

Influence of the territorial specialization in economic activities on the birth rate in Bulgaria

Nikolay Stoenchev, Elena Stefanova

Abstract. The territorial specialization in economic activities is related to the provision of work and income to the population, contributing to sustainable regional development, and should influence the birth rate, since both the economic status and the prospects of the territory exert their influence on population's migration at a young age. The scope of this research encompasses the analysis of the strength and the direction of relationship between the coefficient of localization by economic activities - acting as a factor, and the fertility indicators (including the crude birth rate, the total fertility rate, the mean age of mothers at childbirth and the mean age of mothers at first childbirth by provinces) - acting as a result. The coefficient of localization was calculated in two variants: based on the number of employed individuals by economic activities and based on the gross added value produced, by economic sectors.

Official data from the National Statistical Institute (NSI) were used, with the birth rate being matched with lag values of the factor. Significant dependencies between the studied figures were revealed, which allow to refine management decisions regarding the restructuring of the economy in a regional aspect with a view to a favourable impact on the birth process in a smooth, natural and perspective way.

Keywords: territorial specialization, coefficient of localization, crude birth rate, total fertility rate, mean age of mothers at childbirth, coefficients of correlation

JEL: J13

Introduction

Fertility is a complex social phenomenon and its fulfilment will depend both on traditions as on population's belonging to a specific social, income or ethnic group, on religious affiliation, employment, income, age structure and health status of the population, as well as on the level of education, housing security, the availability of sufficient places in childcare facilities and the availability of adequate forms of financial stimulation for families of childbearing age. The combination of these and many other factors would determine the differences

in the birth rate in a territorial aspect, the differences between cities and villages, and those in dynamics. Bulgaria is a country where different economic activities are unevenly developed across the regions. This would allow to study the effect that is generated by a stronger or weaker development of a given economic activity in an area. This effect will be related to the varying profitability from one economic activity to another, the differences in the nature of work, the latter depending both on the degree of women's participation and on the amount of leisure time available to them. Exerting different economic activities will require different levels of education and qualification and will provide varying career-making and promotion opportunities, there is a variable degree of creativity, autonomy and initiative, with all those being essential for obtaining job satisfaction. As Lyudmil Georgiev states: "The specialization of territorial units in certain productions and activities is one of the most essential manifestations of the territorial division of labour. Like other forms of social division of labour, territorial specialization contributes to the increase of production efficiency, to the growth of labour productivity, to the size of the gross domestic product and to the reduction of production costs" (Georgiev 2015, 11).

The aim of this work is to study the presence, the vector and strength of the relationship between the specialization of the territory in terms of economic activities and the birth rate, thereby improving the information provision of management decisions related to the stimulation of birth rates.

Methods used and sources of information for the application thereof

What was used to examine the strength and the vector of the relationship between fertility rates and the territorial concentration of different economic activities and sectors, was the built-in Pearson correlation coefficient (PCC), function in the Excel software product. The analytical form of this coefficient is as follows:

$$(1) \quad r = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

where:

- \underline{y} means the empirical values of the resulting quantity;
- \bar{y} means the arithmetic average of the empirical values of the resulting value;
- \underline{x} means the empirical values of the magnitude factor;
- \bar{x} means the arithmetic average of the empirical values of the factor value.

In addition, for the purposes of the analysis, the coefficient of territorial specialization by economic activities, also known as coefficient of localization, was used.

It has the following form:

(2)

$$K_L = \frac{R_i}{\sum_n R_i} : \frac{N_i}{\sum_n N_i}$$

where:

R_i - number of employed persons in the i -th activity in the territorial unit;

$\sum_n^{i=1} R_i$ - total number of persons employed in all activities of the territorial unit;

N_i - number of employed persons in the i -th activity in the national economy;

$\sum_n^{i=1} N_i$ - total number of persons employed in all activities in the national economy;

$i = 1 \div n$ - economic activities.

The minimum value of the coefficient is zero, and the maximum value is not limited, judging by the magnitude of the degree of development of the relevant economic activity in the region.

In the present study, for practical reasons, the number of individuals hired was used rather than the number of persons employed.

Calculations were based on official comprehensive statistical information published by the National Statistical Institute (NSI). The specialization of the territory was represented by the index of localization in accordance with the classification of economic activities used by the NSI. The information refers to Bulgaria's administrative provinces, as it is available and accessible and, in our opinion, represents the territorial specialization to a sufficient level. People may live in a particular settlement but may well work in the nearby area, i.e., being daily commuters. Acting as a factor affecting the birth rate, the specialization of the territory in terms of economic activities is involved with its lag values. That is, what was studied was the impact caused by specialization in 2020 on the fertility in 2021. The reason is in the long biological process from the decision on reproductive activity to the birth of children.

In other words, we assume that the state and the change in the factor affecting fertility, whatever it may be, would affect the fertility indicator producing some time lag. The resulting value is the birth rate, represented by the crude birth rate, the total fertility rate, the mean age of mothers at first childbirth and the mean age of mothers at childbirth.

A general view of publications gravitating around the theme examined here

Scientific books in Bulgaria do provide some analyses of territorial disproportions observed in their economic development and dedicated to their interrelation with demographic processes. Some of them (Ilieva, Bardarov 2021, 5-26) are predominantly descriptive and expert in their nature, however they do thoroughly and realistically explain the historical and political

prerequisites for depopulation of some regions and the transformation thereof into territories of low levels of competitiveness, which fail to provide appropriate opportunities of labour fulfilment, which, in turn, would stimulate out-migration and constantly aggravates population's ageing irrespective of the availability of fertile soils and excellent natural and climatic conditions. Ivaylo Ivanov is an author of a monograph providing an analytical overview of sustainable regional development and region-to-region inequalities in Bulgaria applying statistical methods (Ivanov, 2019). Concerning the provinces in Bulgaria, he calculated a province-specific sustainable development index, whereby through appropriate methodology, he aggregated the values of 25 indicators classified by groups such as economic development, social sphere and environment quality. The focus of the said research work evades the direct involvement of demographic characteristics. Nevertheless, it may be accepted that what came as an outcome were well-founded and multiple-aspect assessments of conditions, in which the demographic processes are developing, seen in a territorial aspect. Both the economic component and the demographic component in author's presentation of the state of provinces in the country are contained in the annual analytical work authored by a team of researchers from the Institute for Market Economics *Regionalni profili - pokazатели za razvitiie* ("Regional Profiles: Indicators of Development") (Slavova et al. 2022). This is a publication where the demographic status of individual provinces is highlighted against the background of an array of economic and social characteristics, which are extensively supported by reliable statistical information. There is also a work entitled *Bulgaria 2030* (Bulgaria 2030 2019), which starts with a summarizing presentation of Bulgaria's demographic indices shown in their dynamics. These were highlighted as one of the social aspects of development. Other aspects in the focus of this work are: education, health profile, sports, culture, poverty and social inclusion. The period encompassed is 2008-2017. Economic aspects of development were reviewed such as: macro-picture, labour market, business environment and electronic management, R&D and innovations, transport connectivity and accessibility, and competitiveness of economic sectors. The individual items of this research work present the processes and phenomena in both economy and social sphere in a descriptive fashion and without seeking interconnections or interdependencies.

One of the policies relative to the demographic development, included in the National Development Programme: Bulgaria 2020 (National Development Programme: Bulgaria 2020, 26), and mentioned in this work, is the limitation of disproportions in population's territorial distribution and the depopulation seen in some regions and villages.

The bulk of comments and examination are focused on population's financial situation, however the latter is not correlated to the specificity of economic activities in the respective territory.

Results of the analysis

The idea that the specialization of the territory in economic activities might be correlated with the fertility levels stems from the essential differences detected in the average wages/salaries by economic activities, whereby different grades of financial comfort is enjoyed by young families. An evidence thereof may be found in the indexes presented in Table 1, which illustrate the ratio of the average wages/salaries received by hired personnel in the respective activity vs. the average wages/salaries of all hired persons. As some activities are predominantly parts of the public sector, whereas others are parts of the private sector, then the degrees of completeness of the information may vary from activity to activity. Part of remuneration in some activities within the private sector may be paid evading any exposition and may belong to the so-called grey sector.

Table 1. Indices of average wage/salary by economic activities for 2020

Total = 100

Economic activities (after NACE.BG-2008)	Indices in % Total = 100	Economic activities (after NACE.BG-2008)	Indices in % Total = 100
Total	100	Total	100
Agriculture, forestry and fisheries	72.27	Generating and distribution of information and creative products; telecommunications	244.06
Mining industry	138.35	Financial and insurance activities	159.89
Processing industry	86.53	Real estate operations and transactions	92.23
Production and distribution of electric and heat energy and gaseous fuels	156.61	Professional activities and scientific research	141.80
Water supply; sewerage, waste management and remediation	80.07	Administrative and auxiliary activities	78.77
Civil engineering	80.73	General government	116.53
Trade in and repairs of motor vehicles and motorcycles	87.25	Education	104.88
Transportation, warehousing and mail	83.69	Human health care and social work	101.93
Accommodation and food service	54.52	Culture, sports and entertainment	80.31
		Other activities	65.91

The above calculations were made by the authors based on data from the NSI.

Figures 1 and 2 show graphs of indicators employed for the assessment of fertility, which in this study act as a dependent variable.

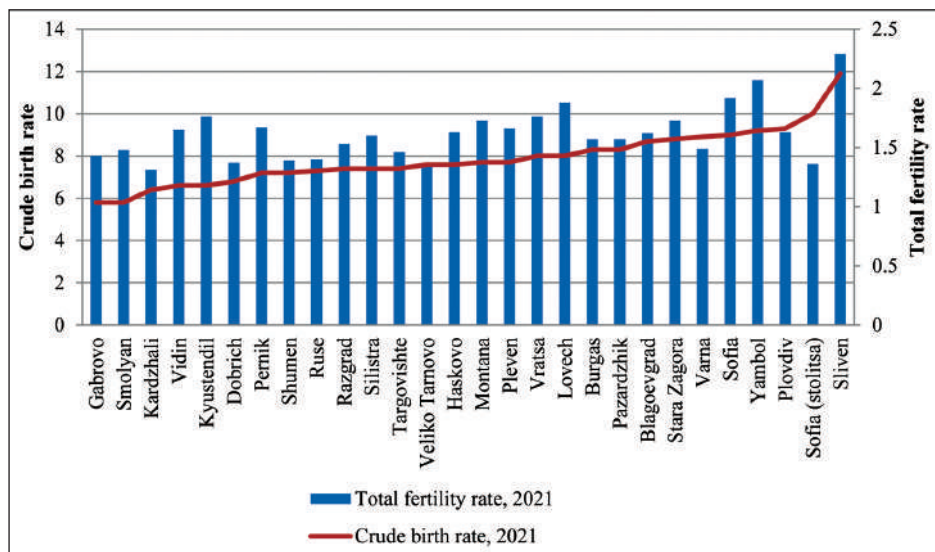


Fig. 1. Total fertility rate and crude birth rate levels by provinces for 2021 (data sorted by Crude birth rate)

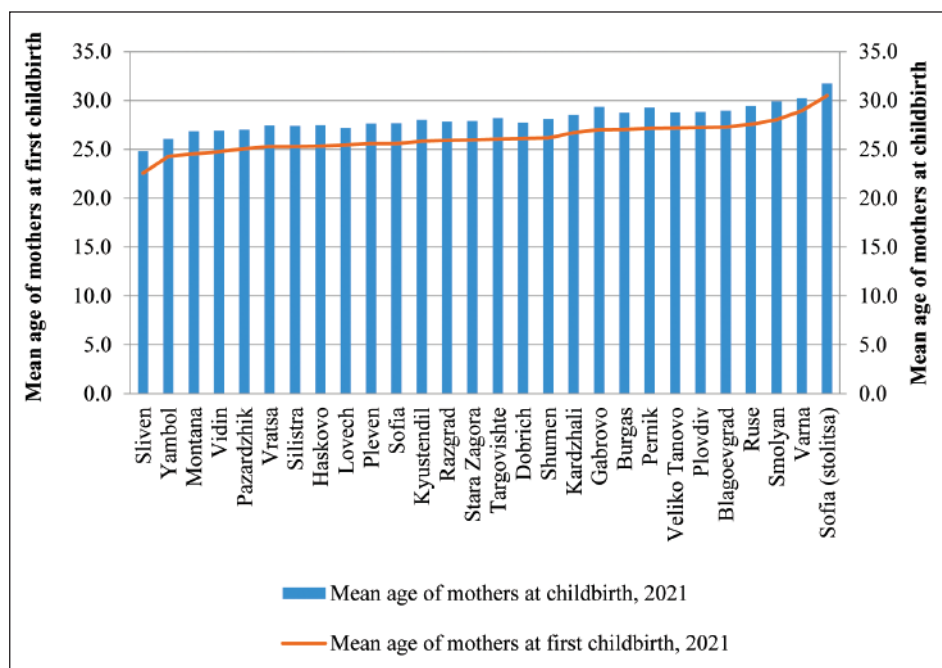


Fig. 2. Mean age of mothers at first childbirth and mean age of mothers at childbirth for 2021 (data are sorted by mean age of mothers at first childbirth)

What is noteworthy is that there is no complete correspondence between the birth rate and the total fertility rate. These two capture different aspects of the studied phenomenon and therefore are worth of being covered separately in this study.

The mean age of mothers at first childbirth by provinces and the average age at childbirth show parallel development, which means that if a method is found to steady and gradual reduction of the average age at first childbirth it would also have effect on the average age at birth of the subsequent children causing no significant impact on the social system, which, in turn, is responsible for the financial aids provided to young families and beds in nurseries, kindergartens and places in schools. Systematic care should also be taken for provision of free genetic analyses of all future mothers, which would minimize births of children with incurable genetic disabilities, rather than just care for live births.

Table 2 shows correlation coefficients between the coefficients of localization of economic activities by provinces and the fertility indicators. There, the coefficient of localization acting as an independent value was derived using the classic method by way of assessing the degree of relative concentration of hired personnel, as seen in its territorial aspect. This variant would be precise and realistic if the types of technology and the productivity rates used in the individual activities and the capital/labour ratio were approximately the same. In order to calculate the coefficients of correlation as shown in Table 3, the coefficients of localization by economic sectors were calculated by using the gross added value by regions. This variant is reasonably expected to be more realistic given the possibility to reflect the incomes received by the population, its life standards and life quality, which are supposed to act as a prerequisite for a timely fulfilment of population's reproductive plans.

While the coefficients of localization are considered as acting as an independent variable, the fertility indicators are considered as acting as a dependent variable. The following activities were excluded: *Mining industry* and *Production and distribution of electric and heat energy and gaseous fuels* as the information thereof on some provinces is classified.

The above calculations were made by the authors based on data from the NSI.

Here are some of the results shown in Table 2 that are the most essential and deserve most attention:

- As regards the activity denominated *Agriculture, forestry and fisheries*, the high values of the coefficient of localization are inversely correlated with the mean age of mothers at childbirth and mean age of mothers at first childbirth. This means that in the provinces characterized by a strong concentration of these activities, which are mostly rural and mountainous areas, what is typical is the earlier birth of a child and the first child. The nature of labour typical of such activities would allow a mother to devote more time to the children-raising process. Moreover, the relatively lower level of education required to carry out these activities, where manual labour still predominates, would be instrumental in this regard.

Table 2. Correlation coefficients between coefficients of localization of economic activities by provinces based on the number of hired persons for 2020 and indicators characterizing the birth rate in 2021

Independent variable. Coefficients of localization in economic activities by provinces based on the number of hired persons for 2020	Dependent variable. Indicators of fertility by provinces for 2021			
	Crude birth rate	Total fertility rate	Mean age of mothers at childbirth	Mean age of mothers at first childbirth
Agriculture, forestry and fisheries	-0.128	0.052	-0.551	-0.522
Processing industry	-0.283	0.115	-0.200	-0.257
Water supply; sewerage, waste management and remediation	-0.335	0.110	-0.322	-0.366
Civil engineering	0.078	-0.336	0.518	0.542
Trade in and repairs of motor vehicles and motorcycles	0.527	0.167	0.065	0.134
Transportation, warehousing and mail	0.049	-0.282	0.433	0.429
Accommodation and food service	0.010	-0.242	0.304	0.355
Generating and distribution of information and creative products; telecommunications	0.286	-0.317	0.616	0.644
Financial and insurance activities	0.401	-0.185	0.488	0.538
Real estate operations and transactions	0.441	-0.132	0.365	0.438
Professional activities and scientific research	0.348	-0.325	0.669	0.724
Administrative and auxiliary activities	0.165	-0.255	0.398	0.400

Table 2 (continued)

General government	-0.314	0.008	-0.265	-0.275
Education	-0.031	0.230	-0.600	-0.586
Human health care and social work	-0.154	0.188	-0.419	-0.438
Culture, sports and entertainment	0.024	-0.242	0.293	0.310
Other activities	-0.041	-0.008	-0.018	0.015

The above calculations were made by the authors based on data from the NSI.

- As regards the *Processing industry* and for the *Water supply; sewerage, waste management and remediation*, the relationship of location with birth rate is not clear. It is relatively weak and negative. This would mean that the concentration of such activities would be associated with earlier and lower fertility levels.

- As regards the activity denominated *Civil engineering*, the highest and positive correlation coefficients are between the studied factor and the average age of the mother. This would mean that the concentration of this activity would be associated with later births. The correlation coefficient between the total fertility rate and the studied factor is moderately high and negative. These are characteristic features of highly urbanized urban areas, where getting a good education and finding a good and promising job and gain a footing in such as job turn out to be a significant priority over birth and upbringing of children.

- As regards the activity denominated *Trade in and repairs of motor vehicles and motorcycles*, the most pronounced and positive is the relationship of the birth rate with the studied factor. This would mean that the concentration of this activity would be typical of provinces showing higher birth rates.

- As regards the following seven types of activities: *Transportation, warehousing and mail, Accommodation and food service, Generating and distribution of information and creative products; telecommunications, Financial and insurance activities, Real estate operations and transactions, Professional activities and scientific research, Administrative and auxiliary activities*, it is characteristic that typically, it turns out that these are the activities where the highest and positive correlation coefficients between the studied factor and the mean age of mothers at childbirth and the mean age of mothers at first childbirth are found. In other words, the highly intellectual labour prevailing in these activities and the mandatory presence in the office of the women who practice them leads to the postponement of births.

- As regards the activity denominated *General government*, the relationship between the birth rate indicators and the studied factor is relatively weak. This may be explained by the employment in this activity of personnel with great experience, meaning that a significant number of women would be beyond childbearing age. The correlation coefficient between the concentration of

this activity and the birth rate is the highest and negative. Put it otherwise, the concentration of the above activity would be associated with lower birth rate levels.

- As regards the activities denominated *Education* and *Human health care and social work*, the correlation coefficients of the studied factor and the average age of the mother turn out to be relatively high and negative. This would mean that the concentration of this activity would be associated with earlier births. Perhaps the fact that the bulk of such activities would be found in the public sector, which tends to create security, coupled with a woman's impossibility, until recently, of building a professional career based on high qualifications, would encourage them to give birth and raise their children at an earlier age.

- As regards persons employed in *Other activities*, there would typically be no clear relationship between the studied factor and result values. A possible reason for this is the heterogeneous nature of the professions involved in this type of activities together with their saturation with male employees mainly.

In Table 3, economic activity is highly aggregated and presented by economic sectors. It is expressed using the produced gross added value by provinces. This should make it possible to express more clearly the difference in the relationship between the concentration of different economic sectors and the fertility rates.

The most pronounced and negative relationship is seen between the coefficient of localization within the sector *Agriculture, forestry and fisheries* and

Table 3. Correlation coefficients between indicators of localization by economic sectors based on the gross added value by provinces and fertility rates

Dependent variable	Independent variable		
	Coefficients of localization by provinces for 2020 based on the gross added value		
	Agriculture, Forestry and Fisheries	Industry	Services
Crude birth rate by provinces in 2021	-0.368	-0.069	0.223
Total fertility rate by provinces in 2021	0.048	0.083	-0.105
Mean age of mothers at childbirth by provinces in 2021	-0.570	-0.058	0.294
Mean age of mothers at first childbirth by provinces in 2021	-0.583	-0.102	0.344

The above calculations were made by the authors based on data from the NSI.

the mean age of mothers at childbirth and the mean age of mothers at first childbirth. This would come to confirm the thesis that being employed in this sector would offer good opportunities to combine a mother's economic activity with the birth and raising of children.

Conclusion

The results of the research conducted give reason to claim that there is an essential relationship between the regional localization of the various economic activities and sectors and the birth rate indicators in many cases. This would mean that some activities create better conditions for high birth rates than others. By providing conditions facilitating the development of these activities, it would be possible to fulfil the ideas of sustainable demographic development, and in a natural and smooth way, without putting an additional burden on the country's social system. Of course, not every activity is suitable to develop everywhere. When choosing activities for territorial specialization, what should be taken into account will be the traditions, the supply of raw materials, the development of the transport infrastructure, the availability of a qualified workforce, the markets for the production and, last but not least, the already built material and technical base.

By changing the priorities in the territorial specialization of production, the total fertility rate would probably not change significantly, but positive results could be expected toward a decrease in the average age of the mother at the birth of the first child and at the birth of a child, which would reduce the medical risks to both mother and child. An exception here would be the excessively young age of the mother in cases of some unplanned births or in those influenced by the mother's religious and ethnic affiliation, which, subject to appropriate information campaigns and free contraceptives provided by health facilities, could be limited to a certain extent.

The improvement of population's age structure, which would be obtained through the development of promising and profitable economic activities in a territory, would certainly lead to an increase in the values of the crude birth rate.

References

- Bulgaria 2030:** България 2030. Анализ на социално-икономическото развитие на страната след присъединяването ѝ към ЕС, 2019. (Bulgaria 2030. Analiz na sotsialno-ikonomicheskoto razvitie na stranata sled prisaedinyavaneto i kam EU, 2019). Available from: file:///C:/Users/User/Downloads/Prilojenie-2%20-%20Bulgaria%202030%20Analiz.pdf [Accessed: 6 March 2023].
- Georgiev 2015:** Л. Георгиев. Идеята за интелигентна специализация в европейското териториално пространство. София: Нов български университет, 2015. (L. Georgiev. Ideyata za inteligentna spetsializatsiya v evropeyskoto teritorialno prostranstvo. Sofia: Nov balgarski universitet, 2015.)

Available from: https://ebox.nbu.bg/pa2015/1_L.Georgiev.pdf [Accessed: 22 April 2023].

- Ilieva, Bardarov 2021:** Н. Илиева, Г. Бърдаров. Регионалните демографски дисбаланси в България. Количествени измерения, причини, политики и мерки за оптимизиране на ситуацията. София: Фондация Фридрих Еберт, 2021. (N. Ilieva, G. Bardarov. Regionalnitate demografiski disbalansi v Bulgaria. Kolichestveni izmereniya, prichini, politiki i merki za optimizirane na situatsiyata. Sofia: Fondatsiya Fridrih Ebert, 2021.) Available from: https://bulgaria.fes.de/fileadmin/user_upload/documents/publications/2021/Regionalni_demografiski_disbalansi_WEB_BG.pdf [Accessed: 15 March 2023].
- Ivanov 2019:** И. Иванов. Устойчиво развитие. Регионални неравенства в България. София: Авангард Прима, 2019. (I. Ivanov. Ustoychivo razvitie. Regionalni nesavarshenstva v Bulgaria. Sofia: Avangard Prima, 2019.)
- National Development Programme: Bulgaria 2020:** National Development Programme: Bulgaria 2020. Available from: <https://archive2018.eufunds.bg/archive/documents/1357828564.pdf> [Accessed: 10 March 2023].
- Slavova et al. 2022:** З. Славова, А. Николов, П. Ганев, Т. Невев. Регионални профили - показатели за развитие. София: Институт за пазарна икономика, 2022. (Z. Slavova, A. Nikolov, P. Ganev, T. Nedev. Regionalni profili - pokazateli za razvitie. Sofia: Institut za pazarna ikonomika, 2022.)

Prof. Nikolay Stoenchev, PhD

Institute for Population and Human Studies
Bulgarian Academy of Sciences
Acad. Georgi Bonchev Str., Bl. 6
1113 Sofia, Bulgaria
Email: mai4@abv.bg

Chief Assist. Elena Stefanova, PhD

University of Chemical Technology and Metallurgy
8 Kliment Ohridski Blvd.
1756 Sofia, Bulgaria
Email: el_stefan@abv.bg