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SOCIO-ECONOMIC DETERMINANTS OF DEVELOPMENT IN REFERENCE TO THE CHANGE IN POPULATION SIZE IN CENTRAL AND EASTERN EUROPE BETWEEN 2008 AND 2019

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ABSTRACT: For most regions of Central and Eastern Europe there has been a noticeable decline in population in recent years. The purpose of this article is to analyse the level of economic and social indicators as well as changes in population size between 2008 and 2019 in the regions of Central and Eastern Europe. In particular, the article attempts to answer the question of how the change in selected economic and social indicators impacts the change in population size. The answer to the above question will be provided with the use of the ratio analysis and thesoft model. The research results show that the two causes of changes in population size (natural causes and migrations) are significantly affected by a group of social indicators, even though – with regard to migration – the significance of economic indicators is increasing and the difference between the former and the latter is not substantial. Consequently, in response to the depopulation process, more attention should be paid to the social dimension of development. In other words, creating proper conditions for personal and professional activity may be more important than using financial instruments.

KEYWORDS: depopulation, socio-economic indicators, demographic indicators, fertility, migration

Introduction

Socio-economic development is understood as a process of positive quantitative and qualitative changes that occur in a particular territory as a result of specific factors and conditions. Additionally, the factors that determine such growth undergo transformation themselves. Consequently, socio-economic development can also be interpreted as changes in certain properties of every element that forms the structure of a socio-economic system (Parysek, 2018). The definition of a socio-economic system assumes that it is created by a set of certain objects that interact with each other and with the external environment. Moreover, it displays all the properties inherent in a system as a whole. If we discuss the socio-economic system in the spatial aspect, we should understand space as an environment of functioning. The concept of socio-economic space complements the category of space with social and economic features. Additionally, it takes into account the semantic content of both components. It must be emphasised that social and economic spaces differ, as their main goals are not always the same. Indeed, for social agents, the goal is not always economic profit. In consequence, the most comprehensive definition of a socio-economic space includes subjects (active participants), objects (sources of the emergence of mutual relations) and relationships between subjects and objects, which all take into account both economic expediency and the balance of interests (Kovalenko-Marchenkova, 2022).

The set of main factors and conditions of socio-economic development varies over time. Nowadays, the role of factors that determine the development of the digital economy is emphasised. In fact, the level of development of modern economies is characterised by structural and qualitative changes under the influence of the rapidly spreading technological innovations, in particular digital technologies (Nowak et al., 2021). However, the use of digital technologies depends on the knowledge and skills of the inhabitants in a given region, hence the role of human capital is important. Consequently, a qualitative aspect expressed through the definition of human capital indicates that the characteristics of the population of a given area are essential for the modern economy and society.

The characteristics of a given population can be described by demographic variables and events. Additionally, we can distinguish demographic phenomena or processes that are ordered chains of population events, linking these events with changes in the state and demographic structure of the population (Okólski & Fihel, 2012). If a demographic process can be both described as long-term and short-term, but has a clear direction and is related to a given demographic change, it constitutes a demographic trend. The impact of demographic processes on socio-economic development has been the subject of many scientific studies. Consequently, demographic aspects, both in the quantitative and qualitative approach, have been reflected in numerous theories and concepts of socio-economic growth. The direction and intensity of demographic processes invariably remain their significance for socio-economic development. It should also be noticed that causal links between demographic and socio-economic determinants are bidirectional. Both the level of socio-economic growth itself, as well as the impact of its various factors and conditions can substantially contribute to the occurrence of specific social attitudes and – through this – affect demographic processes.

It should be emphasised that it is extremely difficult to unequivocally define the extent and intensity of the impact of socio-economic variables on demographic variables. Basic demographic indicators, such as birth rate or migration balance, stem from many variables, including health or personal issues. However, this does not undermine the relevance of analysing connections between demographic and economic-social variables, even though such an analysis goes beyond traditional aspects of the economists' interest and is interdisciplinary in nature. Nevertheless, it can be noted that in the scientific literature more attention is paid to the impact of demographic factors on socio-economic growth than it is to the study of the inverse relationship. Furthermore, "there is a serious research gap regarding the connection between the location of socio-economic activity and typical demographic transformations" (Wiśniewski et al., 2020). Therefore, the purpose of this article is to analyse the level of economic and social indicators as well as changes in population size between 2008 and 2019 in the regions of Central and Eastern Europe. In particular, the impact of changes in economic and social indicators on the changes in demographic indicators that determine population size (natural causes and migration) will be analysed. Simultaneously, it should be emphasised that the precise delimitation of Central and Eastern Europe has not been specified. The research depicted in the article comprised 59 regions located in 11 European Union Member States (Table 1). The authors

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assumed that these regions experience common political (accession of individual countries of the macro-region to the EU between 2004 and 2013), economic and social changes that shape the level of determinants of the socio-economic development.

Table 1. Regions in Central and Eastern Europe

No.	Country	Regions (number)
1	Bulgaria	Severozapaden, Severentsentralen, Severoiztochen, Yugoiztochen, Yugozapaden, Yuzhen tsentralen (6)
2	Czechia	Praha, Střední Cechy, Jihozápad, Severozápad, Severovýchod, Jihovýchod, Střední Morava, Moravskoslezsko (8)
3	Estonia	Eesti (1)
4	Croatia	Jadranska Hrvatska, Kontinentalna Hrvatska (2)
5	Latvia	Latvija (1)
6	Lithuania	Sostinesregionas, Vidurioirvakaru Lietuvosregionas (2)
7	Hungary	Budapest, Pest, Közép-Dunántúl, Nyugat-Dunántúl, Dél-Dunántúl, Észak-Magyarország, Észak-Alföld, Dél-Alföld (8)
8	Poland	Małopolskie, Śląskie, Wielkopolskie, Zachodniopomorskie, Lubuskie, Dolnośląskie, Opolskie, Kujawsko-Pomorskie, Warmińsko-Mazurskie, Pomorskie, Łódzkie, Świętokrzyskie, Lubelskie, Podkarpackie, Podlaskie, Warszawski stołeczny, Mazowiecki regionalny (17)
9	Romania	Nord-Vest, Centru, Nord-Est, Sud-Est, Sud – Muntenia, Bucuresti – Ilfov, Sud-Vest Oltenia, Vest (8)
10	Slovenia	Vzhodna Slovenija, Zahodna Slovenija (2)
11	Slovakia	Bratislavský kraj, Západné Slovensko, Stredné Slovensko, Východné Slovensko (4)

It should be noted that, for most regions of Central and Eastern Europe, there has been a noticeable decline in population in recent years. Especially high dynamics of the decline is recorded in the regions of Bulgaria, Romania or the Baltic States (Judah, 2021; Otovescu & Otovescu, 2019; Daugirdas & Pociute-Sereikiene, 2018; Koyama, 2018). In other words, these regions have been experiencing depopulation, even though the population decline between 2008 and 2019 was primarily caused by natural processes, whereas migration changes have affected the population size to a much lesser degree. The intensity of the depopulation phenomenon is particularly apparent in the analysis of demographic data at a regional scale. While the entire macro-region of Central and Eastern Europe lost 3% of its population between 2008 and 2019, the decrease in individual regions of Bulgaria, Romania, Croatia, Lithuania and Estonia reached even several dozen percent, with the highest (17.4%) recorded in the Bulgarian region of Severozapaden (Truskolaski & Bugowski, 2022). Hence, there is a good reason to carry out the analysis at regional levels.

The article attempts to answer the question of how changes in selected economic and social indicators impact the change in population size in the studied regions. Consequently, the research problem has been formulated as follows: *which group of factors (economic or social) determines changes in population size resulting from natural causes (births and deaths) and migration to a greater extent?* The detailed research questions are:

- Q1: Which group of factors (economic or social) determines natural changes (births and deaths) to a greater extent?
- Q2: Which group of factors (economic or social) determines migration changes to a greater extent?

The answers to the above research questions will be provided with the use of the ratio analysis and the soft model. The first method will be used to analyse the source data (Eurostat). The aggregated data will then be used in a soft model, the estimation of which will allow us to verify the impact of changes in socio-economic factors on the change in population size. It should be emphasised that the conclusions drawn from the study will not be universal; they will concern specific regions in a

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given period with a limited selection of indicators. The reason for this is the fact that a comprehensive theory connecting demographic structures with socio-economic structures has not been formulated so far (Wiśniewski et al., 2020).

Economic and social determinants of the change in population size

Generally, the level of population size in a region is the result of natural changes (births and deaths) and migration balance (Lundquist et al., 2015; Poston & Bouvier, 2010). Both birth rate and migrations are shaped by demographic factors applied in the theories and concepts of socio-economic development. Nevertheless, they do not presume an unconditional and unambiguous relationship between the level of specific economic or social factor and the level of demographic variables such as fertility level or migration balance.

With regard to natural changes in population size, which are mostly a consequence of a particular level of fertility rate, there have been attempts to explain this process through the prism of socio-economic changes. A basic theory linking the process of population reproduction to the modernisation of societies is the demographic transition theory, pioneered by Thompson (1929) and Landry (1934). The theory was eventually formulated by Notestein (1945), who related the level of birth and death rates to technological, social, economic and political determinants (Frejka, 2016). In other words, under the demographic transition theory, the population growth rate depends on the socio-economic characteristics of a society. Technological development and changes in mindset evoke a transition from a traditional society (high birth and death rates) to a modern society (low birth and death rates – relative population stability). Moreover, the second demographic transition theory states that, as a result of further socio-economic changes (e.g. late motherhood due to professional development or voluntary childlessness), fertility rate decreases to the level that does not guarantee a simple generational replacement. Therefore, it can be concluded that basic demographic processes are socially regulated, i.e. social conditions replace natural, nature-based determinants as regulators of population reproduction (Okólski & Fihel, 2012). In the face of low birth rates, immigration becomes the main factor of population growth, while society experiences the third demographic transition characterised by ethnic and denominational changes (Coleman, 2006).

It should be noticed that theories stemming from statistical analyses indicate a negative correlation between fertility level and income. In particular, an increase in real wages raises the alternative cost of having children (Hondroyiannis, 2010). This conclusion is based on the assumption that having children accounts for higher cost for parents with higher levels of income (earnings) and thus higher expectations for their offspring, which additionally raises the cost of upbringing, including education. On the other hand, in the reference literature there can be found a counter-argument, according to which the negative relationship is the result of a limited selection of variables in statistical studies, which omits a few important elements such as women's earning potential. When the correlation between income and fertility is fully analysed, the relationship may be positive (Jones et al., 2008). Similarly, Hirschman argued that modernisation processes in the economy and high incomes as such are not responsible for fertility decline. If income growth generates increased consumption, then – assuming that children are socially desirable assets – fertility rates should be rising. However, Hirschman noticed that economic theory imprecisely defines the role of fertility in consumption by treating the qualitative aspect (higher-cost children with greater levels of investment and consumption) and the quantitative aspect substitutionally (Hirschman, 1994). The overview containing selected economic and social determinants of fertility is presented in Table 2.

In contrast to fertility, where economic and social factors are some of the many variables determining its level, migrations are mostly explained by the difference in the level of socio-economic development between migrant-receiving regions and migrant-sending regions. Moreover, most migration processes directly affect transformations of social structures (Wiśniewski, 2020), both in migrant-receiving and migrant-sending regions. Migration concepts and theories can be divided on the basis of various criteria (after Wickramasinghe & Wimalaratana, 2016). With regard to the level of analysis, we can distinguish between the micro level (the individual's perspective, their expectations and desires), the macro level (the perspective of differences in economic structures of particular regions) and the meso level (the perspective between the micro and macro levels including family

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ties or social networks) (Faist, 2000). What is more, the division can be made with reference to the leading scientific discipline that explains the causes of migration. Hence, we distinguish sociological, economic, geographical, and multidisciplinary theories (Bijak, 2006). The alternative classification divides theories into those explaining the causes of migration processes or their perpetuation (Hagen-Zanker, 2008, p. 6) in relation to the concept of cumulative causation (Massey, 1999).

Table 2. Selected scientific studies on socio-economic determinants of fertility

Author	Fertility determinants
Becker (1960)	Fertility depends on income, value of parental time and other variables characteristic to each family; the New Home Economics (NHE).
Davis (1963)	The most important independent variable is the level of household economic burden, which is a function of household size and potential economic resources.
Schultz (1973)	The income and wages that parents expect to earn during their lifetime are the potential cost of having offspring in the sense of time devoted to bringing them up.
Coale (1973)	Today's fertility rates in marriages are conditioned by birth control, which brings explicit economic benefits.
Leibenstein (1975)	Fertility is the result of autonomous decisions influenced by economic variables.
Caldwell (1982)	Disintegration of the traditional nuclear family leads to a reversed flow of the source of wealth (originally from children to parents, presently from parents to children), making it costly to have children; consequently, fertility is decreasing.
Lesthaeghe (1995)	Ideological variables, strictly associated with Inglehart's 'quiet revolution' (e.g. weakening of social control, growing individual autonomy, purposeful birth control) are important in demographic changes.
Mason (1997)	Mortality decline as a precondition for decreasing fertility rates.
Kreyenfeld (2004)	Women may refrain from parenthood because they foresee that they will not find their way back into the labour market after giving birth.
Jones and Tertilt (2006)	Negative linkage between income (wages) and fertility rates.
Engelhardt (2011)	Negative relationship between fertility and employment levels until mid-1980s, then reversal of the relation; postponing births leads to falling fertility rates.
Bocquier and Costa (2015)	Relating fertility to urbanisation processes; exploring causal relationships between urbanisation and demographic processes.
Jemna and David (2018)	Correlation between fertility and employment level (positive), marriage rate (positive), level of urbanisation (negative) and GDP per capita (economically underdeveloped regions have higher, but declining fertility rates, while regions with high GDP levels have lower, but increasing fertility rates).

The aforementioned authors have divided the existing (the same) theories on the basis of different criteria depending on the adopted objective. Simultaneously, it should be noticed that no general migration theory understood as migration studies has been developed so far. Indeed, a complete analysis of migration is interdisciplinary in nature, and it is not achievable without referring to the achievements of not only demography, but also economics, sociology, political science or history (Górny & Kaczmarczyk, 2003). Selected concepts and theories explaining migrations are presented in Table 3.

Two methodological approaches can be discerned among the above-mentioned scientific studies. The first one assumes that, according to the neoclassical approach, migration level is the resultant of economic benefits and costs. The second view relates to the modernisation theory and posits that migration levels depend on the interaction of push factors in emigration territories and pull factors in immigration territories (Lee et al., 2017). In this article, both with regard to migration and natural causes, the second approach has been adopted, i.e. the level of selected social and economic indicators determines the stage of social development in accordance with the modernisation theory and – through this – it creates, respectively, a set of factors encouraging and discouraging procreation and pushing and pulling migrants.

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Table 3. Selected scientific studies on socio-economic determinants of migration

Author	Migration determinants
Hicks (1932)	Neoclassical concept of migration; migrations are the result of disparity in net economic benefits, primarily resulting from different wage levels.
Fei and Ranis (1961)	Migrations arise from differences in economic potential, in particular from differences in wage levels; migratory incentives are extinguished as economic opportunities level off.
Wolpert (1965)	Migration is determined by the usability of a given place, the individual's level of aspiration, the space for action and the life-cycle phase of a certain person.
Lee (1966)	The migration flow is the inverse of the distance function; there are stages of migration to places with higher development levels, the theory of push and pull factors.
Harris and Todaro (1970)	Migration is driven by income disparity, not just wage differences, which explains rural-to-urban migration in the context of high urban unemployment.
Todaro (1976)	The role of social, cultural and psychological determinants with the decisive role of economic factors, both for internal and external migrations.
Doeringer and Piore (1971)	Migration is caused by differences in the functioning of the labour market – dual labour market.
Piore (1979)	Migrations are a permanent feature of industrial economies; an alternative theory of the nature of the migration process stemming from criticism of assumptions about the beneficial impact of migration for both sending and receiving societies.
Massey (1999)	Cumulative causation; interpersonal connections between migrants create a stimulus for further migration processes in a given community.
Bernard and Kalemba (2022)	The reasons for migration (e.g. employment, education, family, or lifestyle) vary depending on the age groups considered.

Characteristics and selection of economic, social and demographic indicators

The level of socio-economic development can be measured based on a different set of indicators depending on the adopted objective of the study, analysis of the reference literature, and the knowledge and experience of the researcher. Additionally, considering the availability of data for all 59 regions, the authors have proposed the operationalisation of the level of socio-economic development with the use of two groups of factors defined as economic factors and social factors. In both cases, three indicators have been distinguished, i.e. GDP per capita, the share of R&D expenditure (GERD) in GDP, disposable income (economic factors) and the share of people with higher education in the age group ranging from 25 to 64 years old, Internet accessibility, and healthcare standard expressed as the number of hospital beds per 100,000 inhabitants (social factors).

With regard to economic factors, Table 4 presents the regions in which a particular indicator assumes the highest values. Unsurprisingly, in the case of GDP per capita and disposable income, the highest values are reached mainly by the regions comprising state capitals (Praha, Bratislavský kraj, Budapest, Warszawski stołeczny). Similarly, in the case of the share of R&D expenditure in GDP, the Praha region is the leader, while the presence of two other Czech regions (Střední Cechy, Jihovýchod) in the top 5 among 59 regions under the study is noteworthy.

With regard to social indicators (Table 5), in terms of the percentage of people with tertiary education, Lithuanian Sostines regionas (including Vilnius) takes the leading position, slightly ahead of Warszawski stołeczny (Warsaw Capital Region). Further positions are occupied by the regions of Budapest, Bratislavský kraj and Praha. Regarding households with Internet accessibility, the percentage was relatively high (above 70%) in all regions, with the highest in the regions of Praha, Budapest, Zahodna Slovenija, Bucuresti – Ilfov and Eesti. With regard to the quality of healthcare expressed as the indicator referring the number of hospital beds to the number of inhabitants, the leading region in 2019 was Zachodniopomorskie (West Pomerania) followed by the regions: Bucuresti – Ilfov, Budapest, Kujawsko-Pomorskie (Kuyavia-Pomerania) and Yuzhen tsentralen.

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Table 4. Regions with the highest level of economic indicators covered by the study in 2019

		2019	2008	2019/2008
GDP per capita				
1	Praha	46 400	33 700	38%
2	Bratislavskýkraj	39 700	28 300	40%
3	Budapest	30 900	23 800	30%
4	Warszawski stołeczny	30 500	20 500	49%
5	Zahodna Slovenija	27 600	22 800	21%
B+R (GERD) % GDP				
1	Praha	2.56%	2.01%	0.55 pp.
2	Warszawski stołeczny	2.56%	1.24%	1.32 pp.
3	Střední Cechy	2.51%	1.27%	1.24 pp.
4	Jihovýchod	2.48%	1.35%	1.13 pp.
5	Budapest	2.42%	1.32%	1.1 pp.
Disposable income (EUR per capita)				
1	Bratislavský kraj	14 700	10 100	46%
2	Praha	13 900	10 200	36%
3	Zahodna Slovenija	12 800	11 200	14%
4	Vzhodna Slovenija	12 400	9 700	28%
5	Bucuresti – Ilfov	11 600	7 900	47%

Source: authors' work based on Eurostat (2023).

Table 5. Regions with the highest level of social indicators covered by the study in 2019

		2019	2008	2019/2008
Tertiary educational attainment, age group 25-64				
1	Sostinesregionas	55.9%	30.2%	25.7 pp.
2	Warszawski stołeczny	55.5%	27%	18.5 pp.
3	Budapest	47.5%	29.4%	18.1 pp.
4	Bratislavský kraj	45.5%	29.2%	16.3 pp.
5	Praha	45.5%	30.8%	14.7 pp.
Households with Internet accessibility				
1	Praha	93%	62%	31 pp.
2	Budapest	92%	55%	37 pp.
3	Zahodna Slovenija	92%	67%	25 pp.

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4	Bucuresti – Ilfov	91%	50%	41 pp.
5	Eesti	90%	57%	43 pp.
Hospital beds per 100,000 inhabitants				
1	Zachodniopomorskie	1182.45	1085.95	9%
2	Bucuresti – Ilfov	1025.84	993.79	3%
3	Budapest	1004.37	782.54	28%
4	Kujawsko-Pomorskie	864.16	811.02	7%
5	Yuzhen tsentralen	824.74	645.21	28%

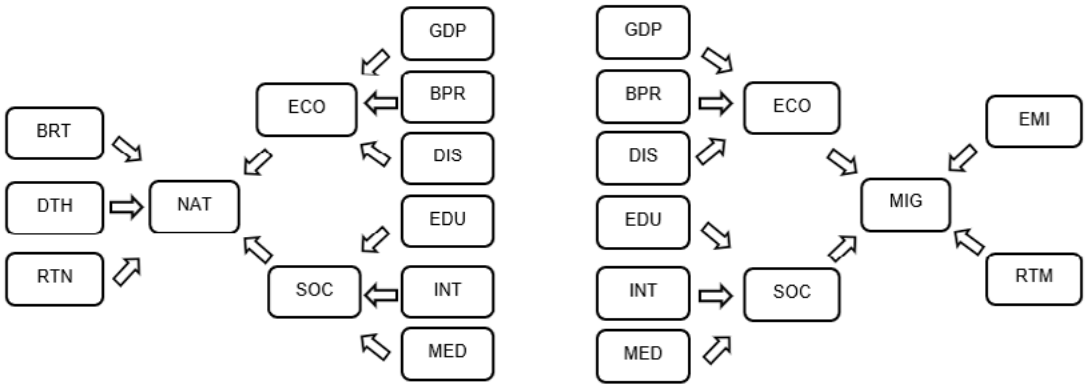
Source: authors' work based on Eurostat (2023).

In the further part of the article, the distinguished indexes will form the basis for defining indicators in the soft model. It should be emphasised that the group of indicators has been reduced due to methodological verification of the method adopted in the study. As a result, indicators comprising unemployment rate or the level of poverty risk have been excluded.

Soft model methodology and the results of the study

A soft model was used to examine the correlation between changes in social and economic indicators and natural mobility and migration. Its structure consists of an internal model that describes the relationship between latent variables and an external model that depicts the relations between latent variables and indicators. The selection of indicators reflects a specific economic theory or results from the research experience, knowledge or intuition. After the completion of the study, the model is verified both substantively (in terms of the compatibility of the parameters of external and internal models with theoretical assumptions) and statistically using Tukey's Jackknifing method and the S–G test (Rogowski, 1990; Perło, 2014; Truskolaski & Bugowski, 2022).

The authors of the article have developed two models (Figure 1) that examine the relationship between selected economic and social indicators and natural population changes and migrations. In particular, the comparison of the results of the two models should answer the question which group of indicators, i.e. economic or social, is more relevant with regard to natural population changes and migrations.



First soft model *Second soft model*

Figure 1. Soft model scheme – impact of economic and social indicators on natural causes of changes in population size and migrations

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The first internal model takes a linear form with three latent variables, i.e. natural causes of the change in population size (NAT), economic indicators (ECO) and social indicators (SOC). Specific latent variables were assessed with the use of indexes that enable comparative analysis of objects tested in accordance with the soft model methodology. It should be added that the indicators are the relations between the level of indexes observed in 2019 and in 2008 respectively. The rationale behind the selection of the years are significant socio-economic events taking place in the area under investigation after 2008; most of all as a result of the convergence process following the accession to the European Union. Table 6 presents the indicators assigned to certain latent variables.

Table 6. Latent variables and indicators in the first soft model

Latent variable	Indicators	Indicator name
NAT	BRT	the ratio of the number of births in 2019 to the number of births in 2008
	DTH	the ratio of the number of deaths in 2019 to the number of deaths in 2008
	RTN	the change in the crude birth rate in 2019 compared to the crude birth rate in 2008
ECO	GDP	the ratio of the level of GDP per capita in 2019 to the level in 2008
	BPR	the ratio of the share of R&D expenditure (GERD) in 2019 to the level in 2008
	DIS	the ratio of the level of disposable income per capita in 2019 to the level in 2008
SOC	EDU	the ratio of the share of people with tertiary education (25 – 64 age group) in 2019 to the level in 2008
	INT	the ratio of the share of households with Internet accessibility in 2019 to the level in 2008
	MED	the ratio of hospital beds per 100,000 inhabitants in 2019 to the level in 2008

The second internal model takes a linear form with three latent variables, i.e. migrations (MIG), economic indicators (ECO) and social indicators (SOC). The methodology for the creation of indicators as well as the rationale for their selection is analogous to the first model. Table 7 presents the indicators assigned to particular latent variables.

Table 7. Latent variables and indicators in the second soft model

Latent variable	Indicators	Indicator name
MIG	EMI	the ratio of the volume of permanent migrants (internal and foreign) in 2019 to the volume of permanent emigration in 2008 – outflow
	RTM	the change in the crude migration balance ratio in 2019 compared to the crude migration balance ratio in 2008
ECO	GDP	the ratio of the level of GDP per capita in 2019 to the level in 2008
	BPR	the ratio of the share of R&D expenditure (GERD) in 2019 to the level in 2008
	DIS	the ratio of the level of disposable income per capita in 2019 to the level in 2008
SOC	EDU	the ratio of the share of people with tertiary education (25 – 64 age group) in 2019 to the level in 2008
	INT	the ratio of the share of households with Internet accessibility in 2019 to the level in 2008
	MED	the ratio of hospital beds per 100,000 inhabitants in 2019 to the level in 2008

For both models, a soft modelling computer programme was used (*pol. MM – modelowanie miękkie 1.0*) developed by D. Karaś. By means of estimation, the following parameters of internal relations were determined and estimation errors were identified using Tukey's Jackknifing method:

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1) The first model (economic and social indicators versus natural causes):

$$NAT = 0.2552\ ECO + 0.6859\ SOC + 0.0180\ R2 = 0.8687 \quad (1)$$

(0.0638) (0.0645) (0.0056)

2) The second model (economic and social indicators versus migrations):

$$MIG = 0.3259\ ECO + 0.4399\ SOC - 0.0016\ R2 = 0.5714 \quad (2)$$

(0.0935) (0.1095) (0.0078)

Both the first and second model were positively verified from the substantive and statistical perspective. Therefore, the results may be interpreted in the manner presented below.

In the first soft model, according to the equation, natural causes of the change in population size in the regions covered by the study are more affected by social indicators (parameter 0.6859) than economic indicators (parameter 0.2552). Factor loadings (correlation coefficients between the unobservable variable and the indicators) and standard deviations (estimation errors) of the first model are presented in Table 8. According to the value of the factor loadings, the latent variable natural causes (NAT) is reflected by the birth ratio (0.9576) to the greatest extent. In other words, birth rate has the greatest impact on the change in population size in the studied regions. With regard to the economic indices (ECO), the indicators take a similar value (from 0.9396 to 0.9706), which implies that they have a comparable impact on the latent variable. As for the latent variable social indicators (SOC), it is likewise reflected by the share of people with higher education and Internet accessibility and, to a smaller extent, by the indicator referring to the provision of medical services.

Table 8. Estimation of the parameters of the first external model

Latent variable	Indicators	Weights	Factor loadings	Determination coefficient
		error	*error*	
NAT	BRT	0.6335	0.9576	0.9169
		0.0444	*0.007*	
	DTH	-0.4355	-0.7517	0.5651
		0.0297	*0.0262*	
	RTN	0.2169	0.3044	0.0926
		0.0381	*0.1208*	
ECO	GDP	0.3274	0.9396	0.8829
		0.0031	*0.0005*	
	BPR	0.3654	0.9706	0.942
		0.0025	*0.0003*	
	DIS	0.3512	0.9616	0.9246
		0.0021	0.0003	
SOC	EDU	0.3705	0.9521	0.9065
		0.0035	*0.0012*	
	INT	0.3848	0.9695	0.9399
		0.0025	*0.008*	
	MED	0.3233	0.848	0.7191

In the second soft model, the impact of social indicators (parameter 0.4399) is also stronger, although the importance of economic determinants (parameter 0.3259) is significantly larger with the latent variable migrations than with the latent variable natural causes of the change in population

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size. Factor loadings (correlation coefficients between the unobservable variable and the indicators) and standard deviations (estimation errors) are shown in Table 9. The factor loadings of the latent variable migrations (MIG) indicate that this variable is definitely better reflected by the relation between the level of permanent migration and outflow than by the change in the raw coefficient of migration balance in general. Similar to the first model, the latent variable of economic indicators (ECO) is equally reflected by all the indicators, whereas the latent variable of social indicators (SOC) is most intensively reflected by the share of people with higher education and Internet accessibility.

Table 9. Estimation of the parameters of the second external model

Latent variable	Indicators	Weights	Factor loadings	Determination coefficient
		error	*error*	
MIG	EMI	0.8453	0.9327	0.8699
		0.0672	*0.0055*	
	RTM	0.3711	0.5702	0.3251
		0.0419	*0.0705*	
ECO	GDP	0.3481	0.9433	0.8899
		0.004	*0.0007*	
	BPR	0.3743	0.9705	0.9419
		0.0015	*0.0002*	
	DIS	0.3219	0.9578	0.9175
		0.0042	0.006	
SOC	EDU	0.3427	0.9436	0.8905
		0.0046	*0.0014*	
	INT	0.3784	0.9641	0.9294
		0.003	*0.001*	
	MED	0.3613	0.8628	0.7445
		0.0065	0.0025	

To sum up, both models show that the two causes of change in population size (natural causes and migrations) are more affected by the group of social indicators, even though – with regard to migration – the significance of economic indicators is increasing and the difference between the values of the parameters is not large. Hence, two research questions have been answered: *which group of factors (economic or social) determines natural changes (births and deaths) to a greater extent?* and *which group of factors (economic or social) determines migration changes to a greater extent?* It should be emphasised that the authors did not try to identify the nature of the scrutinised processes, as the purpose of the model was to define the group of factors whose change determines demographic changes to a greater extent. What is more, the authors did not assume that specific indicators affect demographic variables directly, but that their impact is indirect through the creation of decision-making conditions for procreation and migration in accordance with the modernisation theory.

Conclusions

The change in population size of a region is the result of impact of natural causes and migration. With regard to both the first and the second demographic category, socio-economic factors play an important role in determining their levels. The concepts and theories presented in the article place the causes of demographic changes in, among other things, the alternative cost of parental time, household financial burden, autonomous attitudes towards weaker social ties (fertility determinants), or differentiation of economic potential, attractiveness of labour markets, and role models of other community representatives (migration determinants). However, with regard to both fertility and migration, no general theory that would fully expound a given category has been established yet. The scientific papers mentioned in the article explain selected aspects of the studied phenomena and processes, but they do not encompass all factors and conditions. Nevertheless, it can be said that they

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complement each other. In fact, we cannot speak of a general migration theory or a general fertility theory that would be conceivable within the framework of one social science.

Indeed, the study of the links between socio-economic development factors and demographic factors is interdisciplinary and requires the use of various research tools. Since defining the role of demographic determinants in the development process is methodologically easier, investigating the inverse relationship will always be incomplete. After all, it is impossible to create a complete catalogue of variables determining procreation attitudes or migration decisions. No model will fully embrace personal convictions, attitudes and worldviews that have a significant impact on fertility or decisions to weaken or strengthen family ties due to migration. Nevertheless, attempts to identify correlations between changes in socio-economic factors and demographic factors are important from the perspective of socio-economic life. Indeed, a public debate in the countries under investigation is focused on searching the causes of declining fertility or population outflow to a large extent. The solutions proposed thereto are primarily economic instruments, mainly financial in nature. First and foremost, it is due to the fact that they are easy to apply and positively perceived by society. On the other hand, shaping social factors in such a way as to stop population decline seems a more difficult task to accomplish and one that requires a long-term perspective. Nonetheless, paying more attention to social determinants is essential to stop depopulation processes.

The results of the indicator analysis and soft model for Central and Eastern Europe for the years 2008-2019 confirm the importance of social factors. In reference to the modernisation theory, their change determines a change in demographic indicators to a greater extent than with regard to economic indicators. In addition, it has been ascertained that natural causes account for the change in population size in the scrutinised regions to a larger extent, mostly a high dynamics of birth rate decline. As a result, in response to the low fertility rate and, in consequence, depopulation processes, more attention should be paid to the social dimension of social development. In other words, to increase fertility, creating proper conditions for personal and professional activity may be more important than using financial instruments. This thesis, however, requires further interdisciplinary research with the use of not only statistical analysis tools, but also sociological ones.

The contribution of the authors

Conceptualization, T.T. and Ł.B.; literature review, T.T. and Ł.B.; methodology, T.T. and Ł.B.; formal analysis, T.T. and Ł.B.; writing conclusions and discussion, T.T. and Ł.B.

The authors have read and agreed to the published version of the manuscript.

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CZYNNIKI ROZWOJU SPOŁECZNO-GOSPODARCZEGO A ZMIANA LICZBY LUDNOŚCI W EUROPIE ŚRODKOWO-WSCHODNIEJ W OKRESIE 2008–2019

STRESZCZENIE: W większości regionów Europy Środkowo-Wschodniej w ostatnich latach zauważalny jest spadek liczby ludności. Celem artykułu jest analiza wskaźników społeczno-ekonomicznych oraz zmian liczebności populacji w latach 2008-2019. W szczególności, w artykule podjęto próbę odpowiedzi na pytanie, w jaki sposób zmiana wybranych wskaźników ekonomicznych i społecznych wpływa na zmianę liczby ludności. Odpowiedź na powyższe pytanie zostanie udzielona z wykorzystaniem analizy wskaźnikowej i modelu miękkiego. Wyniki badań pokazują, że na dwie przyczyny zmiany liczebności populacji (przyczyny naturalne i migracje) większy wpływ ma grupa wskaźników społecznych, chociaż w przypadku migracji znaczenie wskaźników ekonomicznych rośnie, a różnica między nimi nie jest duża. W związku z tym w odpowiedzi na proces depopulacji należy zwrócić większą uwagę na społeczny wymiar rozwoju. Innymi słowy, stworzenie odpowiednich warunków do aktywności osobistej i zawodowej może być ważniejsze niż korzystanie z instrumentów finansowych.

SŁOWA KLUCZOWE: depopulacja, wskaźniki społeczno-ekonomiczne, wskaźniki demograficzne, dzietność, migracje

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