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Informal work in Poland – a regional approach

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Abstract. In our paper we try to combine the theories explaining the prevalence of informal work, using a regional approach. Reviewing the literature, we observe that, there is no evidence to confirm that the relationships that occur in cross-country comparisons remain significant when we use regional data and analyse cross-regional variations. Our general question is therefore whether there is simply more informal work in less-developed regions, as the modernization theory asserts. Our analysis concludes that there is limited correlation between the prevalence of informal work and a region's level of development, whereas there is a significant positive autocorrelation between the extent of informal work in the analysed voivodships in Poland.

JEL classification: J21, J44, R12, R23

Key words: Informal work, informal economy, informal employment, modernization theory, cross-regional analysis

1 Introduction

Searching for the reasons for informal employment has become a dominant activity in recent decades. Questions about the nature and characteristics of informal employment are crucial if policies are to be implemented to deal with this phenomenon. In the literature there are several theories that attempt to explain the reasons for informal employment. In our paper we use the modernization approach which asserts that the prevalence of informal employment is connected to economic development and the modernization of governance. Although there is existing literature containing international comparisons of the prevalence of informal employment, there is no study at the regional level. Seeing space as one of the explanatory factors encourages us to combine the regional economy approach with the existing informal employment theories. No evaluations have investigated whether the relations that can be found from cross-country comparisons remain significant when we use regional data and analyse the cross-regional variations. Our general question is whether there is simply more informal employment in less-developed regions, as the modernization theory asserts. Below, therefore, we report the first known study that tests the modernization theory using regional data (NUTS 2 level; 16 Polish voivodships). Because of the scarcity of data on informal employment we

employ individual data from the Polish Labour Force Survey for the year 2014. Further, we assume that people who are registered as unemployed and at the same time undertake any type of work can be considered to belong to the specific group of informal workers. Hereafter, the term 'informal employment' is used to describe this narrow class of informal workers. Testing the modernization theory, we use the following measures that are proposed in the literature: GDP *per capita*, a government quality index, and the Human Development Index.

This paper combines two aspects that until now have been developed in some isolation. Thus our paper has two major parts. First, we aim to present the regional differences in the prevalence of informal employment in Poland. Furthermore, we analyse the concentration of informal workers, using a concentration index, and investigate the spatial autocorrelations at a global and local scale. Indeed, we test the first hypothesis which claims a positive spatial autocorrelation of the prevalence of informal employment between regions in Poland. Second, we examine the modernization theory using the regional data. The second hypothesis says therefore that the phenomenon of informal employment is more prevalent in less-developed regions.

Our results indicate wide variations in spatial concentration. We observe that the proportion of informally employed people to employed people is the highest in the south-east voivodships and in Mazovia. On the other hand, the lowest share is observed in the south-west of Poland and in Wielkopolska. Our analysis reveals that the spatial positive correlations among the proportion of informal workers are statistically significant. This means that the analysed phenomenon tends to show spatial clustering. Moreover, the examination of the modernization theory using the cross-regional approach indicates limited empirical evidence for the assumption that informal employment is more likely to be present in less-developed regions. However, taking into account the large diversification of regional development of Polish voivodships as well as limitations resulting from scarcity of data, we state a lack of strong evidence to reject the modernization hypothesis.

The remainder of this paper is organized into five sections. In the next section, we briefly review the literature on both regional economics and the modernization theory. The second section then introduces the data and methodology used in our empirical investigations. Section three includes empirical analysis on the spatial shaping of informal employment in Poland, and an examination of the modernization theory. The final section then draws conclusions on the theoretical and policy implications of the findings.

2 Literature review

Since we combine two theoretical strains, the review of the existing literature also consists of two parts. First, we aim to discuss the importance of the spatial mode of thinking, and then we present the current state of research on informal employment with a focus on the theories explaining this phenomenon.

2.1 Economic geography and regional studies

The end of previous century brought a new perspective on geography in economic science. Both neoclassical and Marxist-influenced approaches, which tended to be capital-centric in nature (Herod 2001), began to be criticized (Holmes and Rusonik 1991; Herod 1995). Today labour plays an active role in shaping the geography of the economy. It is underlined that space is an important determinant for labour market outcomes (Hanson and May 1992; Fernandez and Su 2004; Mackinnon and Cumbers 2007; Kelly 2011). As Herod (2001, p. 33) argues: 'just as capital does not exist in an aspatial word, neither does job'. Generally, the main assumption refers to the geographic mobility of capital, which has increased over

recent decades. This is strongly related to the lowering of barriers to international trade and the enabling of the free transfer of materials, technologies, people and capital (Coe et al. 2013). However, it should be noted that workers are less mobile than corporations, because of labour reproduction (social reproduction created by institutions like the family, religious congregations, schools and clubs), place attachments (emotional ties to particular places), households (the people with whom the worker lives), regulations (limited geographical mobility because of existing regulations), local cultures of work, and credential recognition (Kelly 2011; Coe et al. 2013).

In this section we will focus on the geography of labour, which in the literature is also called 'labour geography' (Herod 2001, p. 33). In the literature it is underlined that the labour markets are affected by geographically-specific social institutions (Coe et al. 2013). Since the labour market is not a simple negotiation between buyers and sellers in order to set a price, working conditions originate from cultural, social and political institutions. Therefore, the labour market shows geographical variability, which creates very different relationships between employees and employers. This results in a high degree of geographic variability among local labour markets (Coe et al. 2013). Moreover, the study of labour over recent decades has become a broad multidisciplinary subject called 'regional science'. Regional science combines regional economic, social and economic geography, urban economics, transportation science, environmental science, political science and planning theory (Fischer and Nijkamp 2014). Economic studies on the spatial distribution of employment discuss a rich array of aspects. Simpson combines labour economics with urban economics to study labour markets from 'a unique urban perspective' (Simpson 1992, p. 2). A large part of research is devoted to the spatial concentration of labour market incomes. In the literature, there is a significant empirical evidence of spatial concentration of employment (Macauley 1985; Chatterjee and Carlino 2001; Ciccone 2002; Desmet and Fafchamps 2005) and explaining regional differences in the level of employment (Dunford 1996; Bollinger and Ihlanfeldt 2003; Martin and Tyler 2010; Dall Schmidt et al. 2014; Koster and van Stel 2014; Dixon and Lim 2016; Doran et al. 2016; Firgo and Mayerhofer 2018). Another part of empirical research is focused on regional differences in the unemployment level, see e.g. (Martin 1997; Taylor and Bradley 1997; Baddeley et al. 1998; Brueckner and Zenou 2003; Bornhorst and Commander 2004; Novotný and Nosek 2012; Patuelli et al. 2012; Huber 2013; López-Bazo and Motellón 2013; Zierahn 2013; Yang 2014; Zeilstra and Elhorst 2014; Granato et al. 2015; Beyer and Stemmer 2016; Rios 2016). As Fischer and Nijkamp (2014, p. xxviii) argue, 'spatial interdependencies have always been at the heart of regional science research'.

However, the majority of research on regional diversity is focused on the US economy and Western European countries, we also find some studies devoted to the Polish economy. Regional studies in Central and East countries including Poland are mostly concentrated on regional unemployment disparities. Understanding and significance of regional differences in the level and dynamics of unemployment is the basis for extensive research work, among others (e.g., Walsh 2003; Newell 2006; Newell and Pastore 2006; Buettner 2007; Marksoo et al. 2010; Tyrowicz and Wójcik 2010; Ingham et al. 2011; Marelli et al. 2012; Ciżkowicz et al. 2016).

Considering the above we attempt to use labour geography and the regional study approach to explain the prevalence of informal employment in Poland. We propose the following hypothesis about a positive spatial autocorrelation of the prevalence of informal employment between voivodships in Poland. To test this hypothesis, we calculate the inter-regional variations in the prevalence of informal employment.

2.2 Informal employment theory

There are several competing theories that attempt to explain the prevalence of informal employment. The literature suggests at least four approaches to analysing the phenomenon of

informal employment (Williams 2013; Williams and Horodnic 2016). The modernization approach suggests that informal employment is prevalent where there is a lack of economic development and modern governance. According to the neo-liberal theory, on the other hand, informal employment results from excessive taxes and too much interference in the free market. The institutional asymmetry explanation is partly similar, in that it proposes that participation in the informal economy is higher if the asymmetry between the codified laws and regulations of the formal institutions (state morality) and the unwritten rules of the informal institutions (civic morality) is greater (Williams and Horodnic 2015a, 2015b, 2016; Williams et al. 2015). In contrast, the political economy theory assumes that informal employment is the result of too little state intervention and inadequate welfare arrangements. In general, the common aim of these theories is to propose reasons for cross-country variations in different types of informal activities. Despite there being a rich body of empirical studies on cross-national comparisons of the prevalence of informal employment, so far no clear answers have been given.

It is important to note that the primary question regarding informal employment is why workers take a job in the informal sector (Amuedo-Dorantes 2004). The answer seems to be twofold. The first hypothesis considers employment in the informal sector as supply-led and voluntary, arguing that people choose to work in the informal sector as a result of the higher marginal product. This approach is in line with the neo-liberal theory, which assumes that the growth of informal employment stems from people's voluntary decisions, not from involuntary exclusion (Gërxhani 2004; Maloney 2004; Snyder 2004). In this respect, informal workers prefer working in the informal sector to working in the formal sector (Amuedo-Dorantes 2004). People may choose informal work because of the higher marginal revenues (Günther and Launov 2006, 2012), a desire for independence or a greater endowment of entrepreneurial talent (Packard 2007). Moreover, in the case of self-employment the literature provides strong empirical support for the theory of rational choice of self-employment (Blanchflower and Oswald 1991, 1998; Taylor 1996; Uusitalo 2001). The alternative hypothesis views informal jobs as second-choice jobs with poorer working conditions. This approach is followed by structuralists who argue that informal employment is related to low-paid, insecure, unregulated jobs performed by those who are marginalized in the formal labour market (Ahmad 2008; Davis 2007; Gallin 2001). Fields describes the informal sector as the 'murky sector', with an easy entry and an absence of employer–employee relationships. Simultaneously, he suggests that jobs of this kind are typical of the urban areas of less-developed countries (Fields 1975). Thus according to the labour market segmentation theory (Doeringer and Piore 1971; Piore 1972; Taubman and Wachter 1986), the informal sector could be described as a secondary labour market for workers who have no chance of finding a job in the formal market because of personal characteristics, institutional barriers or labour market discrimination. Thus, work in the informal sector should be considered as demand-led and involuntary (Amuedo-Dorantes 2004).

Having in mind the above two perspectives, we can conclude that the assumptions of the modernization approach are in line with the second hypothesis of informality, which understands informal jobs as those with poorer working conditions and the last resort for the unemployed. The modernization approach thus assumes that the cross-country variations in the size of the informal economy result from a lack of economic development and of modern governance (Williams 2013). This is why informal employment is more common in less modern and developed economies and, at the same time, why the advance of modernization will result in the limitation of the phenomenon. This theoretical perspective stems from the statement that formal employment can be seen as a sign of progress and development (Gilbert 1994).

A review of the contemporary literature shows that researchers today continue to explain informal employment using the modernization approach. According to Fields' hypothesis,

poverty may act as one of the determinants of working in the shadows (Fields 1975). Loayza and Rigolini (2006) showed that, in the long run, countries with a lower GDP *per capita* have more informal employment. Gilbert (1994) argued that the informal sector tends to be largest in poorer and less-developed regions since poor families are forced to find some kind of work, even less paid work in the informal sector. Amuedo-Dorantes (2004), conducting research on the informal sector in Chile in 2000, found that household poverty increases the likelihood of work in the informal sector by approximately 3 per cent among male heads of household and by 6 per cent among female heads of household. Previous empirical studies have, predominantly, confirmed the hypothesis that informality is greater in poorer and less modernized economies. As the measures of development of a given country, GDP *per capita*, household final expenditure *per capita*, the Human Development Index (HDI), the Social Progress Index (SPI) or the Purchasing Power Standard (PPS) are generally employed, while modernization is described by the quality of government using the methodology proposed by Charron et al. (2014). Moreover, researchers used various measures of informality, such as informal employment figures derived from the Eurobarometer survey (Williams 2013, 2015b; Williams and Windebank 2015) or the International Labour Organization database (Williams 2015a), the participation of small businesses in the informal economy (Williams and Horodnic 2016) or envelope wages (Eurofound 2013; Vanderseypen et al. 2013; Williams and Horodnic 2015a, 2015b). It is important to note that there is also a widespread recognition that informal employment is also prevalent and even growing in well-developed countries (Kucera and Xenogiani 2009; Feld and Schneider 2010; Schneider and Buehn 2012).

Since in this paper we analyse the variations in informal employment at the regional level, we test the modernization theory, in particular the hypothesis that the phenomenon of informal employment is more prevalent in less-developed regions.

3 Data and methodology

The greatest challenge we face relates to the availability of data; research on informal employment always has to contend with a scarcity of data. We employ individual data from the Polish Labour Force Survey (LFS) for the year 2014.[1] According to the LFS methodology (Central Statistical Office 2016), due to the representative character of the survey and the sample size, the lowest level of administrative division at which the LFS data are available is voivodship (NUTS 2 level). Therefore, we are not able to conduct an analysis on the more disaggregated level.

Because there is this significant heterogeneity among informal workers, we explore a specific group of them: those who are formally unemployed and at the same time perform informal work. A similar approach was used by Tyrowicz and Cichocki (2011). The research sample consists of 364,042 persons, among whom 1,306 were informally employed. All data related to the measurement of the Local Human Development Index and GDP *per capita* come from Eurostat and the Local Data Bank (bdl.stat.gov.pl). We also use the European Quality of Government Index, which comes from the EU Commission's 7th Annual Framework Project of 2013 and is available on the Quality of Government Institute website (http://qog.pol.gu.se/data/datadownloads/qogeuregionaldata).

In the first part of our empirical research we carry out spatial analysis of informal employment in Poland. The aim of this part is to find out whether any particular voivodship

[1] The micro data from the LFS are available from the authors on request. We obtained this data under research proposal no. 168/2015-LFS.

stands out in terms of the number of those informally employed. First we analyse the spatial distribution of the informally employed and the structure of this distribution in comparison with the structure of the spatial distribution for the employed. We use the concentration index and location quotients (LQs) that represent the ratio of the number of informally employed in the voivodship to the total number of informally employed in Poland divided by the similar ratio for the number of employed people. Since some researchers postulate that there is a relationship between the phenomenon of undeclared work and the level of regional development, location quotients are also used to compare the spatial structure for those who are informally employed and GDP, as well as the spatial structure for the unemployed. Location quotients are connected to the labour market because of the traditional construction of this measure. More general applications however can be also found in other studies, for example, to show regional variations in the level and type of entrepreneurship (Hackler and Mayer 2008) or labour migrants (Harris et al. 2015). The study includes limit values for the location quotients in the range of 0.8–1.2 (the LQ cut-off value most often used is 1.0 (Antonowicz 2014), although in the literature other possibilities are also used (Morrissey 2014). Achieving a level in this range means that in the given voivodship there is a similar intensity of undeclared work and other macroeconomic outcomes. Exceeding the value of 1.2 means that in the voivodship the intensity of undeclared work is 20 per cent higher than the intensity of other analysed economic outcomes, for example, GDP *per capita*. We then apply Moran's *I* statistics for testing global and local spatial autocorrelation. To conduct the autocorrelation analysis we follow a commonly used approach about weight functions related to geographic distance (Dormann et al. 2007). Hence we apply a queen contiguity of order 1 weighting scheme as well as k-nearest neighbours. The aim of this analysis is to identify any spatial relations among the numbers of informally employed, and to find out whether there is clustering or dispersion.

In the second part of our empirical analysis we examine the modernization theory using data from the Polish voivodships. We use Spearman's rank correlation coefficient (rs) to examine the correlation between the proportion of informal employees and the development and modernization of given regions. As the measure of development indicators we use the indicators proposed in the literature: GDP *per capita*, the Local Human Development Index and the European Quality of Government Index (QoG). Because of the simplicity of the first indicator, the GDP *per capita*, in the next step we use the Local Human Development Index, which is an expanded indicator. The Human Development Index (HDI), a composite indicator of life expectancy, education and income, is a widely used measure of regional development. We follow the methodology described by Hardeman and Dijkstra (2014) to create the Local Human Development Index (LHDI) for the year 2014. The description of the data used is in Table A1 in Appendix. These two indicators, the GDP *per capita* and the Local Human Development Index, are used to examine the correlation between the development of a region and the prevalence of informal employment. In order to measure the modernization of the regions of our analysis we use the European Quality of Government Index (QoG);[2] a detailed description of this can be found in the paper by Charron et al. (2014).

4 Empirical analysis and findings

This section is divided into two parts. In the first part we conduct a spatial analysis of informal employment in Poland. We describe the spatial distribution of the number of informally

[2] In general the QoG consists of four dimensions: corruption, rule of law, bureaucratic effectiveness, government voice and accountability or strength of democratic and electoral institutions (Charron et al. 2010).

employed people in general terms. In order to correct the dependency of the data on the size of the voivodship we use the ratio of the number of informally employed people to the total number of employees. We also analyse the spatial structure of the informally employed in relation to the spatial structures of GDP and the unemployed, as well as spatial autocorrelation at a global and local scale. We then examine the modernization theory through an analysis of the correlation between the prevalence of informal employment and the measures of the regions' development and modernization.

To enable a better understanding of disparities across Polish voivodships we provide some socio-economic characteristics of analysed voivodships. Firstly, we describe the structure of employment, with the focus on the share of section A (agriculture, forestry and fishing), sections B + C + D + E which indicates industry and sections J + K + M (information and communication, financial and insurance activities, professional scientific and technical activities) in the total employment. Figure 1 presents the shares of employment in given sections in the total employment by voivodships. Importantly, the Polish voivodships are diversified with regard to the types of employment. Share of employment in sections J + K + M which covers mainly high skilled workers is highest in Mazovia (17.22%), where the capital of Poland is located and skilled labour is attracted. On the other hand in voivodships as Swietokrzyskie, Podlasie, Podkarpacie, Lubuskie, Opole and Warmia-Masuria the share of employment in the J + K + M sections is below 5 per cent. Those regions are perceived as less developed and more focused on the agriculture sector. The general trend shows that in voivodships with the lower share of employment in the 'high advanced sectors' the role of agriculture is greater. Whereas, the employment in industry is rather evenly distributed across the country, except Silesia, where the mining industry is located and therefore the share of employment in industry is the highest (38.23%) and Mazovia where the share of employment in industry is 17.5 per cent.

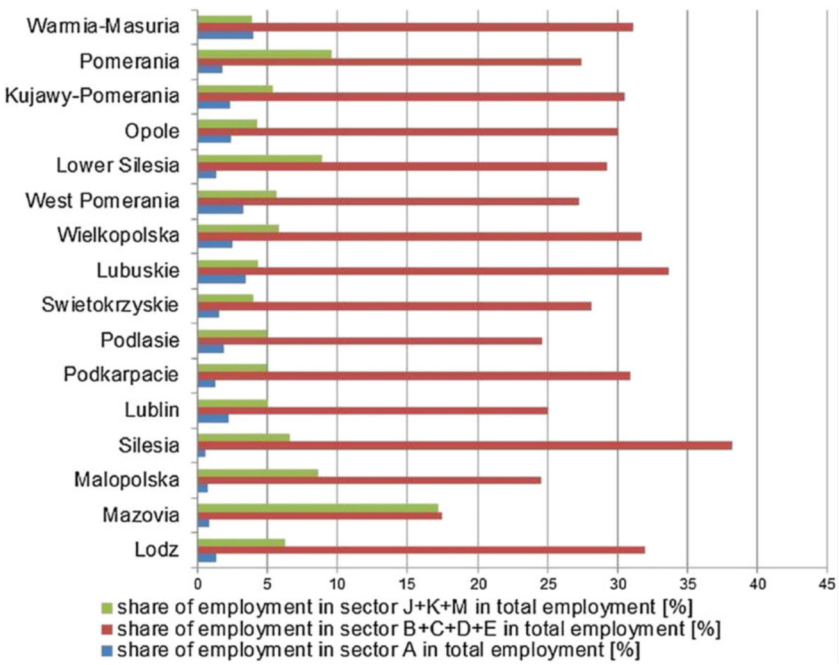

Fig. 1. The shares of employment in selected sectors in total employment by Polish voivodships in 2014
Source: Own elaboration based on data from Local Data Bank bdl.stat.gov.pl/, retrieved on 30 January 2017.

Another important characteristic which may be helpful in explaining regional disparities in informality level in Poland is the share of urban population as percentage of total population and the at-risk of poverty rate. In the Figure 2 we present these two indicators to show the socio-economic diversity of Poland.

The voivodships as Malopolska, Lublin, Podkarpacie and Swietokrzyskie are more rural than urban, what results from a lower number of large cities in these regions. On the other hand Silesia shows the highest share of urban population (77.26%) due to the high concentration of cities. Interestingly, the share of urban population is negatively correlated with the at-risk of poverty rate. In general, in voivodships where the share of urban population is higher, the at-risk of poverty rate is lower. Moreover, the regional variations in the at-risk of poverty rates are large, from 5.2 per cent in Mazovia to 12.2 per cent in Swietokrzyskie. The description of both the structure of employment, the share of urban population and at-risk of poverty rate may be important by explaining and understanding the regional disparities in the share of informal workers.

4.1 Spatial analysis of informal employment

To describe the phenomenon of informal employment in Poland in general terms, we apply measures of spatial concentration. To begin with, we discover that informal employment is characterized by a large variability in space and is concentrated in the south-east of Poland. We realize that this may be due to certain characteristics of the region, such as its size or population. Keeping this in mind, we compare the spatial structure of informal workers with the spatial structure of total employment, according to the following formula:

$$LQ_i = \frac{IW_i/WT_i}{IW/WT} = \frac{SIW}{SWT}, \tag{1}$$

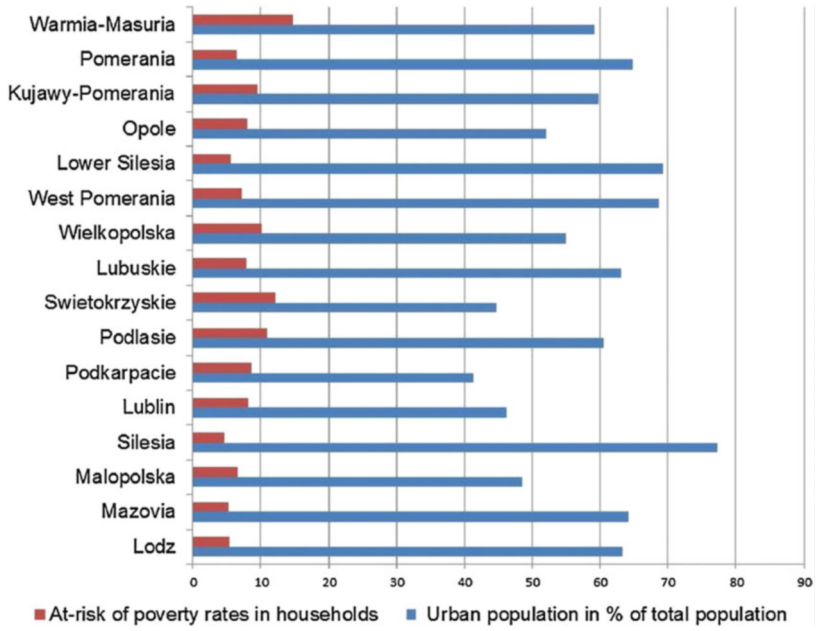

Fig. 2. Urban population as percentage of total population and at-risk of poverty rates by Polish voivodships in 2014
Source: Own elaboration based on data from Local Data Bank bdl.stat.gov.pl/, retrieved on 30 January 2017.

where: IW_i – number of informal workers in region I; IW – number of informal workers in Poland; WT_i – number of employed persons in region I; WT – number of employed persons in Poland; SIW – spatial structure of informal workers; and SWT – spatial structure of employment.

The location quotient expressed in formula 1 is presented in Figure 3, and becomes a measure of the regional diversity of the number of informal workers in relation to the number of people working in the region. For this relationship, the Western voivodships can be described as delocalized, which means that the ratio of people working informally there is on average lower than the ratio of all people working there. The lowest ratio of informal workers compared to employed people can be observed in Wielkopolska. South-eastern and central voivodships (except Lodz) are localized which in this case means that in these regions the ratio of people working informally is on average higher than the ratio of employed people. This shows that the intensity of informal employment in these regions is above average in comparison to the scale of this phenomenon, observed against the background of the number of employees, across the whole country. The largest ratio of informal workers can be seen in Świętokrzyskie. In the three voivodships marked in white, it can be concluded that the ratio of people taking informal jobs and people working formally is similar to the average.

Since some researchers, applying the theory of modernization, postulate a relationship between the prevalence of undeclared work and the level of regional development

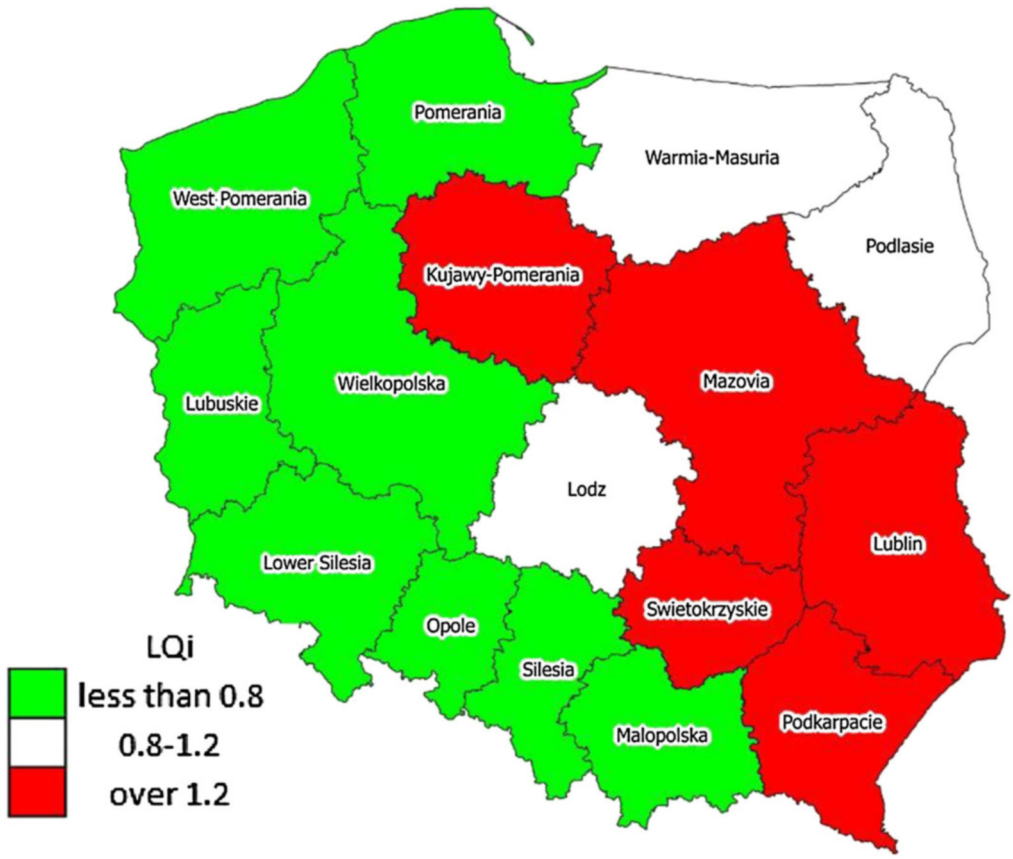

Fig. 3. Location quotients – intensification of informal workers on a background of employment

measured as GDP *per capita*, we compare the structure of people working informally to the spatial structure of GDP. The location quotient is calculated according to the following formula:

$$LQ_i = \frac{IW_i/GDP_i}{IW/GDP} = \frac{SIW}{GDPI}, \tag{2}$$

where: GDP_i – Gross Domestic Product in mln in region i (current prices); GDP – Gross Domestic Product in mln in Poland (current prices); and $GDPI$ – spatial structure of GDP.

Analysing Figure 4, we can see that most of the voivodships (those marked in red) can be considered as localized. These are the regions of central and eastern Poland, except for Mazovia. Figure 4 may be interpreted as showing that in voivodships characterized by a lower level of regional development (measured using GDP), the share of informality in the labour market is greater. The lowest value of the location quotient (at 0.3) is observed in Wielkopolska, which suggests that the intensity of working informally in this region is lowest compared to the scale of this phenomenon observed on the background of GDP across the country. The highest percentage of people working informally in comparison to the share of GDP across the country is recorded in Świętokrzyskie. In only two voivodships, West Pomerania and Lubuskie, is the structure of working informally and the structure of GDP similar.

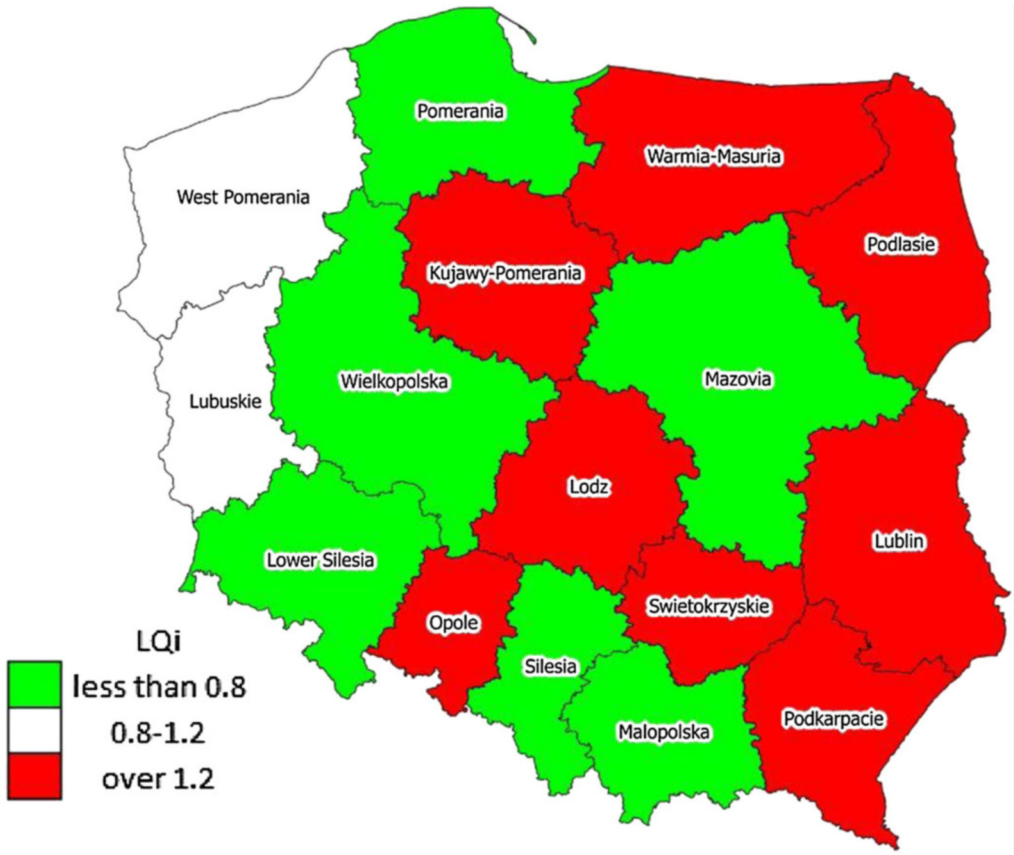

Fig. 4. Location quotients – intensification of informal workers on a background of regional development

Searching for potential causes for the spatial distribution of working informally we also examine the regional diversity of people working informally in relation to those registered as unemployed. Thus location quotients are calculated from the following formula:

$$LQ_i = \frac{IW_i/UNEM_i}{IW/UNEM}, \tag{3}$$

where: $UNEM_i$ – number of persons registered as unemployed in region I; and $UNEM$ – number of persons registered as unemployed in Poland.

The location quotients given in formula 3 are presented in Figure 5. It turns out that in the Eastern voivodships, in Opole and in Świętokrzyskie, the intensity of working informally is above the average in relation to the scale of this phenomenon observed on the background of the unemployed across the country. The highest location quotient, 2.76, is found for the Świętokrzyskie. The Western voivodships (except for Lubuskie) are, in this case, delocalized. In other voivodships, these two structures are comparable. Concluding this part, we can say that in the regions marked in red, more of the unemployed take up informal work, in comparison to the other analysed regions.

We realize that these regional outcomes (total number employed, GDP, number unemployed) do not represent an exhaustive list of features that could be equated with the likelihood

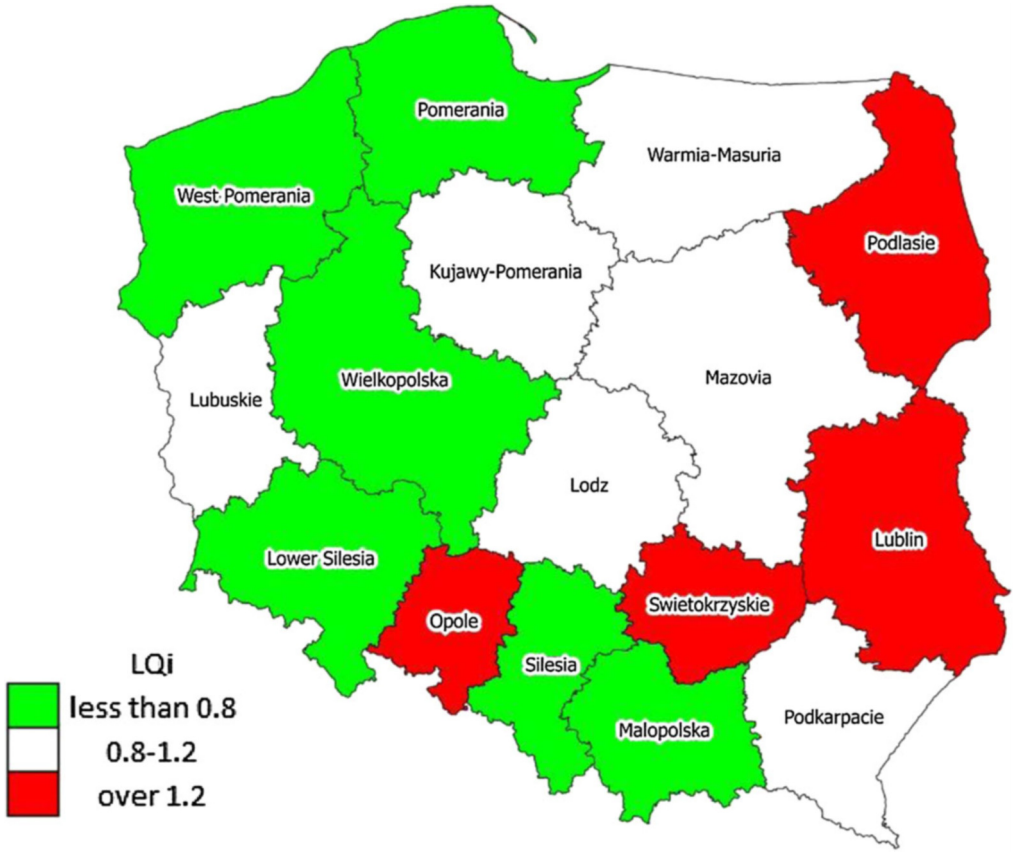

Fig. 5. Location quotients – intensification of informal workers on a background of unemployment

of working informally in particular regions, but in our opinion they seem to be interesting comparative areas for the processes we are examining.

To conduct a more advanced spatial analysis of informal employment in Poland we analyse the ratio of the number of informally employed to the total number of employees for every region (Figure 6). In this way we avoid the problem of the different sizes of voivodships when we conduct a comparative cross-regional analysis.

We can see that the ratio of the number of informally employed people to the total number of employees is the highest in the south-east voivodships and in Mazovia. On the other hand, the lowest ratio is observed in the south-west of Poland and in Wielkopolska. To some extent, it can thus divide the whole country into Eastern and Western parts with different level of informality. However, to be more precise we identified four groups of voivodships having regard to the percentage of informal workers. In the first group (Mazovia, Lublin, Podkarpacie and Swietokrzyskie), where the ratio of informal workers is the highest, the share of rural population is higher than in voivodships with lower ratio of informality. The exception is Mazovia, the most diversified voivodship in Poland with the largest city Warsaw. Some of these voivodships may be also identified as less developed and poorer. In Swietokrzyskie, Podkarpacie and Lublin the at-risk of poverty rate is between 8.2 and 12.2 per cent what is above the national average. Moreover, in these regions the share of employment in high skilled sectors is below the national average. On the other hand, considering the voivodships with the lowest share of informal

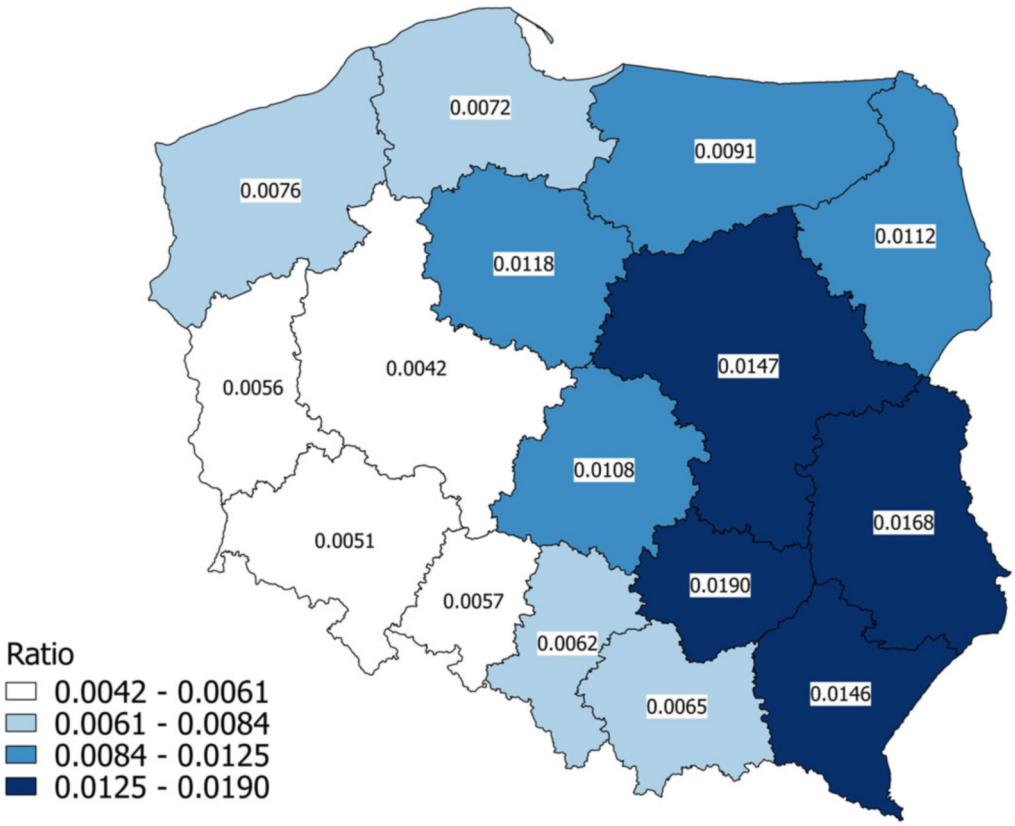

Fig. 6. Ratio of the number of informally employed people to the total number of employees by voivodship

workers (Lubuskie, Wielkopolska, Lower Silesia, Opole), some common characteristics may be observed. Lower Silesia, Wielkopolska and Lubuskie are the voivodships where the share of employment in industry is relatively high. Additionally, Lower Silesia is characterized as a region where employment of high skilled workers is also more prevalent and the at-risk of poverty rate is low, which enables us to classify this region as well developed. Bearing in mind the above socio-economic characteristics and the scope of informality in analysed voivodships, we try to make initial explanations of disparities in the share of informal workers across country. First, the Eastern voivodships which may generally be described as less developed (to some extent with the higher at-risk of poverty rate, with lower share of sectors involving high-skilled workers, more rural) tend to show higher ratio of informal workers in total employment. Second, Western and more industrialized voivodships (like e.g., Silesia, Lubuskie, Wielkopolskie) have a rather smaller degree of informal workers. Third, this cartogram suggests that the informally employed tend to cluster, which means that the phenomenon can be spatially correlated. The next step is therefore to investigate spatial autocorrelation, in order to confirm our conjectures about the spatial clustering. The results of Moran's *I* test are shown in Table A2 in Appendix. Moran's *I* statistics show the possibility of positive spatial autocorrelation, regardless of the weight matrix used.[3] From the randomization test and the very low pseudo p-value we conclude that spatial relations among the numbers of informally employed are statistically significant. This means that the analysed phenomenon tends to show spatial clustering. To locate the voivodships in which high numbers of informally employed are grouped, we also conduct a univariate local Moran's *I* test. The results are presented in Figure 7.

The results confirm our belief that there are regional differences in the prevalence of informal employment and that there is strong, positive spatial correlation at both the global and the local scale. The regions with a high share of informally employed people are located in the South-east (Lublin, Podkarpacie and Świętokrzyskie) and also in Mazovia. On the other hand, the regions with a low share of informally employed people are located in the west of Poland (West Pomerania, Lubuskie, Lower Silesia, and Opole) and in Wielkopolska. However there must be certain forces that mean that the clusters are located in the way they are presented in Figure 7. We can clearly observe two groups of voivodships, one characterized by a higher prevalence of informal employment and the second where the intensity of informal activities is lower.

Moreover, we are aware of differentiations both within analysed voivodships and across country. Therefore, a clear explanation and understanding of the regional differences in the extent of informality is very complicated and needs deeper research. That is why in the next subsection we provide a detailed analysis of the level of regional development in order to better understand and explain the disparities in the share of informal employment.

4.2 Examination of the modernization theory

The spatial analysis of the ratio of informal workers gives rather weak evidence about the relationship between the prevalence of informal employment and the level of a voivodship's development. However, to test the hypothesis that the prevalence of informal employment in a given voivodship is related to the level of the local development, we now analyse the relationship between the variable 'informal employment as % of total employment' (Inform_empl) and three variables that describe the level of regional development

[3] We are aware that obtained results can be biased due to relatively small sample – 16 spatial units. Unfortunately, using the source and methodology applied in our paper, an analysis on more disaggregated level is not possible. A deeper research including survey study is definitely needed.

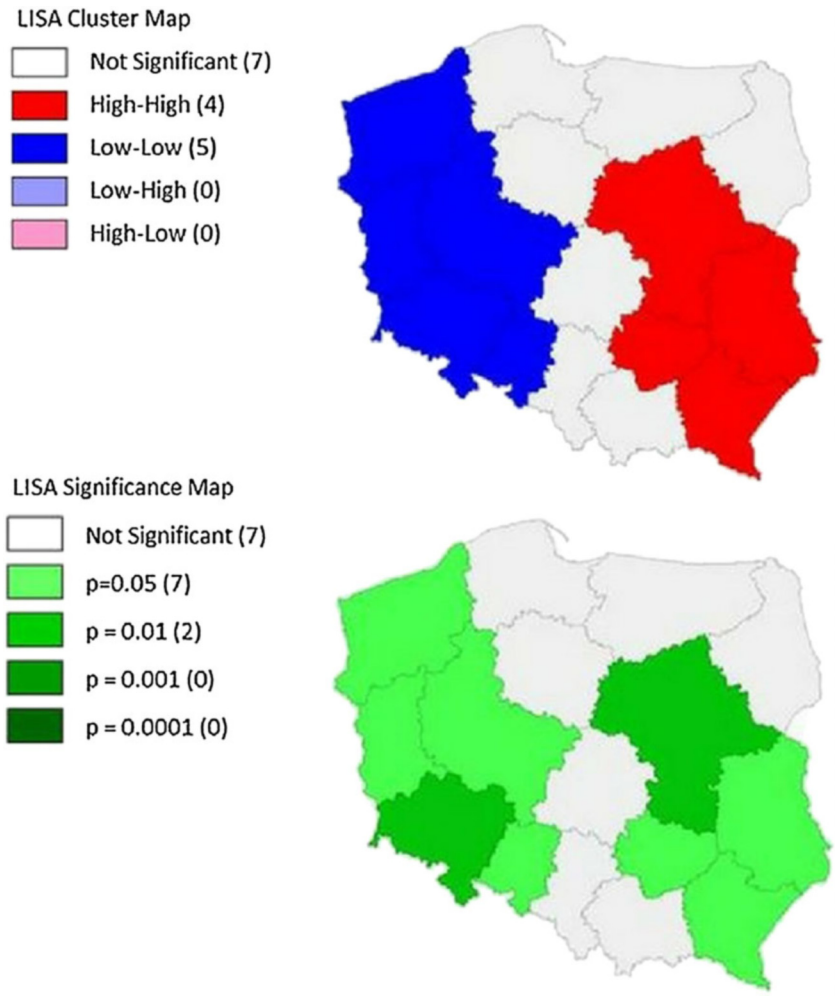

Fig. 7. Univariate local Moran's *I* test results – cluster and significance map

and modernization: GDP *per capita* computed in PLN at current prices (GDP_capita), the Local Human Development Index (LHDI), and the European Quality of Government Index (QoG). In Table 1 we provide the descriptive statistics of the indicators used.

As Table 1 shows, the voivodships in Poland are diversified in terms of indicators used for testing the modernization theory. The three indicators used as proxies for local development reveal that there are significant disparities in Poland in respect of GDP *per capita*, Local Human Development Index and European Quality of Government Index. Moreover, having regard to the spatial analysis conducted in previous section, which indicates a high level of variations in informal employment, a deeper analysis of relations between informality in the labour market and regional development is needed. To analyse this relationship we conduct a bivariate regression analysis. We use Spearman's rank correlation coefficient (rs) because of the non-parametric character of the data. Table A3 in Appendix presents the results of the correlation analysis. From the calculations follows that in the case of GDP *per capita* we observe a negative, strong relationship with the ratio of informal employment. This confirms the assumption of the greater prevalence of informal employment in less-developed regions. However, using other, and, in our opinion, more

Table 1. Descriptive statistics of GDP *per capita*, LHDI, QoG index and the share of informal employment in total employment in analysed voivodships

Voivodship	Informal employment as percentage of total employment	GDP *per capita* (PLN, current prices)	Local Human Development Index	European Quality of Government Index
Lodz	1.08	41,793.00	0.38	–0.56
Mazovia	1.47	71,661.00	0.89	–0.61
Malopolska	0.65	39,867.00	0.57	–0.33
Silesia	0.62	46,415.00	0.34	–0.72
Lublin	1.68	31,233.00	0.36	–0.46
Podkarpackie	1.46	31,664.00	0.12	–0.58
Swietokrzyskie	1.90	32,537.00	0.39	–0.51
Podlasie	1.12	32,304.00	0.46	–0.16
Wielkopolska	0.42	48,014.00	0.51	–0.44
West Pomerania	0.76	37,439.00	0.25	–0.31
Lubuskie	0.56	37,585.00	0.26	–0.19
Lower Silesia	0.51	49,972.00	0.45	–0.73
Opole	0.57	36,195.00	0.37	0.00
Kujawy-Pomerania	1.18	36,374.00	0.25	–0.04
Warmia-Masuria	0.91	31,977.00	0.06	–0.27
Pomerania	0.72	42,580.00	0.51	–0.18
Mean	0.98	40,475.63	0.39	–0.38
Min	0.42	31,233.00	0.06	–0.73
Max	1.90	71,661.00	0.89	0.00
Standard deviation	0.44	9,934.68	0.19	0.22

accurate measures of regional development such as LHDI, we cannot see any correlation between the extent of informal employment and the development of the voivodship. Similarly, there is no correlation between the prevalence of informal employment and the regional quality of government. Having regard to large disparities in the local development of analysed voivodships (presented in the Table 1) and the complex nature of the measurement of development at all, we have to be cautious in formulating general conclusions. We observe that in some of the voivodships (Malopolska, Wielkopolska, Lower Silesia, Pomerania) with the above national average level of development (measured with the use of LHDI), the ratio of informal workers in total employment remains at the lower level than the national average. Similarly, in some less developed voivodships (Podkarpacie, Warmia-Masuria, Kujawy-Pomerania) the share of informal employment is significantly higher. Therefore, we are inclined to the statement of no clear evidence to reject the hypothesis about greater prevalence of informal employment in less-developed regions (in Polish voivodships).

5 Conclusion

The main aim of our paper is to analyse the phenomenon of informal employment from a regional viewpoint. We therefore use spatial analysis to study the variation of this phenomenon. We examine the hypotheses that informal employment is more prevalent in less-developed voivodships and that informal employment tends to be clustered in space.

An initial spatial analysis of the prevalence of informal employment shows that its intensity is above average in the south-east and east of Poland in comparison to the average of this

phenomenon, observed on the background of the number of employees, GDP and unemployment, across the country. On the other hand, in the south-west and west of Poland the intensity of informal employment is lower.

In the next step we perform a spatial analysis of informal employment in Poland having regard to the size of each voivodship. We therefore analyse the number of informally employed people compared to the total number of employees. The analysis confirms that this proportion is highest in the South-east and in the central voivodship Mazovia. On the other hand, this proportion is lowest in the South-west of Poland and in the central Western voivodship Wielkopolska. The spatial analysis for informal employment indicates wide variations in the spatial concentration as well as a tendency towards spatial clustering. The voivodships with a high share of informally employed workers are located in the south-east, while those with a low number are located in the west of Poland.

In conclusion, from our spatial analysis of informal employment we cannot fully confirm the modernization theory. There is some evidence that even in well-developed voivodship such as Mazovia the prevalence of informal employment is high. Having regard to the ambiguity of our results we conduct further analyses. In the second step we use bivariate regression analyses to test the relationship between the prevalence of informal employment and the level of the region's development. We employ the following measures of regional development and modernization: GDP *per capita*, the Local Human Development Index and the European Quality of Government Index. Our results indicate that it is only in the case of GDP *per capita* that there is a negative, strong relationship with the prevalence of informal employment. This confirms the assumption of a greater prevalence of informal employment in less-developed regions. However, using other and, in our opinion, more accurate measures of regional development such the LHDI, we are unable to find any correlation between the extent of informal employment and the development of the region. Similarly, there is no correlation between the prevalence of informal employment and the regional quality of government.

Compiling the results obtained by spatial and bivariate regression analysis, as well as taking into account the large disparities in the local development of analysed voivodships, we state no clear evidence to reject the hypothesis about greater prevalence of informal employment in less-developed regions (in Polish voivodships). Our conclusions are also supported by socio-economic analysis of voivodships which takes into account the structure of employment, urbanization ratio and the at-risk of poverty rate. We find that some voivodships (Malopolska, Wielkopolska, Lower Silesia, Pomerania) with the above national average level of development (measured with the use of LHDI), show lower ratios of informal workers in total employment. At the same time, in some less developed voivodships (Podkarpacie, Warmia-Masuria, Kujawy-Pomerania) the share of informal employment is significantly higher than the national average.

Our paper fills a research gap by studying informal employment from a regional perspective. We are aware of the limitations of our analysis, due especially to the scarcity of data. However, we argue that there is a need to carry out further research on informal employment with the use of regional data. From the example of Poland we show there are wide regional differences in the prevalence of informal employment, which forces us to conduct a regional analysis. Moreover, a significant diversification of the socio-economic development of analysed voivodships, as well as their internal diversity, causes problems in drawing clear conclusions. One solution may be an analysis on more disaggregated level (e.g. NUTS 3), but at this time there is a lack of representative data on these level. The next step for explaining the variations in informal employment in Poland would be also to search for the factors causing this phenomenon. We expect these to be mainly socio-economic factors. Once these have been identified, they can be used for regional policy objectives including the reduction of the scale of this phenomenon.

Appendix

Table A1. The construction of the Local Human Development Index

Dimension	Variable	Description	Direction	Normalization rule
Health	Life expectancy	A measure of the qualitative aspects of living a healthy life.	+	$x_i = \frac{x_i - \min(x_n)}{\max(x_n) - \min(x_n)}$
	Infant mortality rate	Indicator of health in a region that refers to a basic understanding of minimum health conditions required.	-	$x_i = \frac{x_i - \max(x_n)}{\min(x_n) - \max(x_n)}$
Knowledge	Young people neither in employment nor in education and training aged between 18 and 24 years, 'NEET'	A broader measure of the lack of basic knowledge than the number of early school leavers.	-	$x_i = \frac{x_i - \max(x_n)}{\min(x_n) - \max(x_n)}$
	Population aged 25–64 with tertiary education	General access to education and knowledge capabilities in a region.	+	$x_i = \frac{x_i - \min(x_n)}{\max(x_n) - \min(x_n)}$
Income	Gross domestic product (GDP) at current market price *per capita**	Valid proxy for the income dimension from the perspective of freedom of human development.	+	$x_i = \frac{x_i - \min(x_n)}{\max(x_n) - \min(x_n)}$
	Employment rate	Proportion of employed persons aged 15 years or older out of the total population of persons aged 15 years or older.	+	$x_i = \frac{x_i - \min(x_n)}{\max(x_n) - \min(x_n)}$

Source: Own compilation based on Hardeman and Dijkstra (2014).
Notes: *GDP *per capita* is used instead of net adjusted disposable household income *per capita* because of the lack of data. Note that GDP *per capita* is also considered as one of the measures in the income dimension, see Hardeman and Dijkstra (2014, p. 36). Linear aggregation rules are used within given dimensions and geometric aggregation in composing the final composite indicator.

Table A2. Moran's *I* statistics

Spatial weights matrix	Moran's *I*	pseudo p-value
Queen contiguity of the first order	0.50	0.003
k-nearest neighbours (4)	0.35	0.006

Table A3. Correlation coefficients (rs)

	Inform_empl	GDP_capita	LHDI	QoG
Inform_empl	1.000000	–0.523529*	–0.111765	–0.097059
GDP_capita	–0.523529*	1.000000	0.585294*	–0.385294
LHDI	–0.111765	0.585294*	1.000000	–0.132353
QoG	–0.097059	–0.385294	–0.132353	1.000000

Notes: *Statistical significance at 0.05 level; remaining coefficients insignificant.

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Resumen. En nuestro artículo tratamos de combinar las teorías que explican la prevalencia del trabajo informal, mediante el uso de un enfoque regional. Al revisar la literatura se observa que no hay evidencia que confirme que las relaciones que se producen en las comparaciones entre países siguen siendo significativas cuando se utilizan datos regionales y se analizan las variaciones interregionales. Por lo tanto, nuestra pregunta principal es si existe más trabajo informal en las regiones menos desarrolladas, como lo afirma la teoría de la modernización. Nuestro análisis concluye que existe una correlación limitada entre la prevalencia del trabajo informal y el nivel de desarrollo de una región, mientras que existe una autocorrelación positiva significativa entre la cantidad de trabajo informal en los voivodatos analizados en Polonia.

抄録: 本稿では、地域的アプローチを用いて、非公式労働の分布を説明するいくつかの理論を組み合わせることを試みる。文献をレビューすると、国家間の比較で現れる関連性が地域データを用いて地域間の変動を分析した場合にも有意であることを認めるエビデンスは確認できなかった。よって、近代化論の主張のとおりに、開発の進んでいない地域で非公式労働が単純に多くなるのか否かということが全般的な疑問となる。我々の分析では、非公式労働の分布と地域の開発レベルには限定的な相関関係があるが、非公式労働の普及率は分析対象のポーランドの県間で、正の自己相関性が有意に認められる。