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Research Report

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On flexibility of agri-businesses: Are small- or large-scale farms more flexible?

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Enterprise flexibility, against the background of ever-faster changing environs, is deemed to be as a critical prerequisite for staying successful in business. Flexibility may be termed in an economic sense as the capability to adjust production schemes to a new situation without significant additional costs. Newly-developed methods for flexibility measurement and a comprehensive dataset were used to determine the scope and determinants of flexibility in Polish farm operations. It appears that flexibility of production technology is interrelated to farm specialization: Mixed enterprises are using more flexible technologies than dairy and granivore farms, which in turn are able to react more flexibly than crop production farms. Findings also indicate that small-scale farms have more flexible production systems than large-scale enterprises. This is true to say of all farm types. Small farms are apparently capable of changing their production schemes at lower additional costs and better adjusting themselves to changed market conditions. This may serve to explain the persistence of small-scale or dual agricultural structures in several transition countries, such as Poland.

Enterprises in almost all sectors are faced with ever-faster changing environment, characterized by massive changing in economic, political and cultural conditions. Such changes became apparent in the agricultural and food sector since the beginning of the new millennium. Increasing price fluctuations, significant adjustments of nutritional habits in populous economies, progressing climate change and agricultural policy reform efforts pose considerable challenges of adjustment to agri-businesses. Entrepreneurial flexibility is deemed to play a central part for staying successful in business, notably against the background of changing economic and socio-political conditions. Entrepreneurial flexibility, beside other economic indicators such as productivity, is a major yardstick for measuring corporate performance and competitiveness.

In view of the above it is not astonishing that a myriad of media contributions as well as popular scientific and practice-oriented papers point to the necessary of flexible entrepreneurial concepts and production technologies. Deliberations about the topic of flexibility can also be found in economic and occasionally in agri-economic professional literature. The concepts of flexibility discussed there are, however, very specific and heterogeneous.[1] There is hardly any generally valid characterization and measurement of the phenomenon flexibility in economic contexts.[2] And, to date there are no empirical studies on the flexibility of agricultural enterprises available, with one exception (Weiss, 1997).[3] This is why it has been largely unresolved what exactly entrepreneurial flexibility is, secondly, how it can be measured and thirdly, what its determinants are.

[1] 70+ varying definitions of flexibility were found in literature.

[2] Marschak and Nelson (1962) proposed the first generalized definition of flexibility, Cremieux et al. (2005) put forward a general measurement indicator for flexibility.

[3] Another study from the agricultural sector by Mußhoff and Hirschauer (2004) examined the role of time-related flexibility in capital expenditure decisions of agricultural enterprises which was analyzed by means of simulation. Various empirical research projects in the industrial sector investigate the interconnection between size and adaptation capacity of businesses. Those works, however, simplify the use of variability of output as indicator of flexibility.

This is the starting point of this present Policy Brief. Based on up-to-date and innovative IAMO research findings (Renner et. al., 2014; Renner, 2014), the following will be presented below:

— an innovative measure for entrepreneurial flexibility for multiproduct firms,
— the interrelation of the flexibility measure with three established economic effects, namely economies of scope, marginal costs and economies of scale,
— the extent of entrepreneurial flexibility in Polish agriculture,
— a discussion of whether smaller or larger Polish farms are more flexible.

What is and how to measure entrepreneurial flexibility?

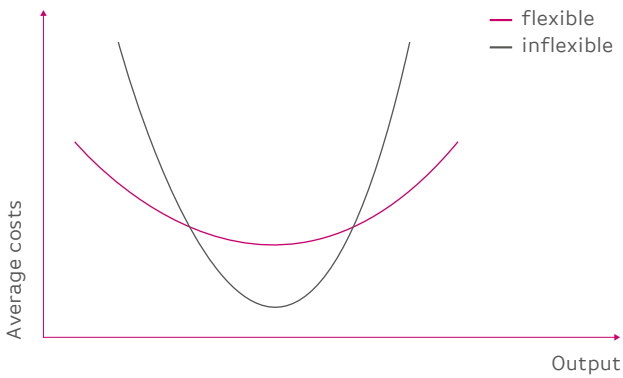
Entrepreneurial flexibility is closely interlinked with economic production decisions and thus a feature of the selected production technology. Hence, flexibility can be described as the capability of adapting production to a new situation without substantial extra costs. By considering costs this distinction in terms of definition explicitly permits an economy-founded assessment of firm's flexibility. This definition can be traced back to Stigler (1939) who characterized the flexibility of a business through the curvature of the average cost curve (Figure 1).[4]

A strong curvature of the average cost curve implies that a deviation from the current production scheme resp. adaptations to another production scheme will entail a high rise in costs. Such a technology would be relatively inflexible. Where the average cost curve, however, is slightly curved firms may vary their production quantity without high additional costs. Such a technology can be termed relatively flexible. Accordingly, flexibility can be evaluated on the basis of the average cost function which is determined by means of econometric methods. In case of businesses with several production lines, the change of total costs at simultaneous change in quantities of all products.

What are the fundamental components of entrepreneurial flexibility?

The above-defined measure of entrepreneurial flexibility, i.e. the curvature of the average cost curve, can be broken down into three components: Firstly, an economies-of-scope effect; secondly, an marginal cost effect and thirdly, an economies-of-scale effect. Those effects can mutually enhance or compensate each other. The economies of scope effect captures impacts from cost savings due to joint production. Scope economies (scope diseconomies) are given when several products are jointly produced at lower (higher) costs than separately. High scope economies resp. low scope diseconomies thus ceteris paribus entail higher flexibility and vice versa. The second component, the marginal cost effect, reflects the impacts of changed additional costs at variations of produced quantities. Slightly rising or falling marginal costs favor ceteris paribus quite high flexibility while grossly increasing marginal costs characterize rather low flexibility. The third component, the economies of scale effect, provides information about changes of costs at a simultaneous (proportional) change of production quantities of all products. A comparatively low (under-proportional) cost rise combined with an increase in the quantity of all products suggests a scale-inefficient and simultaneously relatively inflexible production scheme. This means in summary that flexible production technologies have high economies of scope, low marginal cost increases and high economies of scale.

Figure 1: Flexibility and average cost curve



Source: Author's graph following Stigler (1939).

How flexible is agricultural production in Poland?

Poland's agriculture is characterized by a vast number of small family farms and a few large agri-businesses. Econometric methods and farm-specific data of approx. 8,500 Polish farm operations for the years 2004 to 2007 were used to determine the extent of production flexibility for four different farm specializations: Crop production, dairy, granivore and mixed farm businesses (Figure 2).

The results suggest tangible differences in the extent of entrepreneurial flexibility between the four farm types. This means, the flexibility of a given production technology is closely connected to farm specialization. Mixed farms have, possibly not unexpected, comparably flexible technologies as they are capable of adapting their production quantities at relatively low costs. They benefit from rather low scope disadvantages and a favorable marginal cost structure. Polish crop production farms have the lowest flexibility in their production methods. This is essentially the consequence of quite high scope disadvantages and scale-inef-

[4] This measure of flexibility covers adaptation costs for a given production technology, i.e. the flexibility of a production method per se. Adaptation costs of a technology change, namely a complete conversion of production and range of products are not determined in this approach.

Figure 2: Distribution of flexibility according to farm specializations

Source: Author's graph based on calculations by Renner et al. (2014).

Figure 3: Determining factors of flexibility

Source: Author's graph based on calculations by Renner et al. (2014).

ficient production. Crop-production businesses in Poland are particularly structured into small-scale farms in international comparison and still operate far below their optimal economies of scale level. Dairy and granivore farms rank between mixed and crop-production farms in terms of their flexibility levels. They operate relatively scale-efficiently in comparison to crop-production farms but have tangible unfavorable marginal cost effects compared to mixed farms.

Are small- or large-scale farming business more flexible?

Entrepreneurial flexibility is linked to various farm's characteristics, as illustrated by regression results based on the above-mentioned data. The central finding is that the flexibility of an agricultural business significantly decreases with increased farm size. This means that smaller farms ceteris paribus appear to have a higher flexibility than larger enterprises, in other words, they are capable of varying their production schemes at lower costs. This is true to say of all farm types.[5] The higher flexibility of smaller businesses suggests that, in terms of dynamics, they have certain competitive advantages over larger operations. The latter often have advantages in rather static terms, e.g. in the form of scale advantages or higher productivity (Figure 3).

The relationship between flexibility and other corporate characteristics proves to be less unambiguous for all farm types. High capital intensity[6], however, is typically associated with lower flexibility. This applies especially to mixed and granivore farms. Our calculations have not yielded robust results for crop-production and dairy farms. A high share of family work typically leads to higher flexibility, especially for dairy and granivore farms. What is also interesting is that generally farms with higher market integration can respond more flexibly. Socio-demographic (such as age and training of farm manager) and regional factors play only a negligible role for explaining flexibility.

Concluding comment

Entrepreneurial flexibility, beside other indicators such as productivity, is a central indicator for performance and competitiveness of agricultural businesses. The flexibility measure for multi- product enterprises developed by IAMO provides information as to whether farms are capable of adapting their production to changed framework conditions at relatively low costs; i.e. whether they can respond flexibly in economic terms.

Results of econometric calculations for the agricultural sector in Poland suggest that smaller and diversified enterprises with good integration into product markets, low capital intensity and high share of family labor apply relatively flexible production methods. Smaller full-time farms are apparently selecting flexible production strategies in order to survive on the market beside larger, often 'more powerful' business structures.

Flexibility may contribute to clarifying two problems in agricultural economic and transition economy research: On the one hand, why small farms are able to survive in the long term in spite of empirically verified increasing returns to scale in agriculture, and, on the other, why many transition economies show marked dual farm structures, i.e. parallel existence of small- and large-scale structured agri-businesses.

[5] Other empirical studies also found a negative relationship between flexibility and farm size, e.g. in the mentioned empirical analysis of the agricultural sector by Weiss (2001) and several empirical analyses of the industrial sector (cf. e.g. Zimmermann, 1995 and Nor et al., 2007).

[6] Capital intensity is defined is the share of fixed costs in total costs.

Further Information

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