors affecting the motivation to exit farming – evidence from Estonia

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Abstract
After Estonia restored independence, the number of individual farms increased rapidly during the 1990s. Since 2001, the number of farms has substantially decreased. Therefore, based on the survey data, this paper aims to explore the factors underlying the motivation to exit farming in Estonia. Cluster analysis is used to form relatively homogeneous groups of farms, and to investigate between-group differences in the motivation to exit as well as other farm characteristics. Logistic and ordered logistic regressions are applied to estimate the effects of selected variables on exit probability. The study reveals that the farms that are least likely to exit are large-scale farms and small-scale family farms. In small-scale farms, a reliance on family labour and a diversification of activities reduces the exit probability. The size of agricultural area was found to correlate negatively to exit intentions, while a higher share of rented land increases the exit probability. Also, the health of the farmer and the renting out of land are significant determinants to farm exit.

Keywords: *Farm exit, farm succession, structural change, Estonia, logistic regression, clustering.*

1. Introduction

The restructuring of agriculture in Estonia and other Central and Eastern European Countries (CEECs) began in the late 1980s (Sarris et al., 1999; Rizov et al., 2001). In the past 20 years, the social and economic changes in CEECs have been extensive and the pace of reforms has been fast. In farming, a generational change usually occurs every 25–30 years (Schnicke et al., 2008). Therefore, in the coming decade, we can expect a generational change via farm exits and succession to become more apparent in Estonian agriculture.

When the reasons for exiting from farming and farm succession in CEECs are studied, the general social and economic backgrounds as well as developments during transition should be accounted for. In Western Europe, family farms have been the prevailing form of agricultural producers (Glauben et al., 2004), but in Estonia private farms were only (re)established after the collapse of the Soviet system (and its collective and state farms). In the 1990s decollectivisation was implemented together with land, property and agricultural reforms; this resulted in newly established or restituted family farms and former collective farms being privatised, sometimes divided (Viira et al., 2009). Therefore, with the progression of the reforms, the number of registered farms increased rapidly in the 1990s. Due to a lack of capital, the newly established farms were not able to modernise their machinery and buildings. Therefore, most of the assets were depreciated by the beginning of the 2000s (Estonian Ministry of Agriculture, 2000). Since 2001, the number of agricultural holdings in Estonia decreased by 58% from 55,748 to 23,336 in 2007 (Statistics Estonia, 2009). This decline is mainly due to how farms are registered. However, this implies that many of the farms established in the 1990s did not become viable.

A characteristic feature of the farming sector, as opposed to most sectors of the economy, is that enterprises are traditionally passed on within families (Glauben et al., 2004). In Estonia, the establishment of private farms at the beginning of 1990s did not follow this typical farm life cycle. Rather than being

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taken over by successors, these new private farms were established by ex-workers of collective farms, heirs who had the opportunity to claim for restitution of land, and entrepreneurial individuals wishing to establish private farms. Therefore, there was a significant variation in age, previous experience and other characteristics in those who began private farming at this time. Today, small-scale farms are family farms that were established due to the restitution of land, the disintegration of former collective farms or the expansion of household plots (Chaplin et al., 2004). Large-scale producers are mostly corporate or co-operative farms, with a few exceptions in individual farms that have grown and will continue to expand (Lerman, 2001). These newly established farms could be considered first-generation family or private farms.

Farm structures in Estonia (and several other CEECs) can be considered dualistic, in that a large proportion of relatively small farms produce a small share of total agricultural output, while relatively few large agricultural holdings produce most of the agricultural output (Sarris et al., 1999). In most of the Western European countries and in the USA, the number of farm transfers has been decreasing for decades. Therefore, the total number of farms has decreased and the average farm size has increased (Browne et al., 1992; Calus et al., 2008). In this respect, the structural changes in Estonian agriculture, while still in transition, follow a similar pattern to that in Western Europe, even though the starting points are different. As many CEECs are today EU members, the developments of the Common Agricultural Policy (CAP) also have an impact on future farm structures. We can expect the trend in decreasing farm transfers and increasing farm size in the EU to continue in the light of the 2003 CAP reform, which decoupled farm subsidies from production, and its 2008 "Health Check", which aims to lead the CAP towards more equal direct payments between different farms and member states (Commission of the European Communities, 2008; Happe et al., 2008; Peerlings & Ooms, 2008).

Lobley and Potter (2004) suggest that the nature of farm households and the pattern of land holding are undergoing significant change as farm families become more pluriactive and increasingly subsumed to external capital influences. The connection between occupancy of holdings and land management is becoming more complex and differentiated in space, with an ever-greater diversity of ways in which it is possible to be "a farmer". The heterogeneity of rural households means that while farming is a main source of income to some, it is a lifestyle choice for others who derive most of their income outside of the farm (Katchova, 2008).

Studying the determinants of farm exits contributes to understanding the reasons why some farms turn out to be unviable after the first-generation farm operators resign. However, as the break in farm structures occurred only 20 years ago, the farm succession patterns in Estonia are undetermined and not extensively researched. Therefore, the aim of this paper is to explore the reasons behind the stated intentions of exiting from farming in Estonia. The analysis is based on a survey that was carried out in December 2007. The farmers were asked about their future perspectives and preferences on the CAP developments discussed within the "Health Check" context. Unexpectedly, 22% of the respondents declared that they plan to exit from farming within the following 3 years (2008–2010) (Institute of Economics and Social Sciences, 2008). In this paper, two methodological approaches are used. Firstly, cluster analysis is used to derive relatively homogeneous groups of farms with distinct views on their future perspectives, and economic and social characteristics. Secondly, logistic and ordered logistic regressions are applied to estimate the effects of more significant factors on stated exit plans.

This paper is organised as follows: Section 2 provides the literature review with respect of the theories, methods and results of previous research. The data, selected variables and applied methods are described in Section 3. In Section 4, the results of the cluster analysis, and logistic and ordered logistic regressions are outlined and discussed. In Section 5, the main conclusions are drawn.

2. Review of the factors affecting exit and succession decisions

The closely connected topics – exit from farming, and farm transfer and succession – have been subjects of interest to many researchers of different disciplines and many quantitative (e.g. Kimhi, 1994; Kimhi & Bollman, 1999; Foltz, 2004; Glauben et al., 2004; Breustedt & Glauben, 2007; Väre, 2007) and qualitative studies (e.g. Mann & Mante 2004; Mann, 2007). In studies of farm exit and farm transfers, a variety of different methodological approaches have been used. Several studies have been based on econometric analyses (Weiss, 1997; Kimhi & Bollmann, 1999; Glauben et al., 2002; Foltz, 2004; Glauben et al., 2004; Breustedt & Glauben, 2007; Väre, 2007), simulation modelling (Happe, et al., 2008, Sahrbacher et al., 2008, Schnicke et al., 2008) as well as more theoretical and descriptive approaches (Williams & Farrington, 2006; Mann, 2007; Calus et al., 2008).

The farm typically passes through the farm life cycle – entry, growth and exit stages (Boehlje &

Eidman, 1984, Potter & Lobley, 1996, Glauben et al., 2004). In the exit stage, the farmer is faced with the options of either liquidating the farm or transferring it to a successor. If the farm is transferred within the family, the viability of the farm will be optimised. If there is a farm exit, the liquidation value will be optimised (Glauben et al., 2002; Calus & Van Huylenbroeck, 2008). As exit is a large disinvestment, it can take some time and therefore can lead to an actual exit only after a few years. However, the exit decision is still taken prior to actual exit and given the available information at the time the decision is made (Peerlings & Ooms, 2008).

The age of the farm operator, his or her spouse, and potential successors is widely accepted as one of the main determinants of farm exit (Väre, 2006; Peerlings & Ooms, 2008; Schnicke et al., 2008). Calus and Van Huylenbroeck (2008) suggest that succession effect plays a role from the age of 45 and early designation of the successor gives the farmer an incentive to invest and improve the management. Calus et al. (2008) add that the negative growth of farms, beginning at the age of 57 of a farmer without a successor, confirms that these farms begin to disinvest. Therefore, farm development at the end of the farm life cycle is strongly affected by succession prospects. Väre, (2006) found that farm transfers to a new entrant, in general, take place somewhat earlier than farm closures. Burton, (2006) argues that while a farmer's age would seem like a useful tool to ascertain the potential change on the farm in the future, many other structural and economic features of the farm are known to influence decision-making.

Previous research from Estonia highlights the significance of age, condition of health, presence of successor, and both mental and physical support of a family as the main factors to influence the farmer's decision to exit (Põder, 2008). Also, a farm may not be transferred to a successor because no successor exists, or there is a potential successor who is not interested in agricultural activities (Schnicke et al., 2008). It has been suggested that in most of the farm exit cases, older farm operators pass the management of their business to a successor or leave farming because of poor health or death (Bentley & Saupe, 1990; Gale, 2003).

As the decision to exit depends on the farmer's strategic behaviour, there is also evidence that farmers who develop and expand their farms have more positive expectations for the future and are less risk averse (Hansson et al., 2008). Also, levels of education and managerial ability have been singled out as important drivers of farm growth on the side of the farm (Breustedt & Glauben, 2007; Schnicke et al., 2008). The farm-specific human capital, which is acquired in childhood as a by-product of growing up, increases the value of the transferred physical asset; therefore, the offspring are the highest market bidders for their parents' land (Glauben et al., 2004). In transition countries, this farm-specific human capital might be a scarce factor in first-generation family farms. The lack of farm-specific human capital can be one of the reasons why a significant share of farms established in the 1990s has exited from farming.

The size of the household and value of its assets is often an important determinant of farm exit and growth (Glauben et al., 2002, 2004; Väre, 2006; Calus et al., 2008; Peerlings & Ooms, 2008; Sahrbacher et al., 2008). In addition to the availability of land, farm growth is strongly influenced by the availability of labour and capital (Peerlings & Ooms, 2008). Structural changes, increased capital requirements and low expected rates of return are among the reasons to explain the decline of entry of young farmers (Gale, 2003; Williams & Farrington, 2006; Schnicke et al., 2008). Farm exits due to financial stress are likely among farm operators in the early or middle phases of their careers, when many use debt financing to expand their businesses (Gale, 2003). Different capital market structures among countries (Benjamin & Phimister, 2002) as well as risk considerations (Serra et al., 2004) may affect farmers' investment and disinvestment decisions, in turn affecting the change in the number of farmers in a region.

Rizov et al., (2001) argue that a shift to individual farming in CEECs was limited by capital constraints, which reduced the ability to make investments in new technology and production systems, thereby decreasing the present value of expected earnings from individual farming. Access to non-farm capital sources, such as income from off-farm employment, pensions or movable assets contribute to reducing capital constraints, and in a transition period they may be more effective in securing external finance than farm buildings or land. While the shift to individual farming was influenced by capital constraints, the continuation of individual farming is also influenced by capital constraints, which may still be higher in CEECs compared to Western Europe.

High specialisation together with a higher degree of on-farm diversification raises the probability of farm succession within the family (Glauben et al., 2002, 2004). Better economic conditions outside agriculture might increase the incentive for young farmers – or especially for potential successors – to leave farming, since there are better job opportunities outside the agricultural sector (Gale, 2003; Williams & Farrington, 2006; Schnicke et al., 2008). The link between farmers' exit decisions and

off-farm income is found to become more and more prominent because it has been increasing steadily over time (Väre, 2006). Income loss when retiring and the location of the farm together with the production line were found to be among the most important determinants of early retirement and the transfer or closure of farms (Väre, 2007).

Another aspect that can affect farm transfer is uncertainty, which can be exogenous or endogenous. Changes in legislation and environmental conditions are exogenous factors that influence the transfer possibilities of a farm. When general economic conditions or specific farm conditions are clear and good, a transfer will be more likely than in the case of an uncertain or unfavourable policy or economic environment (Calus et al., 2008). It is obvious that transition economies such as those of the CEECs have faced many principal economic reforms and legislative changes during the past 20 years. This relative uncertainty about the stability of economic conditions coupled with the fast development of other economic sectors might have contributed to the decline in the number of farms. Finally, environmental factors such as the general social and economic conditions, how conductive the local culture is for entrepreneurship, existing infrastructure and the distance from markets also affect the relative costs and profitability of starting up and the transfer of an individual farm (Rizov et al., 2001).

The studies of farm exit and farm succession are often based on surveys carried out in a sample of farms that have exited from the sector or have been transferred. Also, surveys where farmers are asked about their intentions regarding their exit or succession plans are frequently made. The problem with the latter is that the plans the farmers make for succession have been found to be time inconsistent. Väre, (2007) suggests that the succession plans, as stated by elderly farmers in the questionnaires, do not provide information that is significant and valuable in predicting true, complete successions. Therefore, the exit of farmers should be analysed based on observed behaviour rather than on stated plans and intentions. Calus et al. (2008) suggest that an average of 8% of farms indicate a change in their succession perspectives each year. During the 10 year period prior to farm transfer or exit, uncertainty in succession plans becomes more significant, implying that the wishes and perception of the farmer are not always in accordance with the future plans of the children. The discrepancy between intention and behaviour is highest in medium-sized farms. Farms with low total farm assets have both low intention and behaviour for farm transfer. On large-scale farms, intention and behaviour are largely focused towards farm transfer; while in medium-sized farms, intention and behaviour do not always coincide. This is because uncertainty about future viability, the development of the farm, government policies and judgements concerning on-farm and off-farm employment opportunities play important roles in the decision of farm transfer. This reflects the uncertain survival possibilities of medium-sized farms, which in turn may refer to a larger set of off-farm alternatives for farm operators.

However, much of the research on the farm is often confined to the opinions of the principal operator of the farm (Morris & Evans, 2004). In contrast to empirical studies that analyse the determinants of succession on the basis of census data, farm surveys derive an advantage from the fact that detailed and direct information can be obtained from the respondents' subjective evaluation of the succession situation (Glauben et al., 2004). Therefore, we have to accept that there are discrepancies between stated intentions and actual behaviour. However, intentions may lead to decisions and decisions determine behaviour. The intention to exit might not lead to actual exit but probably will not lead to farm growth either. Hence, it is important to study also the factors that influence the intentions of farmers.

Consequently, farm exit and succession are highly complex phenomena that are affected by several social, economic and environmental factors as well as the individual characteristics of farm operator that simultaneously influence the decisions of a farmer and the performance of a farm. Therefore, in this study, two different methodological approaches – cluster analysis, and logistic and ordered logistic regressions – were used to investigate the factors that underlie the intentions to exit from farming. The use of two approaches helped in giving more insights about the interactions between stated exit plans and farm-characteristic factors that influence these plans.

3. Data and methods

3.1. Data

In December 2007, a survey was carried out to ask Estonian agricultural producers about their plans and perspectives for the upcoming years (2008–2010) and to indicate their preferences on the possible agricultural policy developments discussed in the mid-term review of CAP 2003 reform, known as "Health Check". The questionnaire was comprised of six sections. In the first section, general information about the farm was requested; the second section dealt with farm labour, the third concentrated on farm income and the fourth section was related to land use. In the fifth section, the

respondents were asked to evaluate the prospects of their farm and their weaknesses, and strengths as farmers. In the sixth section, farmers were requested to give opinions on the main CAP developments discussed in the "Health Check" context.

The questionnaire was posted to a random sample of 1000 farmers among the population of farms whose economic size exceeded 2 ESU[1] in 2005. In total, 284 questionnaires were returned (response rate 28.4%). In the survey, farms were classified into three size groups – $2 \leq 8$ ESU, $8 \leq 16$ ESU and ≥ 16 ESU. The farms of economic size $2 \leq 8$ ESU constituted 70% of sample farms and 63.4% of respondents. Farms from the size group $8 \leq 16$ ESU formed 12.3% of the sample farms and 17.3% of responded farms. The group of farms whose economic size exceeded or equalled 16 ESU constituted 17.7% of the sample and 19.4% of the responded farms. Therefore, the structure of the sample farms and responded farms with respect to their economic size remained relatively uniform.

The timing of the survey coincided with high agricultural commodity prices on the world markets and good crop yields in Estonia. Despite the positive economic outlook at the time, 22% of respondents indicated that they intended to exit from farming in the upcoming years (Institute of Economics and Social Sciences, 2008). It is common that in the case of posted surveys not all respondents provide answers for all the questions. Therefore, the data provided by only those producers that supplied information about all the 18 variables that were used in the analysis, was used. As a consequence, answers from 202 producers remained valid for cluster analysis, and logistic and ordered logistic regressions.

3.2. Variables

The choice of variables for the analyses was based on the findings of previous researches reviewed in Section 2. Age is often a significant determinant of farm exits. We expect that older farm operators are more likely to exit from farming. The share of family labour in the total farm labour was added in order to control whether there were differences in exit probability in family farms compared to corporate farms that rely mainly on hired labour. The share of agricultural produce in total farm revenues was used as a proxy for the specialisation in agricultural production. We expect that more specialised producers are less likely to exit from farming. On the other hand, we use the share of non-agricultural activities in total farm revenues as a proxy for non-agricultural diversification and expect more diversified farms to exit less likely.

Off-farm work and rent out of agricultural land are used to control if off-farm income has an effect on farm exit decision. Location in less favoured areas (LFAs) indicates that a farmer may have some natural disadvantages compared to other farmers. At the same time, location in LFAs enables farms to receive higher subsidies for compensation. We added this variable to test whether location in LFAs increases the exit probability due to natural disadvantages or higher LFA subsidies reduce the probability of exit.

Participation in investment subsidy schemes enables farms to acquire modern equipment and improve productivity. At the same time, participation in these schemes requires farms to continue farming for at least 5 years after the investment. The effects of investments and participation in investment subsidy schemes on farm exit should be considered in the context of the deficit of investments in 1990s. The Estonian farming sector used mainly machinery and buildings that had previously been used by collective farms. Due to a lack of the capital and credit, the investments into new equipment were not sufficient to replace the depreciating old equipment. Therefore, at the beginning of the 2000s, many farmers were faced with the situation where investments were necessary since the depreciated equipment did not allow for production with reasonable quality and costs. Therefore, the farmers that were not planning to exit have been participating in investment subsidy schemes and participation in these schemes has enabled them to improve productivity and increase production, which in turn may reduce their longer-term probability of exit. On the other hand, farms that have not invested will sooner or later be faced with the situation where their equipment is so depreciated that they cannot continue production. Therefore, this variable was added to control if participation in investment subsidy schemes can be associated with a lower probability of exit.

Agricultural area was used as an indicator of farm size. Our assumption was that larger farms are less likely to exit. We expect that a higher share of rental land in the farm's total land use increases the uncertainty about future land use possibilities and land rent. As discussed in Section 2, greater uncertainty has been found to increase the probability of exit.

We used a dummy variable to differentiate farms with livestock from arable farms. We expect that due to the large investments needed in animal production, farms that keep agricultural livestock are more likely to exit due to capital constraints.

The farmers were asked if their agricultural area would decrease or increase in the coming years. We use this as a proxy for farm growth and expect that

farms that plan to expand their area are more likely to continue. It was assumed that farms that rate their availability of successors higher are less likely to exit. Knowledge was used as a proxy for education and managerial skills. We expect that a higher level of knowledge will decrease exit probability. Evaluation on capital availability was used as a proxy for capital constraints that could lead farms to exit. As the poor health of the farm operator could lead the farm to exit, we used a farmer's evaluation on his or her condition of health to control this hypothesis. Family support has previously been found to be an important factor in determining farm exit (Põder, 2008). We expect that higher mental support and involvement of family members in farming encourages farm operators to continue farming. The definitions and description of variables together with their descriptive statistics are given in Table I.

The respondents were asked to state on a scale of three – "Yes", "Not certain" and "No" – if they intend to give up agricultural production in the coming 3 years. Of 202 valid answers, 21.3% declared "Yes", 30.7% were "Not certain" and 48.0% indicated "No". In the cluster analysis, "Yes" was scaled as 1, "Not certain" was scaled as 0.5 and "No" was scaled as 0. Therefore, in the cluster analysis, the answer "Not certain" was treated as 50% probability of exit. In the logistic estimation, "Yes" was scaled as 1, and "Not certain" and "No" were scaled as 0, i.e. those who were not certain if they would exit or not, were considered as not exiting. In ordered logistic estimation, the answers were ordered as follows: "Yes" was scaled as 3, "Not certain" as 2 and "No" as 1.

The average age of the farm operator was 55.8 years (median 55 years). Around 30.7% of respondents were older than 63 years and only 8.9% of respondents were younger than 40 years. Considering that the retirement age for men is 63 years in Estonia, the average age of farm managers is quite high. The average share of family labour in the farm labour usage was 70.4%. On average, agricultural production accounted for 49.1% of farm revenues. The average share of subsidies in total farm revenues was 41.6% and the share of revenues from non-agricultural activities was 9.3%. Off-farm work was declared by 26.2% of the respondents and 46.5% of the farms were located in LFAs. The average agricultural area of farms was 145.8 ha (median 42.0 ha),[2] 17.3% of the respondents rented land to other farmers, while 62.4% of the farmers rented land from other landowners. On average, 26.0% of the total agricultural land was rented. Agricultural animals were kept in 69.8% of the sample farms and 18.8% of the farms estimated a decrease and 21.8% estimated an increase in their arable area; on average, "No changes" was declared. The respondents were also asked to evaluate their availability of successors, knowledge in agricultural production, capital availability, condition of health and (mental) support from the family. Knowledge in agricultural production together with family support received highest average evaluations. The condition of health was rated "adequate" on average. The availability of successors and the availability of capital had the lowest average evaluations, indicating the potential bottlenecks in farm transfer and succession in the Estonian farming sector. The average age of the sample farms was 12.7 years (median 14 years), while the maximum duration of farming was 27 years. This confirms our suggestion that private farming has lasted one generation in Estonia. However, this variable was not used in the further analysis because many respondents did not provide this information.

3.3. Cluster analysis

In this study, cluster analysis was used to derive groups of farms based on 18 variables described in Table I. The clustering method can be described as a multivariate statistical procedure that starts with a data set containing information about a sample of entities and attempts to reorganise these entities so that the entities within each cluster would be relatively homogeneous and as distinct as possible from entities in other clusters (Aldenderfer & Blashfield, 1984). The chosen approach is analogous to the one used by Baker et al. (2007) in studying the strategies amongst Danish food industry firms, except that we have omitted the hierarchical clustering stage.

The higher the ratio of elements to characteristics the better the cluster analysis performs. In order to reduce the number of variables and avoid problems with multicollinearity amongst variables, principal component analysis (PCA) was carried out first as suggested by Arfini et al. (2001) and Iraizoz et al. (2007). PCA enables the number of variables to be reduced in a manner that preserves the number of elements and efficiently eliminates correlated characteristics. The factors derived from the PCA could be used and interpreted as exogenous variables in further analyses (e.g. cluster analysis or logistic regression) (Lawson et al., 2009). However, in this paper the factor scores of individual observations derived from the PCA were used as inputs for the clustering procedure instead of the initial values of the variables. Therefore, the results of PCA are not further analysed.

Cluster analysis was performed using 10 factors derived from PCA. The selection of factors is often

Table I. Definition, description and descriptive statistics of variables.

Variable	Definition	Scale/measurement	Mean	Standard deviation	Minimum	Maximum
Exit	Intention to give up agricultural production in the coming 3 years	Cluster analysis: 1 – Yes, 0.5 – Not certain, 0 – No logistic regression: 1 – Yes, 0 – Not certain, 0 – No ordered logistic regression: 3 – Yes, 2 – Not certain, 1 – No	0.37	0.40	0	1
Age	Age of the of the farm operator	Years	55.8	11.6	23	85
Flabour	Share of family labour in farm labour	100% = 1	0.70	0.37	0	1
Agrev	Share of agricultural produce in total farm revenues (including subsidies) of farm	100% = 1	0.49	0.27	0	1
Othrev	Share of non-agricultural activities in total farm revenues (including subsidies) of farm	100% = 1	0.09	0.18	0	0.92
Off_farm	Off-farm work of the head of farm	1 – Yes, 0 – No	0.26	0.44	0	1
Lfa	Location in less favoured area	1 – Yes, 0 – No	0.47	0.50	0	1
Invest	Participation in investment subsidy scheme	1 – Yes, 0 – No	0.09	0.29	0	1
Area	Agricultural area of the holding	ha	145.8	355.7	1	2600
Rentout	Rent land to other producers	1 – Yes, 0 – No	0.17	0.38	0	1
Rental	Share of rented land in total land use	100% = 1	0.26	0.30	0	1
Animals	Animal production in the farm	1 – Yes, 0 – No	0.70	0.46	0	1
Areachange	Estimation of change in agricultural area	1 – Decreases significantly, 2 – Decreases, 3 – No changes, 4 – Increases, 5 – Increases significantly	2.96	0.79	1	4
Successors	Evaluation on availability of successors	1 – Very poor, 2 – Poor, 3 – Adequate, 4 – Good, 5 – Very good	2.42	1.07	1	5
Knowledge	Evaluation on knowledge and skills in agricultural production		3.44	0.60	2	5
Capital	Evaluation on availability of capital		2.69	0.77	1	5
Health	Evaluation on health		2.97	0.81	1	5
Family	Evaluation on family support		3.62	0.80	1	5

based on eigenvalue criterion. For the factor to be used in further analysis, its eigenvalue should be at least 1. PCA produced seven factors with eigenvalue larger than 1. These factors encompassed 61.5% of the total variance in the variables. However, 10 factors were used in the cluster analysis to increase the variance captured by the factors. These factors encompassed 76% of the total variation in variables. The non-hierarchical *k*-means clustering algorithm was used to derive 10 clusters.[3] The number of derived clusters was selected so that there would be at least two groups of farms where the average of *exit* variable (which can be considered as proxy of probability of exit) was significantly smaller than the sample average, and at least two groups where the average of *exit* would be significantly larger than the sample average.

In this paper, we assume that studying the between-group differences of farms may reveal some underlying factors or combinations of factors that can be associated with farmers' attitudes towards exiting from farming. Therefore, clusters are divided into three main categories – firstly, clusters that have significantly lower than sample average evaluations on the probability of exit; secondly, groups of farms whose evaluations on the probability of exit do not differ significantly from the sample average; and thirdly, clusters that have significantly higher than sample average exit probability. In each farm group, the averages of all variables are compared with the sample means.

3.4. Logistic and ordered logistic regressions

The second approach applied in this study is econometric analysis using logistic and ordered logistic regressions, with *exit* as a dependent variable, to explain how the underlying factors affect the probability of answering "Yes" to the question if the farmer has the intention of giving up agricultural production in the coming 3 years.

In the logistic regression answer "Yes" to the exit was scaled as 1, and "Not certain" and "No" as 0. The remaining 17 variables were initially considered as exogenous. The model for the underlying latent variable ($exit_{M1}*$) is as follows:

$$\begin{aligned} exit_{M1}* = {} & \beta_0 + \beta_1 age + \beta_2 flabour + \beta_3 agrev + \beta_4 othrev \\ & + \beta_5 off\_farm + \beta_6 lfa + \beta_7 invest + \beta_8 area \\ & + \beta_9 rentout + \beta_{10} rental + \beta_{11} animals \\ & + \beta_{12} areachange + \beta_{13} auccessors \\ & + \beta_{14} knowledge + \beta_{15} capital + \beta_{16} health \\ & + \beta_{17} family + e. \end{aligned} \quad (1)$$

Where *exit* is a function of continuous unmeasured latent variable $exit_{M1}*$, whose values determine the value of observed binary variable *exit*.

$$exit = 0, \ [exit_{M1}* \leq 0]$$
$$exit = 1, \ [exit_{M1}* > 0]$$

In the ordered logistic regression, the answers to the question of whether the farmer intends to exit from farming in the coming years were ranked as follows: "No" as 1, "Not certain" as 2 and "Yes" as 3. The same exogenous variables were used as in logistic model. The underlying latent variable model ($exit_{M2}*$) is as follows:

$$\begin{aligned} exit_{M2}* = {} & \delta_1 age + \delta_2 flabour + \delta_4 otherv + \delta_5 off\_farm \\ & + \delta_6 lfa + \delta_7 invest + \delta_8 area + \delta_9 rentout \\ & + \delta_{10} rental + \delta_{11} animals + \delta_{12} areachange \\ & + \delta_{13} successors + \delta_{14} knowledge + \delta_{15} captial \\ & + \delta_{16} health + \delta_{17} family + e. \end{aligned} \quad (2)$$

In the ordered logistic model, *exit* is a function of continuous unmeasured latent variable $exit_{M2}*$, whose values determine what the observed ordinal variable *exit* equals. The continuous latent variable $exit_{M2}*$ has various threshold points (κ_i) that are estimated together with the model. The value of the observed variable *exit* depends on whether a particular threshold is crossed.

$$exit = 1, \ [exit_{M2}* \leq \kappa_1]$$
$$exit = 2, \ [\kappa_1 \leq exit_{M2}* \leq \kappa_2]$$
$$exit = 3, \ [exit_{M2}* \geq \kappa_2]$$

The estimates of initial logistic (1) and ordered logistic (2) models are given in Appendix I. In both logistic and ordered logistic models, likelihood ratio tests were used to test the significance of individual explanatory variables in explaining the variation of the *exit* variable. The variables that were statistically insignificant with respect to the explanatory power of the estimated model were dropped from the restricted model.

4. Results and discussion

4.1. Cluster analysis

In Table II, the derived 10 clusters are ordered ascending from left to right according to the mean of the *exit* variable.[4] In clusters 4 and 6, the average probability of exit from farming is significantly lower than sample average. The difference between the mean of *exit* in cluster 10 and the sample mean is weakly significant. Therefore, we also consider cluster 10 as a distinct group of farms that has a lower than average exit probability. Based on the stated exit plans, these three clusters of farms can be considered as the most viable farm groups. Or, to put it in another way, the average farmers in these three groups are those that are least likely to (state)

Table II. Descriptive statistics of derived farm clusters.

	Cluster										Sample mean
	4	6	10	3	5	9	1	2	8	7	
Number of farms	23	25	18	14	30	10	22	27	13	20	–
Exit	0.11***	0.12***	0.19*	0.25	0.40	0.40	0.48	0.52	0.62**	0.65***	0.37
Age	53.4	64.1***	52.8	58.7	52.0*	46.4**	58.6	63.4***	55.3	46.7***	55.8
Flabour	0.94***	0.83	0.15***	0.65	0.85***	0.89	0.52**	0.89***	0.84	0.37***	0.70
Agrev	0.56	0.60*	0.63**	0.16***	0.31***	0.36	0.68***	0.33***	0.61*	0.64***	0.49
Othrev	0.03***	0.03***	0.04**	0.63***	0.14	0.04	0.01***	0.04**	0.01***	0.07	0.09
Off_farm	0.09**	0.08***	0.11	0.14	0.87***	0.80	0.00***	0.07***	0.69***	0.00***	0.26
Lfa	0.26*	0.32	0.39	0.43	0.83***	0.40	0.32	0.70**	0.23	0.45	0.47
Invest	0.00	0.00	0.83***	0.00	0.00	0.10	0.00	0.00	0.0	0.10	0.09
Area	47.2***	41.5***	940.9***	43.6***	49.5***	57.7*	110.3	37.6***	35.2***	190.8	145.8
Rentout	0.04**	0.00**	0.06*	0.21	0.13	0.80***	0.09	0.11	0.85***	0.10	0.17
Rental	0.20	0.12***	0.39*	0.18	0.30	0.38	0.34	0.16*	0.10***	0.48***	0.26
Animals	0.89*	0.60	0.78	0.43**	0.73	0.10***	0.82	0.89***	0.69	0.60	0.68
Areachange	3.39**	2.76	2.83	2.93	3.00	3.00	2.50**	2.48***	3.08	3.80***	2.96
Successors	2.61	2.24	2.61	2.71	2.90**	1.80*	2.00*	1.48***	2.00	3.65***	2.42
Knowledge	3.17**	3.88***	3.44	3.50	3.67*	3.10***	3.14**	2.96***	3.77*	3.75**	3.44
Capital	2.22***	3.08**	2.94	3.07*	2.87	1.70***	2.77	1.96***	2.69	3.35***	2.69
Health	3.04	2.96	3.17	3.21	3.23*	3.00	2.77*	1.89***	3.46**	3.45**	2.97
Family	4.30***	3.68	3.72	3.07**	3.90**	3.30	2.50***	3.41	3.92	4.15***	3.62

*Significant at 0.10 level.
**Significant at 0.05 level.
***Significant at 0.01 level.

exit farming. On the other hand, clusters 8 and 7 can be considered as the least viable, as the average of *exit* in these groups is significantly higher than the sample average. The probability of exit in the remaining clusters 3, 5, 9, 1 and 2 cannot be asserted as significantly different from the sample mean. Next, the characteristics of viable farms in clusters 4, 6 and 10, and those of the most likely exiting farms in clusters 8 and 7 are studied more closely.

4.2. The "viable" farms in clusters 4, 6 and 10

In farm groups 4, 6 and 10, the probability of exit from farming is significantly lower than the sample average. However, these three clusters are not similar in other 17 characteristics. The average size of agricultural area is one of the main differences between these three farm groups. While farms in clusters 4 and 6 are smaller than the sample average and similar in size (47.2 and 41.5 ha, respectively), cluster 10 represents large-scale producers with an average area of 940.9 ha. This implies that the Estonian farm structure is likely to remain dual as our results do not indicate that medium-sized farms would state exit plans less often than the average farm.

Due to scale differences, it is obvious that farms in clusters 4 and 6 have a higher average share of family labour than large-scale farms of cluster 10. Therefore, we can describe cluster 10 as large-scale corporate (or family) farms and clusters 4 and 6 as small-scale family farms. Lower exit probability of small-scale family farms is in line with the findings of Breustedt and Glauben (2007) that farms with a relatively higher rate of family members working in the farm show lower exit rates. According to Peerlings and Ooms (2008), a high share of family labour may reflect either a lack of off-farm labour opportunities or a relatively high on-farm labour return, which both result in fewer exits. In both small-scale farm groups, off-farm work was declared significantly less frequently than in sample average. However, the average age of a farm manager was 64.1 years in group 6. The high average age can explain the low off-farm employment in this group. In cluster 4, the average age of the farm manager (53.4 years) was not significantly different from the sample average. However, a high share of family labour could be explained by the significantly higher than average family support for continuing farming, the higher than average wish to increase the farm size and the higher than average share of farms with livestock production, which is more labour intensive than crop production and may not allow family members to take off-farm jobs. On the other hand, high share of family labour may indicate lack of off-farm work opportunities.

The large-scale agricultural producers of cluster 10 and the small-scale farms of clusters 4 and 6 derive a larger proportion of their revenues from

agricultural production than the sample average farm. Therefore, these farm groups can be considered more specialised in agricultural production than the sample average farm. At the same time, farms in all three groups have a significantly smaller than sample average proportion of non-agricultural sales in their total sales, indicating low diversification with non-agricultural activities. The only farm group where the share of revenues derived from non-agricultural activities significantly exceeds the sample average is cluster 3. In this group, the average probability of exit is lower than the sample average; however, this difference is not statistically significant.

Location in LFAs indicates that farmers may face some natural disadvantages arising from their location. At the same time, location in the LFAs enables farms to receive higher subsidies compared to farms that are not located in LFAs. In farm clusters 4, 6 and 10, the average share of farmers situated in LFAs was smaller than the sample average. This was only significantly smaller in cluster 4, though. Therefore, we cannot conclude that location in the LFAs and receiving LFAs subsidies could be associated with the probability of staying in or exiting from farming. Since 2001, farm investment subsidies have had a significant share in farm-support programmes in Estonia. Our results indicate that large-scale agricultural producers have been the main beneficiaries of investment subsidy programmes. In cluster 10 (large-scale producers), 83% of farms have received investment subsidies. However, based on cluster analysis results, it is not possible to infer whether the low exit probability is more affected by investments or due to the large scale of these producers. In fact, lower exit probability may have been one of the reasons for making extensive investments, and therefore investments and low exit rates are interrelated.

On average, 17% of respondents declared that they rent land to other agricultural producers. However, in clusters 4, 6 and 10, the share of farms that rent land to other producers was significantly lower. In small-scale family farm groups, the average share of land rented from other landowners was lower than in the whole sample. On the other hand, in large-scale farms the share of rental land exceeded the sample average significantly. This implies that small-scale family farms usually own most of their agricultural land, which they probably have acquired via restitution. Large-scale farms, in addition to agricultural land they have acquired via privatisation or purchases, rent a significant part of the land they use from smaller landowners who became landowners via agricultural and land reforms in the 1990s. Of the three "viable" farm groups, only group 4, i.e. one of the small-scale farms' groups, had positive expectations towards expanding their agricultural area. The average response from other groups indicated that they do not plan to extend their farms.

The average evaluation on availability of successors did not differ significantly from the sample average. This implies that also in "viable" farm groups, farmers confirm, on average, that the situation with availability of successors is poor. Therefore, in a longer perspective, even the farms that claim they will continue farming in the next 3 years might not be viable due to a lack of successors.

The average of evaluations on the level of knowledge in farming differed in all three groups. The average of *knowledge* in cluster 10 was equal to the sample mean. One of the small-scale producers' groups (cluster 4) estimated that their knowledge was smaller than the sample average, and the other small-scale producers' group estimated that their knowledge is higher than the sample average. While farms in cluster 4 indicated their wish to extend their agricultural area, at the same time they assess their knowledge and capital availability to be smaller than the sample average. This might be explained through psychological reasons, since farm managers who want to expand their business may feel that they lack knowledge because they are seeking new opportunities more intensively than other farmers. Also, as expanding the business requires investment, and they feel that they lack capital more than the average farmer. On the other hand, farms in cluster 6 reported significantly higher than sample average levels of knowledge and also rated capital availability higher than the sample average. It can be assumed that cluster 6 represents individuals who are retired and keep a small-scale farm as a part of their lifestyle and a source of income aside from the pension. As farmers in this group are significantly older than average farmers and they do not plan to extend their business, they do not need extra capital for investments; also, based on their life experience, they might estimate their knowledge more highly. However, this implies that shortage of capital and knowledge are two factors of which small-scale farmers who want to continue and expand agricultural production are short.

4.3. The "exiting" clusters 8 and 7

Clusters 8 and 7 differ from the other farm groups in significantly higher average values of *exit* variable. The average age of farm managers in group 8 is equal to the sample average while in group 7 it is significantly lower. Therefore, the reasons behind exit intentions in these two groups are probably not related to ageing.

The average farms in clusters 8 and 7 are very different in scale. While the average agricultural area in cluster 8 is only 35.2 ha, which is the lowest of in all 10 groups, the average farm in cluster 7 has 190.8 ha of agricultural land, which is higher than but not significantly different to the sample average. This implies that a small-scale of production could be one of the reasons behind the intentions to exit from farming. At the same time, the composition of cluster 7 suggests that medium-sized farms might also be those that are more likely to exit. However, as suggested by Calus et al. (2008), there might be discrepancies between intentions and behaviour in medium-sized farms.

As expected, small-scale farms in cluster 8 use more family labour than medium-sized farms in cluster 7. In both farm groups, the share of revenues from agricultural production is larger and the share of revenues from non-agricultural activities is smaller than the sample average. In cluster 8, off-farm work is declared by 69% of respondents and renting land to other farmers was declared in 85% of the cases. This implies that off-farm work and rental income are very important income sources in this farm group, and, therefore, the farm managers might plan or they may have already begun exiting from farming to concentrate on off-farm work and income. Therefore, renting out land to other producers can be seen as one of the first steps in the withdrawal from active farming. In cluster 7, off-farm work was not declared and only 10% of respondents declared renting land to other farmers.

With respect to location in LFAs, participation in investment subsidy programmes, and the share of farms with animal production, these two farm groups did not differ significantly from the sample average.

Farms in cluster 8 do not plan to expand their agricultural area, and on average they evaluate the availability of successors as "poor". With regard to the availability of capital and family support, these farms are similar to the sample average farm. However, they rate their knowledge and condition of health higher than the average farm. Farms in cluster 7 give somewhat mixed signals. While indicating the highest cluster average probability of exit from farming, they state the highest belief in expanding their farm and assess their availability of successors, knowledge, and availability of capital, condition of health and family support significantly higher than sample average. The younger than average age might also play a role in their higher assessments of their health, family support and knowledge, as younger people tend to have more positive expectations and although they assess the availability of a successor higher, by the time they have reached an older age and want to transfer the farm, the situation regarding the availability of successors might be completely different. At the same time, farm managers in these farms are significantly younger than average, so they might start a new career off-farm, but they are not currently having off-farm income sources. This indicates uncertainty and inconsistency in answers about the plans and strengths and weaknesses the farm managers of medium-sized farms have about their farms, which is in line with the findings of Calus et al. (2008).

4.4. Logistic and ordered logistic estimations

The variables that had a low effect on the overall explanatory power of models (1) and (2) were dropped, based on likelihood-ratio tests. In the logistic estimation, the variables that had a significant effect on the overall significance of the model were: *flabour*, *area*, *othrev* and *rental*. In the ordered logistic regression, the following variables had a statistically significant effect on the overall significance on the model: *flabour*, *area*, *rentout* and *health*. Finally, all the variables in logistic and/or ordered logistic estimations that were significant with regard to the overall explanatory power of the models were used for fitting restricted logistic and ordered logistic models (3) and (4).

For the logistic regression, the restricted model of underlying latent variable ($exit_{M1}*$) is as follows:

$$exit_{M1}* = \beta_0 + \beta_1 flabour + \beta_2 otherv + \beta_3 area + \beta_4 rentout + \beta_5 rental + \beta_6 health + e. \quad (3)$$

For the ordered logistic regression, the underlying latent variable model ($exit_{M2}*$) is as follows:

$$exit_{M2}* = \delta_1 flabour + \delta_2 otherv + \delta_3 area + \delta_4 rentout + \delta_5 rental + \delta_6 health + e. \quad (4)$$

The results of logistic and ordered logistic regressions of restricted models (3) and (4) are presented in Table III. Both, logistic and ordered logistic estimates reveal that there is a significant negative relationship between the share of family labour and the probability of stating exit from farming. This reveals that family farms may be more viable due to the higher availability, flexibility and efficiency of family labour. Also, this is due perhaps to affordability, since the farm family might not perceive the true opportunity costs of using their labour on the farm, and, therefore, they are not seeking off-farm working opportunities. It can also be assumed that in some cases family members may not have suitable off-farm work opportunities, which is a reason for the low opportunity cost of family labour.

Table III. Coefficients of logistic and ordered logistic regressions.

	Logistic regression	Ordered logistic regression
Intercept/intercept 1	−0.7696 (0.9099)	0.5172 (0.6807)
Intercept 2		2.0146*** (0.6936)
Flabour	−1.2645** (0.5809)	−1.0383** (0.4473)
Othrev	−5.4618** (2.1362)	−0.9896 (0.7847)
Area	−0.0026** (0.0013)	−0.0022*** (0.0008)
Rentout	0.6689 (0.4628)	0.8651** (0.3603)
Rental	1.3695** (0.6436)	0.2015 (0.4873)
Health	0.1431 (0.2360)	−0.3504** (0.1745)
	Pseudo $R^2 = 0.1134$; Loglikelihood = 92.71; $n = 202$	Pseudo $R^2 = 0.0515$; Loglikelihood = 200.05; $n = 202$

**Significant at 0.05 level.
***Significant at 0.01 level.
Note: The quantities in parentheses beside the estimates are the standard errors.

In the logistic regression, the estimated coefficient of variable *othrev* is negative and statistically significant, implying that diversifying farm business with non-agricultural activities decreases the probability of planning to exit from farming. However, in ordered logistic regression, the estimated coefficient for other revenues is insignificant.

An increase in average farm size has been a long-term trend in agriculture. Farm size is widely accepted as a factor that has a positive effect on farm viability and succession, and a negative effect on the probability of farm exit (Glauben et al., 2004; Breustedt & Glauben, 2007; Peerlings & Ooms, 2008). Both models have similar and statistically significant negative estimates for coefficients for agricultural area. This suggests that larger farm size has a positive effect on the probability of the continuation of farming and larger farms are less likely to exit from farming.

It is argued that having off-farm non-labour income would allow for exiting from farming because another source of income is available. On the other hand, having off-farm non-labour income gives a source of income that enables the farmer to continue production even if on-farm income is low. Peerlings and Ooms (2008) found that off-farm non-labour income has no effect on exit. In this analysis, we consider renting land to other producers as a proxy for off-farm non-labour income. For a given farm size, an increase in the amount of land rented out shifts the composition of family income towards an increase in rental income and a decline in income generated from farm production activities. Ordered logistic estimation suggests that renting out land to other agricultural producers implies that the probability to exit from farming increases. This is in line with the characteristics of cluster 8, with high probability of exit, high share of renting out land and also high participation in the off-farm labour market. Therefore, the results suggest that renting out land could refer to a potential exit from the sector. It can also be argued that the decision to rent out one's land is taken after the exit is decided, so that the renting out of land is a result of the exit decision. In our dataset, 35 farmers (17.3% of the respondents) declared that they rent out a portion of their agricultural land and 37.1% of those farmers stated that they are not certain whether they will exit from farming or not in the next 3 years, 28.6% stated that they plan to exit and 34.3% declared that they plan to stay in farming. Therefore, we cannot associate the renting out of land with a certain exit in all the cases and a significant portion of farmers who rent out some of their land are not certain about their continuation or exit. Nevertheless, we can associate the fact that a farmer rents out land with a higher probability of exit compared to the farmer who does not rent his land to other farmers. This is in line with Glauben et al. (2004) who found that the probability of succession, as well as the likelihood of having nominated a successor, significantly declines with the amount of land leased out.

Goetz and Debertin (2001) and Breustedt and Glauben (2007) found that in regions where farmers have a larger share of owned land, farm exit rates are lower. A large share of owned land may indicate a relatively close emotional tie between the family and its owned business, and thus their inclination to quit farming is relatively low. In addition, a large share of owned land may provide a better credit capacity, increasing the financial stability of the enterprise. The logistic estimation confirms that a larger share of rental land increases the probability of exit from farming. This can be related to uncertainties about the length and prolongation of rental agreements and the increasing trend in land prices.

The condition of the health of farm operator was found to be significant factor in ordered logistic

regression. This indicates that, as expected, farm managers with a better health condition are less likely to plan to exit from farming.

The farmer's age has often been found one of the main determinants of farm exit and succession. In logistic and ordered logistic regressions, we used the farmer's age as an explanatory variable for stating exit but the *age* variable was insignificant and the signs of the estimates of logistic and ordered logistic regressions were inconsistent (see Appendix I). Therefore, based on the results of logistic and ordered logistic regressions, we cannot confirm that the farmer's age is among the most important determinants of farm exits in Estonia.

Several studies have examined the impact of off-farm employment on the survival of farms. The results reported in publications are controversial. Foltz (2004) finds that a farmer will choose to stay in business if the expected utility of staying in business is greater than exiting. Part-time farmers have been found to have lower expectations of continuing in farming (Pfeffer, 1989; Roe, 1995; Weiss, 1997, 1999). In contrast, Tweeten (1984) and Breustedt and Glauben (2007) suggest that small firms can survive provided that they use off-farm activities to maintain their total income. Kimhi and Bollman (1999) and Kimhi (2000) find that the exit probability decreases with off-farm work. They conclude that off-farm work is a "stable phenomenon" rather than the first step towards farm exit. Goetz and Debertin (2001) suggest that off-farm employment both stabilises household income and lowers the transaction costs of closing down the farm. They show that off-farm employment on the one hand lowers the probability of a net loss of farmers, but on the other hand, leads to higher exit rates if a net loss occurs.

It can be concluded that off-farm employment can have multiple impacts depending on the particular situation. In many cases, it can be a better economic alternative to farming or the first step out of farming, but in other cases, it is a source of income that allows farmers to keep their farms and farming lifestyles that otherwise would not provide a sufficient livelihood for their household. Our results show that in cluster 8, with a higher share of farm managers working off-farm, the exit probability is higher. Also, the estimated coefficients for *off_farm* variable in the unrestricted models (1) and (2) are positive (but insignificant). Therefore, we can assume that off-farm work is a factor that increases the probability of farm exit in Estonia.

From Appendix I, it follows that the initial models (1) and (2) also had consistently positive (but statistically insignificant) estimates for participation in investment subsidy schemes, animal production and the availability of successors. This implies that participation in investment subsidy schemes might indicate that the farm is more likely to exit from farming, which is not in line with our expectations and also the characteristics of farms in cluster 10. Estimates for *animals* suggest that farms with livestock production are more likely to exit, which may be related to higher capital and the on-farm labour requirements of animal production. The estimates for *successors* in models (1) and (2) imply that positive assessment about the availability of successors could be correlated with higher exit probability. The estimates of *successors* may be influenced by the medium-sized farms of cluster 7 that give somewhat contradictory signals – the high probability of exit and the high availability of successors. However, all these estimates are not statistically significant.

The estimates of *areachange* and *knowledge* were consistently negative, and insignificant in unrestricted models (1) and (2). This implies that farmers who are planning to increase their agricultural area (grow) are less likely to exit from farming, and also farmers that evaluate their knowledge more highly are less likely to exit from farming. Both of these results are in line with our expectations.

In initial models (1) and (2), the estimates for variables *agrev*, *lfa*, *capital* and *family* had inconsistent signs and were statistically not significant. Therefore, we cannot draw significant conclusions based on their estimates. The inconsistency of the signs of the estimates can be due to differences in the scaling of *exit* variable (see Section 3 and Table I). Considering the original set-up of the question about plans of exiting from the sector and the three possible answers of "Yes", "Not certain" and "No", the signs of ordered logistic estimates seem to be more in line with our expectations that the higher specialisation on agricultural production, better capital availability and higher family support have negative effects on exit probability. Our assumption was that the effects of being located in LFA differ and depend on the extent of natural disadvantages compared with non-LFA and the amount of additional LFA subsidies compared to other subsidies. Based on the results in Appendix I (and also the results of cluster analysis), we cannot confirm either of these assumptions.

5. Conclusions

Farm exit and succession are part of a larger discussion on agricultural change in the European countryside and its political implications. As private farms were re-established in CEECs during the transition from a socialist to a market economy approximately one generation ago, the generational

change is already a highly relevant topic. In Estonia, there has been a rapid decline in the number of agricultural holdings in recent years, which means that a considerable number of farm exits have taken place instead of farm transfers. As this will have an impact on the development of Estonian agriculture and rural areas, it is of great interest as to which type of farms will exit and which will remain operating in the sector.

Based on the survey of agricultural producers carried out in 2007, this paper attempted to study what characterises those Estonian farms who intend to exit from farming, and those that will continue farming, farmers were asked about their intentions to give up agricultural production in the coming 3 years. Cluster analysis was used to derive homogeneous groups of farms with distinct future perspectives and compare their economic and social characteristics. Logistic and ordered logistic regressions were used to identify factors that significantly influence the probability of exit from farming.

The results of the cluster analysis indicate that three groups of farms have a lower than average probability of exit. The first group consists of large-scale farms. These farms are more specialised in agricultural production, most of them rent land from others, use hired labour and have participated in investment subsidy schemes. The other two groups that do not plan to exit are small-scale family farms that are characterised by smaller than average agricultural area and rely mostly on family labour. They are more specialised in agricultural production and less diversified with less non-agricultural activities than the average farm. In one of the small-scale farm groups, the farm operators are above retirement age. They state high support from family, good knowledge in agricultural production, and no serious capital constraints to hinder their continuation in farming. So we could conclude that these farmers will continue farming as a part of their lifestyle and derive additional income in the form of pensions. The other small-scale farm group indicate the will to expand their farm, but they lack knowledge and capital. However, they report high support from family members. This indicates the limiting factors for those small-scale farms that intend to grow.

The logistic and ordered logistic regressions revealed that in small-scale farms relying on family labour decreases the probability of exit. At the same time, the diversification of farm activities with non-agricultural activities has a positive effect on the continuation of farming. Our analysis also suggests that the size of the farm is positively correlated to a continuation of farming but a higher share of rented land in total land use is increasing the risk of exiting from farming. The renting out of one's agricultural land refers to a higher probability of exit and this could be taken as the indicator of a planned resignation from farming. Also, the good condition of health appears to be a significant factor in decreasing the probability of exit.

This refers to the continuing trend of the polarisation of producers in Estonian agriculture, as on the one hand a small number of very large producers remain in the sector and provide the majority of agricultural output; while on the other hand, there is large number of small producers who continue farming as a part of their lifestyle. This process is part of a trend in European agriculture. Lobley and Potter (2004) suggest that a growing number of farmers are expected to disengage from mainstream agriculture to a greater or lesser degree. This takes a variety of forms, ranging from the diversification of income on or off the farm to the exit of farmer and its replacement with "lifestylers" who only marginally, or not at all, depend on agricultural income. Marsden et al. (2002) describe that the notion of the "family farm" based solely on bulk agricultural production as the centre of the agrarian model of development will be progressively replaced with the shift towards leisure and lifestyle farming, professionally run entrepreneurial holdings and multifunctional businesses, which exploit the economies of scope and synergy.

As stated above, if farm structures, structural changes, farm exit and succession are studied in CEECs, the special historical and social context of those transition countries have to be considered. Rizov et al. (2001) suggest that the shift to and development of individual farming could have been hindered by the high specialisation of collective farm members who may not possess the necessary skills to start-up a full-time individual farm. After 20 years of experience of private farming in dynamic and liberal economic conditions, one can expect that the next generation of farmers are not constrained by this high individual specialisation and have acquired more farm-specific human capital.

It has been suggested that the dual farm structure in CEECs is not viable in the medium term and appropriate policies will have to be applied to facilitate the move towards more balanced and equitable farm structures (Sarris et al., 1999). Our results suggest that there is still a tendency that farm structures remain dual in Estonia as the least likely exiting farm types are large-scale corporate farms and small-scale family farms.

Estonia, like the other EU members, has set the goal of stimulating the entrance of young farmers into the sector. Young entrants are more innovative, more motivated towards the longer term, and better able to adapt and their entrance makes the sector

more productive, competitive and viable (Williams & Farrington, 2006). However, whether this policy goal is achievable remains to be seen. Part of future research should concentrate on the young farmers to whom the farm has been successfully transferred and investigate into what has motivated them to work in the sector.

The future research on Estonian farm exits, transfer and succession should also include the analysis of data about family characteristics to study how those characteristics influence exit or the continuation of farming. The topic of farm exits will remain relevant as it is projected that the number of agricultural holdings in Estonia will continue to decline. However, a variety of different farmers with different goals, whether it is lifestyle, some alternative activity, or something else, will remain operating in rural areas.

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Notes

1. ESU stands for economic size units defined for the purpose of FADN. 1 ESU equals standard gross margin of 1200 EURs.
2. The average agricultural area of farms whose economic size exceeded 2 ESU in 2007 was 108.0 ha (Statistics Estonia, 2009).
3. Software package STATISTICA 8.0 was used for PCA, cluster analysis, logistic regression and ordered logistic regressions.
4. We consider the cluster average of the *exit* variable as a proxy of probability of exit from farming in the respective group.

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Appendix I. Estimates of logistic and ordered logistic regressions.

	Logistic estimation	Ordered logistic estimation
Intercept/intercept 1	0.1248 (2.0559)	1.4526 (1.5720)
Intercept 2		2.9769* (1.5828)
age	−0.0116 (0.0173)	0.0017 (0.0129)
flabour	−1.3373** (0.5809)	−1.2276** (0.4874)
agrev	0.0789 (0.8249)	−0.0493 (0.6218)
othrev	−5.8628** (2.3846)	−0.9197 (0.6218)
off_farm	0.4353 (0.4773)	0.5421 (0.3517)
lfa	0.1569 (0.3964)	−0.0193 (0.2922)
invest	0.3384 (0.7480)	0.3115 (0.6025)
area	−0.0029* (0.0015)	−0.0022*** (0.0009)
rentout	0.5668 (0.5041)	0.7697** (0.3765)
rental	1.3988** (0.6790)	0.1981 (0.5054)
animals	0.0572 (0.4265)	0.2353 (0.3159)
areachange	−0.0130 (0.2577)	−0.1266 (0.1951)
successors	0.1017 (0.2079)	0.0059 (0.1508)
knowledge	−0.3023 (0.3639)	−0.1829 (0.2592)
capital	0.0523 (0.3010)	−0.0973 (0.2159)
health	0.0694 (0.2778)	−0.33196 (0.2029)
family	0.1227 (0.2574)	−0.0117 (0.1858)
	Pseudo $R^2 = 0.1299$	Pseudo $R^2 = 0.0614$
	Loglikelihood = 91.00	Loglikelihood = 197.95
	$n = 202$	$n = 202$

*Significant at 0.10 level.
**Significant at 0.05 level.
***Significant at 0.01 level.
Note: The quantities in parentheses beside the estimates are the standard errors.

III

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THE DETERMINANTS OF FARM GROWTH, DECLINE AND EXIT IN ESTONIA.
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The Determinants of Farm Growth, Decline and Exit in Estonia

Die bestimmenden Faktoren für die Vergrößerung, den Rückgang der Größe und den Ausstieg der landwirtschaftlichen Betriebe

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Abstract

The process of structural changes in Estonian agriculture is influenced by both socioeconomic factors that are similar in other western countries and transition-related factors. This current paper aims to investigate the effects of such socioeconomic factors on the probabilities of farm growth, decline and exit relative to retaining the previous farm size. The survey and agricultural registers' data are used for multinomial logit estimation. The results indicate that the farm growth probability is highest in the 40-49 year age group. The availability of successors significantly reduced farm exit probability, and the level of education of the farm operator increased the farm growth probability. While off-farm work was more probable in smaller farms and in cases of more educated and younger farm managers, it was evident that the off-farm employment of the farm operator significantly increased the probability of farm exit. While the larger farms have a higher probability of remaining in business, and lower probability to exit or decline, they do not have higher growth probability. Participation in a semi-subsistence farming scheme reduces the exit probability. It has been shown that farms founded during the beginning of transition due to restitution have lower decline and growth probabilities, indicating that such farmers are emotionally more inclined to maintain the farms of their forefathers.

Key words

structural changes; farm exits; farm growth; economic transition; semi-subsistence farming; Estonian agriculture

Zusammenfassung

Der Prozess der strukturellen Veränderungen in der estnischen Landwirtschaft wird von sozioökonomischen Faktoren, die ähnlich in anderen westlichen Ländern sind, sowie von mit dem Übergang verbundenen landesspezifischen Faktoren beeinflusst. Im diesem Artikel werden die Auswirkungen solcher sozioökonomischen Faktoren auf die Wahrscheinlichkeit des Wachstums, Rückgang der Größe und Ausstieg der landwirtschaftlichen Betriebe untersucht, im Vergleich zu der Lage, wenn die Größe sich nicht ändert. Für die Multinomialen Logit-Modelle werden Daten aus den Umfragedaten und Daten aus dem Landwirtschaftsregister verwendet. Die Ergebnisse zeigen, dass die Wahrscheinlichkeit des Wirtschaftswachstums eines Betriebes am höchsten ist, wenn der Betreiber zwischen 40 und 49 Jahre alt ist. Die Existenz von Nachfolgern hat eine negative Wirkung auf den Ausstieg. Das Ausbildungsniveau des Betreibers erhöht die Wahrscheinlichkeit des Wirtschaftswachstums des Betriebes. Es ist offensichtlich, dass die Beschäftigungsmöglichkeiten des Betreibers außerhalb des Landwirtschaftsbereichs die Wahrscheinlichkeit des Ausstiegs erhöhen. Während die größeren Betriebe deutlich seltener aussteigen oder ihre wirtschaftliche Größe zurückgeht, ist ihre Wachstumswahrscheinlichkeit auch nicht größer. Zur gleichen Zeit senkt die Teilnahme an einem Semi-Subsistenzbetriebe-Schema die Ausstiegswahrscheinlichkeit von Betrieben.

Schlüsselwörter

strukturelle Änderungen; Ausstieg der landwirtschaftlichen Betriebe; Wachstum der Betriebe; wirtschaftlicher Übergang; Semi-Subsistenzbetriebe Schema; estnische Landwirtschaft

1 Introduction

Expansion, contraction and exit are the farm development phases often associated to the farm family life cycle, which comprises of the entry, growth, maturity, decline, and exit stages. In the exit phase, the farm is handed over to the next generation or liquidated (BOEHLJE, 1973; POTTER and LOBLEY, 1992, 1996; LOBLEY et al., 2010). In Western countries, the number of farms is largely decreasing, implying that the remaining farms, on average, increase in size (GALE, 2003).

In the last 100 years, three structural breaks have occurred in Estonian agriculture, influencing both farm ownership and size structure. The first structural break occurred in 1918 when the Republic of Estonia was founded. At the time, 58% of the total land belonged to about 1,000 manors of the nobility, with the average holding being 2,114 ha. The rest of the land was operated by 51,600 farms with an average size of 34 ha. In 1920-30s, the manor lands were nationalised and new farmsteads were parcelled out. These reforms contributed to the creation of a new social order, in which the equitable distribution and individual control of property occupied a pivotal role. The stated aim of the spatial reconfiguration was to promote an egalitarian society and to encourage entrepreneurial individualism, as well as to bond citizens to the state and its cherished republican ideal, rather than to customary communal institutions. Therefore, the spatial reconfiguration of land rights was an important way of communicating egalitarian ideals and integrating the national territory (MAANDI, 2010). By 1939, the number of farms was 140,000 with an average size of 23 ha (PIHLAMÄGI, 2004).

The second structural break, collectivisation, began with the Soviet occupation in 1940. The main part of collectivisation occurred in 1949-1952, during which the land, assets and animals of the last private farms were collectivised. The restructuring of collective farms continued throughout the occupation: in 1949, there were about 9,000 collective farms; 326 collective and state farms with average area of 7,628 ha remained by 1989 (UNWIN, 1997).

The third structural break began at the end of the 1980s with establishment of private farms on the marginal land of collective farms. In 1989, aside from the collective farms, there were 828 private farms with average area of 25 ha. The first reforms and changes carried out during the years leading to the collapse of the Soviet Union culminated in the transition from socialist collectivised agriculture to market-based private farming after Estonia regained its independence. In 1991, the restitution of land to its pre-collectivisation owners and the privatisation of collective farms began (VIIRA et al., 2009a).

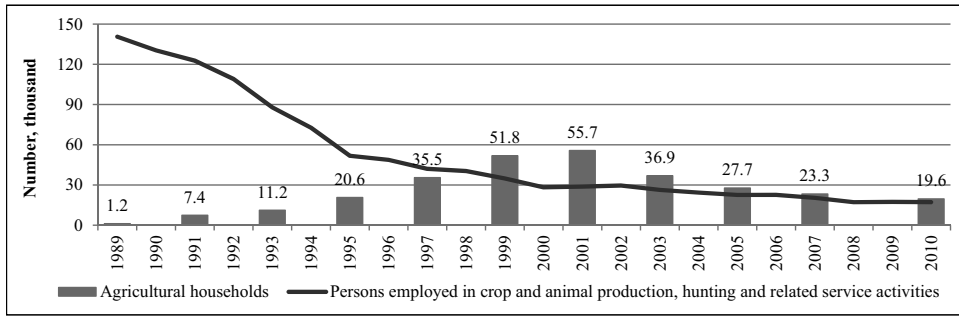
Since the continuity of the ownership was considered important, in part, the land, agricultural and ownership reforms of the 1990s followed the same ideological goals of the land reforms in the 1920s (CSAKI and LERMAN, 1994). In the political debate, the pre-Second World War family farms were presented as the ideal and natural way of agrarian structure in which the rightful owners of the land could use their property as they saw fit, as opposed to forced the collectivisation and industrialisation of Soviet agriculture in which the workers of collective farms had little property and no real interest in the fruits of their labour. The prevailing notion was that Estonian families would return to their rural roots in large numbers, creating family farms that would provide sustenance to the majority of the rural population, create strong families and rural communities.

In the case of CEEC land reforms, distributional effects involved two separate and sometimes conflicting issues: 1) the legal ('historical justice') demands of pre-collectivisation landowners whose land was confiscated by communist regimes or who were forced to participate in the collectivisation, and 2) social equity concerns (SWINNEN, 1999). In Estonia, the latter was addressed by allowing the opportunity to privatise land by pre-emptive rights (for people whose buildings were located on land subject to privatisation) or on general grounds (for rural inhabitants in the vicinity of their homes) (EMA, 2002). During the agricultural reform, a local reform committee in each collective farm decided how the farm's assets would be distributed for compensation to pre-war owners, privatisation or sale. From the economic point of view, the idealisation of family farming could be cited as a hindrance that led to the separation of many of the functioning collective farms and the creation of many private farms that became unviable (IVASK, 1997).

In the euphoria of the moves towards independence, it was estimated that there would be 40,000-60,000 private farms in Estonia by 2000 (UNWIN, 1997). This proved true as the number of agricultural households[1] increased to 55.7 thousand by 2001, with

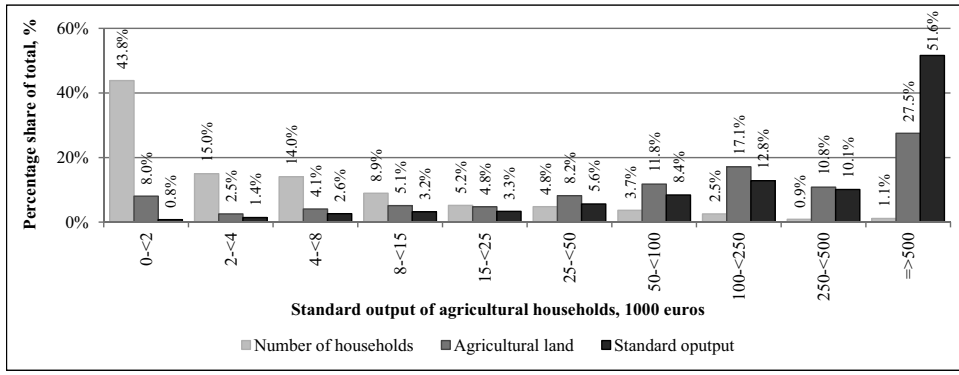
[1] Due to the fact that the definitions of agricultural holdings have changed several times in 1989-2010, we have used agricultural household as a synonym of farm. Here, household plots are not accounted as agricultural households. In 1989 collective farms and private farms are considered as agricultural households. From 1991-1999 agricultural enterprises and private farms were considered as agricultural households. Agricultural enterprise was defined as a legal person whose main activity according to the Estonian Business Register is agriculture. Private farm was defined as a holding with more than 1 ha of agricultural or forest land (STATISTICS ESTONIA, 2002). Since 2001 agricultural holdings were considered as agricultural households. Agricultural holding is defined as a single unit both technically and economically, which has single management and which produces agricultural products or maintains its land which is no longer used for production purposes in good agricultural and

Figure 1. Number of agricultural households and agricultural employment in Estonia in 1989-2010



Source: STATISTICS ESTONIA (2012)

Figure 2. Distribution of agricultural households, agricultural land and standard output in Estonia in 2010



Source: STATISTICS ESTONIA (2012)

an average of 16 ha of agricultural land per household (Figure 1). Agrarian restructuring and the creation of private farms led to a situation where, in 2001, the number of people employed in agriculture, hunting and related service activities was 28.8 thousand, while the number of agricultural households was two times higher. Evidently, many of the 55.7 thousand agricultural households were unable to provide full-time employment for at least one household member. By 2010, compared to 2001, the number of agricultural households had decreased by 64.8% to 19,600 with an average of 48 ha of agricultural land each, and agricultural employment had decreased to 17.2 thousand persons.

However, the size distribution of agricultural households remains skewed: in 43.8% of the households, the standard output (SO) was less than 2,000 euros in 2010[2]. These households managed 8.0% of agricultural land and produced 0.8% of the total SO (Figure 2). At the same time, in 1.1% of the house-

environmental condition, where there is at least 1 ha of utilised agricultural land, or there is less than 1 ha of utilised agricultural land but agricultural products are produced mainly for sale. Units where agricultural products are not produced but only land is maintained in good agricultural and environmental condition are included from 2007 (STATISTICS ESTONIA, 2012).

[2] In the agricultural census, economic size of agricultural households is estimated. From 2010 economic size of the holding is measured as standard output of the holding. Standard output is defined as the monetary value of gross agricultural production at farm-gate price corresponding to the average situation in a given region which is calculated on the basis of crop area, number of livestock and standard output coefficients. Standard output does not include VAT, other taxes on products and direct payments (STATISTICS ESTONIA, 2012; COMMISSION REGULATION (EC) NO 1242/2008).

holds SO was at least 500,000 euros. This 1.1% of households managed 27.5% of agricultural land and produced 51.6% of the total SO. In 2011, 946 thousand ha of agricultural land was utilised in Estonia. In 1991, the utilised agricultural area was 1,375 thousand ha and the area of arable land was 1,116 ha, implying that approximately 200-400 thousand ha of agricultural land has been left idle in transition. In 2011, the share of the agricultural sector in value added was 3.6% and in employment 3.2%. The value of Estonian agricultural output was 810.6 million euros in 2011, of which arable products comprised 41.5% (cereals 15.5%, oilseeds 7.7%, fodder 7.9%) and animal products 47.8% (milk 26.0%, pork, 10.7%, cattle excl. milk 5.3%) (STATISTICS ESTONIA, 2012).

Therefore, due to the context of transition, the development of Estonian farm structures in the past 25 years differs from the traditional development of the family farm based structure in western countries, as described by e.g. TAYLOR et al. (1998), PESQUIN (1999), ERRINGTON (2002), CALUS et al (2008). In the beginning of the period, the number of farms increased rapidly due to the processes of transition, restitution and privatisation, while the relative uncertainties about the stability of economic conditions coupled with the fast development of other economic sectors have contributed to the decline in the number of farms (VIIRA et al., 2009a). Since the newly established farms were not taken over from the preceding generation, this process cannot be characterised as smooth intra-family farm successions. Growing up on a farm and socialisation within a farm family are regarded as specific investments in human and social capital, which can be seen as a transaction specific investment and the accumulation of attitudes and skills that are adjusted to the specifics of decision making in individual family farm units (HUFFMANN, 1977; PESQUIN et al., 1999; GLAUBEN et al., 2004b). As a large proportion of farms were returned to the heirs of the pre-war owners, many new owners lacked the human and financial capital necessary for managing an individual farm. HEDIN (2005) found that non-monetary values like the desire to recover family property and the sense of duty towards ancestors were important factors for new landowners, and in many cases economic motives for the recovery of land were of minor importance.

The decrease in the number of farms and the increase in average farm size from 2001 to 2010 imply that farm growth, decline or exit could be observed in many cases. In Estonia, the rapid decline in the number of farms has raised questions if the chosen paths of agricultural and ownership reforms were correct, and if the agricultural policy has been preferential for larger farms. Taking into account the context of changes since 1991-2010, we assume that in addition to economic and socioeconomic factors, farm growth, decline and exits have also been affected by transition-specific factors, such as in the way the farm was established (e.g. restitution of pre-war farm, privatisation of part of collective farm etc.) or participation in semi-subsistence farming schemes in new EU member states. Given the large decrease in the number of agricultural households, we expect that a large portion of the households that have exited the agricultural sector were restituted farms. However, in recent years, the decline in the number of farms has slowed down (Figure 1). Hence, one generation after the beginning of the transition, it is intriguing to study if the process of structural changes is driven by similar factors as in other western countries or still exhibits the characteristics of post-communist transition.

Therefore, the aim of this paper is to study the effects of various farmer- and farm-specific characteristics on the probability of farm growth, decline and exits relative to retaining the previous farm size. The factors under consideration are: the age of the farm operator, farm size measured by the value of the farm's standard output, off-farm employment status of the farm operator, farm operator's evaluation on the availability of successors, and his/her level of formal education. Also, the effects of the farm specialisation (grazing livestock), the way the farm was established (restitution), and participation in semi-subsistence farming scheme are analysed. We use multinomial logit regression and farm survey data from 2007 and 2011, which is combined with the 2006 and 2010 data from the national paying agency's registries about land use, animal stock and farm payments.

2 Factors that Affect Farm Growth, Decline and Exit

BOEHLJE (1990) categorises five models of structural change: the technology, human capital, financial, institutional, and sociological (family farm) model. In our analysis, we mainly draw on the sociological and human capital models, as these are closely related to the family farm life cycle and farm family characteristics.

Numerous studies suggest that the age of the farm operator is one of the main factors in farm

growth and survival (WEISS, 1999; VÄRE, 2006; PEERLINGS and OOMS, 2008; SCHNICKE et al., 2008). In the entry stage, the farm operator has to acquire a "critical mass" of managerial ability and the capital necessary for growth. In the exit stage, the farm operator is interested in reducing his/her commitment (BOEHLJE, 1990). This implies that farm growth is less likely in the younger and older age groups of farm operators. In addition, the effect of age is interrelated with the availability of successors. If the farm is transferred within the family, its viability is optimised prior to succession. In the case of farm exit, liquidation value is optimised. The succession effect plays a role from the age of 45 and the early designation of the successor motivates the farmer to invest and improve the management of the farm (GLAUBEN et al., 2002; CALUS and VAN HUYLENBROECK, 2008; CALUS et al., 2008; VÄRE, 2006).

Human capital, i.e. level of education, managerial ability, experience and skills, has been noted as an important factor in farm growth. Managerial input is also critical to the cost and production relationships of a farm. If managerial capacity is a fixed factor, then costs will eventually rise with increased farm size, since higher levels of output receive less and less managerial input (BOEHLJE, 1990).

RIZOV (2003) has suggested that the analytical background of JOVANOVIC's (1982) model, in which individuals are unsure of their abilities when they enter business but uncover their true efficiencies over time, is appropriate to explain the farm-sector transformation in former communist countries as many individuals established private farms without knowing if they have what it took to become an entrepreneur. In the study of the role of human capital in the decisions of rural households regarding the selection of the farming mode (cooperative, full-time individual farm, part-time individual farm, hybrid, or absentee landowner) in Romania, RIZOV (2005) found that, while the farm type selection process was complicated by the factor of market imperfections characterising transition, households with a higher level of human capital (education, broader work experience) were more likely to opt for either full- or part-time individual farming, or selected absentee landowner type and rented out land, while deriving income from off-farm work. Therefore, higher human capital can be associated with the more effective management of individual farms and better opportunities in the off-farm labour market. Households with lower human capital were more likely to select a cooperative type of farming.

Also, it has been argued that human capital may increase the earning capacity of a farm operator in the non-farm economy, therefore reducing the probability of farm survival if the farm operator chooses to dedicate 100% of his/her labour input outside the farm (WEISS, 1999); or increasing the probability of farm survival if only part of the labour input is used off-farm, and the off-farm income complements earnings from agricultural production (BREUSTEDT and GLAUBEN, 2007; BOEHLJE, 1990). Off-farm employment has more of an impact on the farming sector in areas where there are more non-farm employment opportunities (BOEHLJE, 1990), and also in the younger age group of farmers who can benefit more from the change in their careers due to the longer time horizon (RIZOV and MATHIJS, 2003).

Gibrat's Law implies that farm growth is independent of the initial farm size. However, WEISS (1999) shows that smaller farms grow relatively faster than larger farms. Several studies have reported a negative relationship between farm size and farm exits. More land makes it easier to overcome borrowing constraints and therefore reduces development restrictions and increases succession probability (GLAUBEN et al., 2004a; BREUSTEDT and GLAUBEN, 2007). According to the financial model of structural changes, agricultural land is one of the main production factors that determine farm income. Simultaneously, land constitutes a major part of farm capital. If capital gains from land are foreseen, the farmer is expected to obtain more agricultural land to increase the farm's future value (BOEHLJE, 1990). In Estonia, the average level of direct payments per ha of agricultural land is one of the lowest in the EU; however, the payments have been increasing since 2004 and are expected to converge towards average EU levels in the future (EUROPEAN COMMISSION, 2011). Therefore, in Estonia, the expected future capital gains from agricultural land have been and will continue to be a strong motivator for farm expansions.

The technology model of structural changes mainly deals with the adaptation of technology and scale economies. Primarily, the interest lies in the long-run cost curve and factors that affect the curve, among which agricultural policy is often of interest (BOEHLJE, 1990). In this paper, we analyse the effects of the semi-subsistence farming scheme on farm growth, decline and exit probabilities. Subsistence farming is often associated with rural poverty, or lifestyle and consumption preferences. Semi-subsistence farms normally produce for their own needs but also

sell to local markets. The semi-subsistence farming measure was a transitional measure for supporting semi-subsistence farms in the new EU member states that were undergoing restructuring (DAVIDOVA et al., 2009). The semi-subsistence farming scheme was one of the payment schemes in the 2004-2006 Estonian Rural Development Plan. Participation in the scheme provided farmers with an annual flat rate payment of 1,000 euros for five years. The aim of the scheme was to maintain smaller agricultural holdings and enhance their survival. Farmers were obliged to continue with agricultural activities for five years and increase the revenues from agricultural production (EMA, 2005).

In addition to the semi-subsistence farming payment, semi-subsistence farms were eligible also for single area payment, other types of direct payments and rural development support measures. In 2006, 16.1% of all the recipients of farm subsidies in Estonia received semi-subsistence payments. Of the 3,217 semi-subsistence farms 16.3% received only semi-subsistence payment and 83.7% received also other farm payments. The average area of these semi-subsistence farms that received other farm payments was 36.9 ha, and average SO 15,173 euros, their average level of all farm payments was 205 euro/ha and farm payments comprised 56% of their total SO. In case of the farms that did not receive semi-subsistence payments, the average area was 47.8 ha, the average SO was 24,548, the average level of all farm payments was 95 euro/ha and farm payments comprised 37% of their total SO. Therefore, the semi-subsistence farms had considerably higher average level of subsidies. However, the uptake of the measure in Estonia was lower than in other new EU member states. One of the reasons for relatively low participation was the requirement to continue agricultural activities in the next 5 years. Given the rapid decline in the number of agricultural households in Estonia between 2003 and 2010 (Figure 1), it is likely that those agricultural households that were unsure about continuation of farming, did not sign the contract for the next 5 years.

Farm survival is also influenced by the type of activities undertaken. A high share of animal production indicates relatively high sunk costs in closing down the farm. BREUSTEDT and GLAUBEN (2007) found that in regions specialised in livestock production the loss in the number of farms was significantly smaller. In our sample, specialist grazing livestock (in the following we use 'grazing livestock' for abbreviation of this farm type) was the most frequent farm type (Table 2). In this farm type, the SO of grazing livestock (i.e. equidae, all types of cattle, sheep and goats) and forage for grazing livestock constitute more than 2/3 of farm SO (COMMISSION REGULATION (EC) NO 1242/2008). Substantial structural changes have occurred in this farm type in recent years in Estonia. In 2004, there were 2,146 milk quota owners in Estonia; in 2012, 918 quota owners remained. Hence, in 8 years, 57.2% of the milk producers had quit milk production (ARIB, 2005). Also, in 2006-2010, the number of grazing livestock farms in the registries of the paying agency decreased by 5.3%, while the total number of farms in the registries declined 2.9%. Therefore, it was analysed whether specialising in grazing livestock had an effect on farm growth, decline and exit probabilities.

3 Data and Method

The data was obtained from two farm surveys conducted in December 2007 and March 2011. The survey of 2007 aimed to investigate the perspectives and intentions of Estonian agricultural producers in the upcoming three years (2008-2010) (VIIRA et al., 2009b). The questionnaire was posted to a random sample of 1,000 farmers from the population of 6,724 farms whose economic size exceeded 2 ESU in 2005. In total, 290 questionnaires were returned (response rate 29%). In 2011, the survey was repeated among the respondents of the previous survey. Of the 290 posted questionnaires, 228 were returned (response rate 78.6%). The structure of the questionnaire was similar to that used in 2007. In addition, farmers were asked if they had quit agricultural production in 2008-2010. Since all of the respondents did not answer all the questions, data from 196 respondents is used in the present analysis.

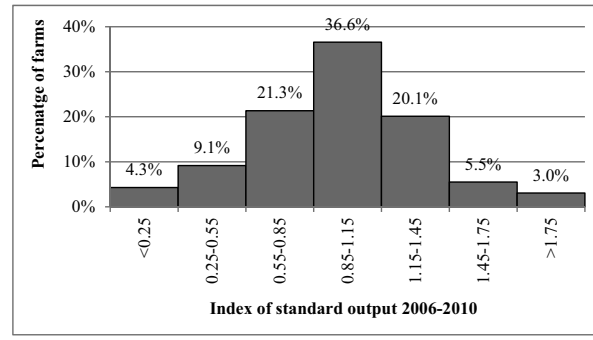
The survey data was complemented with data from the registries of the paying agency (ARIB – Estonian Agricultural Registers and Information Board) regarding land use, crops, agricultural animals, and participation in payment schemes. Based on the registry data of 2006 and 2010, SO as defined in the COMMISSION REGULATION (EC) NO 1242/2008 were calculated for each farm, based on Estonian SO coefficients used in 2011 (RURAL ECONOMY RESEARCH CENTRE, 2012). The derived SO of 2006 and 2010 were used in order to measure the economic size of the farms in 2006, and estimate changes in the farm's economic size between 2006 and 2010. Among those 164 farms that did not quit agricultural production between 2006 and 2010, the average SO in 2006 was 71,034 euros, and 80,305 euros in 2010. This indicates

that the average economic size of the remaining farms increased by 13.1%. In 2006, the average SO of those farms that quit agricultural agricultural production between 2006 and 2010 was 11,836 euros.

Previous studies have investigated the effects of various determinants on the probability of farm growth or decline based on stated intentions (BARTOLINI and VIAGGI, 2012), or on empirical growth rates (RIZOV and MATHIJS, 2003; PEERLINGS and OOMS, 2008; BAKUCS and FERTŐ, 2009). Based on empirical data from 2007 and 2011, we aim to study the effects of various factors on the probability of farm exit, decline and growth, relative to retaining farm size. Since the SO in farming may vary from year-to-year depending on crop rotations, calving or culling rates and timing, diseases, etc., it is reasonable to assume that the variation of SO within a specific range should be considered as relative stability rather than farm growth or exit. However, there is no empirically correct threshold for growth or decline rates.

Based on the percentiles of changes in the SO (Table 1) and an average of 13.1% growth in SO in 164 remaining farms (32 farms exited between 2006 and 2010), a 15% growth and decline threshold was considered appropriate for the analysis. Hence, if a farm's SO in 2010 was less than 85% of its SO in 2006, the farm size was considered to be decreasing. Therefore, of the 164 farms that retained agricultural production, 34.8% (Figure 3), and in the whole sample of 196 farms 29.1%, were deemed to be decreasing. If the farm's SO in 2010 exceeded 115% of the respective value in 2006, the farm was considered to be increasing (28.7% of farms that retained agricultural production and 24.0% of the farms in the whole sample). If the SO in 2010 was in the range of 85-115% compared to the value in 2006, the farm size was considered to be stable (36.6% of farms that retained agricultural production and 30.6% of the farms in the whole sample). The farms for which the farm operator declared that the farm has ceased agricultural production, or which the SO was zero in 2010, were considered to be those that have exited from farming (16.3% of the whole sample).

Figure 3. Distribution of farms that retained agricultural production according to the changes in the standard outputs in 2006-2010 (N=164)



Source: own calculations

Table 1. Percentiles of farms that retained agricultural production according to the changes in the standard outputs in 2006-2010 (N=164)

Percentile	N	Range (index of standard output)	Average standard output in 2006, euros	Average area in 2006, ha
0.1	17	0.069-0.509	21,352	38.0
0.2	16	0.509-0.686	13,256	33.8
0.3	16	0.686-0.799	13,586	28.5
0.4	17	0.799-0.890	147,681	231.9
0.5	16	0.890-0.953	54,416	97.6
0.6	16	0.953-1.010	74,297	153.2
0.7	17	1.010-1.124	31,160	87.2
0.8	16	1.124-1.233	88,490	292.4
0.9	16	1.233-1.364	156,739	278.4
1.0	17	1.364-9.532	107,863	101.7

Source: own calculations

The definitions and descriptive statistics of dependent and independent variables are given in Table 2. Multinomial logit regression was used to estimate the effects of the explanatory variables on the probability of farm exit, decline and growth relative to the base situation, which here is retaining the farm's economic size in the range of 85-115% of the respective figure in 2006. The multinomial logit regression model was specified as:

$$\text{Logit}(\text{development}_{j|\text{stable}}) = \alpha_0+\alpha_{1jk}\text{age}+\alpha_{2jl}\text{size}+\alpha_{3j}\text{off\_farm}+\alpha_{4j}\text{semisubs}+\alpha_{5j}\text{education}+\alpha_{6j}\text{successors}+\alpha_{7j}\text{restituted}+\alpha_{8j}\text{gr\_livestock}+\varepsilon_j. \quad (1)$$

Table 2. Definition and descriptive statistics of variables

Variable	Definition	Scale/measurement	Obs	Mean	Std. dev.	Min	Max
Dependent variable							
Development	Exit or change in farm standard output (SO) in 2006-2010	0=stable (2010 SO 85-115% of 2006 SO)	60				
		1=exit from farming	32				
		2=decreasing (2010 SO <85% of 2006 SO)	57				
		3=increasing (2010 SO >115% of 2006 SO)	47				
Explanatory variables							
Age	Age of the farm operator in 2007	<40 years	16	35.0	4.2	25	39
		40-49 years	38	44.9	2.9	40	49
		50-59 years	66	54.3	2.9	50	59
		≥60 years	76	68.7	5.8	60	85
Size	Farm size measured in 2006 SO (thousand euros)	1st quartile	49	4.4	1.8	0.4	7.7
		2nd quartile	49	10.0	1.6	7.7	13.4
		3rd quartile	49	21.0	5.8	13.4	31.6
		4th quartile	49	210.1	329.9	31.6	1458.6
Off_farm	The farm operator has an off-farm job.	0=no, 1=yes	196	0.24	0.43	0	1
Semisubs	The farm is participating in the semi-subsistence farming scheme.	0=no, 1=yes	196	0.45	0.50	0	1
Education	Farm operator's level of education	1=basic education 2=secondary education 3=vocational education 4=higher education	196	2.79	1.00	1	4
Successors	Farm operator's evaluation on the availability of successors	1-very poor, 2-poor, 3-adequate, 4-good, 5-very good	196	2.37	1.08	1	5
Restituted	The farm was established on the basis of restituted land.	0=no, 1=yes	196	0.59	0.49	0	1
Gr_livestock	Farm is specialised in grazing livestock.	0=no, 1=yes	196	0.52	0.50	0	1

Source: own calculations based on survey data from 2007 and 2011, and paying agency data from 2006 and 2010.

From the model specification in equation (1), *development*$_j$ are the probabilities of farm exit, decline or growth relative to retaining the farm's economic size (stable) within the chosen boundaries (85-115%). The α_j are the parameters to be estimated simultaneously for the three regression equations represented by equation (1), and ε_j are the corresponding residual terms.

The variable *Age* measures the age of the farm operator. In 2006, the average age of the respondents was 56.5 years. In the empirical estimation, the variable is categorised into four (k) groups of <40, 40-49, 50-59 and ≥60 years and the group of ≥60 years is used as the basis for comparisons. The variable *Size* is classified into 4 (l) quartiles according to the SO of farms in 2006. The first three quartiles are used as dummy variables in the empirical estimation and the fourth quartile is a basis for comparisons. In the first size quartile, the farm SO ranges from 360 to 7,652 euros, in the second quartile the SO range is 7,652-13,358 euros, and in the third quartile 13,358-31,634 euros. In the fourth quartile, the values of farm SO are between 31,634 and 1,458,626 euros.

Off_farm is a dummy variable that represents whether the farm operator has an off-farm job in addition to the work in the farm. 24% of the respondents declared having an off-farm job. The dummy variable *Semisubs* indicates whether the farm was participating in the semi-subsistence farming scheme in 2006. 45% of the respondents participated in the scheme. *Education* describes the level of formal education of the farm operator and is a proxy for human capital. The variable is scaled increasingly starting from the value 1 (basic education) to 4 (higher education). This variable is assumed to be roughly continuous. The variable

Successors describes the farm operator's subjective evaluation about the availability of successors for farm transfer in the Likert scale from 1 (very poor) to 5 (very good), and is assumed to be roughly continuous. The mean of the given evaluations was 2.37, indicating that most of the farmers do not consider farm transfer to a successor likely. 59.7% of the farm operators evaluated the availability of successors as 'very poor' or 'poor', and just 16.3% of the respondents evaluated the availability of successors as 'good' or 'very good'.

The dummy variable *Restituted* indicates whether the farm was established at the beginning of transition on the basis of restituted land or founded in some other way. In our sample, 14 farms (7.1%) were established as a result of the privatisation of a functioning previous collective farm or part of the collective farm, 56 farms (28.6%) were established as private farms on rented, privatised or bought land[3], 11 farms (5.6%) were bought from other farmers, and 115 farms (58.7%) were established on the basis of restituted land or farmsteads.

Gr_livestock is a dummy variable that indicates whether the farm was specialised in grazing livestock (milk, beef, sheep or goats) in 2006. In the sample, 52.0% of the respondents belonged to the *Gr_livestock* farm type, 30.6% of the respondents were specialised in arable production, 16.8% were farms with mixed activities and 1 farm was specialised in horticulture.

4 Results and Discussion

The estimates of the specified model (1) are given in Table 3. Next, the estimated effects of explanatory variables are discussed.

Table 3. The results of multinomial logit estimates

Variable	1=exit from farming	2=decrease of standard output>15%	3=growth of standard output>15%
Intercept	1.076 (1.865)	0.284 (1.129)	-2.273 (1.319)*
Age<40	-1.222 (1.406)	-1.001 (0.828)	0.464 (0.804)
Age 40-49	-1.521 (0.951)	-0.929 (0.635)	1.238 (0.644)*
Age 50-59	-1.274 (0.691)*	-0.759 (0.487)	0.441 (0.589)
Successors	-1.095 (0.350)***	-0.236 (0.199)	0.263 (0.207)
Farm size 1st quartile	2.936 (1.265)**	1.562 (0.697)**	1.039 (0.734)
Farm size 2nd quartile	1.881 (1.278)	1.119 (0.644)*	0.250 (0.664)
Farm size 3rd quartile	1.239 (1.382)	1.579 (0.630)**	0.903 (0.600)
Off_farm	1.568 (0.698)**	0.293 (0.523)	-0.287 (0.566)
Semisubs	-1.862 (0.658)***	-0.321 (0.431)	-0.562 (0.469)
Education	-0.056 (0.293)	-0.019 (0.215)	0.471 (0.263)*
Restituted	0.364 (0.625)	-0.700 (0.422)*	-1.052 (0.440)**
Gr_livestock	-1.160 (0.642)*	0.364 (0.420)	-0.367 (0.448)
McFadden pseudo R^2		0.223	
Log likelihood		-207.044	
Number of observations		196	

Figures in parentheses are standard errors.
*significant at 0.1 level; **significant at 0.05 level; ***significant at 0.01 level
Source: own calculations

4.1 Farm Life Cycle

In this paper, we use the age of the farm operator and the farm operator's evaluation on the availability of successors as the variables related to the farm life cycle. The estimates of the model confirm the relevance of the farm life cycle on farm growth, decline and exit. From Table 3, it appears that the probability of exiting from farming is lower in younger age groups compared to the farm operators in the age group ≥60 years. The difference is significant at the 0.1 level in the 50-59 year age group. The signs of regression coefficients indicate that the probability of farm size decline is also lower in younger age groups. However, these coefficients are not statistically significant. It appears that the probability of farm growth is significantly higher if the farm operator is 40-49 years old. In the age groups <40 years and 50-59 years, the farm growth probability did not differ significantly

[3] There were several ways in which a private farm could have been established. In 1988 a regulation was adopted for the allocation of the marginal land of collective farms to private farms, as well as selling of agricultural machinery to private farms (EMA, 2002). The Farm Law of 1989 envisaged, in addition to hereditary (based on pre-collectivisation farms), establishment of new tenant farms. In order to address the social equity concern (SWINNEN, 1999), the Estonian Land Reform Act of 1991 enacted the privatisation of land by pre-emptive rights (for people whose buildings were located on land subject to privatisation) or on general grounds (for rural inhabitants in the vicinity of their homes) (EMA, 2002).

compared to age group ≥60 years. This is in line with BOEHLJE's (1990) suggestion that the farm operator first needs to acquire a "critical mass" of capital and managerial ability before farm extension, and it supports the findings of GLAUBEN et al. (2002), CALUS and VAN HUYLENBROECK (2008), CALUS et al. (2008), VÄRE (2006) that the succession effect plays a role from the age of 45, and the early designation of the successor motivates the farmer to invest and improve the management of the farm.

Our results confirm the results of earlier studies (WEISS, 1999; CALUS and VAN HUYLENBROECK, 2008; POTTER and LOBLEY, 1992) about the significance of the availability of successors on farm survival prospects. From Table 3, it appears that if the availability of successors (in the farmer's opinion) is good, the probability of farm exit is significantly lower. However, the results do not indicate whether the farmer's subjective evaluation about the availability of successors have a significant influence on the probabilities of farm decline and growth.

4.2 Human Capital

Human capital is a crucial factor in economic development, both at micro and macro levels. As proxies of human capital, we use the farm operator's formal level of education and the farm operator's off-farm job status. RIZOV and MATHIJS (2003) suggest that farms with managers possessing greater stocks of human capital should be more efficient, and therefore should survive and grow relatively faster. Our results show that the farm operator's level of education has a moderately significant (at 0.1 level) positive effect on the probability of farm growth. With respect to the probability of farm decline and exit, the effect of education was insignificant (Table 3). The positive effect of level of education on farm growth probability implies that for new entrants and those young farmers who have taken over the family farm, supportive educational and advisory system would increase farm growth and survival probabilities.

In our sample, the farm operator's level of education had a significant effect on the probability of having an off-farm job, confirming the argument that human capital may increase the earning capacity of a farm operator in the non-farm economy.[4] In addition, the probability of having an off-farm job was significantly higher in the case of younger farm operators and smaller farms. The average of the *Education* variable of those farm operators that had an off farm job was 3.04, compared to 2.70 in the farms where the farmer did not have an off-farm job. The average age of farm operators that had an off-farm job was 52.6 years, compared to 57.7 years of those operators who did not have an off-farm job. The average area of the farms where the farm operator had an off-farm job was 93.4 ha, compared to 124.1 ha if the farm operator did not have an off-farm job. The estimates of model (1) indicate that in Estonia, having an off-farm job has a positive effect on the probability of farm exits. With regard to the probabilities of farm decline or growth, the effect of having an off-farm was insignificant. Therefore, our results indicate that in Estonia it is more likely that an off-farm job reduces rather than increases the probability of farm survival.

4.3 Size and Specialisation

In our analysis, farm SO was used as a measure of farm size. In Estonia, where the farm size structure is dualistic, it is often argued that larger farms have better preconditions for competition and growth. Our results indicate that farm size has a significant negative effect on farm exit probability in the 1st size quartile and on decline probabilities in the first three size quartiles. The small farms in the 1st quartile of SO had a significantly ($p<0.05$) higher probability of exiting from farming compared to farms in the 4th quartile. In the case of farm decline, the first three size groups (quartiles) had a significantly higher probability to decline compared to large farms in the 4th quartile. At the same time, farm size did not have a significant effect on the probability of farm growth. This is in accordance with the findings of WEISS (1999), RIZOV and MATHIJS (2003) who suggested that larger farms tend to exhibit lower growth and decline rates. However, it also suggests that in the case of dualistic size structures the results of the analysis would benefit if the sample of very large farms were studied separately from the sample of smaller farms.

As a measure of farm specialisation, a dummy variable *Gr_livestock* was used, indicating if the farm was specialised in grazing livestock in 2006. The results in Table 3 demonstrate that the farms specialised in grazing livestock have a significantly ($p<0.1$) lower probability to exit from farming. This result is in line with BREUSTEDT and GLAUBEN (2007), who found that in regions specialised in livestock production the loss in the number of farms was significantly smaller.

[4] The results of the respective binary logit regression are not reporter here.

4.4 Semi-subsistence Farming and Way of Establishment of the Farm

DAVIDOVA (2011) has suggested that the CAP has to help semi-subsistence farms to commercialise or exit. Our results indicate that participation in the semi-subsistence farming scheme in 2006 did not have a significant effect on the probabilities of farm growth (which could be considered as a proxy for commercialisation) and farm decline (Table 3). However, participation in the semi-subsistence farming scheme significantly decreased the probability of farm exit. Nevertheless, our results do not confirm its effect on farm growth (commercialisation), which was one of the aims of the scheme. The results may also be influenced by the fact that the ending point of the considered period was also the ending point of a large part of the five-year contracts of the scheme. Therefore, in the following years, the negative effect of the scheme on the exit probability of smaller farms may diminish. Our results confirm the suggestion of DAVIDOVA et al. (2009) that subsistence production could be favoured by households with non-farm income or retired households who wish to satisfy lifestyle and consumption preferences. In the survey, farmers were asked to position their farming related values in the Likert scale of 1 to 5 between two extremes: 'profit is more important than farming as a lifestyle' (1) and 'farming as a lifestyle is more important than profit' (5). The average of this variable was 4.0 in the case of semi-subsistence farmers and 3.5 in the case of farmers that did not participate in the scheme. In the cases where farm operators have lifestyle and consumption preferences, it is also probable that the farms will remain in business, but will decrease in size as the farm operator gets older. However, the results indicate that through decreasing the farm exit probability, such payment schemes are slowing down the process of structural changes.

In the Estonian land, agricultural and ownership reforms in the early 1990s, it was decided that the pre-war farms and farmland should be returned to the heirs of the dispossessed owners. GLAUBEN et al. (2004a) found that farms that have been run by the same family for several generations show a higher probability of being transferred within the same family. Our results indicate that the farms that were founded based on returned land or farmsteads are on average smaller (64.0 ha compared to 191.6 ha if the farm was established via privatisation or bought), and they have significantly lower growth and decline probabilities. At the same time, such farms do not have a higher probability to exit. Also, the operators of restituted farms value farming as a lifestyle more highly than other farmers. The average of this variable was 4.0 in the case of restituted farms and 3.4 in the case of other farms. This confirms the suggestion of HEDIN (2005) that the operators of such farms consider it important to maintain the farms of their forefathers.

5 Conclusions

In this paper, we analyse the effects of some socioeconomic and transition-specific factors on the probability of farm growth, decline and exit. Survey data from 2007 and 2011 is combined with data from the registries of the national paying agency. Farm growth and decline rates are calculated based on standard outputs. We consider 15% thresholds, both for farm growth and decline. Farm exits are determined based on the responses of farm operators in 2011 and SO in 2010. Multinomial Logit regression is used in order to estimate the model.

The results indicate that the farm growth probability is highest in the 40-49 year age group. Compared to the age group of ≥60 years, farm operators in younger age groups have a lower probability to exit or decline. The availability of successors has a significant negative effect on farm exit probability. This is in line with previous findings regarding the farm life cycle and succession effect (CALUS et al., 2008; WEISS, 1999). We also show that the level of education of the farm operator is positively affecting farm growth probability. The positive effect of education on farm growth probability implies that for young farmers a supportive educational and advisory system would increase farm growth and survival probabilities. In addition, our data confirmed the positive relationship between education and working off-farm as suggested by BOEHLJE (1990). Off-farm work is more probable in smaller farms and in cases of younger and better educated farm managers, and it is increasing the probability of exiting from farming. Grazing livestock farms were shown to have a significantly lower probability to exit from farming.

Our results indicate that the semi-subsistence farming scheme slowed down the process of structural changes in regard to smaller farms. The farms that participated in the semi-subsistence farming scheme had a lower probability to exit in the considered period (2006-2010). However, the semi-subsistence farming scheme did not have a significant effect on the probability of farm growth or decline. It is likely that

the effects of the semi-subsistence farming scheme will begin to diminish now that it has completed.

In most western countries, the prevailing farm ownership and management type is the family farm that is handed down from one generation to the next. In Estonia, such succession patterns are not well developed due to the structural breaks of the past 100 years. Nevertheless, our results suggest that farms that were established based on returned land or farmsteads do exhibit lower decline and growth probabilities, and they are more inclined to retain the farm size. This implies that the continuity of the ownership and respect for forefather's work is a factor that influences the process of structural changes.

While participation in the semi-subsistence farming scheme reduces the exit probability, and the fact that a farm has been founded on the basis of restituted land or farmstead reduces farm growth and decline probability, the effects of other factors imply that the process of structural changes in Estonian agriculture today is largely following the same pattern as in other western countries. Farm growth is more likely in the case of middle-aged (40-49 years) and better educated farm operators; farm decline is more likely in the case of smaller farms. Exit from farming is more likely if the farm operator's age is 60 years or more, if the farm is very small (1st quartile of SO), or if the farm operator has an off-farm job, and it is less likely if the farm is a grazing livestock farm.

Today, the structure of Estonian agricultural producers is polarised – there are a large number of small producers that cultivate a relatively small proportion of land, and a relatively small number of larger agricultural producers that cultivate most of the agricultural land. The tendency towards a dualistic farm structure was also suggested by UNWIN (1997): "If Estonia is indeed to move to a position of economic convergence by which it will be able to join the EU, its agrarian economy will have to undergo further substantial changes. Ironically, this may well lead to a landholding structure much more reminiscent of the 1,000 collective farms that existed in 1952 or the ca. 1,000 large landed estates liquidated by the 1919 Land Reform, than of the numerous small private farms existing in the 1930s or the estimates of perhaps 60,000 private farms by the end of the 1990s that were being suggested at the beginning of the decade." Our results show that larger farms have a higher probability to remain in business, and they have a lower probability to exit or decline. At the same time, larger farms do not have higher probability to grow. In addition to the fact that the farm size structure is dualistic, the findings of PÕDER et al. (2011) suggest that the values of the operators of large and small farms also tend to be polarised. This implies that in regard to dualistic farm structures, the future analyses of farm growth, decline and exit would benefit if the effects were studied separately in farm size groups.

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Discrepancies between the Intentions and Behaviour of Farm Operators in the Contexts of Farm Growth, Decline, Continuation and Exit – Evidence from Estonia

Unterschiede zwischen den Absichten und dem tatsächlichen Verhalten der Betreiber von landwirtschaftlichen Betrieben im Falle von Wachstum oder Rückgang der Größe des Betriebes oder von einem Ausstieg aus der landwirtschaftlichen Produktion – der Fall Estland

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Abstract

A considerable body of research on farmers' behaviour is based on the surveys regarding their behavioural intentions. The theory of planned behaviour states that while the formation of intentions normally precedes behaviour, several factors affect the realisation of the intended behaviour. Therefore, the usefulness of ex-ante surveys for predicting farmers' behaviour requires more attention to reduce the potential biases in such analyses. The paper investigates how well the farmers' intentions correspond with the behaviour in cases of farm exits, continuation of farming and farm size changes in Estonia. Based on the farm survey in 2007, the follow-up survey in 2011, and paying agency's registry data, the ex-ante data on the intentions is combined with ex-post data on actual behaviour. A recursive bivariate probit regression is used to study the effects of selected socioeconomic characteristics on the probabilities of intended and realised behaviour, and the effects of stated intentions on actual behaviour. The results indicate that the usefulness of intentions in predicting actual behaviour differs, depending on the nature of the question in the farm life cycle context. Intentions are found to be a better predictor of actual behaviour when the considered event is regarded as positive (continuation of farming and farm growth) rather than negative (farm exit or farm shrinkage).

Key Words

intention-behaviour discrepancy; farm exits; farm growth; theory of planned behaviour; structural changes; Estonian agriculture

Zusammenfassung

Die Studie hat den Unterschied zwischen der Verhaltensabsicht und dem tatsächlichen Verhalten der Betreiber untersucht. Viele Studien über Betreiber der landwirtschaftlichen Betriebe basieren auf der Forschung des geplanten Verhaltens der Betreiber. Die Theorie des geplanten Verhaltens sagt, dass, obwohl die Absicht das Verhalten vorhersagt, gibt es mehrere Faktoren, die die Absichten und das tatsächliche Verhalten beeinflussen. Das Ziel des Artikels ist die Erforschung des Unterschieds zwischen den Absichten und dem tatsächlichen Verhalten der Betreiber im Falle eines Ausstiegs aus der landwirtschaftlichen Produktion und einer Änderung der Größe des landwirtschaftlichen Betriebes. Die Forschung basiert auf Studien über landwirtschaftliche Betriebe aus dem Jahr 2007 und 2011 und auf den Zahlen aus dem Register der Zahlungsstelle. Die Angaben über Absichten sind kombiniert mit den Daten zum tatsächlichen Verhalten der Betreiber. Das rekursive bivariate Probit-Modell wurde verwendet, um den Einfluss von ausgewählten sozioökonomischen Faktoren und Absichten auf das Verhalten zu erforschen. Die Ergebnisse zeigen, dass die Zweckmäßigkeit der Absichten bei der Prognose über dem tatsächlichen Verhalten differiert, abhängig von der Absicht, die erforscht wird. Die Absichten, aus der landwirtschaftlichen Produktion auszusteigen, waren nicht statistisch signifikant verbunden mit dem tatsächlichen Verhalten bei dem Ausstieg aus der landwirtschaftlichen Produktion. Die Absichten, die Größe des Betriebes zu verkleinern, waren nicht so nützlich im Vergleich, die Absichten die Produktion fortzusetzen und den Betrieb zu vergrößern bei der Erklärung des realen Verhaltens.

Schlüsselwörter

Unterschied zwischen der Verhaltensabsicht und dem tatsächlichen Verhalten; Theorie des geplanten Verhaltens; Ausstieg der landwirtschaftlichen Betriebe; Wachstum der Betriebe; estnische Landwirtschaft; strukturelle Änderungen

1 Introduction

The long-term trend of decreasing farm numbers and increasing average farm size has been well-observed in Western countries (GALE, 2003; CALUS et al., 2008; GEBREMEDHIN and CHRISTY, 1996; BREUSTEDT and GLAUBEN, 2007; LOBLEY and POTTER, 2004). This on-going change, characterised by a decline in farm transfers to successors and a decrease in the number of new farm entrants, implies significant changes for rural societies; therefore, it draws significant attention from both researchers and policy-makers.

In farm management literature, farm exits and growth are often associated with the concept of the farm life cycle, according to which a farm typically passes through entry, growth, maturity, and exit stages (BOEHLJE, 1973; POTTER and LOBLEY, 1992; AHITUV and KIMHI, 2002). Between the entry and exit stages farmers have to choose among the strategies of farm growth, status quo or gradual decline. For growth, farmers need to invest both financial and human capital, while success is determined by the availability of both. In the exit stage, the farm is either transferred to a successor or liquidated; farm operators who exit from agriculture either retire or seek off-farm employment.

The EU's Common Agricultural Policy (CAP) has a diverse set of measures to address the structural problems of the farming sector, e.g., an early retirement scheme promotes earlier exits with the aim of increasing the average size of the remaining farms. Payments for farms situated in less favoured areas (LFA) and semi-subsistence farms aim to increase livelihoods and thereby slow down exits from farms in disadvantaged areas or very small farms. Measures for young farmers and investment subsidies aim to accelerate farm growth.

After Estonia regained its independence in 1991, ownership, land and agricultural reforms were initiated in order to transform the socialist planned economy to a market-based system. The land reforms in post-communist Central and Eastern European Countries (CEEC) had two, sometimes conflicting, aims: 1) to establish historical justice via restitution of (or compensation for) land to pre-collectivisation landowners or their heirs; 2) to provide some level of social equity by allowing rural inhabitants to privatise land in the vicinity of their homes (SWINNEN, 1999). In addition to restitution and compensation, Estonian agricultural reform aimed to privatise the assets of collective farms (EMA, 2002). This lead to the development of a dualistic farm structure characterised by large agricultural enterprises (mainly those previous collective farms that remained relatively intact during the reforms), and an increasing number of small private farms in the 1990s.

From 1991-2001, the number of agricultural holdings increased markedly from 2,679 to 55,748 (SOE, 1995; SOE, 2013). There were several factors that encouraged the establishment of private farms: in 1989-1992, the government and collective farms subsidised inputs and services for new farms (ALANEN, 2004; OECD, 1996); the wish to return to a traditional (family farm) lifestyle, and an opportunity to work according to one's desire (KELAM, 1993). Therefore, new farmers had somewhat naïve expectations about the viability of small farms in the market economy (TAMM, 2001). From 2001-2010, the number of agricultural holdings decreased from 55,748 to 19,613 (SOE, 2013). Therefore, more than 50% of the Estonian farms established in the 1990s turned out unviable in the first decade of the 2000s.

In 2010, 43.8% of smallest Estonian agricultural holdings (standard output (SO) <2,000 Euros) accounted for 0.8% of the total SO, and managed 8.0% of agricultural land, while 1.1% of the largest agricultural holdings (SO ≥500,000 Euros) accounted for 51.6% of total SO, and used 27.5% of agricultural land (SOE, 2013). Therefore, a considerable decline in farm numbers and the dualistic farm structure makes the survival of small family farms and the growth of larger agricultural enterprises an acute and controversial topic in Estonian agricultural policy discussions.

In response to the structural changes and structural policies, there is a considerable body of research addressing the issues related to farm growth, exit and succession. The empirical data used in the analysis is one of the distinguishing features of these studies. The ex-ante approach is usually based on surveys in which farmers are asked about their subjective evaluations and opinions on the likelihood of future events (e.g. GLAUBEN et al., 2004; HENNESSY, 2002; KERBLER, 2012; VIIRA et al., 2009). In the ex-post approach, research is based on the data from agricultural censuses,

farm registers, etc., which document actual events and decisions taken by farmers (e.g. KIMHI, 1994; KIMHI, 2000; KIMHI and BOLLMAN, 1999; BREUSTEDT and GLAUBEN, 2007; FOLTZ, 2004; WEISS, 1999; STIGLBAUER and WEISS, 2000; CALUS et al., 2008; PIETOLA et al., 2003). The advantage of ex-ante farm surveys is that detailed and direct information can be obtained about the respondents' subjective evaluation of the situation, and motives for planned behaviour. However, several studies have questioned the usefulness of ex-ante surveys in the prediction of the future behaviour of farmers due to discrepancies between the stated intentions and actual behaviour (THOMSON and TANSEY, 1982; GLAUBEN et al., 2002; VÄRE et al., 2010; VÄRE, 2007; LEFEBVRE et al., 2013). VÄRE et al. (2010) studied the planned and actual succession in Finnish farms and found that in 63% of cases farm operators acted according to the stated intentions. THOMSON and TANSEY (1982) studied the intentions of dairy farmers regarding herd size and found that in 33-50% of cases farmers acted according to their stated intentions. LEFEBVRE et al. (2013) investigated farm investments in land and found that 74% of the farms behaved consistently with their intentions. This implies that the information from intention can be of dubious quality. VÄRE et al. (2010) argue that if the survey results cannot be consistently linked to the observed behaviour, then the surveys cannot be justified as an expensive means that attempt to provide information for predicting behaviour. Therefore, the integration of farm surveys that study intentions and the investigation of actual behaviour is important in improving our understanding about structural changes in agriculture, and to assess the usefulness of intentions stated in farm surveys for predicting actual behaviour (GLAUBEN et al., 2002).

We use data from two farm surveys and the registries of Estonian paying agency (ARIB) in order to investigate the correspondence between intended and actual behaviour. In 2007, a survey was conducted that investigated the perspectives and intentions of Estonian farmers for the coming three years (2008-2010), and their views on the potential policy changes discussed within the context of the CAP's "Health Check". Amid other questions, respondents were asked whether they would continue with or quit farming, and whether the agricultural area of their farm would increase, remain stable, or decrease. In 2011, the survey was repeated in order to collect data about the actual behaviour of farm operators regarding farm exit and farm size changes.

Based on this data, this paper investigates the correspondence between intended and actual behaviour in cases of farm exits, continuation of farming, farm growth and decline, and studies the factors that affect the intended and actual behaviour of farm operators in the aforementioned cases, therefore covering different stages of farm life cycle.

2 Factors Affecting Intention Behaviour Discrepancy

In this paper, the intention behaviour discrepancy is analysed in the framework of the theory of planned behaviour (TPB). According to the TPB, the probability that behaviour will occur depends on the intention of an individual to engage in that behaviour; and intentions are a function of three determinants: attitude towards the behaviour, subjective norm, and perceived behavioural control (AJZEN and FISHBEIN, 1980; AJZEN, 1987; AJZEN, 1991).

The attitude towards the behaviour refers to the degree to which a person has a favourable or unfavourable appraisal of the behaviour in question (FISHBEIN and AJZEN, 1975). It is influenced by behavioural beliefs about the consequences of the behaviour and the evaluation of those consequences. Personal feelings of moral obligation or responsibility to perform or refuse to perform a certain behaviour affect attitudes (AJZEN, 1991). As farmsteads are often the homes in which the family has lived for generations, family members, in most of the cases, have a considerable emotional connection to the farmstead and to the family traditions. In CEECs, the historical context should be taken into account – the sense of duty and wish to return to traditional family farms were important drivers in the restoration of private farms in the 1990s. The wish to keep the family home and traditions alive and to transfer the farm to the next generation can be associated with moral obligation, even though it may not be economically rational or feasible. People favour behaviours they believe have largely desirable results, and they form unfavourable attitudes towards behaviour they associate with mostly undesirable consequences (AJZEN, 1991). Farm operators may perceive the shrinkage of farm size and farm exit as unfavourable events (e.g. failure to maintain the family's traditions, loss of income), and, inversely, farm growth or transfer as positive events. This can influence the development of negative attitudes towards exit and decline, and positive attitudes towards

farm growth and succession. At the same time, other actors may perceive farm exit as a favourable event (e.g. economically rational).

Subjective norm refers to the perceived social pressure to perform or not to perform the behaviour, and it is based on the normative beliefs about what certain people will think of the person performing that behaviour, as well as the motivation of the person to comply with or defy the social pressure (FISHBEIN and AJZEN, 1975). Considering the strong emotional links that families have with farms, one can expect that the farm operator is faced with pressure from family to ensure the viability of the farm, and the potential successor is faced with pressure to take over the farm. However, at the same time, the general economic development and agricultural policy may influence the development of attitudes and social pressures that favour farm exit instead of transfer, and therefore, can be in conflict with attitudes and pressures that emphasise the importance of family traditions. For example, a farm operator may concurrently feel pressure from the older generation to maintain the family farm and prepare for farm transfer, while pressure from spouse and children (incl. potential successors) to prepare for exit, e.g. when they see farming as too hard a profession to provide a sufficient livelihood for the next generation.

The perceived behavioural control is based on the control beliefs, i.e. beliefs on how much control one has over the outcome as opposed to how much the outcome is controlled by external factors like other people, economic developments, etc. The perception of control is assumed to be a reasonably accurate reflection of the actual control (AJZEN, 1991). The more favourable the attitude and the subjective norm towards the behaviour, and the greater the perceived behavioural control, the stronger an individual's intention should be to perform the behaviour under consideration (AJZEN, 1991; AJZEN, 2005). As a general rule, it is found that when behaviour poses no serious problems of control, they can be predicted from intentions with considerable accuracy (AJZEN, 1991). However, the realisation of most intentions depends to some degree on such non-motivational factors as the availability of the necessary opportunities and resources (e.g. time, money, skills, and cooperation with others) (SUTTON, 1998). Also, intentions are likely to predict a single action more correctly than the behaviour that consists of a sequence of actions. Collectively, these factors represent the level of control the person has over the behaviour and the higher the level of control the stronger the intention-behaviour relations (SHEERAN, 2002).

In the research of inconsistencies between intentions and behaviour, it is vital that the degree to which an intention is measured is at the same level of specificity as the behaviour. The more similar the time, target, action, and context of one indicator is to those of the other, the stronger the relation between intention and behaviour (AJZEN, 2005). The discrepancies between planned and actual behaviour may be induced by poor survey design and data quality (COURNEYA, 1994; VÄRE et al., 2005). Another limitation is that the surveys are typically addressed to one respondent (e.g. farm operator), while the actual decisions involve the actions of different actors like family members (VÄRE et al., 2010), whose actions, while being outside the farm operator's control, have a considerable influence on the behaviour of the operator. The time interval is another consideration. As people constantly review new information and intervening events occur, it is likely that their intentions will change over time. Therefore, the longer the time interval between intentions and behaviour, the more likely is the occurrence of inconsistency between the original intention and actual behaviour (AJZEN, 2005; FISHBEIN and AJZEN, 1975). For example, GLAUBEN et al. (2002) demonstrate the time-inconsistency of farm operators' retirement plans – as time passes from the stated plans, the farm operator will revise his/her plans repeatedly and will postpone retirement, therefore causing a bias in the intended succession time.

SHEERAN (2002) suggests that the properties of intentions such as certainty and accessibility of intentions, as well as the degree of formation of the intentions that indicates how well persons have thought through the consequences of their decision to perform a particular behaviour, should also be taken into account in studying how well intentions predict behaviour. One limitation is that the intentions stated in the surveys may be provisional (SUTTON, 1998). While some respondents may have already formed intentions, it is likely that for others the intentions are merely hypothetical. Persons who have well-formed intentions, as they have thoroughly considered the outcomes of their decisions, should be more likely to anticipate problems and try to enact the intentions. The persons who have not thoroughly considered their plans should more likely encounter unforeseen obstacles in realising the intended behaviour, and should therefore change their intention more likely (SHEERAN, 2002).

In the different life cycle stages, the priorities and challenges of farms differ. As farm exit or continuation and growth or decline are dependent on different set of actors and actions, the discrepancies between intentions and behaviour should differ in the aforementioned cases. As discussed above, the intentions are affected by attitudes, subjective norm and perceived behavioural control (FISHBEIN and AJZEN, 1975; AJZEN, 1991). Therefore, it is reasonable to assume that, in general, the farm operators have positive attitudes towards the continuation of farming and farm growth, and negative attitudes towards exiting from farming and the shrinkage of farm size. Also, it is likely that farm liquidation and/or reduction of the size of the farming operation requires the farmer to take a sequence of single and possibly unprecedented actions, and to consider more thoroughly the intentions of other family members, in comparison with the continuation of farming as before. In this situation, it is more likely that the farm operator's subjective norm is in conflict with the opinions of his/her family members. Decision to reduce the farm size or end the farming operation is closely linked to the intentions of the family members of the farm operator, implying that the farm operator does not have full control over these decisions. Therefore, considering these arguments, our hypothesis is that the farm operators' intentions regarding exiting from farming and shrinkage of farm size are less useful in predicting actual exits and contraction compared to the intentions regarding continuation of farming and farm growth in predicting actual continuation and farm growth.

3 Method and Data

According to the TPB, the intention formation and behaviour could be regarded as a sequence of actions with a causal relationship between intention and behaviour. Therefore, it is reasonable to assume that both intentions and behaviour may be influenced by similar farm- and farmer-specific factors accounted for in the model, as well as similar unobserved factors. This implies that the error terms of models describing intentions and behaviour may be correlated. Therefore, a recursive bivariate probit model, as suggested in MADDALA (1983), was considered appropriate for the present analysis, as it facilitates simultaneously controlling for unobserved heterogeneity, and considers the structural features of the problem by using the predicted values of intentions as regressors in the equations that describe the actual behaviour. Previously, the recursive bivariate probit model has been used in e.g. explaining the irrelevance of stated plans in predicting farm successions (VÄRE et al., 2010); studying the relevance of production contracts with regard to exit decisions in pig production (DONG et al., 2010).

In general form, the recursive bivariate probit model employed in this study has the following recursive structure:

$$y_1^* = \beta_1' X_1 + \varepsilon_1 \quad (1)$$

$$y_2^* = \gamma y_1 + \beta_2' X_2 + \varepsilon_2 . \quad (2)$$

Unobservable variables y_1^* and y_2^* in equations (1) and (2) are related to binary observable variables as follows: y_1=1 if y_1^*>0, and 0 otherwise; y_2=1 if y_2^*>0, and 0 otherwise. X_1 and X_2 indicate sets of explanatory variables, β_1 and β_2 are respective parameters to be estimated, γ is a parameter that indicates the effects of stated intentions on realised behaviour, and ε_1 and ε_2 denote errors that may or may not be correlated. The error ε=(ε_1,ε_2) is assumed to be normally distributed with mean zero. The correlation between errors ε_1 and ε_2 is given by ρ. If ρ is significantly different from zero, the errors of the two models are significantly correlated, implying dependency between intentions and the actual behaviour through the unobservable variables.

As considered in Section 2, the probability that behaviour will occur depends on the person's intention to engage in that behaviour; and intentions are a function of three determinants: attitude towards the behaviour, subjective norm, and perceived behavioural control. However, the data available for the present research set constraints on the direct application of the theory, as it lacks direct measures of attitudinal, normative and control elements. Therefore, in the empirical part, the effects of various socioeconomic variables on the probabilities of intention and actual behaviour are studied. The socioeconomic characteristics of farms and farm operators are considered as proxies for variables that describe attitude towards the behaviour, subjective norm and perceived behavioural control.

The model structure described by equations (1) and (2) is employed in four empirical models that study: a) intended and actual exits; b) intended and actual continuation of farming; c) intended and actual decline of farm's agricultural area; d) intended and actual agricultural area growth. In addition, the following explanatory variables are used in the models:

age of the farm operator, farm's agricultural area, share of rented land in farm's agricultural area; binary variables concerning off-farm job of the farm operator, farm's participation in semi-subsistence and LFA payment schemes, farm specialisation on arable crops, farm operator's affiliation to farming associations; farm operator's evaluation about his/her knowledge and experience, availability of successors, and condition of health.

Since the farm's agricultural area and the share of rented land in the farm's agricultural area are positively correlated, these variables are not used simultaneously in the empirical models. In the models of farm size decline (c) and farm growth (d), share of rented land in farm's agricultural area is used instead of farm's agricultural area. It is assumed that the decisions regarding farm exit and continuation of farming are more affected by the farm size as this represents the income earning potential of the farm; and farm decline and growth are more affected by the share of rented land. The expiry of rental agreements or opportunities to conclude new rental agreements could affect the intended and realised farm decline and growth.

The data for this study were obtained from two farm surveys conducted in December 2007 and March 2011. The 2007 survey investigated the perspectives and intentions of Estonian agricultural producers in the coming three years (2008-2010) and the farmers' opinions about the possible developments of the CAP discussed within the "Health Check" context. The questionnaire was posted to a random sample of 1,000 farmers from the population of 6,724 farms, the economic size of which exceeded 2 ESU in 2005[1]. In total, 29.0% of the questionnaires were returned. Amid other questions, farm operators were asked whether they would continue with or quit farming, and whether the agricultural area of their farm would increase, remain stable, or decrease in upcoming three years. In March 2011, the survey was repeated among the respondents of the previous survey. Of the 290 posted questionnaires, 78.6% were returned. In addition to collecting data similar to the previous study, the farmers were asked if they had quit agricultural production in 2008-2010. The data from two surveys was complemented with data from the registries of the paying agency (ARIB) regarding land use, crops, agricultural animals, and farm payments. Based on the registry data of 2006 and 2010, SO, as defined in the COMMISSION REGULATIONS (EC) NO 1242/2008, were calculated for each farm, based on Estonian SO coefficients used in 2011 (RURAL ECONOMY RESEARCH CENTRE, 2012). For those farms for which operators did not respond to the 2011 survey, it was assumed that if the farm had positive SO in 2010, it was operating and had not exited.

After integration of the datasets and excluding the data given by the respondents who did not provide answers for all the relevant variables, data from 251 farms remained valid for the analysis of intended and actual exits and continuation of farming. Farm growth or decline can only be planned and measured if the continuation of farming is planned and realised. Therefore, for the analysis of intentions regarding farm size changes, farms that planned to exit from farming and farms that actually exited from farming were excluded from the sample, resulting in valid answers from 198 farm operators. The definitions and descriptive statistics of dependent and independent variables are given in Table 1.

There are four models for which the effects of stated intentions on actual behaviour are estimated:

a) *Farm exit.* In 2007, farmers were asked if they would exit from farming in 2008-2010. The respondents could answer – 'yes', 'do not know', and 'no'. The answer 'yes' is considered as an intention to exit farming (variable *Exit_int*). Information about the realised exit (*Exit_real*) was gathered in the survey of 2011 and from the registries of the paying agency[2].

[1] ESU stands for economic size units defined for the purpose of FADN. 1 ESU equalled standard gross margin of 1,200 Euros in 2007.

[2] The survey of 2007 asked farm operators about their intentions regarding exit and continuation of farming. As there were no questions about the succession plans, this dataset did not provide an opportunity to analyse the effects of intended succession on farm growth, or discrepancies arising from the mismatch of intended and realised succession. From the comparison with the paying agency's registry data it occurred that, in 2007-2011, 6 sample farms that continued production had been transferred to successors. In 2007, none of the operators of these farms indicated an intention to increase their agricultural area; 1 respondent declared an intention to decrease farm size. In 2007-2010 the agricultural area of 2 of these farms declined >15%. The change of agricultural area of other transferred farms remained within the boundaries of 85-115% of their agricultural area in 2007. The average age of operators of these farms was 69.3 years and average agricultural area of the farms 46.0 ha. Five of the 6 transferred farms were participating in the semi-subsistence farming scheme. This suggests that obligation of the semi-subsistence farming scheme to maintain agricultural production for 5 years, was one of the most important considerations behind these farm transfers.

b) *Continuation of farming*. The answer 'no' for the previously mentioned question was considered as an intention to continue farming (*Cont_int*). Information about the actual continuation of farming (*Cont_real*) was gathered in the survey of 2011 and from the registries of the paying agency.

c) *Farm shrinkage*. In 2007, respondents were asked whether they intend to increase or decrease the agricultural area of their farms in 2008-2010. The answer could be given in the scale of five: 1=decrease significantly, 2=decrease somewhat, 3=do not change, 4=increase somewhat, and 5=increase significantly. We consider the change in the farm's agricultural area as proxy of farm size change. The answers 1 and 2 were considered as an intention to reduce the farm's agricultural area. Based on these answers, a binary variable *Decl_int* was formed. Information about the actual changes in the farm's agricultural area was gathered by comparing the survey data of 2007 and 2010 and paying agency's data of 2007 and 2010. Farm size was considered decreased (*Decl_real*) if its agricultural area in 2010 was <85% of the 2007 figure[3].

d) *Farm growth*. The answers 4 and 5 were considered as an intention to expand the agricultural area. The binary variable *Grow_int* is based on these responses. The farm size was considered as increased (*Grow_real*) if its agricultural area in 2010 was ≥115% of the 2007 figure.

Table 1 provides definitions and descriptive statistics of the dependent and explanatory variables used in the empirical models. Stemming from the arguments of the family farm life cycle concept, the age of the farm operator is one of the main factors that determines whether the farm is about to grow, be stable, shrink or exit (BOEHLJE, 1973; WEISS, 1999; VÄRE, 2007; GLAUBEN et al., 2002; CALUS et al., 2008).[4] We assume that the age of the farm operator has an effect on attitudes, subjective norms and perceived behavioural control. We expect that younger farm operators have positive attitudes towards the continuation of farming and farm expansion, and that elderly farmers are faced with higher pressure from family members encouraging exiting or constricting farming. However, this does not necessarily imply that elderly farmers agree with the other family members. Therefore, the subjective norm of elderly farmers may be in conflict with the views of other family members. Also, we assume that the elderly farmers have a lower level of perceived behavioural control, since their decisions regarding farm exit or continuation, and farm shrinkage or growth are more dependent on potential successors and other family members.

According to Gibrat's Law, farm growth is independent of initial farm size. However, it has been shown that the relative growth is higher in smaller farms (WEISS, 1999), and that larger farms are less likely to exit because of lower credit constraints and the ability to provide higher incomes (BREUSTEDT and GLAUBEN, 2007). We expect that due to the higher income providing potential, operators of larger farms have more positive attitudes regarding continuation of farming. Also, we presume that in case of larger farms the attitudes of family members are more in line with the outlook of the farm operator and support continuation of farming. Therefore, we assume that larger farms are more likely to behave according to the stated intentions.

In 2007, 49.9% of the agricultural land was used on the grounds of rental agreements in Estonia (SOE, 2013). In our sample of farms that intended and actually continued farming, the average of shares of rented land was 29.6%. However, the weighted average share of rented land was 43.2%, implying a higher share of rented land in larger farms. According to the survey of 2007, the average duration of rental agreements was 5 years. It is assumed that the share of rented land may affect perceived behavioural control regarding farm growth and shrinkage. Farm operators who have a higher share of rented land may have a better perception of behavioural control regarding farm expansion, as they have previous experience with expansion

[3] Since the farm's agricultural area may change from year to year depending on buying or selling plots, and new rental agreements or the expiry of previous agreements, we consider the variation of agricultural area within a specific range as relative stability rather than growth or decline. Based on the percentiles of changes in agricultural area (Annex I) and previous work (VIIRA et al., 2013), a 15% growth and decline threshold was considered appropriate in this analysis. In the process of model selection, 10% growth and decline thresholds were also tested. The results did not vary significantly between 10% and 15% thresholds.

[4] In Annex II, the distribution of responded farm operators according to the age groups is compared with the data from the farm structure survey (FSS) of 2007. It appears that the share of middle-aged (45-54 years) farm operators among the respondents was 6.8% points higher, and the share of more senior farm operators (≥65 years) 6.0% points lower than the results of FSS. Given that the FSS results also represent agricultural households in which economic size was <2 ESU (and probably had a higher share of older farm operators), we consider the differences in age distributions as minor.

via renting land, and most likely they are better informed about the situation in the rental market of agricultural land. At the same time, farm operators with a higher share of rented land may have a better perception of behavioural control over farm shrinkage, as they are well aware of the expiry dates of their rental agreements and therefore they are able to consider the potential shrinkage of their agricultural land. However, the realisation of the intentions regarding expansion via renting additional agricultural land depends not only on the behaviour of the farm operator and landowners but also on the behaviour of other farmers in the area who are competing for the same land. The higher dependence on the other actors may reduce the perceived behavioural control and increase the likelihood of discrepancies between intentions and behaviour.

Off_farm indicates whether the farm operator had an off-farm job in 2007. The effect of off-farm employment on farm survival has been found to be twofold. If part of the available labour input of the farm operator is used off-farm, it may provide additional income that may help maintain the farm as well (BREUSTEDT and GLAUBEN, 2007). However, an off-farm job may also lead to farm exits, especially in younger age groups who may benefit more from

Table 1. Definition and descriptive statistics of variables used in the analysis

Variable	Definition	Scale/ measurement	Obs*	Mean	Std. dev.	Min	Max
Dependent variables							
Exit_int	Intention to exit from farming in 2008-2010 as stated in 2007	0=no, 1=yes	251	0.056	0.230	0	1
Exit_real	Realised exit from farming in 2008-2010		251	0.171	0.378	0	1
Cont_int	Intention to continue farming in 2008-2010 as stated in 2007		251	0.649	0.478	0	1
Cont_real	Farm is operating in 2011		251	0.829	0.378	0	1
Decl_int	Intention to reduce agricultural area in 2008-2010 as stated in 2007		198	0.167	0.374	0	1
Decl_real	Agricultural area in 2010 ≤85% of agricultural area in 2007		198	0.172	0.378	0	1
Grow_int	Intention to increase agricultural area in 2008-2010 as stated in 2007		198	0.247	0.433	0	1
Grow_real	Agricultural area in 2010 ≥115% of agricultural area in 2007		198	0.162	0.369	0	1
Explanatory variables							
Age	Age of the farm operator in 2007	Years	251	55.35	12.16	23	85
			198	54.17	12.09	23	79
Area	Farm's agricultural area	Hectares	251	144.0	352.4	1.0	2605.2
			198	171.5	389.9	2.0	2605.2
Rental	Share of rented land in farm's agricultural area	100%=1	251	0.269	0.304	0	1
			198	0.296	0.303	0	1
Off_farm	The farm operation had an off-farm job in 2007	0=no, 1=yes	251	0.259	0.439	0	1
			198	0.237	0.427	0	1
Semisubs	The farm was participating in semi-subsistence farming scheme in 2007		251	0.438	0.497	0	1
			198	0.455	0.499	0	1
LFA	The farm was participating in LFA payment scheme in 2007		251	0.498	0.501	0	1
			198	0.525	0.501	0	1
Arable	Farm was specialised in field crops in 2007		251	0.303	0.460	0	1
			198	0.293	0.456	0	1
Associations	Farm operator was a member of farming associations in 2007		251	0.422	0.495	0	1
			198	0.455	0.499	0	1
Know_exper	Average of farm operator's evaluation on his/her agricultural knowledge and experience	1=very poor, 2=poor, 3=adequate, 4=good, 5=very good	251	3.528	0.596	1.5	5
			198	3.578	0.563	2	5
Successors	Farm operator's evaluation on the availability of successor		251	2.426	1.094	1	5
			198	2.571	1.091	1	5
Poor_health	Farm operator's evaluation on his/her condition of health	1=very good, 2=good, 3=adequate, 4=poor, 5=very poor	251	3.068	0.790	1	5
			198	3.020	0.760	1	5

* In the models a) and b) considering farm exits and continuation of farming, the data from 251 farms remained valid; in the models c) and d) that explain decline and growth of agricultural area, data from 198 respondents remained valid.
Source: own calculations

career changes (RIZOV and MATHIJS, 2003). In the Estonian context, it has been found that exit from farms is more likely where operators have an off-farm job (VIIRA et al., 2013). Therefore, we assume that farm operators who had an off-farm job have less positive attitudes towards the continuation of farming and farm growth. If the off-farm employment provides an adequate level of income, these farm operators may perceive social pressure to quit or constrict farming to reduce their physical workload. Therefore, having an off-farm job may increase the likelihood of discrepancies between intentions and realised behaviour.

Several farm payments are enforced on the basis of contracts between the farm and the paying agency. In Estonia, the contracts of LFA and semi-subsistence farming payments prescribed that the farm should continue agricultural production for a 5-year period. If the farm ceases agricultural production earlier, then the payments received should be reimbursed to the paying agency. The semi-subsistence farming scheme was a transitional measure for supporting semi-subsistence farms in the new EU member states that were undergoing restructuring (DAVIDOVA et al., 2009). Participation in the scheme provided farmers with an annual flat rate payment of 1,000 Euros for five years. The scheme aimed to maintain smaller agricultural holdings and enhance their survival. In order to be eligible for semi-subsistence farming payment, a farmer had to be registered as a sole principal, use at least 0.3 ha agricultural land for crop production, or keep at least one agricultural animal (EMA, 2005). The aim of the LFA payment scheme is to maintain the countryside in less favoured areas through the continual use of agricultural land. The LFA payment rate in Estonia has been 25 Euros/ha since 2004. (EMA, 2005). According to the registry data of Estonian paying agency (ARIB), 14.2% of the recipients of farm payments received semi-subsistence farming payment, and 47.7% of the recipients of farm payments received an LFA payment in 2007. While both the LFA and semi-subsistence farming payments provide farms with additional income, which could improve their livelihood, we expect that farm operators, before taking the obligation and signing the contracts, have thoroughly considered the prospects of the continuation of farming in the next five years. Even though they had fulfilled the requirement by 2011 and this obligation was no longer relevant, we suppose that operators of these farms have more positive attitudes towards the continuation of farming, and their realised behaviour is more in line with their revealed intentions.

The decisions regarding farm growth or exit may also be influenced by the farm type. BREUSTEDT and GLAUBEN (2007) found that in regions that are specialised in livestock production, the decline of farm numbers is smaller. The persistence of livestock farms may be influenced by higher sunk costs as the farm buildings and technology may have fewer alternative uses, and stronger emotional commitments of livestock farmers to their farms and herds. In the empirical analysis, a binary explanatory variable *Arable* is used. *Arable* indicates whether the farm was specialised in field crops in 2007. In this farm type, the SO of field crops constitutes more than 2/3 of farm SO (COMMISSION REGULATION (EC) NO 1242/2008). Considering the high prices of cereals and oilseeds at the end of 2007 when the first survey was conducted, we assume that arable farms had positive attitudes towards the continuation of farming and farm growth. We also consider that farm operators of arable farms are emotionally less associated with their productive assets compared to livestock or mixed farms. Therefore, we assume that the probability of discrepancies in the case of arable farms between intentions and realised behaviour is lower.

Higher levels of human and social capital can be associated with higher level of perceived behavioural control, more reasoned and better-informed intentions and decisions. As discussed in Section 2, the level of intention formation has a positive effect on realisation of the intention. Thus, we assume that the higher the level of human capital in the farm, the better the intentions about the farm exit, continuation, growth or decline should be formed, and the more likely it is that the farm operator acts in accordance with his/her intentions. As the members of farming associations (variable *Associations*) participate in larger farmers' networks, we expect them to be better informed about developments in markets, technologies, agricultural policy, etc. In the 2007 survey, farm operators had to evaluate both their agricultural knowledge and experience as agricultural producers. Both evaluations were given on a scale of five ranging from 1 (very poor) to 5 (very good). Variable *Know_exper* is an average of the evaluations given in these two categories – agricultural knowledge and experience – and it is considered to be a proxy of the level of human capital of farm operators.

The availability of suitable and willing successors is one of the key factors when it comes to developing the farm in the later stages of the farm life cycle (GLAUBEN et al., 2002; CALUS et al., 2008; VÄRE, 2007). In the survey of 2007, the respondents were

asked to evaluate the availability of successors on a scale of five. We assume that if the farm operator is not sure whether his/her successors are interested in taking over the farm in the future, or if there are no successors available, he or she has a lower level of perceived behavioural control over the continuation of farming and farm growth. Also, we assume that if the farm operator is more confident about handing the farm over to the successor in the future, he or she has a more positive attitude towards continuation of farming and farm growth. Therefore, we expect that the more positive the farm operator's evaluation on the availability of successors is, the lower the probability of discrepancy between intention and realised behaviour.

The similar argument also applies in terms of the condition of health, because it is another source of uncertainty in the intention-behaviour model as the person might not have much control over it, especially on the sudden appearance of serious health problems. Therefore, we assume that if the farmer's evaluation about his or her condition of health is poor (variable *Poor_health*), he or she has a lower level of perceived behavioural control over continuation of farming and farm growth. If the farm operator's condition of health remains strong enough to carry on with farming, he or she may still be running the farm three years later. Therefore, from the intention-behaviour compatibility point of view, poor health could be considered as a source of discrepancy.

4 Results and Discussion

Table 2 summarises the intentions about continuation or exiting from farming, as stated by farm operators, and it compares these with actual behaviour. In 2007, 14 farm operators (5.6% out of the 251 respondents in the analysis) reported the plan to exit from farming. Four of these farms exited and 10 continued farming. 74 farm operators (29.5%) were uncertain about exiting from farming. Of those farm operators, 19 (25.7%) exited and 55 (74.3%) continued. Of the 163 (64.9%) farm operators who did not plan to exit, 20 (12.3%) exited and 143 (87.7%) continued. From another perspective, of the 43 farms that quit in 2008-2010 just 9.3% reported that intention in 2007; 44.2% were uncertain about exiting, and 46.5% did not intend to exit farming. Of the 208 farms that stayed in business, 68.8% acted in accordance with their stated plans; 26.4% of them were uncertain about it and 7.0% were those who stated an intention to quit.

Table 2. Actual and planned behaviour regarding exiting from farming in 2008-2010

Intentions stated in 2007 regarding exiting from farming in 2008-2010	Actual behaviour in 2008-2010		Total
	Exit	Continue	
Exit from farming	4	10	14
Not certain	19	55	74
Will not exit	20	143	163
Total	43	208	251

Source: own calculations

The comparison of the intended and actual change of the agricultural area of 198 farms in the analysis (Table 3) shows that between 2007 and 2010 the agricultural area declined >15% in 34 farms (17.2%). In 132 farms (66.7%), the agricultural area in 2010 was 85-115% of the area in 2007. In 32 cases (16.2%), the agricultural area in 2010 was >15% higher than in 2007. In 33.3% of the 33 (16.7%) farms in which operators stated an intention to reduce farm size, agricultural area declined >15%, in 63.6% of farms it remained relatively stable, and in one farm the area increased >15%. Of the 116 (58.6%) farms in which operators stated that the agricultural area would not change, in 19 (16.4%) farms it declined, in 88 (75.9%) farms it remained stable, and in 9 (7.8%) farms it increased. In 2007, the intention to increase the farm's agricultural area was declared by 49 (24.7%) farm operators. In 4 (8.2%) of these farms, the agricultural area declined, in 23 (46.9%) it remained stable and in 22 (44.9%) it grew. From another perspective – of the 34 farms in which the agricultural area declined >15%, the intention to decrease agricultural area was reported in 11 cases (32.4%). The relative stability of farm size was intended and maintained in 88 farms (66.7%). Farm growth was intended and realised by 22 operators (68.8%).

From Tables 2 and 3, it is evident that the discrepancy between intentions and actual behaviour is more frequent in cases of exiting from farming and decline of farm size. Just 9.3% of actual exits and 32.4% of farm shrinkages in 2008-2010 coincided with the respective intentions revealed in 2007, compared to 68.8% intention-behaviour compatibility in cases of continuation of farming and farm growth. Aggregation of the previous results reveals that farm operators' behaviour was consistent with intentions in 58.6% of the cases when the question was about exiting from farming and in 61.1% of the cases when the question was about farm size changes. Therefore, the compatibility of farm operators' intentions and behaviour in this study is similar to the 63% reported by

Table 3. Actual and planned behaviour regarding farm size changes in 2008-2010 compared to 2007

Intentions stated in 2007 regarding change of agricultural area in 2008-2010	Actual change of agricultural area, 2010 compared to 2007			Total
	Decline (agricultural area <85% of 2007 level)	Stable (85-115% of agricultural area retained)	Growth (agricultural area >115% of 2007 level)	
Decline	11	21	1	33
Do not change	19	88	9	116
Grow	4	23	22	49
Total	34	132	32	198

Source: own calculations

VÄRE et al. (2010). However, as we hypothesised, the level of consistency between intention and behaviour varies according to the stages of farm life cycle under scrutiny.

The estimated coefficients and average marginal effects of the explanatory variables in the specified recursive bivariate probit models a) to d) are presented in Table 4. The parameter estimates of intended behaviour indicate that in cases of continuation of farming (model b) and farm growth (model d) intentions have positive and statistically significant effects on actual behaviour. Intention to continue with farming increased the probability of actual continuation by 33.4%, and intention to expand agricultural area increased the probability of agricultural area growth by 37.0%. The effect of intended exit (model a) on actual exit was positive but statistically insignificant. Therefore, according to the current results, in the case of farm exits, revealed intentions are not acceptable predictors of actual behaviour. However, the effect of intended farm shrinkage (model c) on actual farm size decline was positive and statistically significant ($p<0.1$). Intention to constrict agricultural area increased the probability of realised agricultural area decline by 28.1%. In the models of farm exits (a) and shrinkage (c), the correlation (ρ) between error terms of equations that explain intention and actual behaviour was statistically insignificant. This implies that after accounting for all the explanatory variables used in the models, there are no unobserved explanatory variables left that would explain both intended and actual behaviour in a statistically significantly way. In the models of continuation of farming (b) and farm growth (d), the ρ was statistically significant, indicating that the intentions and actual behaviour are significantly affected by similar unobserved explanatory variables. Therefore, the conclusions drawn from Tables 2 and 3, and the results from Table 4, confirm our hypothesis that intentions are better predictors of actual behaviour in cases of continuation of farming and farm growth, compared to farm exits and shrinkage. Next, it is considered how the socioeconomic variables affect the intention-behaviour discrepancies.

The age of the farm operator has been found to be a significant determinant of intention-behaviour discrepancies (VÄRE et al., 2010; GLAUBEN et al., 2002). The results in Table 4 indicate that in the cases of continuation of farming and farm growth, elderly farmers are more likely to deviate from their respective stated plans. In the cases of farm exits and shrinkage, *Age* did not have significant effect on intended behaviour and therefore we cannot conclude that in those cases the age of the farm operator is related to discrepancies between stated plans and actual behaviour. The results also indicate that the probabilities of intending continuation of farming (model b) and farm growth (model d) decrease significantly as the farmer gets older. If the farm operator's age increases by 1 year, the probability of intending continuation of farming decreases by 0.4% and the probability of intended farm growth decreases by 1.1%. While the *Age* did not significantly affect the actual continuation of farming and farm growth, it had a significant positive effect on the probabilities of realised farm exits and shrinkage. If *Age* increases by one year, the probability of farm exit increases by 0.4% and probability of farm shrinkage by 0.5%.

The farm's agricultural area had a significant positive effect on the intention of continuation of farming (model b). Every 10 ha of agricultural land increased the probability of intending continuation of farming by 0.3%. Considering the positive significant effect of intended continuation on realised continuation, this implies that smaller farms are more likely to have discrepancies between intentions regarding continuation of farming and actual continuation. The results also show that large farms are less likely to exit from farming and more likely to continue with farming. Every additional 10 ha of agricultural land decreased the exit probability by 0.8% and increased the probability of continuation by 0.8%.

Table 4. The results of the recursive bivariate probit estimates

	Model							
	a) Farm exit		b) Continuation of farming		c) Farm shrinkage		d) Farm growth	
Dependent variable	*Exit_int*		*Cont_int*		*Decl_int*		*Grow_int*	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Intercept	0.1823 (1.8069)		0.6205 (0.9527)		-1.0314 (1.4101)		2.1433 (1.1654)*	
Age	0.0149 (0.0143)	0.0013	-0.0142 (0.0079)*	-0.0045	0.0121 (0.0113)	0.0023	-0.0467 (0.0103)***	-0.0109
Area	-0.0013 (0.0015)	-0.0001	0.0008 (0.0004)**	0.0003				
Rental					2.0529 (0.5086)***	0.3966	0.7863 (0.3883)**	0.1841
Off_farm	0.3844 (0.4592)	0.0334	-0.4908 (0.2085)**	-0.1552	-0.2523 (0.3336)	-0.0487	-0.6224 (0.2929)**	-0.1457
Semisubs	-0.1081 (0.3640)	-0.0094	0.2601 (0.1797)	0.0822	-0.0790 (0.2506)	-0.0153	-0.1226 (0.2296)	-0.0287
LFA	-1.0338 (0.3954)***	-0.0897	0.1540 (0.1779)	0.0487	0.1742 (0.2505)	0.0337	0.0243 (0.2331)	0.0057
Arable	-0.3596 (0.3558)	-0.0312	0.2289 (0.1927)	0.0724	-0.3746 (0.2897)	-0.0724	0.2505 (0.2393)	0.0586
Associations	1.0387 (0.3917)***	0.0901	-0.1386 (0.1915)	-0.0438	-0.4512 (0.2901)	-0.0872	0.0139 (0.2544)	0.0032
Know_exper	-0.8225 (0.3448)**	-0.0714	0.2513 (0.1592)	0.0795	-0.1299 (0.2444)	-0.0251	-0.2474 (0.2187)	-0.0579
Successors	-0.2030 (0.1842)	-0.0176	0.2193 (0.0906)**	0.0693	-0.4584 (0.1440)***	-0.0886	0.2965 (0.1113)***	0.0694
Poor_Health	0.1906 (0.2476)	0.0165	-0.3204 (0.1319)**	-0.1013	0.1587 (0.1801)	0.0307	-0.1696 (0.1591)	-0.0397
Dependent variable	*Exit_real*		*Cont_real*		*Decl_real*		*Grow_real*	
Intercept	-0.1956 (1.2045)		-0.9005 (1.0240)		-0.3178 (1.2662)		-0.4490 (1.3588)	
Exit_int	0.9632 (1.6040)	0.1950						
Cont_int			1.5968 (0.2773)***	0.3346				
Decl_int					1.3214 (0.7824)*	0.2809		
Grow_int							2.4174 (0.3620)***	0.3700
Age	0.0196 (0.0108)*	0.0040	-0.0079 (0.0091)	-0.0016	0.0231 (0.0102)**	0.0049	-0.0131 (0.0129)	-0.0020
Area	-0.0039 (0.0018)**	-0.0008	0.0037 (0.0016)**	0.0008				
Rental					-0.5810 (0.5020)	-0.1235	-0.1915 (0.4366)	-0.0293
Off_farm	0.6630 (0.2622)**	0.1342	-0.3091 (0.2356)	-0.0648	0.2967 (0.2875)	0.0631	0.1556 (0.3026)	0.0238
Semisubs	-0.5234 (0.2360)**	-0.1060	0.2933 (0.2006)	0.0615	0.1291 (0.2346)	0.0274	0.1165 (0.2420)	0.0178
LFA	-0.5174 (0.2911)*	-0.1047	0.3726 (0.2026)*	0.0781	-0.0942 (0.2383)	-0.0201	0.1765 (0.2468)	0.0270
Arable	0.2132 (0.2254)	0.0432	-0.2939 (0.1958)	-0.0616	-0.3492 (0.2903)	-0.0742	-0.0316 (0.2596)	-0.0048
Associations	-0.0812 (0.2606)	-0.0164	0.0581 (0.2114)	0.0122	0.2986 (0.2546)	0.0635	-0.4388 (0.2919)	-0.0672
Know_exper	-0.3072 (0.2041)	-0.0622	0.0917 (0.1769)	0.0192	-0.0416 (0.2183)	-0.0088	-0.0512 (0.2283)	-0.0078
Successors	-0.2169 (0.1229)*	-0.0439	0.0448 (0.1141)	0.0094	-0.1018 (0.1383)	-0.0216	-0.0189 (0.1157)	-0.0029
Poor_Health	-0.0277 (0.1682)	-0.0056	0.1131 (0.1378)	0.0237	-0.5882 (0.1907)***	-0.1250	-0.0789 (0.1766)	-0.0121
Disturbance correlation ρ	-0.5199 (0.7862)		-0.9174 (0.1230)***		-0.2683 (0.4364)		-0.8635 (0.1999)***	
Log likelihood	-131.75		-227.17		-147.38		-145.43	
N	251		251		198		198	

Figures in parentheses are standard errors; *Significant at 0.1 level; **Significant at 0.05 level; ***Significant at 0.01 level.
Source: own calculations

The share of rented land of the farm's agricultural area had a significant positive effect on both the intention to decrease farm size (model c) and the intention to increase farm size (model d). This suggests that farms with a higher proportion of rented land in their total agricultural area were less likely to deviate from their intentions regarding farm shrinkage and farm growth. This could be explained by the good awareness about the expiry dates of existing rental agreements (decline in farm's agricultural area) and better information about opportunities to conclude new rental agreements (farm expansion). As discussed in Section 3, these factors may contribute to the farm operators' higher level of perceived behavioural control over the short-term (3 years) changes in the agricultural area. However, the effect of *Rental* on the probabilities of realised farm shrinkage and growth were statistically insignificant.

The farm operators with an off-farm job had a significantly lower probability to declare an intention to continue farming (model b) and intention to extend the farm's agricultural area (model d). On average, the farm operators who had an off-farm job had a 15.5% lower probability to state an intention to continue farming, and a 14.6% lower probability to state an intention to expand the farm's agricultural area. If the positive significant effects of the intended behaviour on the realised behaviour in models b and d are considered, this implies that farm operators who have an off-farm job are more likely to deviate from their plans regarding continuation of farming and farm growth. This could be related to the income level provided by the off-farm job compared to the income earning potential of the farm. If the income earning potential of the farm is lower than the income provided by the paid job, then the farmer might have a less positive attitude about the continuation of farming or farm growth. In addition, in such a case he or she may feel pressure from family members to reduce his or her own farm workload. While the positive effect of having an off-farm job on the probability of intended exit was statistically insignificant, its positive effect on the probability of realised farm exits was significant. An off-farm job increased the probability of farm exit by 13.4%.

Our assumption was that farm operators, who had taken a 5-year obligation to continue farming within the semi-subsistence farming or LFA payment schemes, had more positive attitudes and better-formed intentions regarding the continuation of farming. The results indicate that participation in the semi-subsistence farming scheme had a positive effect on the intended continuation of farming; however, the estimated coefficient is only significant at the 15% level. Participation in the LFA payment scheme had a significant negative effect on the probability of intended exit; however, the intended exit did not have a significant effect on actual exits. Considering the significant negative effects of participating in LFA or semi-subsistence farming scheme on the probability of realised farm exits, and positive effects (though estimated coefficient of *Semisubs* is significant at 15% level) on the probability of continuation of farming, there is positive but statistically weak evidence that farmers who have taken the 5-year obligation to continue farming are less likely to depart from their intended behaviour regarding farm exit and continuation of farming. The weak statistical significance of the estimates may be related to the fact that those who did participate in the scheme had to maintain agricultural production for five years, but by 2011 they had fulfilled the requirement and this obligation was no longer relevant. In the farm decline and growth models, the effects of variables *Semisubs* and *LFA* were statistically insignificant.

It was assumed that arable farms are less likely to have discrepancies between intentions and realised behaviour, as the operators of arable farms might have had a more positive attitude towards continuing and expanding production due to high cereal prices at the end of 2007 when the first survey was conducted. From Table 4, it stems that while the signs of the estimated regression coefficients of *Arable* are in line with our assumption, the estimates are statistically insignificant.

A higher level of social and human capital should positively affect the perceived behavioural control and improve the formation of intentions. Our results reveal that members of farming associations had a significantly higher probability to report an intention to exit farming, while the association membership did not have statistically significant effect on realised exits. The parameter of *Know_exper* indicates that farmers with a higher level of knowledge and experience are less likely to intend to exit and also less likely to actually exit from farming. The level of knowledge and experience has a positive (significant at 12% level) effect on the probability of intended continuation of farming. Taking into account the statistically significant positive effect of intended continuation of farming on realised behaviour, this implies that in this model a lower level of knowledge and experience increases the likelihood of discrepancy between intention and behaviour.

The availability of successors is one of the key determinants of farm viability in the exit phase of a farm's life cycle. It is argued that the succession effect has an influence on farm growth from the age of 45 of the farm operator, and the early designation of the successor motivates the farmer to invest and improve the management of the farm (GLAUBEN, et al., 2002; CALUS et al., 2008). Results from Table 4 confirm that the availability of successors has significant negative effect on the probability of intended farm shrinkage, and positive effects on the probabilities of intended continuation of farming and farm growth. This implies that in cases of farm growth and continuation of farming the good availability of successors increases the likelihood of intention-behaviour compatibility. However, in the case of farm shrinkage, the good availability of successors increases the likelihood of intention-behaviour discrepancy. This inconsistency may be related to the fact that while the decision making often involves other family members in family farms, the intentions of farm operators were studied in the survey of 2007 and not the intentions of other family members. When it comes to actual behaviour, the effects of *Successors* are negative (significant at 0.1 level) with respect to the probability of actual exits. The effects of this variable on the actual continuation of farming, farm shrinkage and growth are statistically insignificant.

The poor condition of health had a significant negative effect on intended continuation of farming. While the other estimates of this parameter were statistically insignificant, the estimates of model c (farm shrinkage) indicate that farm operators who evaluate their condition of health as poor are less likely to actually decrease the farm size. This implies that a poor condition of health may decrease the farm operators' perceived behavioural control over the continuation of farming and therefore increases the probability of respective discrepancy. However, if the condition of health permits and farmers who evaluated their health as poor keep on farming, they are not likely to reduce the agricultural area of their farms.

5 Conclusions

The theory of planned behaviour states that intentions should predict behaviour. It also emphasises that the formation of intention depends on attitudes, perceptions of control and subjective norms, and there are a number of external and internal factors that affect the likelihood of actually carrying out the formed intentions (AJZEN, 2005; SUTTON, 1998; SHEERAN 2002).

This research aimed to study the effects of the stated intentions and selected socioeconomic characteristics on the farmers' behaviour in cases of farm size changes and farm exit, using recursive bivariate probit regression. To this end, data from the Estonian farmers' survey in 2007 on the farmers' intentions on exit and farm size changes for the period of 2008-2010 was complemented with data from the follow-up survey of those farmers in 2011, and paying agency's registry data.

The results of the present study are in line with the conclusions of VÄRE et al. (2010), THOMSON and TANSEY (1982), GLAUBEN et al. (2002), and LEFEBVRE et al. (2013) in that the value of the stated plans of the farmers for predicting actual behaviour is limited as considerable discrepancies exist. The study confirmed our assumption that the discrepancy between farmers' future intentions and actual behaviour depends on the nature of the behaviour under scrutiny, and intentions are better predictors of actual behaviour when the considered event (continuation of farming and farm growth) could be regarded as positive rather than negative (exit from farming, farm shrinkage).

As noted in several studies (VÄRE et al., 2010; GLAUBEN et al., 2002), the farmers' age is a significant determinant of decisions taken in different phases of the farm life cycle. VÄRE et al. (2010) found that elderly farmers are more likely to diverge from their intentions regarding farm succession. In the present study, the realised behaviour of older farmers was more likely to diverge from intentions in the contexts of continuation of farming and farm growth. The relevance of farm size in farm survival has been noted by e.g. RIZOV and MATHIJS (2003), and GLAUBEN et al. (2002). Our results indicated that farm size had a positive effect on the probability of intended continuation of farming, and the probability of mismatch between intended and actual continuation of farming was larger in smaller farms. These results are somewhat in contrast with the findings of LEFEBVRE et al. (2013) in that smaller farms are less likely to modify their intentions (in the context of land investments). The share of rented land of the farm's agricultural area had a significant positive effect on both the probabilities of intended farm growth and intended farm shrinkage, implying the lower probability of intention-behaviour discrepancy. This result may be related to better perceived behavioural control of farm operators who rent a significant part of their agricultural land over their short-term land use changes.

The positive relationship between farm operator's off-farm job and farm exits has previously been found by e.g. RIZOV and MATHIJS (2003), and STIGLBAUER and WEISS (2000). WEISS (1999) found that farm operator's off-farm increases the likelihood of reduction of farm size. According to our results having an off-farm job increased the likelihood of intention-behaviour discrepancy in cases of continuation of farming and farm growth; and increased significantly the probability of realized farm exits. A higher level of social and human capital should result in more clearly formed intentions. In the present analysis, the farmers with a higher level of knowledge and experience were more likely to realise their intentions regarding the continuation of farming.

Successors are one of these important other actors who considerably affect the planning of the future of the farm. However, as the plans of the potential successors are not necessarily in line with the intentions of the acting farm operators, the plans of the successors may be a source of discrepancy if the farm operator is unaware of these plans (VÄRE et al., 2010; GLAUBEN et al., 2004). This was demonstrated in the present analysis by the fact that while the good availability of successors reduced the likelihood of intention-behaviour discrepancy in the cases of continuation of farming and farm growth, it increased the probability of intention-behaviour mismatch in case of farm shrinkage. Therefore, for predicting actual behaviour on the basis of ex-ante research, the collection of the background information on the successors and their plans could explain the sources of discrepancies and the impact of the outside actors on both formation of the intentions and realisation of them in the behaviour.

The farmer's health condition plays a central role in decisions on exit or growth (GALE, 2003). However, the connection with behaviour was not so straightforward in this study. Farmers who evaluated their condition of health as good in 2007 were more likely to intend to continue farming. A poor condition of health increased the likelihood of discrepancy between intended and actual continuation of farming. At the same time, farmers with poor health, if they continued farming, maintained the size of their agricultural area. This implies that the fact that there is a high level of unpredictability in using health condition for predicting behaviour should be taken into account.

The theory of planned behaviour was used in this research as a general frame, but the limitations of the available data did not allow for studying directly the elements influencing the formation of intentions. The incorporation of questions about the attitudes, perceptions of control and subjective norms, as well as questioning the main external actors in future farmers' surveys, and the investigation of the actual behaviour of the farm operators, could immensely contribute to understanding the development of intentions and possible sources of discrepancies between intentions and behaviour.

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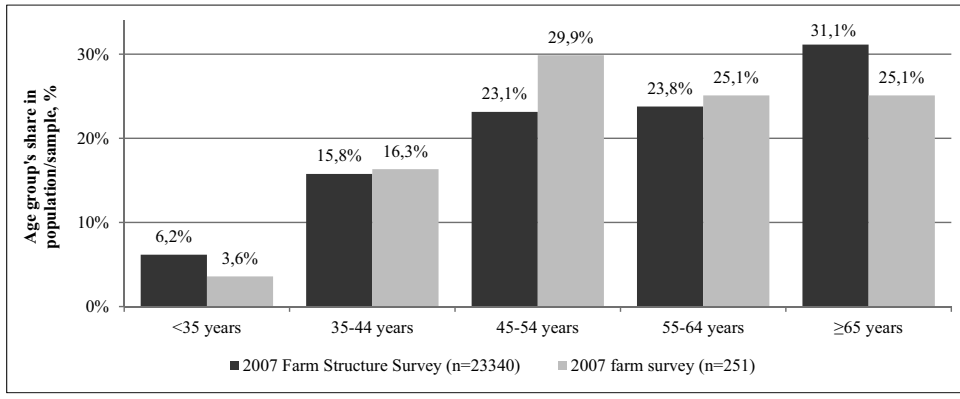
Annex

Annex I Percentiles of farms that retained agricultural production according to the changes in the agricultural area in 2007-2010 (N=198)

Percentile	N	Range (index of agricultural area)	Average agricultural area in 2007, ha	Average agricultural area in 2010, ha
0.1	20	0.126-0.756	46.9	23.8
0.2	20	0.756-0.874	249.2	204.9
0.3	20	0.874-0.961	204.9	191.5
0.4	19	0.961-0.985	328.7	321.1
0.5	21	0.985-1.000	52.0	51.8
0.6	19	1.000-1.012	133.6	134.1
0.7	19	1.012-1.037	102.1	104.5
0.8	20	1.037-1.083	185.3	196.1
0.9	20	1.083-1.268	292.7	339.0
1	20	1.268-5.185	127.6	248.6

Source: own calculations

Annex II Distribution of age groups of farm operators according to agricultural census of 2007 and in 2007 farm survey



Source: SOE (2013); own calculations

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