EXPLORING THE ROLE OF SUCCESSION PATTERNS IN CENTRAL AND EASTERN EUROPEAN'S DUALISTIC FARM STRUCTURES

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Abstract

This paper analyses the interplay between farm adjustments on individual farms in dualistic farm structures over time using an agent-based simulation approach. In particular, explore the development of individual farms when there are off-farm work opportunities and different propensities of younger farm successors to take over the farm. Results show that despite of large numbers of individual farms leaving agriculture, the impacts on land use, production, and income are independent on different propensities to take over a farm.

Key words: dualistic farm structures, individual farms, generation change, succession

1. Introduction

Farm structures in many Central and Eastern European countries (CEEC) are dualistic. A large number of small farms operate in parallel to a small number of large farms (EURORSTAT 2003). Numbers of medium-sized market-oriented farms are increasing. Most small-scale farms are individual family farms that have been created due to the restitution of land, the disintegration of former collective farms, or the expansion of household plots (Chaplin et al., 2004). Large-scale farms are mostly cooperative farms, with a few exceptions of individual farms that have grown and will continue to grow larger (Lerman, 2000). Many factors determine and drive farm structures. In essence, farm structures are the result of a complex interplay of economic, social, cultural, historical, political, technological, and geographical drivers inducing a variety of adjustment reactions (Balmann et al., 2006, Happe, 2004, Happe and Kellermann, 2007, Happe et al., 2006). When investigating structural change in dualistic farm structures, it is the ensemble of individual farms and corporate farms which is changing over time.

As regards individual farms, the socio-economic characteristics and activities of farm households have been considered major drivers and inhibitors of change (Buchenrieder et al., 2007). The level of education, the age of the operator, off-farm work opportunities, and non-economic considerations have been mentioned as important driving factors on the side of the farm. One characteristic of individual farms is that they have farm-family owned production factors which can be employed in different ways. Diversification in the individual farm case can be non-agricultural enterprises, capital investments, or non-farm employment. Non-farm employment can generate additional income that can compensate for losses generated on the farm (Chaplin et al., 2004). Yet, it can also delay change processes. Under unfavourable economic conditions during transition, it is often economic distress (i.e. insufficient farm incomes) that drives rural families to diversify and to open up non-farm income sources (Möllers, 2006). Opening up to non-farm income sources and to engage in part-time farming can also increase the probability of farm exit in the future (Goetz and Debertin, 2001; Pfeffer 1989; Weiss, 1997). Taking off-farm work opportunities is moreover related to the level of education (Chaplin et al., 2004). Accordingly, better qualified persons can potentially be employed in more off-farm activities. For younger, well-skilled farmers it is thus often easier to find jobs outside agriculture. Higher education is often related with a higher chance to work in other sectors than farming (Breustedt and Glauben, 2007).

This paper provides a first analysis of the interplay between farm adjustments on individual farms in dualistic farm structures over time using an agent-based simulation approach. In particular, explore the development of individual farms when there are off-farm work opportunities and different propensities of younger farm successors to take over the farm. We understand farm structures as an evolving complex system with dynamic adjustment processes. This is reflected in the agent-based model AgriPoliS (Happe, 2004; Happe et al., 2006, Kellermann et al. 2007). The model integrates key components of regional agricultural structures: heterogeneous farm enterprises and households, space, markets for products and production factors. As regards the objective of this paper, AgriPoliS links farmer characteristics (age, farm succession) to off-farm working opportunities. Moreover, we consider the simultaneous and competing development of individual farms and corporate farms. As AgriPoliS allows initialising and simulating the development of many individual farms, conclusions about distributions and paths of potential developments can be drawn.

2 Method, data and scenarios

The following subsection explains briefly the basic version of the used agent-based model AgriPoliS and the model specifications necessary to analyse the impact of off-farm work opportunities on the development of individual farms. For a detailed model description the reader is referred to Happe et al. (2006), Happe (2004) as well as Kellermann et al. (2007).[1]

2.1 Modelling framework AgriPoliS and simulation scenarios

The agent-based model AgriPoliS represents key characteristics of an agricultural region, such as farms located in the region and their development. Farms in the region act individual and interact with each other. Individual farms' actions lead to certain phenomena such as structural change at the regional scale. Interaction between farms takes place predominantly via the land market, where farms compete for free plots of land in an auction. Individual farms' actions are determined by their objective to maximise total household income. The optimal mix of activities at the farm level is determined by a mixed integer programming model, that allows farms to choose between different production alternatives, to invest in new stables and machineries, hiring labour forces, taking out short-term loans, offering family labour forces off-farm and saving money. As regards farm labour, we differentiate between the family labour force and hired labour. In general, farm family labour can be used on the farm or off-farm. Offering family labour off-farm means a diversification of income sources since family labour is used to generate non-farm income. In many cases, this mix of on-farm and off-farm income sources has been considered a first step out of agriculture, as mentioned in the introduction (Goetz & Debertin, 2001; Pfeffer, 1989; Weiss, 1997).

Each period, farms account their revenues and expenditures. At the end of every period farmers have to decide whether they stay in agriculture, even if they have already taken up some off-farm work, or whether to leave agriculture. In AgriPoliS there are two reasons for leaving agriculture. The first is if equity capital is negative.

[1] All three publications are available online. Kellermann et al. 2007 includes beside the general model description the latest extension done within the EU project IDEMA.

The second reason to leave is when opportunity costs for labour, land and capital are higher than their expected income from agriculture in the next period less rental expenditures and transport costs.

To represent dualistic farm structures we consider individual and corporate farms. All farms are profit maximisers. That is, we do not consider subsistence or semi-subsistence farms.

In the following analysis, we assume that a successor will take over an individual family farm ("IF" in the following)[2] at generation change only with a certain probability. This probability is systematically varied in the following simulations from 0% to 75%. Important for this analysis is also the age structure of the farmers in the region. As we do not have empirical data about it, an equal distribution is assumed. Thereby, each farm receives a random age at the beginning of the simulations. Note, that this is also a first attempt towards analysing the impact of farm succession and farmers' age patterns on structural change. In this paper we hence concentrate on the likelihood to take over a farm and keep age distributions constant. We focus on the probability whether a succession takes place on IF or not. The explained assumptions are the most important to analyse the impact of off-farm work opportunities on the development of IF. Further assumptions for the simulations, which are not changed for this analysis, are explained in detail in Blaas et al. (2007), Sahrbacher et al. (2007) and Schnicke et al. (2007). Of relevance for this paper is the assumption of increasing wage levels.

2.2 Data and scenarios

The data we used for this study to initialise the simulation represents the farm structure of the Slovak region Nitra. A detailed description of this region can be found in Sahrbacher et al. (2005). Kellermann et al. (2007) includes a description how a region is represented in AgriPoliS. Here we give a brief description of the region concerning its dual structure.

In general, farms smaller than 5 hectare are not considered, because we consider only market-oriented, profit maximising farms and no semi-subsistent or subsistent farms. Nevertheless, we reflect the dual structure of the region shown in Table 1 and Table 2. In Table 1 we show the total figures of several characteristics of the initialised region. The initialised region corresponds to one fourth of the region Nitra. That means all presented figures have to be multiplied by 4 to represent the whole region.[3] More than three-quarter of the farms (80%) are IF. Their average size amounts to 60 ha. However, they use only 16% of the land. The relatively large average farm size of IF is caused by the existence of some big IF with a size between 100 and 500 ha.

[2] This applies to corporate farms as well but due to their legal type they are assumed to be able to hire easily "external" labour for every position within the enterprise.

[3] This downscaling of the region has technical reasons. One simulation over 25 periods with the downscaled region takes two hours. Happe 2004 found out that the downscaling of the region has no significant impact on the results.

Table 1: Regional characteristics in total and importance of IF

Characteristics	Total	IF	Average number of animals per IF
	[Number] [Hectare]	[%]	[Number]
Farms (IF and CF)	327	80	
UAA	97,373	16	
Beef cattle	2,224	49	4
Dairy cows	9,653	2	1
Breeding sows	9,140	0	0
Fattened pigs	46,517	2	4

Source: own calculations.

On the opposite only 20% of the farms are corporations or cooperatives with an average size of 1,275 ha. Half of them are larger than 1,000 ha and use 73% of the total UAA in the region. Livestock production is less important in the initialised region, as it becomes obvious by a comparatively low livestock density of 0.28 livestock units per hectare.[4] Most of the livestock production takes place in corporate farms ("CF" in the following). Individual farms play only in beef fattening an important role, 49% of the beef cattle are fattened in IF. On average there are four beef cattle, one dairy cow and four fattening pigs kept on IF.

Table 2: Number and share of farms and UAA used in different farm size classes

Farm size classes	Farms	UAA	Number of farms	Number of IF
	[%]	[%]	[Number]	[Number]
5-10 ha	26.0	0.4	85	85
10-50 ha	31.2	3.1	102	102
50-100 ha	10.7	3.0	35	18
100-500 ha	16.5	7.9	54	54
500-1000 ha	5.2	12.2	17	4
> 1000 ha	10.4	73.3	34	0

Source: own calculations.

Besides the regional characteristics, we give information about the age distribution of the initialised region, presented in Figure 1 below. As mentioned, we assume an equal distribution. The age of individual farmers is chosen randomly during the initialisation of the region and corresponds more or less to an equal distribution.

[4] The livestock density is calculated based on the total number of animals. Thereby, one dairy cow is equal to 1.5 livestock units (LU), a fattening bull to 1.2, a breeding sow to 0.45 and a fattening pig to 0.13.

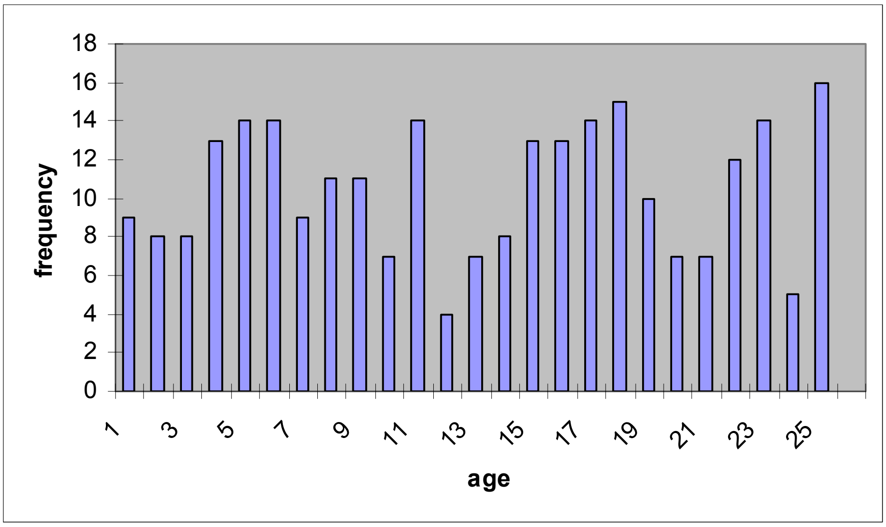


Figure 1: Farmers' age distribution on IF

Source: own.

The agricultural policy framework as background for the simulations is the situation after the accession of the Slovak Republic to the European Union and the introduction of the Common Agricultural Policy (CAP). As the initial data are from 2001, we consider in the first three periods a pre-accession policy. In the fourth period the accession policy is introduced. That means, SAPS-payments (Single area payment scheme) are phased in and top-ups for arable land are introduced. Further details about the policy implementation can be found in Blaas et al. (2007) and Schnicke et al. (2007). The simulations run for 25 periods that each farm is faced with a generation change (by assuming a generation change every 25 years). Within the political framework, with steadily increasing payments we analyse the impacts of different succession patterns on IF.

According to the objective of this paper, the point of origin for analysing the simulation results are scenarios where we assume different probabilities for IF to be handed over to the next generation. Former simulations showed that the increasing payments create incentives for individual and corporate farms to stay in the sector (Blaas et al., 2007). However, in the simulations done for Blaas et al., 2007 we only consider economical reasons for leaving agriculture. Farms quit there either, in-between two generation changes by age-dependent opportunity costs or with 25% higher opportunity costs at a generation change.[5] On the other hand, the overall economic conditions of the 12 countries acceded the EU in 2004 have improved. Better economic conditions outside agriculture might increase the incentive for young farmers or - especially for potential successors - to leave agriculture, because there are better job opportunities outside the agricultural sector. Additionally, there are non-economical reasons for possible successors to leave agriculture, which are not considered in AgriPoliS so far. Thus, a probability is introduced, by which a farm is not handed over to a successor. This probability subsumes the following reasons why a farm is not handed over to a successor:

1. No successor exists (non-economical reasoning).
2. There is a potential successor but he/she is not interested in agricultural activities (non-economical reasoning).

[5] In the basic AgriPoliS version opportunity costs are 25% higher during the generation change because we assume that the successor is better educated than the older farmer (Breustedt and Glauben, 2007).

3. There is a potential successor but he/she expects agricultural income earning options less profitable as alternative jobs (economical reasoning, but the opportunity costs of farms are not explicitly calculated).

As we have no empirical data about how many IF are handed over to a successor and as it is not exactly predictable how the macroeconomic conditions will develop in the New Eastern Member States in the next 25 years, we vary the probability to leave the sector between 0 and 75%. In detail, we conduct four different simulations described in Table 3.

Table 3: Scenario description

Scenario	Description
S_0	farms have a successor, they only quit when their opportunity costs are higher than their expected farm income or when their equity capital is zero
S_25	probability of 25% that the farm is not handed over to a successor because of the above mentioned reasons
S_50	probability of 50% that the farm is not handed over to a successor because of the above mentioned reasons
S_75	probability of 75% that the farm is not handed over to a successor because of the above mentioned reasons

Source: own.

A probability of 0% is equivalent to a 100%-probability that a succession takes place on the IF. Nevertheless are farms also in this scenario faced with the decision to stay in the sector or to leave it as opportunity costs for owned input factors of labour, land and capital are annually calculated in the model. If these opportunity costs are not covered a farm leaves the sector.

3. Results

3.1 Development of the number of Individual farms

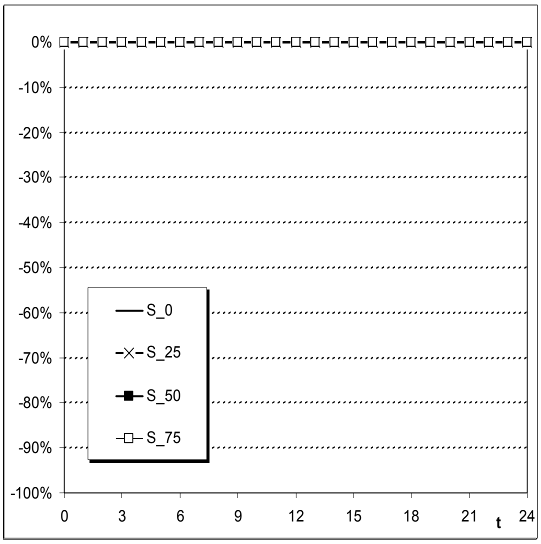
Figure 2 (a) shows the relative decline in the number of IF in the four scenarios described. All scenarios are characterised by a decline in the number of farms but the development differs between scenarios. Scenario “S_0” shows a persistence of IF until period t=12. This point marks a “kink” and will be dealt with in more detail in section 3.4. After period t=12, IF exit steadily and their number decreases in t=24 to 50% of the original sample. The persistence of farms in the first 12 periods is strongly influenced by the fact that the policy framework of the newly introduced Common Agricultural Policy (CAP) in the New Eastern Member States sends out comparatively high incentives for all farms to remain in the agricultural sector as incomes and profits directly increase as a result of the introduced support measures.[6]

[6] The policy-induced impact comes from the premiums paid as Single Area Payments (SAPS) for arable land and grassland. SAPS-Payments incrementally increase according to the phasing-in of payments (EC Reg. No 1782/2003). The policy impact has been verified by conducting the simulations under the same parameter settings (0%-probability of no succession on IF) but under the pre-accession policy. The simulation results in the “S_0”-Scenario under a pre-accession policy are characterised by a steady exiting of individual farms.

Regarding the developments in scenarios "S_25" and "S_50" there is - due to the assumptions on the probability of succession - a steady decline in the number of farms from the beginning. It is remarkable that both curves show a "kink" at period t=12 and thereafter, similarly to scenario "S_0". Regarding the development in scenario "S_75" it shows a continuously strong exit of IF over all periods.

3.2 Development of the number of Corporate farms

The persistence of farms becomes even more obvious by focussing on CF, cp. Figure 2 (b). They constitute a kind of constant as their number remains stable across all parameter settings and all periods.[7] Nevertheless, there are interdependencies between these two legal types. There are movements between IF and CF with regard to the shares of land use, but there are as well "internal" developments and shifts on IF and CF with regard to their input factor use and their production structure. This was shown and analysed in Schnicke et al. (2007). On the subject of agricultural commodity markets, CF hold an exposed importance with respect to plant and livestock production. This has to be kept in mind as a background for a further assessment on individual farm dynamics as their importance for the agricultural commodity market is rather marginal.



(a) Individual farms (b) Corporate farms

Figure 2: Relative decline in the number of farms

Source: own calculations.

[7] Test-simulations which assume a pre-accession policy framework reveal that the persistence of CF under the actual accession policy is caused by the increasing level of support payments (as this is also the main reason for IF to stay in the sector).

3.3 Why do farms exit?

The simulations show in the scenario where the probability that a succession on IF does not take place is set to 0% a persistence of IF until period p=12. After that initial phase of no farm exits farms leave the sector at a steady rate.
In view of the reasons why farms leave the sectors, Table 4 gives more details about theses for IF. The initial number of IF amounts to 263 in all scenarios. According to the scenario settings there are 3 reasons for leaving the sector. First, if the opportunity costs for owned input factors are not covered. This can take place at the end of each simulation period. Secondly, if there is a probability that the succession takes not place. In the first scenario "S_0" farms can only leave for the first reason. The third reason, negative equity capital, does not appear in this simulation. Hence it is not reported. The other scenarios are characterised by an increasing share of IF that leave the sector for the second reason, but there are still farms leaving for the first reason as well.

There are some farms which leave the sector in every scenario, e.g. all those 132 farms that exit in scenario "S_0" exit as well in the scenarios "S_25", "S_50" and "S_75", but for different reasons. In the scenario "S_0" the opportunity costs of owned input factors would have not been covered if the farm had stayed in the sector. This is the case in period t=12 and thenceforward. These 132 individual farms leave in the scenario "S_25"as well, either for the reason of being randomly affected by having no successor in the case of a generation change or for the reason of uncovered opportunity costs (as in the scenario "S_0"). It can be concluded that there are some "exit-farms" which re-appear independent of the scenario. A priori, one could argue that a scenario where the likelihood is higher (25%, 50%, or 75%) that IF are "forced to leave" has some implications for the remaining farms as those have less competitors for free parcels of land. Furthermore, there is more free land on the land market as more farms are leaving and release their land to the land market. This enables other farms to grow and to realise economies of scale (e.g., Happe et al. 2006, Schnicke et al. 2007).[8] The higher the probability for IF that the farm is not taken over the less strong acts the "selection process" upon the farm sample. That means the higher this probability the higher is the probability that better-performing farms which have already grown or which can potentially grow are affected by a randomly induced "force" to leave the sector. This effect, however, can also be observed in some real-world situations, where farms are not taken over even if they could generate sufficient income.

[8] Future efforts will orientate to link certain individual farm characteristics, e.g. the farm size with the probability to have a successor or not. The recent literature gives some hints that larger individual farms have a higher probability to be overtaken than small ones (Kimhi and Nachlieli, 2001 and Breustedt and Glauben, 2007).

Table 4: Individual farms exiting and exit reasons in all scenarios

Scenario	Initial number of IF (t=0)	Surviving farms (t=24)	Farms exiting	Reason of exit	
				Opp.-costs not covered	No succession
	[number]	[number]	[number]	[number]	[number]
S_0	263	131	132	132	-
S_25	263	110	153	94	59
S_50	263	79	184	74	110
S_75	263	47	216	40	176

Source: own calculations.

3.4 Specific phenomena: Explaining the kink

As mentioned in section 3.1, the development of the total number of individual farms is characterised by a kink in period t=12. This result is far away from being representative for any particular development. Nevertheless, it offers a good opportunity to ask what has led to this phenomenon, and why it appears more strongly in one scenario than in the others.

As mentioned before, and shown in Table 4, in scenario "S_0", over 25 time periods, all farms leave because of uncovered opportunity costs. Accordingly, in period t=12 and thereafter, more farms leave because of this reason. This kink is also apparent in the other scenarios, cp. Figure 2 (a). But in the other scenarios it is less pronounced. Merely, in the scenario where we assume the non-existence of a successor by 75% this kink does not appear at all. Opportunity costs affect all production factors. With increasing labour costs, labour diversification and off-farm income are increasingly an option for comparatively unprofitable farms. A further reason for the appearance of that kink is related to the increase in land rental prices (cp. Table 5). Their strong increase is mainly induced by the increase of the area-related SAPS-payments.[9] A rental price level which is significantly above the starting level increases the opportunity costs of owned land. Small IF have a comparatively high share of owned land, particularly in comparison to CF. Hence, they are more affected by changes in opportunity costs of land, i.e. changes on the land rental level. Over time the non-active use of their own land, i.e. closing down the farm and renting-out of owned land appears as a more profitable opportunity.

Table 5: Development of rental prices for agricultural land (arable land and grassland)

Scenario	Initial rental price (t=0)	Rental price (t=12)	Rental price (t=24)
	[€/ha]	[€/ha]	[€/ha]
S_0	26	114	170
S_25	26	114	170
S_50	26	114	169
S_75	26	114	167

Source: own calculations.

9 The variation of the probability for IF that a succession takes place or not has almost no impact on the development of rental prices (cp. Table 5).

This exit process is still rather general, and can differ greatly between farms. In the following, we thus depict the exit path of one particular farm type. In the modelled sample, more than 15% of the farms are similar to the example farm “IF-FC-3”.[10] Hence, they follow similar exit patterns. Table 6 below shows selected key indicators at different points in time of that farm. It shows that on the path to exiting, the farm’s income sources, production basis and equipment change considerably. What can be seen is that this particular does not exit immediately, but gradually, by increasing off-farm employment, reducing the amount of land, and abstaining from re-investment.

Table 6: Selected characteristics of farm IF-FC-3

Period	Total area	Rented	Rent/ha	Off-farm income	Own machinery	Agri-service	SAPS
	[ha]	[ha]	[€/ha]	[€]	[Yes/ No]	[Yes/ No]	[€]
Initialisation t=0	40 (all arable)	35	27	1,672	Yes	No	1,052
t=1	40	35	27	2,190	No	Yes	1,044
…	…	…	…	…	…	…	…
t=12	12.5	7.5	27	3,339	No	Yes	2,586
t=13 Farm exits	5 (own land)	Own land rented out	195 (rented out)	3,478	Farm exits	Farm exits	Farm exits

Source: own calculations.

According to the initialisation of the typical farm sample all farms, including the example farm, possess an initial farming equipment of a bundle of machinery which consists of tractors and harvesters and livestock production facilities. This equipment and machinery is dimensioned according to the initial production volume, i.e. agricultural land in use and herd sizes. The useful life time of machinery is set to 12 years, that of livestock production facilities to 20 and 25 years, depending on the line of production. During initialisation, a random age is assigned to assets. All machinery and equipment is depreciated over these periods. In general, if farms leave because of opportunity costs, the farm’s decision to continue or close down the farm is based on future revenues, premiums and costs. The costs for depreciation and maintenance for machinery and stables are assumed to be fully sunk and therefore not considered as relevant costs. In that sense, the decision on “staying or leaving” in the period as long as a farmer has own machinery is not conducted on a full cost pricing basis. After having used the machinery until the end of its useful life, farms decide either to re-invest in a bundle of new machinery or to hire those machines as “Agriservices”. Particularly smaller farms such as the example farm “IF-FC-3” and farms with initially old machinery and equipment opt for this possibility. Instead of re-investing, they flexibly hire machinery on a per hectare basis. Compared to own machinery, the costs of hired machinery are not sunk. In contrast to the decision basis of “staying or leaving” in the situation of having own machinery, the costs for “Agriservices” are directly considered for that question in the case that farms manage their land by hiring “Agriservices”. Hence, the costs and revenues are calculated on a full cost pricing basis. As a consequence, in the absence of sunk costs for machinery and equipment, the threshold for leaving is reduced even further.

[10] FC = Field Crop farm type.

Compared to the decision basis in the period when a farm has own machinery capacities, this full cost pricing basis promotes the exiting of farms as the relevant costs are considered and reduce the profitability of the farming activities. Within the weighted typical farm sample exist a numerous number of that small farms which decide in that way and exit the agricultural sector in the end.

3.5 Implications for structural change

After having discussed the development of farms and reasons for exiting, it is important to ask about the importance of these results for structural change in general. The question is: Does it matter if up to 80% of individual farms leave during one generation? Does it matter with regard to land use, farm size, income and labour input?

Table 7 shows the dualistic farm structure of the study region by summarising information on initial land use shares and the average farm size of IF and CF and the development of these figures until the end of the simulations in period t=24. Table 7 depicts the two most "opposed" scenarios "S_0" and "S_75". IF use in the scenario "S_0" only 16% of the agricultural area in the modelled region at the beginning of the simulation runs and this share increases up to 33% in the final period t=24. The development looks different in the scenario "S_75" as it depicts an opposed extreme scenario with regard to the question of farm succession. In the "S_75"-Scenario the probability of no succession is much higher and therefore are more large IF affected by the problem that a successor does not take over the farm such that the land left behind from these farms can only partially be occupied by the remaining IF, but also by CF as there decrease in size is less strong in this scenario.

Table 7: Shares on land use and average farm size of IF and CF (in t=0 and t=24)

Scenario	Land use of IF / Ø-size IF		Land use of CF / Ø-size IF	
	t=0	t=24	t=0	t=24
S_0	16% / 60 ha	33% / 242 ha	84% / 1,275 ha	67% / 1,026 ha
S_75	16% / 60 ha	22% / 457 ha	84% / 1,275 ha	78% / 1,186 ha

Source: own calculations.

With regard to the average farm size there is a strong sample-effect within the shrinking group of IF. According to the design of the succession processes, this group declines the strongest in the scenario "S_75". What are the reasons for the CF's decreasing and the IF's increasing in size? By competing for free plots of land farms calculate their internal shadow price for an additional hectare. Considering that there are economies of scale, most operate in the range of increasing returns to scale and are able to offer higher bids by competing for free land. Furthermore causes the higher amount of livestock production (in absolute and relative terms) which is mostly kept in CF a lower profitability of CF compared to IF. In addition, CF have a higher share of grassland and the withdrawals of IF are assumed to be slightly lower than the salaries paid to agricultural employees.[11] These are all reasons why IF have in general a higher shadow price for land and therefore are able to pay higher land rental prices.

[11] The reason for that is the fact that an individual farm managed by family members is assumed to be more flexible and frugal in the case of financial shortages.

As already mentioned in section 3.3, the probability of a successor not taking over the farm applies to all individual farms, independent of their profitability. That is also the reason why the decrease of the land use share for CF is the lowest in that scenario “S_75” as a high share of successful IF is “forced” left the sector. Therefore, these farms can not appear as strong competitors for free land as it is the case in the other scenarios.
This is most pronounced in the scenario “S_0” and the movement of land from CF to IF is the largest in this scenario. Note, however, that if another random seed were chosen, the situation could be different.

Regarding selected other indicators like e.g. “Revenue per Annual Working Unit (AWU)” or “Income per AWU” results between scenarios do not differ much (cf. Table 8). Considering the differences in the number of individual farms between scenarios, revenues per AWU and incomes per AWU show no significant differences. Hence, the differing assumptions on the succession processes on IF have only a very limited impact on the regional production volume (proxy: revenues) and as well on the labour force remuneration (proxy: incomes).

Both indicators are observed at the initial period (t=0), after implementing a new support payment scheme (t=4) and in the final period (t=24). Revenues only slightly increase whereas the income indicator increases drastically after the implementation of a new support scheme. Both indicators have to be assessed against the background of an annual decrease in the labour input down to the half of the initial level (-2.7% p.a.). That is mainly caused by a decline in livestock production, but less by farms leaving the sector (Schnicke et al. 2007).

Table 8: Revenues and income per AWU (t_0=100, relative changes)

Scenario	Revenue per AWU			Income per AWU		
	t=0	t=4	t=24	t=0	t=4	t=24
S_0	100	+2	+37	100	+74	+186
S_25	100	+2	+38	100	+74	+186
S_50	100	+3	+39	100	+75	+187
S_75	100	+3	+40	100	+74	+186

Source: own calculations.

4. Discussion and conclusion

In this paper we presented a first attempt to model and simulate the impact of specific farm household characteristics on structural change in a dualistic farm structure. Here, we focussed on varying a successor’s likelihood to take over a family farm. We identified exemplary developments and specific phenomena at the regional level, but also with regard to an individual farm type.

If, on the one hand, structural change were measured only in terms of the number of farms of a specific type and in terms of average farm size, results revealed that the structure of farms develop differently. Hence, with regard to these indicators, results give a hint that succession processes on IF have some influence on the development of dualistic farm structures.

The specific development of the number of farms is also strongly related to the prevalent policy. These promote a persistence of farms (IF as well as CF) in the medium-term perspective. The step-wise relaxation of the assumption that every IF has a successor induces an exiting of IF and underlines the importance of succession processes on family farms. This is not surprising, yet in the face of the heterogeneity of farms initialised, the fact that different farms exit in the scenarios leads to some difference between scenarios.

If, on the other hand, the question is asked what these results imply for total production and land use in the region, results clearly show: Almost nothing! The effect of farms leaving the sector is compensated by other farms growing, and hence realising economies of scale. Also the overall decline in labour total labour input is more due to a decrease in labour intensive livestock production rather than individual farms leaving. This study focuses on IF, whereas CF constitute a kind of constant in all scenarios. With regard to the commodity output market IF contribute only a marginal part either they remain in the sector or they numerously leave it by default of a successor. But with regard to rural labour markets the question of individual farms' adjustment patterns can supposed to play an even more important role. With regard to the dualism of the initialised farm structure, results give some hints that dual farm structures persist. But we find a kind of convergence as the initialised IF grow and CF decrease in size towards are trinomial farm structure in the medium-term. Some IF have already grown or will grow in the future and against that background they rather show characteristics of corporate farms although they have a completely different ownership structure.

The simulation results can not be generalised as they strongly depend on specific assumptions and the model initialisation. More repetitions will be necessary to support the identified patterns. Roles of smaller farms, e.g. in the context of rural viability, and as a social buffer have neither been addressed nor modelled. Hence, some caution should be applied to generally discrediting the role and persistence of small-scale farms.

This paper is far from complete. It is a first starting point and requires many augmentations. With regard to the model design, future efforts will orientate on a linkage of farm characteristics - e.g. the farm size with the probability of having a successor or not - to gather research activities that have already undergone explorations to this matter. Furthermore, the question of age patterns and the distribution of age patterns among farmers should be analysed more in-depth as this is a further aspect that determines events and intensity of structural change.

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