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**Foreign-owned firms,
agglomeration externalities and knowledge flow**

Theses of doctoral dissertation

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1. Introduction

How can we explain the uneven distribution of economic activities? This is the fundamental question that motivates economists to study the spatial processes of economic interactions. Economists usually sum up the main reasons behind the spatial concentration of industries through the following three features described by Marshall (1920). Benefits that arise from the large market size, as economies of scale enable buyers and suppliers to achieve higher productivity and lower transportation costs. The large size of the local labour market provides further benefits for both employers and workers. The wide range of jobs available locally in an industry creates safety for workers. It also helps firms to easily find suitable workforce as they can recruit from a large pool of people with similar skills and work experience. In other words, industrial concentration makes labour market matches more efficient. The third benefit of industrial concentration is referred to as knowledge spillover effects. As firms with similar or related activities concentrate in space, we expect that professional knowledge is also accumulated. Locally concentrated knowledge provides additional benefits to firms in case they are capable to exploit it and learn from each other (Lengyel 2004).

The benefits described by Marshall (1920) are researched and rediscovered by many scholars (Krugman 1991, Fujita et al. 1999, Rosenthal – Strange 2001, 2004, Lengyel 2010). Besides the above externalities of regional industrial concentration, other sources and types of agglomeration economies have been explored. Urbanisation economies, that is accounted for large city size (Frenken et al. 2007, McCann 2008, Capello 2016) or Jacobs externalities that arise from the variety of activities available in cities (Jacobs 1960, Taylor – Csomós 2012). However, agglomeration economies described by the variety and technological similarity of present technologies in regions brought a break-through in the research of agglomeration economies (Hidalgo et al. 2018, Frenken et al. 2007, Neffke et al. 2011). The introduction of related variety enabled us to better understand knowledge spillover processes inside and across industries in regional economies.

Over the past two decades numerous studies highlighted the importance and positive effects of agglomeration economies on regional employment (Frenken et al. 2007, Van Oort et al. 2013, Lengyel – Szakálné Kanó 2013), value-added (Boschma – Iammarino 2009, Boschma et al. 2012, Czaller 2016) and productivity (Boschma et al. 2014, Quatraro 2010) on empirical basis (for overview see Elekes 2016, Content – Frenken 2016). However, it is still an

open question whether knowledge spillover effects in a specific industry (the case of industrial specialization) or knowledge exchange across industries (large variety of present industries) support more the development of regional economies (Glaeser et al. 1992, Beaudry – Schiffauerova 2009, Sebestyén et al. 2011, Caragliu et al. 2016).

By the beginning of the 21st century industrial concentrations based on the agglomeration economies of Marshall (1920) have been called industry clusters and a lot of research searched for the determinants of their success. Mechanisms of knowledge spillovers are in the centre of these studies, as it became clear that successful clusters continuously introduce innovations, which requires knowledge accumulation and learning (Lengyel 2004, Iammarino – McCann 2006, Lengyel 2010). Research on networks of knowledge sharing inside agglomerations turned out to be key to understand the way agglomeration externalities work (Ter Wal – Boschma 2009), and small industry clusters seem to be a suitable context for these studies (Giuliani – Bell 2005).

The main aim of this dissertation is to better understand agglomeration economies and particularly knowledge exchange and learning in agglomeration through empirical studies in the context of Hungary. Therefore, the dissertation is organized around three general questions. First, *how do agglomeration economies influence firm survival in Hungary?*

Firm survival or the ability of firms to continue their operation in the following year is a rarely applied firm performance measure. My first empirical study shows that localization economies, urbanization economies, variety and variety of technologically similar industries support firm survival in Hungary.

After the political and economic shift in Hungary, a dual economic structure emerged, where the differences between domestic and foreign-owned companies determine the structure and interactions of the economy (Szanyi 2010). The fewer foreign-owned firms represent higher economic performance than the larger group of domestic companies (Halpern – Muraközy 2012, Lengyel – Szakálné Kanó 2013). This is especially true in terms of export (Radosevic 2002, Resmini 2007, Elekes et al. 2019). One of the reasons behind these differences could be that foreign-owned and domestic companies can benefit differently from agglomeration economies and therefore from the variety of locally available, technologically related industries (Lengyel – Szakálné Kanó 2013, Szakálné Kanó et al. 2019, Elekes et al. 2019). Therefore, the second question of the dissertation reflects on the possible differences

in domestic and foreign-owned firms' survival chances: *does the related variety of industries in regions influence the survival of domestic and foreign-owned companies differently?*

When we search for the positive externalities of agglomeration in regional economies, we are usually unable to observe the local knowledge flows and learning processes behind knowledge spillovers, we only infer them. In recent history, many studies focused on cluster knowledge networks to explicitly capture the flow of knowledge and interactive learning inside the agglomeration of a specific industry (Giuliani 2007, Ter Wal – Boschma 2009, Broekel – Boschma 2012). These studies discovered that not all the companies have access to the locally concentrated knowledge inside industry clusters, but only the ones that actively participate in local social networks (Giuliani – Bell 2005, Iammarino – McCann 2008). Collaboration in networks of knowledge exchange is, amongst others, determined by the absorptive capacity and other properties of companies (Giuliani – Bell 2005).

By examining tie formation in cluster knowledge networks, we can better understand do motivations and conditions of collaborative knowledge exchange between firms. This could also allow us to more accurately capture the differences of domestic and foreign-owned companies in terms of knowledge exploitation in agglomerations. As a consequence, the third research question is the following: *does domestic/foreign ownership of companies influence their collaboration ties in cluster knowledge networks?*

2. Aim of the research and theoretical background

It is generally acknowledged that the concentration of economic activities in space generates positive externalities. Regional economics identifies different agglomeration economies. Localisation economies refer to the spatial concentration of firms in a specific industry and therefore arise from labour market pooling, specialised suppliers and knowledge spillovers as Marshall (1920) described in his influential early works. Urbanization economies is the result of city size and arise from the economies of scale in public services. It is available for any firms in a region independent of their industry (McCann 2008). Jacobs externalities arise from the variety of economic activities in a region, which accounts for the high possibility of inter-industry knowledge spillover effects (Jacobs 1960). As it is closely related to

innovation and regional economic performance, knowledge spillovers across firms are the most important and yet most mysterious benefits arising from agglomeration.

Most empirical studies on agglomeration economies and regional economic growth refer to the classic question on whether spatial concentration of similar economic activities (specialization of regions) or different activities (variety in regions) support regional growth (Beaudry – Schiffauerova 2009). Results are still controversial (Glaeser et al. 1992, Henderson et al. 1995). Recently, evolutionary economic geography contributed to this classic debate significantly (Boschma – Frenken 2006, Van Oort 2015). In their influential work Frenken et al. (2007) show that not specialization or variety of economic activities determine economic growth in regions, but the related variety of industries. Related variety means that industries in a region do not have too close knowledge bases, so they can learn from each other, but also their knowledge is not too far, and therefore firms can understand each other. Contrary, unrelated variety refers to the variety of industries in a region with very different technology, required professional skills and routines (Elekes 2016).

Frenken et al. (2007) argue that specialization, related variety and unrelated variety have different effects on regional economic growth. Concentration of technologically very similar companies in space (regional specialization) helps productivity through knowledge spillovers and learning inside an industry. Concentration of technologically different, but related industries (related variety) helps the appearance of new industries and regional employment growth through inter-industry knowledge spillovers (Elekes 2016). Variety of technologically not related industries in a region does not lead to knowledge spillovers, but this unrelated variety of economic activities could be beneficial in cases of industrial shocks. Therefore, agglomeration economies and therefore related variety increase the chances of learning and knowledge spillovers.

Industry clusters, the geographic concentrations of economic activities that operate in the same or interconnected sectors (Gordon – McCann 2000), foster higher innovation and economic performance of firms (Krugman 1991; Porter 1990; Cooke 2002). Their success is usually explained by agglomeration externalities (Rosenthal and Strange 2004; Tallman et al. 2004) and the parallel competition and collaboration of firms that enhance learning and knowledge exchange (Cooke et al. 2007). Combining the different pieces of knowledge at firms is the key process behind new knowledge creation and innovation (Cooke et al. 2007, Giuliani – Bell 2005, Giuliani 2013).

Knowledge networks capture the social interactions behind innovation or in other words, they represent ties of collaborative knowledge production to achieve economic benefits (Balland et al. 2015). Knowledge networks can represent informal advice seeking, co-invention of patents, collaboration on R&D projects or common product development. They do not capture pure business transactions, but rather collaborations behind new knowledge creation and knowledge exchange, which requires trust and stability.

Literature on agglomeration economies mainly captures the externalities and knowledge spillover effects arising from the industry structure of regions (McCann 2008, Van Oort 2015). However, new knowledge could be extra-regional (Bathelt et al. 2004). Channels of extra-regional knowledge could be trade (Fagerberg 1988, Dosi et al. 1990, Marwah – Tavakoli 2004), mobility of workforce (Inzelt 2008, Neffke – Henning 2013, Lengyel – Eriksson 2017), foreign direct investment (FDI) (Young et al. 1994, Inzelt 2000, Elekes et al. 2019) or access to knowledge networks (Varga 2007, Hau-Horváth et al. 2016, Varga – Sebestyén 2017).

Importance of agglomeration economies in context of the transition economy of Hungary take unprecedented attention in the past few years (Elekes – Lengyel 2016, Elekes et al. 2019, Szakálné Kanó et al. 2019). FDI is considered as one of the key drivers of regional transition and regional development (Radosevic 2002, Resmini 2007). Following the economic transition in Hungary, investments of multinational companies greatly influenced the structural change of regions (Lengyel – Leydesdorff 2011, Radosevic 2002, Resmini 2007, Elekes et al. 2019). The importance and influence of foreign-owned firms in Hungary is demonstrated by the findings as hiring workforce from foreign-owned firms increase the productivity of domestic companies (Csáfordi et al. 2018). Moreover, firms engaged in international trade benefit more from agglomeration economies than firms without international trade experience (Békés – Harasztosi 2013).

Despite domestic and foreign-owned firms developed ties only slowly, related variety induced employment growth by the early 2000s (Elekes – Lengyel 2016; Lengyel – Szakálné Kanó 2013) and it decreased the probability of domestic firm exit (Szakálné Kanó et al. 2019).

To sum up, Hungary has a dual economic structure, where there is a gap between domestic and foreign-owned firms. The current economic structure depends greatly on FDI (Lux 2017). Domestic and foreign-owned firms can exploit agglomeration economies and engage in knowledge networks differently due to their dissimilar level of technology, routines and extra-regional connections.

3. Structure of the dissertation, hypotheses and applied methodologies

The dissertation has four different parts after the introduction and follows the below structure. Chapter 2 provides a literature review on agglomeration economies, firm survival, clusters, knowledge networks and foreign-owned firms in Hungary.

Chapter 3 is the first empirical study in the dissertation. It details the relationship between firm survival, agglomeration economies and foreign ownership. It tests the following two hypotheses:

Hypothesis1: Probability of firm survival is significantly influenced by related variety in Hungary.

Hypothesis2: Related variety supports the survival of domestic firms more than the survival of foreign-owned firms.

Hypotheses are tested on the basis of a firm-level panel dataset from the Hungarian Statistical Office. The influence of agglomeration economies on the survival of new firms established in 2005-2011 are tested by Cox (1972) proportional hazard models.

Chapter 4 presents the second empirical study. It identifies the importance of firm ownership on cluster knowledge network tie formation in context of the printing and paper product cluster of Kecskemét, Hungary. The chapter tests the following hypothesis:

Hypothesis3: Ownership of firms significantly influences tie formation of companies in cluster knowledge networks.

To test this hypothesis, I use exponential random graph models (ERGMs) to identify key factors behind tie formation in the cluster knowledge network. This allows to test for the importance of ownership on knowledge exchange in clusters.

Chapter 5 is the synthesis of the dissertation and sums up results, main conclusions, limitations and details future research possibilities.

4. Overview of the results

The main results of my research is summarized by the following three thesis:

Thesis 1: survival of firms in Hungary is supported by related variety.

My first empirical chapter shows that firm survival in Hungary is influenced by urbanization economies, variety and most importantly related variety. Contrary to other studies I do not find localization economies to support firm survival (Neffke et al. 2012, Basile et al. 2017), but urbanization economies decrease survival chances of firms. It is mainly interpreted as competition effects that lead to higher selection of firms.

Results also show that variety of economic activities in a region supports firm survival. This highlights the importance of Jacobs externalities on firm survival in Hungary. Most importantly, the concentration of technologically related industries has a strong, positive influence on the survival of firms. Variety of technologically similar companies seem to enable externalities that support the operation of Hungarian firms, and it supports my first thesis.

Thesis 2: related variety has a stronger support on the survival of foreign-owned firms.

Differentiation between foreign-owned and domestic companies shows that related and unrelated variety both significantly help firm survival. However, related variety has a stronger influence on the survival of foreign-owned firms. This might come from the higher absorptive capacity of foreign-owned firms to exploit agglomeration economies and concentrated knowledge. At the same time, it questions the stronger embeddedness of domestic firms in regional economies around Hungary.

Knowledge spillovers are not explored directly in these studies, we can only infer on their importance. Therefore, my second empirical work searches for the determinants of knowledge flow inside agglomeration.

Thesis 3: Ownership of firms determines tie formation in cluster knowledge networks.

Through the case of the printing and paper product cluster of Kecskemét I show that ownership of firms significantly influences the way they form knowledge sharing ties. The main conclusion of the study is that there is a strong ownership related homophily effect on tie formation in clusters, which is against the free circulation of knowledge from foreign firms to local domestic companies. This means domestic firms are more likely to form ties to other domestic companies, while foreign-owned firms are more likely to collaborate with foreign-owned firms. The reasons behind this could be the different routines, capabilities and knowledge bases of firms in the two ownership groups.

In sum, this dissertation details the mechanisms through agglomeration economies and knowledge spillovers work in the transition economy of Hungary. Foreign-owned firms are considered as external sources of knowledge (Young et al. 1994, Elekes et al. 2019). My research show that the presence of foreign-owned firms has a limited influence on domestic companies. This conclusion leads to interesting conclusions in terms of knowledge flow efficiency. Studies in context of Hungary have already shown that agglomeration externalities and knowledge spillovers influence firm performance (Varga 2007, Szakálné Kanó et al. 2019). However, to benefit from agglomeration and concentrated knowledge, firms have to participate in social networks (Giuliani – Bell 2005, Giuliani 2007). The research on the Hungarian cluster shows that both foreign and domestic companies actively participate in the local knowledge network, however, ties between ownership groups are less likely. This does question the efficient diffusion of external knowledge in Hungarian agglomerations.

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