

Assessing The Relationship Between Regional Policy Indicators in Visegrad Four Countries

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Abstract: Regional policies are paramount for the development of any country. These policies are formulated over the years in lieu of demands from the region and time concurrently. Initially, policies are focused on bridging disparities but recently targeting entrepreneurship and quality of life development. However, these policies are faced with various problems. The study aims at identifying the interrelationship between selected regional policy indicators in EU Visegrad four group of countries. Secondary data from the OECD on regional disparity, entrepreneurship, innovation, and quality of life indicators pertinent to the selected regions were used for the analysis. Data used for the analysis were from the years 2008, 2012, and 2016 with a four-year lag period. Correlation analysis was undertaken using the DisplayR software in this research. The research found that there is a continuous mixed relationship between Regional Disparity, Entrepreneurship, Innovation, and Quality of Life indicators with the Innovation variables showing highest positive correlations in the countries. Furthermore, the higher the disparities, the lower and the quality of life and vice versa, hence the regional disparity indicator poses a significant effect on the quality of life.

Keywords: regional policy; Visegrad group countries; indicators; correlation analysis

JEL Classification: J18; R11; C26; N34

1. Introduction

The study aims to examine the relationship between regional policy indicators in V4 countries (Slovakia, Hungary, Poland, and the Czech Republic) following their inclusion in the EU in 2004. The EU dedicated a budget towards regional policies to reduce disparities and promote cohesion among new member states with a lower per capita GDP. The goal of these policies is to promote economic growth, reduce poverty and improve citizens' quality of life by increasing competitiveness and employment in regions.

The V4 countries, joined the EU in 2004 and now form a Central European political and economic forum. They have diverse strides in regional policy success and varying economic backgrounds. Regional policy is crucial for long-term economic success, with goals to promote GDP growth, reduce poverty, and improve residents' quality of life. This policy also aims to eliminate inequalities, increase competitiveness, and improve the quality of life of citizens in the new member states. The concept of regional policy indicators has been influenced by various theories and has been challenged by globalization and the rise of economic geography. The right regional policy is crucial for social progress, while wrong or imprecise policies can be

harmful (Jacobs & Šlaus, 2010). Several studies have explored regional policy indicators in European countries and the need for these indicators for economic and social development (see Ehrlich et al., 2012; Ferry & McMaster, 2013; Gal & Lux, 2014; Káposzta & Nagy, 2015; Faragó & Varró, 2016). However, little research has been done on the relationship between these policy indicators. The need for a competitive and dynamic regional policy indicator is essential for a country to achieve total economic and social growth (Iammarino et al., 2019).

The V4 countries were selected for spatial analysis due to their proximity and shared EU membership since 2004. They represent a Central European forum promoting shared interests in various areas of development. The study contributes to literature on regional policy by documenting a mixed relationship between regional policy indicators in all V4 countries. The Czech Republic and Poland have strong economies fueled by policy funding and labor market growth, but regional disparity still affects quality of life.

2. Literature Review and Proposition

The European Union regional policy started in 1975, aimed at solving economic, social, and political challenges in poorer regions. The policy was established after the European Economic Community in 1958. Researchers have focused on rising economies in Europe and their impact on labor migration and poverty (Pekovic, 2017; Mehedintu et al., 2019). Advancements in globalization and integration have led to increased labor migration in transition countries compared to older EU members. Poverty is prevalent in advanced transition economies that are transitioning from developing to developed economies (Butkus et al., 2020).

Regional policy is a crucial aspect of government policymaking in the European Union and is considered necessary in the V4 countries. These countries have different socio-economic and political issues compared to older EU members and vary in their success with regional policy and economic background. Despite these differences, the momentum for regional policy indicators only increased due to external factors, primarily the European Union, pressing the central administration to prioritize regional policy issues (Bache et al., 2020).

The link between regional disparities and people's quality of life is becoming a hot topic in politics and social development plans. Regional policy aims to reduce regional disparities and improve the quality of life for those who live in a certain area. It is one of the factors that goes under the general phrase "quality of life," measured using Poverty Gap, Income Inequality, Employee Compensation and Tax Revenue which is significant in assessing social growth. The Economist Units established the quality of Life indicator in 2005 to measure the standard of living and life satisfaction in specific countries.

This index relates subjective survey results to objective factors to compare quality of life across countries (Karmowska & Marciniak, 2014). The index includes indicators such as poverty gap, income inequality, employee compensation, and tax revenue. The relationship between regional disparity and entrepreneurship in the V4 countries shows a positive correlation between unemployment and population rate with entrepreneurial activity, specifically self-employment (Tudorache, 2019). Research confirms that R&D is necessary for regional attractiveness and can help bridge unemployment, highlighting the connection between regional disparity and innovation (Radulescu et al., 2018).

Also, The relationship between quality of life and regional disparity cannot be ignored as regional disparity is damaging quality of life and driving people to relocate, worsening the situation in peripheries. Therefore, both economic distribution and redistribution should be considered (Ubarevičienė et al., 2014; Navicke & Lazutka, 2018). Research shows that GDP has a significant impact on reducing poverty and improving quality of life (Butkus et al., 2020; Grdinić, 2017). Studies have also explored the relationship between quality of life and entrepreneurship and found that increased GDP leads to a decrease in poverty for better quality of life. Examples of such studies include (Vodá & Florea, 2019; Radulescu, 2018).

As income increases, some money is saved and invested. Families receiving transfers can participate in previously unavailable activities and use the payments as start-up capital for businesses. Research by Dajcman (2020) found confidence transmission from Germany to several V4 countries that led to entrepreneurship. The presence of both vertical and horizontal motives of entrepreneurship suggests a shift towards a more bottom-up approach over time (Stack et al., 2017; Veremchuk, 2020; Okoń-Horodyńska et al., 2018).

Some researchers have explored the impact of quality of life on innovation in the V4 countries (Popovici and Calin, 2015). A study by Cieślik found a positive effect of innovation participation and quality of life in the V4 economies (Cieślik, 2022). Indicators of innovation, such as computer use at home for work and learning, and internet access, have been categorized by organizations such as the OECD and World Bank as they improve productivity and information sharing. Estonia has a more advanced internet use compared to many Western countries due to its traditional banking system (Colombo & Martinez, 2020). Innovation can lead to increased knowledge and know-how, which can have a significant impact on product and process improvement and the ability to introduce improved products to the market (Odei et al., 2021).

The findings above align with the EU's policy agenda for growth and job creation, Europe 2020, which aimed for smart, sustainable, and inclusive development to improve competitiveness and productivity (Eskelinen, 2004). The strategy has made significant contributions to the EU's socio-economic development, but further progress is needed to stimulate R&D investment and fight poverty and social exclusion. Antti and Kaisa (2011) report limitations in the relationship between indicators like technology, productivity, and economic growth.

The study aims to explore the relationship between selected regional policy indicators in the V4 countries and determine if the relationship is positive or negative. The persistent challenges will be identified and the differences between the indicators in the V4 countries will be explored. The findings will contribute to a higher level of performance of the regional policy. Further research is needed to fully understand the interrelationship between the indicators.

2. Methodology and Data

The NUTS classification (Nomenclature of territorial units for statistics) of regions given a whole country representation as a region was adopted for this research (Eurostat, 2019). Hence, the number of units analyzed is V4 countries, i.e., the Czech Republic, Hungary, Poland and Slovakia. Data for the empirical analysis were taken from the OECD and World

Bank for the period between 2008, 2012, and 2016. The above periods were selected in light of the economic depression that happened between the years 2008 to 2010 (Verick & Islam, 2011; Chang et al., 2013; Plešivčák, 2020; Mura et al., 2020).

The study is described as a comparative study that will analyze data gathered from the OECD (Melecký & Skokan, 2011). The selected indicators come from EU structural indicators and the Europe 2020 strategy and reflect the level of economic, social, and territorial policies. The data will be analyzed for each of the individual V4 countries. correlation analysis is carried out to determine the relationship between variables. To estimate the significance of one variable on another, the Pearson correlation coefficient is mostly used, which is adapted in this paper (Sensuse et al., 2015). The Pearson correlation is mathematically represented by:

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

Where:

r = Correlation coefficient

n = the number of pairs of scores

$\sum xy$ = the sum of the products of paired scores

$\sum x$ = the sum of x scores

$\sum y$ = the sum of y scores

$\sum x^2$ = the sum of squared x scores

$\sum y^2$ = the sum of squared y scores

The results of the analysis in the figures below indicate how the indicators have a varied correlation with one another in the respective V4 countries. The results show the strength of

Table 1. Description of indicators and variables used – Part 1. Adapted from OECD Stat and World Bank Database.

Indicators	Variables used (Abbreviations)	Description	Source
Regional Disparity (D)	Unemployment Rate (Unemp)	The numbers of unemployed persons as % of the labor force.	Egeberg (2010); Almeida et al. (2020)
	Labor Force (Labor Market)	labor force is persons who fulfil the requirements for inclusion in working class	Melecký and Skokan (2011)
	Population Rate (Popu)	The annual total changes in population (%).	Melecký and Skokan (2011); OECD (2016)
	Gross Domestic Product (GDP)	GDP per capita in PPPs, US dollars	OECD (2016)
Quality of Life (Q)	Poverty Gap (Povty. Gap)	The difference between the poverty threshold and disposable income of the poor).	OECD (2016)
	Income Inequality (Income. Ineq)	Level of Household disposable income in a particular year.	OECD (2016)
	Employee Compensation (Emp. Comp)	Gross wages and salaries payable in cash or in kind, and the total contributions paid to employers.	OECD (2016)
	Tax Revenue (Tax Rev)	Revenues collected from taxes and other (% of GDP).	OECD (2016)

Table 1. Description of indicators and variables used – Part 2. Adapted from OECD Stat and World Bank Database.

Indicators	Variables used (Abbreviations)	Description	Source
Entrepreneurship (E)	Business Confidence (B. Confi)	Total amount of Information on future developments.	OECD (2016)
	Foreign Direct Investment (FDI)	The value of cross-border transactions related to investment during a given period (% of GDP).	OECD (2016)
	Self-Employee (Self. Employ)	People whose primary activity is self-employment and who employ others	OECD (2016)
	Inventors (Invent)	Share of total number of inventors of patent families (in %)	OECD (2016)
Innovation (I)	Information Technology Goods Export (ICT. Exp)	ICT goods export is based on the World Customs Organization Harmonized System (in million USD).	OECD (2016); Cieřlik (2022)
	Access to Computers at home (Access. Comp)	Proportion of households with computer access at home (%).	OECD (2016)
	Internet Access (Internet)	Proportion of households with Internet access at home (%).	Colombo and Martinez (2020)
	Research and Development (R&D)	Total expenditure (current and capital) on R&D carried out by all institutions (% of GDP).	Schot and Steinmueller (2018)

the relationship between sixteen observed variables which represent one of the indicators characterizing regional policy. Out of these, the linear correlation was analyzed in 120 pair of variables for each country.

3. Results

We initiate our discussion by providing the detailed analysis explained by our model. Interpretation of the correlation coefficient values is used according to the statistic 'DisplayR' software. From the point of view of the achieved results of the correlation coefficient r , the values of strong correlation in interval above 0.60 ± 1 and perfect correlation (± 1) are important.

The result for a model representation of Poland is shown in Figure 1.

As seen in Figure 1, the results show a strong positive correlation (as one variable increase so does the other and vice versa). An observation of (38) 33.3% pair of variables is seen in our first results, of which (4) 3.33% pair of variables reached perfect positive correlation ($r = +1$) in Poland. In figures, there are colored darkest and dark blue and white letters. Non-surprisingly, perfect positive correlation has the pair of variables household having a personal computer with internet access, and household with the personal computer with variable poverty gap. Other perfect positive correlation relationships indicate pairs of variables – the households with internet access and R&D expenditure, and variable of poverty gap with GDP. The latter relationship can be explained that the higher level of GDP means lower percentage by which the mean income of the poor falls below the poverty line. Other

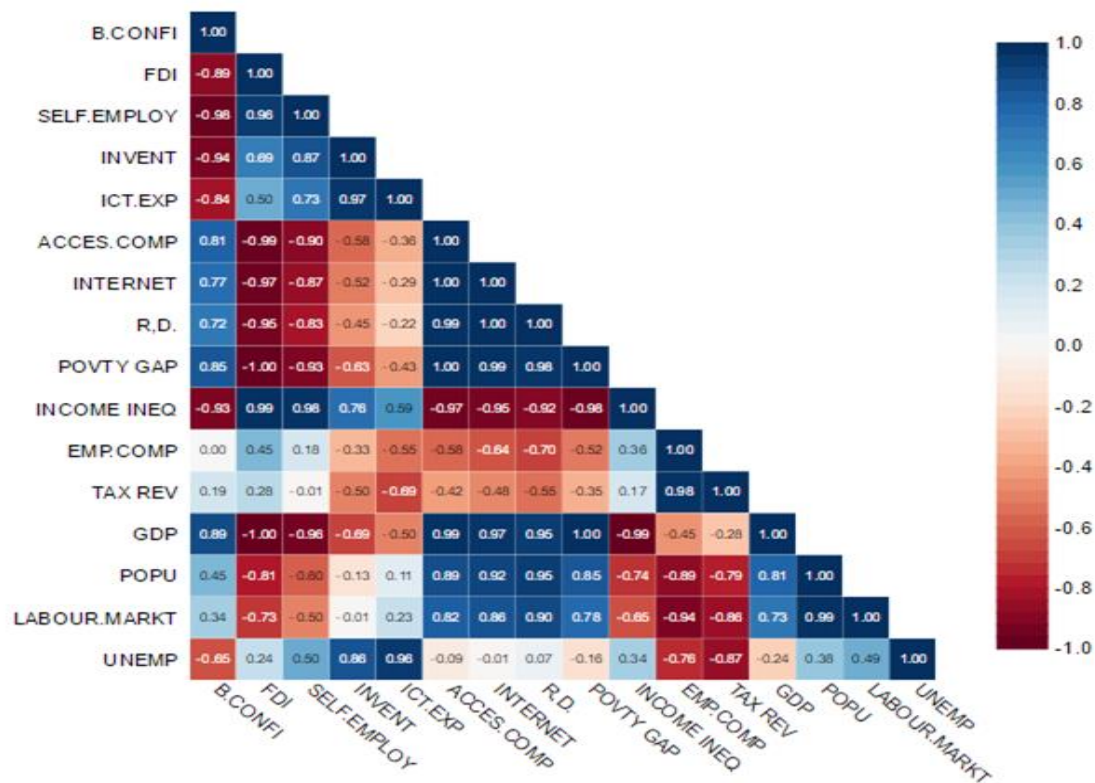


Figure 1. Correlation analysis for Poland (Legend: ± 0.29 low correlation, ± 0.30 and ± 0.49 moderate correlation, ± 0.60 and ± 1 strong correlation)

variables which relate to Innovation activities indicate a very strong positive correlation with other Innovation variables and Regional Development variables (labor market, population rate and GDP).

A strong negative correlation (as one variable increases, the value of the other decreases and vice versa) was observed in 30% pair of variables (36); the perfect negative correlation was reported in 1.67% (2) pairs of variables) – in Figure 1 with dark red color. This relationship exhibits pair of variables FDI with GDP, and FDI with poverty gap variable. The fact that FDI shows a negative correlation with GDP may mean that the Polish economy is relatively closed and does not support FDI by any financial or other incentives (FDI between observed period the FDI exhibit relative low level, they doubled in 2017 and following years). A strong negative correlation was observed as well between Business Confidence variables (FDI, number of self-employed and entrepreneurs) and some Innovation variables (households with computer access, internet connection and R&D). The other observations show that the variable poverty gap has a strong negative relation with Innovation variables and with GDP indicator. A strong negative correlation (-0.94 to -0.96) indicate income inequality with another Innovation indicator (R&D expenditure) and business confidence variable.

To determine the strength of the relationship between variables in Figure 2, we will closely observe the strongest relationship between sixteen variables in the Czech Republic, then as it was in Poland. A strong positive correlation was recorded between 38.34% (46) pair of variables, of which 6.67% (8) indicate a perfect positive correlation. Some of the Entrepreneurship

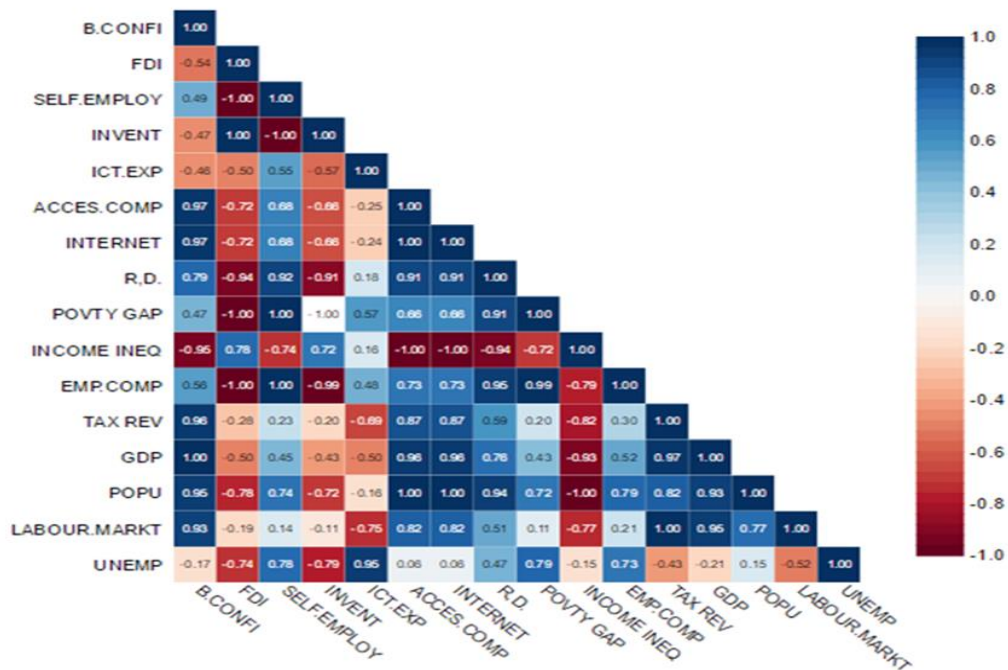


Figure 2. Correlation analysis for the Czech Republic (Legend: ± 0.29 low correlation, ± 0.30 and ± 0.49 moderate correlation, ± 0.60 and ± 1 strong correlation)

indicators illustrate perfect positive correlation (business confidence with GDP, FDI with inventors, a self-employed person with employee compensation and with poverty gap). As expected, a very strong positive relationship $+0.98$ indicate business confidence variable with tax revenues and with indicators of Innovation variable (household having a personal computer, internet access both $+0.97$).

Above mentioned Innovation indicators (household having a personal computer, internet access) are perfectly correlated with population rate and very strongly correlated ($+0.98$) with GDP. And as in the case of Poland, the variables household having a personal computer and internet access are perfectly positively correlated with each other. Quality of Life indicators are strongly correlated with Regional Disparity indicators. The tax revenue variable indicates a perfect correlation with the number of a labor force variable ($+1.00$) and GDP ($+0.97$); GDP is strongly correlated with the number of a labor force as well ($+0.96$).

On the other hand, only 22.5% (27) set of observations indicate strong negative correlations and from these observations, 5.84% (7) are perfectly negatively correlated. The variable FDI shows this relationship with two variables representing Quality of Life indicator (employee compensation, poverty gap) and self-employment variable which belongs to the same group of Entrepreneurship indicators. Another variable from the Entrepreneurship group is negatively correlated with each other - self-employment with inventor's variable. Regarding Innovation variables household having a personal computer and internet access represents a perfect negative correlation with the income inequality variable. The last observed perfect negative relationship shows the latter mention variable with the population rate variable. The group of two Entrepreneurship indicators (business confidence and inventors) show an almost perfect correlation (-0.96 to -0.99) with the income inequality and employee compensation variables.

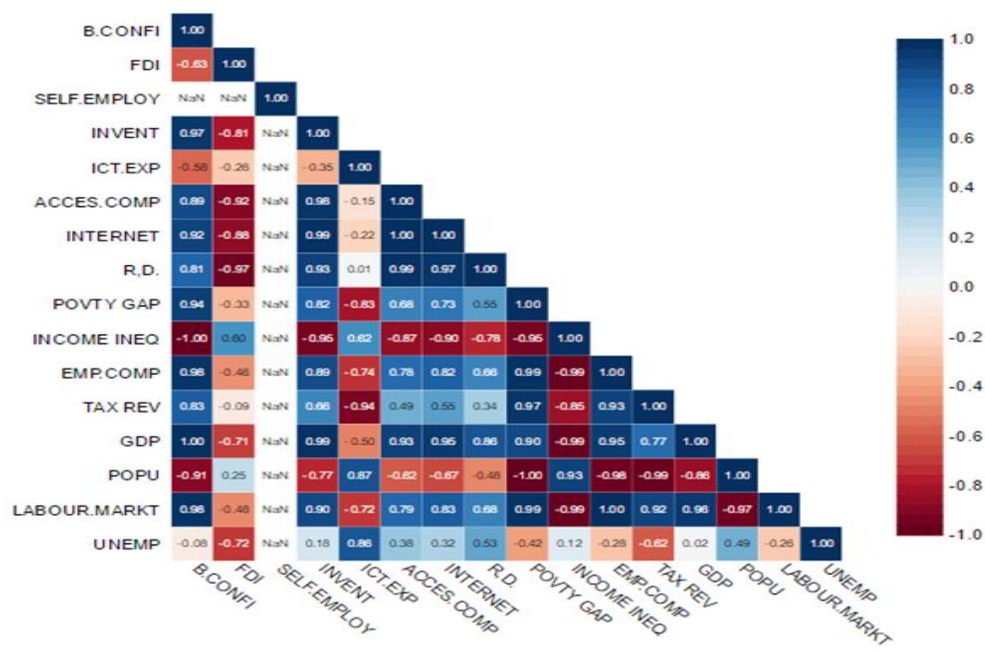


Figure 3. Correlation analysis for Slovakia (Legend: ± 0.29 low correlation, ± 0.30 and ± 0.49 moderate correlation, ± 0.60 and ± 1 strong correlation)

In the case of Slovakia (Figure 3), we observe a positive strong correlation relationship between 37.5% (45) pairs of variables, and which of that 2.5% with perfect positive correlation are. This represents variables from the Innovation category - a household with a personal computer and internet access. Another Innovation variable – business confidence is perfectly correlated with GDP. A very strong correlation was observed additionally with the variable of labor force and employee compensation (+1) and with a poverty gap (+0.99). It can be explained with relative high rates of unemployment in Slovakia which should lead to the high number of people in poverty which require additional social benefits and allowances. An almost perfect correlation exhibits inventor’s variable as well with GDP, with internet access (+0.99) and with a household with a personal computer (+0.98).

Strong negative correlation represents in Slovakia a 25.84% (31) set of variables, which of them 1.7% (2) perfect negative correlation was observed. It represents the relationship between business confidence and income inequality variable (-1) and poverty gap and population rate variable (-1). Another significant negative correlation is seen in the relationship of income inequality variable and number of labor force, GDP and employment compensation (-0.99) and tax revenues and rate of the population (-0.99). This result supports our presumption of labor market characteristics in Slovakia, relative high rate of unemployment, the relatively low level of wages and salaries should mean that even though people work, their wages are not enough to cover the cost of living and that quality of Life indicator are considered unsatisfactory.

In Hungary, 36.66% of the variables showed a strong positive relationship, with 5.8% having a perfect positive correlation, such as household with a personal computer and internet access with FDI and GDP. There was a perfect positive correlation between labor force indicator and poverty gap variable. However, 32.16% of the variables showed negative significance and 5.8% had a perfect negative relationship between innovation indicator

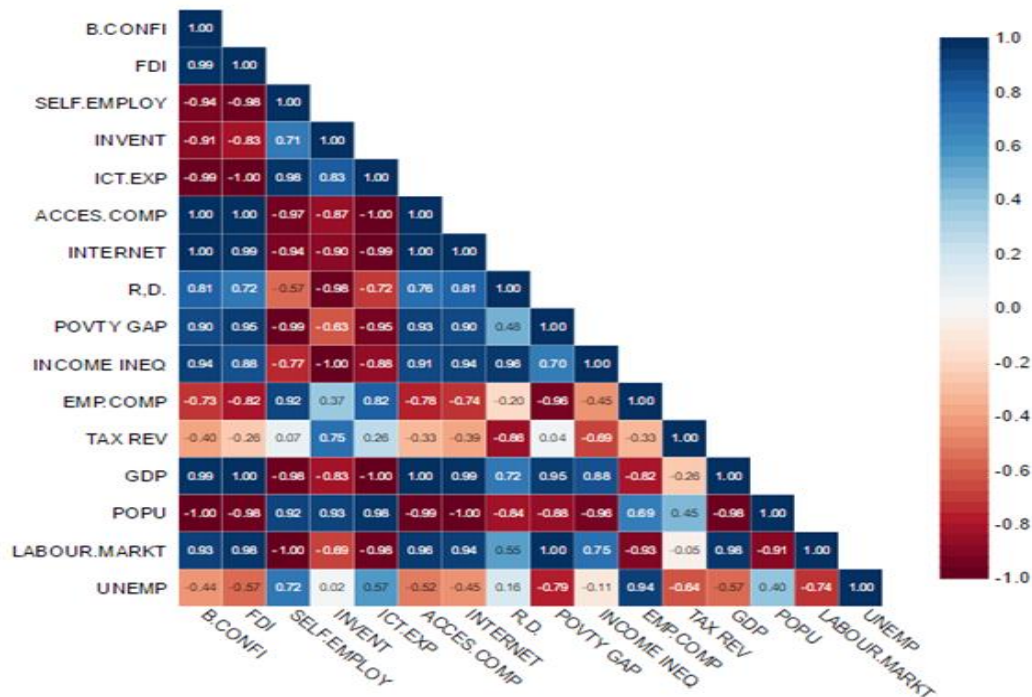


Figure 4. Correlation analysis for Hungary (Legend: ± 0.29 low correlation, ± 0.30 and ± 0.49 moderate correlation, ± 0.60 and ± 1 strong correlation)

variables and labor force variable. The population rate had a strong negative correlation with business confidence, FDI, household with a personal computer, income inequality and GDP.

4. Discussion

In each country where both significant negative and positive results are seen, it is denoted as a mixed relationship in the country. Except for Hungary, the positive relationships between variables exceeds the negative relationship in the observed countries. The number of perfect positive or negative correlations is the same in Hungary and in the Czech Republic. The results of the Czech Republic and Poland can be seen as very similar in significance of positive correlations in respect to the Innovation indicator variables with Regional Disparity indicator variables (GDP, population rate and labor force). In Slovakia and Hungary both strong positive and negative relationship of these indicators can be seen.

The relationship between Entrepreneurship and Regional Disparity in the Czech Republic and Poland is mostly negative, while in Hungary and Slovakia it is both strong positive and negative. The research supports the findings of Dvouletý (2017) who found a negative relationship between Entrepreneurship and Regional Disparity in the European Union. The key problems of regional policies in selected EU countries have negative effects on their implementation, as established by the empirical literature. The relationship between Entrepreneurship and Quality of Life in Poland, Hungary, and the Czech Republic is mixed with both positive and negative significance. This supports the research of Vodá and Florea (2019) which shows the interdependence between Entrepreneurship and Quality of Life in terms of achieving the Keynesian theory's focus on entrepreneurship development as a means of reducing disparity.

The relationship between Entrepreneurship and Innovation in Poland is negative, while in Hungary, Slovakia, and the Czech Republic it's a mixed relationship with the strongest correlation in Hungary. This supports the idea that Entrepreneurship and Innovation are complementary and vital for organizational success. The results partly affirm the findings of Zhao (2005) and Dajcman (2020) that a combination of the two is essential for organizational success and sustainability in a dynamic environment. The results of Entrepreneurship and Innovation indicator in Poland are low, implying a low likelihood of innovation boosting entrepreneurship. Entrepreneurship and innovation are necessary components in the world of economics and management and are reflected in many businesses school programs and some economic policies and models. The need for entrepreneurship and innovation to converge is recognized in economic and social terms (Mustar, 2009; Smith & Woodworth, 2012).

Innovation and Regional Disparity shows positive correlation in Poland and the Czech Republic. This supports the idea of the importance of regional development of the "creative class" for innovation and growth (Brincikova & Darmo, 2014; Ozgen et al., 2012). Globalization demands a growing community of mobile entrepreneurial knowledge workers to spur growth in regions with a suitable environment and innovation framework (Audretsch et al., 2006; Butkus et al., 2020). The results of Innovation and Regional Disparity indicate significant representation in Poland, the highest among all countries selected. Capello (2007) supports interregional theory that output growth is determined by productivity and technology growth, but it is criticized for spillover from investment and R&D and provision of public services. Cieřlik (2022) criticizes the theory for not considering spillover effects. The results support the idea of higher growth levels in regions with suitable manufacturing environment and open innovation framework.

Quality of Life and Regional Disparity have a mixed relationship, except in Poland where there is a strong negative correlation. Innovation also shows a strong negative correlation with Quality of Life in Poland. The relationships between the variables in different countries need further analysis. There is a mixture of positive and negative correlations between all four indicators, indicating that regional disparity affects quality of life. Improving access to goods and services and increasing collaboration can reduce regional disparities and improve quality of life.

5. Conclusions

In this paper, we aimed to explore the relationship between key regional policy indicators, namely, Entrepreneurship, Innovation, Quality of Life, and Regional Disparity indicators in the V4 countries. The study found a mix of positive and negative relationships regarding regional policy indicators in the V4 countries. Poland and the Czech Republic were found to be among the fastest growing economies in the V4 countries due to increases in policy funding, a strong labor market, and good employee compensation. The findings of the study are complimented by previous studies (Alacevich, 2021). Regional policies are influenced by structured policies to manage economic, social and political activities with limited resources. The primary goal of regional policies is debated as whether it achieves performance or equity, with efficiency aiming to optimize regional contribution to national

development and equity aiming to reduce socio-economic disparities between regions. The meaning of these terms varies widely.

Many countries aim to balance regional productivity and equity through their regional policies (Bachler et al., 2014). Despite this, our analysis shows that regional policies in V4 countries face challenges and are not effectively implemented. The results indicate that a higher regional disparity leads to lower quality of life and vice versa, so regional disparity has a significant impact on quality of life. The practical implications of our empirical results are far-reaching. Entrepreneurship can create jobs and stimulate economic growth, while also providing individuals with the opportunity to pursue their passions. Quality of life can be improved through the development of innovative policies, products and services by government and policy makers, Innovation can lead to new products and services that can improve the lives of people in the regions researched and provide a competitive advantage.

The limitation of our study as it aimed at identifying the interrelationship between the indicators, it relied solely on correlation analysis. Future research should possibly focus on regression analysis to ascertain the effect of one variable on another.

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