Investigation of the returns to scale of fishing enterprises of the primorsky territory

Investigación de las devoluciones a escala de empresas pesqueras del territorio primorsky

Investigação de retornos à escala de empresas de pesca do território de primorsky

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Abstract

The opinion that only large fishing companies can ensure a high level of productivity and, as a whole, the effectiveness of economic activity, is widely spread in economic literature. In this paper, the task is to study the impact of the size/scale of fishing enterprises on their productivity. For this purpose, the stages of quantitative measurement of the scale effect were established. In the framework of this article, the intellectual roots of the concept of returns to scale are examined in detail. The review of literature, studying the correlation between operational size, productivity and other indicators of production efficiency, is given. Using the data for eighteen seaside fishing companies, the indicators of production scale ("The volume of production per one conventional ton of catch") and indicators of efficiency ("The volume of production per one worker") were calculated. Based on the results, it was defined, that large fish producers of Primorye did not always work better in terms of labor productivity. This proves the existence of more complex relations between the size of the enterprise and the productivity of its resources. It is suggested that the differences in productivity are more likely to be caused by differences in production technology, rather than returns to scale. The results demonstrate the importance of distinguishing between the categories "returns to scale" and "returns to size", and suggest that the increase of productivity among small companies can be achieved due to extending of their access to advanced technologies, rather than simply expanding their scale. The research is positioned as a pilot, and suggests further in-depth

Resumen

La opinión de que solo las grandes compañías pesqueras pueden garantizar un alto nivel de productividad y, en general, la eficacia de la actividad económica, está ampliamente difundida en la literatura económica. En este documento, el trabajo es estudiar el impacto del tamaño / escala de las empresas pesqueras en su productividad. Para este propósito, se establecieron las etapas de medición cuantitativa del efecto de escala. En el marco de este artículo, se examinan en detalle las raíces intelectuales del concepto de rendimiento a escala. Se brinda una revisión de la literatura, estudiando la correlación entre el tamaño operacional, la productividad y otros indicadores de la eficiencia de la producción. Utilizando los datos de dieciocho empresas pesqueras costeras, se calcularon los indicadores de escala de producción ("El volumen de producción por tonelada convencional de captura") e indicadores de eficiencia ("El volumen de producción por trabajador"). Según los resultados, se definió que los grandes productores de pescado de Primorye no siempre trabajan mejor en términos de productividad laboral. Esto demuestra la existencia de relaciones más complejas entre el tamaño de la empresa y la productividad de sus recursos. Se sugiere que es más probable que las diferencias en la productividad sean causadas por las diferencias en la tecnología de producción, en lugar de los retornos a escala. Los resultados demuestran la importancia de distinguir entre las categorías "retornos a escala" y "retorna a tamaño", y sugieren que el aumento de productividad entre las pequeñas empresas se puede lograr debido a la extensión de su acceso a tecnologías avanzadas, en lugar de

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development of the methodology, taking into account the results obtained.

Keywords: fishing industry of the Primorsky Territory, fishing enterprises of the Primorsky Territory, returns to scale, returns to size.

simplemente expandir su escala. La investigación se posiciona como un piloto, y sugiere un mayor desarrollo en profundidad de la metodología, teniendo en cuenta los resultados obtenidos.

Palabras clave: industria pesquera del territorio de Primorsky, empresas pesqueras del territorio de Primorsky, retorno a escala, retorno a tamaño.

Resumo

A opinião de que apenas grandes empresas pesqueiras podem garantir um alto nível de produtividade e, em geral, a eficiência da atividade econômica, é amplamente divulgada na literatura econômica. Neste documento, a tarefa é estudar o impacto do tamanho / escala das empresas pesqueiras em sua produtividade. Para tanto, foram estabelecidos os estágios de mensuração quantitativa do efeito de escala. No âmbito deste artigo, as raízes intelectuais do conceito de desempenho em escala são examinadas em detalhe. Uma revisão da literatura é fornecida, estudando a correlação entre tamanho operacional, produtividade e outros indicadores de eficiência de produção. Utilizando os dados de dezoito empresas de pesca costeira, foram calculados os indicadores da escala de produção ("O volume de produção por tonelada de captura convencional") e os indicadores de eficiência ("O volume de produção por trabalhador"). De acordo com os resultados, definiu-se que os grandes produtores de peixe do Primorye nem sempre funcionavam melhor em termos de produtividade do trabalho. Isso mostra a existência de relações mais complexas entre o tamanho da empresa e a produtividade de seus recursos. Sugere-se que as diferenças na produtividade são mais prováveis de serem causadas por diferenças na tecnologia de produção, em vez de retornos à escala. Os resultados demonstram a importância de distinguir entre as categorias "retornos de escala" e "retorna ao tamanho" e sugerem que o aumento da produtividade entre as pequenas empresas pode ser alcançada devido à expansão do acesso a tecnologias avançadas, ao invés de simplesmente expanda sua escala. A pesquisa está posicionada como piloto e sugere um desenvolvimento mais profundo da metodologia, levando em conta os resultados obtidos.

Palavras-chave: indústria de pesca do território de Primorsky, empresas de pesca do território de Primorsky, retorna à escala, retorna ao tamanho.

Introduction

Since the beginning of market reforms in Russian economy, it has been noted that the disaggregation of fishing enterprises has led to a decrease in their productivity. Relatively large enterprises showed higher economic performances in comparison with smaller companies. Primorye researchers concluded that the disaggregation and disintegration of industrial production, as a prerequisite for the development of competitive-market relations in the industrial sector, is an erroneous decision, the result of which was the disintegration of economic relations between enterprises (Korneyko & Latkin, 2015; Vorozhbit & Korneyko, 2016 ; Kuzubov, 2016; Vorozhbit, 2013; Korneyko & Vorozhbit, 2015; Korneiko, 2015). In addition, the disaggregation of enterprises in capital-intensive industries (such as the fishing industry) had anti-investment nature.

Intensive competition caused the market failures, and fishing companies began to compete at a price level, which covered only variable costs. In such conditions, financial resources were not enough to conduct active investment policy. At present, the material and technical base of fishing enterprises in Primorye is in critical situation. This is evidenced by the high level of physical and moral deterioration of the fishing fleet and almost complete cessation of its renewal, reduction in the production capacities of fishing enterprises. Own sources for the renovation of basic capital are not formed, and credit sources are short-term and medium-term. Despite the fact, that in recent years the economy of Primorsky Krai has been experienced economic stability (Table 1), the output of marketable products amounts to only one-fifth part of this indicator in 1989, and the total volume of aquatic

bio-resources harvesting amounts to one-third part of the volume in 1988. The situation of fishing enterprises is complicated by the unresolved issue of sanctions removal from Russian economy. Therefore, foreign channels for investments in the renovation of the fishing fleet remain closed, and the strengthening of the ruble reduces financial sustainability of the export-oriented enterprises. As a consequence, the number of regional fleet decreases (for example, in 1990, there were 499 vessels in the Primorye Territory, in 2008 - 474, and in 2015 – only 314 vessels), and the volume of accounts payable and accounts receivable increases.

Table 1. The results of the work of fishing industry enterprises of Primorsky Krai for 2012 -2015

Indicators	Units of measurement	2012	2013	2014	2015
Catching of fish and non-finfish	thousand tons	831.9	798.0	778.0	739.3
Fish production, including canned food	thousand tons	669.2	667.3	646.6	646.7
Supplies to the domestic market	thousand tons	263.0	232.0	215.5	307.5
Share of supplies to the domestic market in total production output	%	39.3	31.2	30.6	44.9
Export supplies	thousand tons	452.1	568.4	523.2	116.9
Share of exports in total production output	%	67.7	76.5	80.5	77.4

Source: Federal Service of Statistics of the Primorsky Territory

Positive correlation between the operational size (i.e. the size connected with the normal (operating) activity), productivity, and other indicators of production efficiency was found by the foreign researchers already in the 1980's. The concept of returns to scale was the typical explanation for this phenomenon. Fishing enterprises, however, required more detailed study. The aim of the paper is to analyze the impact of the size/scale of fishing enterprises on their productivity.

Literature Review

For the first time ever, K. Marx paid attention to the leading role of large enterprises in the increase of productivity, in implementation of capital-intensive technological innovations, despite the mutually exclusive position of his source, the classical political economy (Marx, 1990). The possibility of using the scientific organization of labor at large enterprises was for him an argument in favor of increasing the concentration of production. The large firms appeared at the end of the 19th century and really demonstrated a higher level of productivity and innovations (Henrekson, 2005). They ensured economies of scale, becoming global oligopolies, and today 25% of Americans work in firms with more than 10,000 employees, and only 16.6% work in small firms with 20 employees (Nightingale & Coad, 2013). For example, Schumpeter recognized this transformation and shifted the emphasis from entrepreneurs to the research and development (R & D) departments of large firms. By 1942, he proposed "to accept that a large-scale institution became the most powerful engine of progress" (Schumpeter J. A.). Similarly, in the 1950s Galbraith wrote: "This is nothing more than a pleasant fiction, the statement that technological progress is a product of incomparable ingenuity of a small person, forced to use his wit in competition with a neighbor" (Galbraith, 1967).

Galbraith's views reflected a strong postwar consensus on the importance of large firms in the national economy, based on Keynesian demands for active state industrial policy, the elements of which were the cooperation with industrialists and unions, the support of large firms, the protection of national markets. The expansion of international trade, global spread of American manufacturing technologies, low European prices for oil caused worldwide growth, and the issue of the role of a large enterprise in increasing the efficiency of economic activity in economic literature considered as resolved. As noted above, this issue was discussed the most often

within the framework of the concept of returns to scale.

At the same time, the notions of "returns to scale" and "returns to size" are often used interchangeably, but in practice the theory of production finds differences between them under certain conditions. Based on Frish's work on the interrelation between the production technology and the U-shaped form of the average cost curve , Giora Hanoch from Jerusalem has proved that these two concepts are equivalent, only if the changes in incoming costs are proportional to the change in the size of the enterprise (Frisch, 1965; Hanoch, 1975). Later, Chambers presented the methods of production (for example, homothetic or homogeneous functions) for further explanation of the relationship between these two concepts (Chambers, 1984).

Theoretically, the relationship between returns to size and returns to scale can be reduced to two important approaches. The former calls both concepts equivalent, if the mode of production is homothetic, i.e. is in such a state, when the increase in size is not connected with changes in the relative share of various production factors (Boussemart et al, 2006; Diewert & Fox K). Obviously, if the increase in output is due to a change in the relative proportions of resources, used in production, it can't be asserted that this is the result of change in scale. Instead, in the literature this is interpreted as the effect of income, received from the savings of production factors, due to the technological progress (Mundlak, 2005).

The second approach is based on the representation of size elasticity, as a shell of scale elasticity, that means that the returns to size (global concept) are usually greater than the returns to scale (local concept).

Results Of The Research

The literature, given above, helps us to distinguish between the returns to scale and the returns to size. To illustrate this, suppose that the enterprise can manufacture products, using various resources, at a given level of production technology:

$$Y = f(X),$$

where Y is the total output;

X – is the volume of various resources, used in production (for example, land, labor, capital and intermediate factors);

$f(...)$ is a generalized function of production, formed by a combination of resources, used in production.

To establish the relationship between the output level (Y) and the size of the enterprise (i.e., the proportional increase in all resources), the generalized function of production can be re-formulated as:

$$f(kX) = G[k, X / |X|, f(X)],$$

where $|X|$ is the Euclidean norm of the original resource vector X,

k is a scalar, and $X / |X|$ is a ray from passing into Euclidean N space.

As an illustration of the relationship between average costs and the scale / size of the firm, we present figure 1. For each given technology, the average cost curve is characterized by *Tech1, Tech2, ...* and to a certain extent, average costs are reduced, but the law of diminishing returns leads to an increase in costs per unit of output. In order to neutralize the negative trend, a new technology can be used. For example, when the company becomes larger, it is able to use more advanced technology in production (due to the increase in capital investments), that leads to the shift from *Th1* to *Th2*. This shift, as a rule, is accompanied by a certain change in incoming resources (for example, the capital-labor ratio). As a consequence, average costs can be reduced more, regardless of existence of positive returns to scale. This means that the benefits from increasing the company's size can be the result of increasing returns to scale or technological progress, improving the combination of resources.
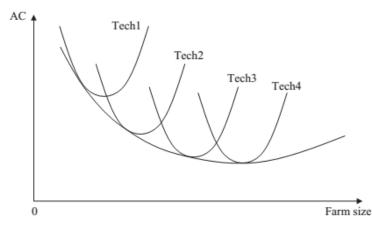
Figure 1. – The ratio between average costs and operational size (*AC* – average costs, *Farm size* – size of the enterprise) [19, p. 21].

Based on the theoretical material, described above, the strategy for further analysis can be formed. The assessment of correlations between productivity, returns to scale and the size of fishing enterprise includes the following stages: (I) the assessment of the impact of fishing enterprise's size on its productivity; (II) determining the returns to scale, when the production technology is homogeneous; and (III) determining the return to scale, when the production technology is heterogeneous.

At the first stage, in the framework of this study, we rank the fishing enterprises of Primorsky Krai according to their sizes ("The volume of production per one conventional ton of catch") and productivity ("The volume of production per one worker") in Table 2. Both indicators are calculated on the basis of cost approach to the assessment of effectiveness: the first reflects the ratio of output of fish and seafood products to actually received catches, the second shows the ratio of production output to the number of employees at the enterprise. The sample includes 18 fishing companies of Primorye, operating in the exclusive economic zone of the Russian Federation.

Table 2. Ranking of fishing enterprises of Primorsky Krai, according to their sizes and productivity, 2015

		The volume of production per one conventional ton of catch, thousand rubles	Labor productivity, thousand rubles
		Place	Place
1	AO "Dalrybprom"	1	4
2	PAO "NBAMR"	6	6
3	ZAO "Fishing kolkhoz "Vostok-1"	3	5
4	OOO "ROLIZ"	16	9
5	ZAO "Intraros"	8	1
6	PAO "Dalryba"	12	7
7	OAO "TURNIF"	11	2
8	OOO "Daltransflot"	4	3
9	OAO "Fishing kolkhoz "Primorets"	9	14
10	OOO "Interrybflot"	5	8

11	OOO " Fishing kolkhoz "Tikhiy Okean"	13	16
12	ZAO Pacific	2	11
13	PAO "PBTF"	10	13
14	Fishing kolkhoz "Ogni Vostoka"	14	17
15	OOO " Fishing kolkhoz "Noviy Mir"	7	10
16	OOO "Insof Marin"	15	12
18	AO "Vostoktransservis"	17	15

Source: Federal Agency for Fishery of the Russian Federation, The Department of Fisheries and Aquatic Biological Resources of the Primorsky Territory

On the basis of the data from Table 2, it can be seen that the large fish producers of Primorye do not always work better in terms of labor productivity. For example, one of the largest enterprises ZAO Pacific received only the 11th place among 18 companies, while a relatively small enterprise OAO TURNIF, ranked the 11th in size, was the best in terms of labor productivity. Thus, fishing producers of Primorye show that there are more complex relationships between the size of the enterprise and the productivity of its resources.

Conclusion

Summarizing, we should note the following. Although the advantages of large enterprises are often attributed to increasing returns to scale, the results of this analysis allow to suggest that this may not be so. Much more likely, differences in productivity are due to the differences in production technology, rather than returns to scale. The results demonstrate the importance of distinguishing between the categories "returns to scale" and "returns to size".

Our results show, that smaller farms have limited opportunities for improvement of productivity by increasing their size, if they are not able to use different technologies. However, the use of advanced technologies involves more than just purchasing new fishing gear and fishing vessel, suitable for increasing the operating size. For example, enterprises need to acquire the knowledge and skills to cope with a more complex system of managerial, financial, technical and operational issues, related to the work of large farms. This is not necessarily a simple process, and like any other type of transformation in fisheries, the success depends on many conditions, including the availability and accessibility of financial, human, social and natural resources.

Our conclusions are also relevant in case of considering the current situation, when fishery enterprises of Primorsky Krai have a fairly small scale of innovations and show little interest in innovative development (Korneyko, 2016). High level of physical and moral depreciation of the fishing fleet and almost complete cessation of its renewal during the last ten years, the raw material orientation of Russian exports and its non-competitiveness in the world market, the reduction in the production capacities of fisheries indicate a low entrepreneurial confidence of fishing enterprises. It is obvious, that the creation and effective use of the results of innovation activities are currently the most important conditions for the dynamic development of fishing enterprises.

In this context, the government can play a certain role, promoting for innovations, for example, through the capacity building, exchanging of information, by assisting in training and supporting research and development activity, by concessional taxation of enterprises, using innovations to import substitution, by facilitating the consolidation of assets of fishing enterprises, with the aim to form several integrated competing structures (for example, a fishing-industry cluster) (Korneyko & Zyan, 2016; Titova et al, 2016; Sarycheva et al, 2016; Titova, 2014).

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