



The Farmland Rental Paradox: Extreme land ownership fragmentation as a new form of land degradation



Petr Sklenicka*, Vratislava Janovska, Miroslav Salek, Josef Vlasak, Kristina Molnarova

Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Prague 165 21 Czech Republic

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ABSTRACT

Extreme farmland ownership fragmentation is becoming a limiting factor for sustainable land management in some countries. Scattered, excessively small parcels cease to be viable for individual farming, and owners feel forced to rent these parcels to larger enterprises farming on adjacent land. Our study demonstrates a phenomenon that we call the Farmland Rental Paradox, where very small parcels tend to create large production blocks by being rented to larger farmers, and therefore to significantly homogenize the land-use pattern. The parcel size established as the threshold for this phenomenon is 1.07 ha. Below this threshold, the smaller the parcels were, the larger the blocks that they tended to create.

Using the example of the Czech Republic, a state with extremely high farmland ownership fragmentation, it is demonstrated that this phenomenon can currently determine the land use of up to 40% of the country's farmland. Our study also points to other countries where this phenomenon may apply, especially the transitional countries of Central and Eastern Europe.

The study discusses the tempo of the fragmentation process, which accelerates exponentially in countries with the equal inheritance system. It goes on to discuss defragmentation, social impacts of the dominance of the land rental market, and environmental impacts of significant homogenization of the land-use pattern. The serious negative impacts of extreme land-ownership fragmentation show that this phenomenon can be considered as a significant form of land degradation.

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Introduction

The high level of farmland ownership fragmentation in some Eastern and Central European countries (e.g., Kopeva and Noev, 2001; Sabates-Wheeler, 2005; Ciaian, 2008) significantly complicates farming activities. Especially in recent centuries, farmland has been broken into small land-ownership parcels, and has been losing its attractiveness for farming, particularly for the landowners themselves. The plots are unprofitable for owner-cultivation due to the small, often scattered and inconveniently shaped parcels, which lead to higher expenditure and lower farm productivity (Gonzalez et al., 2004; del Corral et al., 2011; Sauer et al., 2012; Latruffe and Piet, 2012). In the fragmentation process, many parcels become inaccessible, as the current density of the road network is far from adequate for the high level of fragmentation (Sklenicka, 2006). In

practice, owners tend to rent these non-viable parcels to large tenants.

The dominance of the land rental market, together with the prevalence of large tenants, can cause significant homogenization of land-use patterns (Sklenicka and Salek, 2008). This, in turn, can lead to a loss of spatial heterogeneity of the landscape, followed by a decrease in habitat connectivity, with negative impacts on species diversity (Kruess and Tschardtke, 1994; Lindborg and Eriksson, 2004). A homogeneous landscape structure also causes a number of problems in soil erosion control and flood management (Van Oost et al., 2000), and is usually perceived as less esthetically valuable (de la Fuente de Val et al., 2006).

The role of the farmland rental market depends on a number of conditions and specific features in each state or region. For example, in the EU countries, the share of rented farmland is highly variable, from 18% in Ireland to 89% in Slovakia (Eurostat, 2012). Some factors behind this variability are common to most countries, e.g. legal and economic conditions (land taxes, tenure regulations, transaction costs, sale and rental prices, market imperfections). Moreover, in contrast to European countries with traditional economies, the situation in the so-called transitional countries has been significantly influenced by their varying approaches to land reforms after 1990 (Lerman, 2001; Vranken and Swinnen, 2006; Ciaian et al., 2012;

* Corresponding author at: Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Kamycka 129, Prague 165 21, Czech Republic.
Tel.: +420 776 323 824; fax: +420 234 381 848.

E-mail addresses: sklenicka@fzp.czu.cz (P. Sklenicka), janovska@fzp.czu.cz (V. Janovska), salek@fzp.czu.cz (M. Salek), jvlasak@fzp.czu.cz (J. Vlasak), molnarova@fzp.czu.cz (K. Molnarova).

Skaloš et al., 2012). In our previous work (Sklenicka and Salek, 2008), we confirmed the key driving role of farmland ownership in the share of rented land in the conditions of extreme fragmentation of land-ownership. Extreme fragmentation of farmland ownership is a phenomenon prevailing especially in the Central European countries (Van Dijk, 2003). Its main cause lies in the history of inheritance proceedings (Sklenicka et al., 2009). Over a period of several centuries, ongoing equal division of land among the heirs has exponentially transformed viable land holdings into a fine-grained mosaic of functionally ineffective parcels. There are three ways to amend this fragmentation: on the ownership level, by land consolidation projects, or by the sales market (Van Dijk, 2003; Sklenicka, 2006), or on the tenancy level by the rental market (Vranken and Swinnen, 2006). As land consolidation projects take a relatively long time, and as the land sales market does not function very well in most transitional countries, the land rental market takes the leading role.

Extreme land fragmentation can therefore in some cases lead to a high proportion of rented farmland in an agricultural area. On the basis of rental agreements, individually-owned small parcels are consolidated into production blocks. Van Dijk (2003) expresses land fragmentation in terms of average area per landowner, and reports that the value in Central Europe is below 5 ha.

However, Sklenicka et al. (2009) found that the variable expressing land fragmentation should be the number of parcels per owner. This variable is generally more accurate in describing the spatial arrangement of land ownership, as one owner can own several parcels scattered throughout an area. The authors state that the average area per landowner in the Czech Republic is 2.7 ha, which is further subdivided into more than 6 parcels, resulting in an average parcel size of 0.4 ha. The Czech Republic therefore ranks among the countries with the highest level of land-ownership fragmentation, but it is at the same time the country with the highest average area of production blocks (89.3 ha) in the EU, where the average block size is $26.07 \text{ ha} \pm (\text{SE}) 21.63$ (Eurostat, 2012). This immense disproportion is facilitated mainly by the abnormal share of rented farmland. With 83%, the Czech Republic takes second place for rented farmland in the EU, where the average share is $44.61\% \pm (\text{SE}) 22.29$ (Eurostat, 2012). A similar level of farmland fragmentation has been observed e.g. in Romania, where Sabates-Wheeler (2005) reported an average parcel size of 0.43 ha. Other reported values include 0.6 ha in Bulgaria (Kopeva and Noev, 2001), 0.3 ha in Macedonia (Noev et al., 2003), 0.45 ha in Slovakia (Ciaian, 2008), and 0.38 ha in Slovenia (Ministry of Agriculture, Forestry and Food, 2007).

Studies addressing the influence of land ownership fragmentation on spatial characteristics of land use usually focus on forested landscape segments (e.g. Brown, 2003; LaPierre and Germain, 2005), or on entire complex landscapes. In the latter group, e.g. Turner et al. (1996) demonstrated that different ownership groups produce quantitatively distinct landscape patterns. However, there have been very few studies concentrating on farmland, although the process of land-ownership fragmentation is continuing in many European countries, and in some countries it is already becoming a limiting factor for sustainable land use. Studies on links between ownership and agricultural landscape patterns mostly deal with different ownership classes on a regional scale (e.g. Caspersen and Fritzboeger, 2002; Gude et al., 2006). A positive correlation between fragmentation of farmland ownership and farmland use is generally assumed, but Swinnen et al. (2006) and Sklenicka and Salek (2008) mention very high land-ownership fragmentation as a reason for farmland consolidation through the rental market. However, despite the intensive development of land change science in the last two decades (Rindfuss et al., 2004), we have found no relevant wide-ranging study on parcel scale focusing on the mutual relationship between land-ownership fragmentation and land-use

fragmentation, or on land-ownership fragmentation as a driving force for the land rental market.

In this study, we hypothesize the existence of a phenomenon that we have called the Farmland Rental Paradox (FRP¹) in highly fragmented ownership patterns. This paradox states that, when they keep decreasing below a critical level, smaller land ownership parcels tend to create larger land-use blocks. If there is support for our hypothesis, we intend to find a threshold in parcel size for this phenomenon, and, on the basis of this threshold, to determine the percentage of land-ownership parcels in the Czech Republic influenced by this phenomenon. Our study is the first to hypothesize the existence of FRP. Similarly, the relationship between land ownership and the use of farmland has never been tested on a similar scope at the most detailed level, i.e. at parcel scale. The scope of this study includes only blocks of land which are farmed entirely on the basis of ownership or on the basis of tenancy, as these are the extreme cases of land use practice, suitable for a first study of the hypothesized phenomenon.

Materials and methods

Data collection

The primary spatial unit in our study is the farmland production block, where we determine the number of land-ownership parcels, their average size, and whether the block is farmed by the owner or by a tenant. The data was collected throughout the Czech Republic. The area of the Czech Republic was divided into 13 parts according to the regional administrative units (the Prague Capital City Region is excluded from our study, as the proportion of farmland is negligible).

Information on the individual blocks was obtained from the Land Parcel Identification System (LPIS). The information most relevant to our study obtained from the Land Blocks layer (in .shp format) included the Block Area (BA; ha), User Identification and Land-Use Type. Information on land ownership was obtained from the database of the Land Register, along with the digital cadastral map. The variables derived from these maps were Mean Parcel Size (MPS; ha) for the area of the land block and Owner Identification. To determine whether a block is farmed by the owner or by a tenant, we compared the data from LPIS with data from the Land Register (User Identification x Owner Identification).

Spatial analyses of this primary data were performed in the GIS environment (Arc GIS 10.1). First, only land blocks listed as farmland were selected from LPIS (232 545 land blocks). These land blocks were divided into 10 categories according to their size, representing the whole range of land block sizes occurring in the Czech Republic. In the next step, five sample blocks were chosen from each size category in each of the 13 regions by stratified random selection, to ensure coverage of the entire Czech Republic. Because the goal of this study is to compare fully rental-based and fully individual farming, blocks with mixed ownership (blocks where the user owns part of the parcels and rents the rest) were removed from the dataset. Only blocks farmed entirely either on an ownership basis or on a tenancy basis were included in the statistical analysis ($n = 281$).

To estimate the proportion of farmland affected by FRP, a cumulative curve describing the representation of land-ownership parcel size categories in the Czech Republic was constructed. The data was obtained from the Czech Office for Surveying, Mapping and Cadastre. The intersection of this cumulative curve with the threshold

¹ FRP – Farmland Rental Paradox.

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