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THEORETICAL AND EMPIRICAL ASPECTS OF THE URBAN RESILIENCE – BETWEEN PAPERS AND FINDINGS FOR POLISH AND CZECH CITIES

Summary: The paper is devoted to the issues referring to urban economic resilience concepts. Its goal concerns recognition of the theoretical and methodological concepts referring to the urban resilience in economic terms, as well as an attempt of their application to quick assessment of the resilience in selected cities of Poland and Czech Republic. After presentation of the definitions of resilience the basic resilience approaches were discussed. The paper is also supplemented by the empirical evidence of selected cities and towns of Poland and Czech Republic, which is an attempt for diagnosis of their resilience in last 15 year.

Keywords: resilience, urban economic resilience, adaptive cycle model, equilibrist approach, evolutionary approach.

JEL Classification: R1, R12.

Introduction

The paper is devoted to the new concept of cities development linked with the urban resilience. It also refers to the first stage findings of scientific project financed by the Polish National Research Centre named: *Urban Resilience Concept and Post-Industrial Cities in Europe* (UMO-2011/01/B/HS5/03257), which is also accompanied by the international research network financed by the Regional Studies Association e.g.: *Research Network on Transition and Resilience for Post-Industrial Agglomerations in Central Europe*. Both projects are conducted by researchers from the University of Economics in Katowice (Poland),

the Technical University in Ostrava (Czech Republic), the University of Applied Sciences in Leipzig (Germany) and the Strathclyde University in Glasgow (Scotland). It is also supported by practitioners from a local government sector: Katowice and Bytom municipalities (Poland).

The overall goals of the paper are recognition and review of theoretical and methodological concepts referring to the urban resilience in economic terms, as well as an attempt of their application to diagnosis of the urban economic resilience in selected cities of Poland and Czech Republic.

1. Theoretical and methodological basis

Introducing the ‘resilience’ and the ‘urban resilience’ to issues of transformation of cities and regions seems to be a new idea for local and regional development planning, not only in Central European conditions but also in a vast international context. Cities and regions are affected by ongoing trends of transformation. They face with many internal and external problems like: poverty, pollution, economic decay, natural disasters, as well as social disturbances. Some of them can adapt to such challenges, while in others structural change leads to decline. In this context the concept of urban resilience and urban economic resilience offers ideas that make it easier to understand and prepare for.

While there is an emerging research focus on sustainable cities, smart cities, green cities, competitive cities, creative and attractive cities, or even slow cities – there still remains poor scientific understanding of factors that make some city resistant or vulnerable to social, economic or environmental shocks.

The debate about sustainable development along with adaptation to climate changes has introduced the idea of resilience to the urban and the regional studies [Simme and Martin, 2009]. Urban vulnerability and resilience notions are also triggered by major urban threats and disasters, like the terrorist attacks in New York, the Asian tsunami and Hurricane Katrina in New Orleans. Generally speaking the notion of resilience is the ability of a system to recover from disturbance and disruption [Simme and Martin, 2009]. There is much ambiguity across the term of resilience, and there is no universally agreed definition of resilience in economics, social science as well as in regional and urban studies. Thus resilience can be defined as follows:

- the stability of a system against interference, but it is more than response or coping with challenges, it is a kind of systemic property [Welter-Enderlin, 2006],

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- the capacity to avoid and manage natural and human-induced hazards [Bosher, Coaffee, 2008],
 - the concept for understanding, managing, and governing complex socio-ecological systems [Walker et al., 2006],
 - the reactions of a system to specific extraordinary events and shocks [Simme, Martin, 2009].

The urban/regional resilience is perceived as a degree to which cities/regions are able to tolerate alternation before re-organizing around new set of structures and processes [Drobniak, 2012b]. The urban resilience can be also measured by how well a city can simultaneously balanced ecosystem (biological environment) and human functions (socio-economic environment). According this, the urban resilience is not only ‘response to impact’ – like disaster or economic decay – but also there are a society and an economy that are flexible and able to adjust in the face of uncertainty [Barnett, 2001; Foster 2007].

In that context, the urban economic resilience can be seen as a city’s capacity to address socio-economic problems in a way that generates long-term success. It is the ability to capitalize on positive opportunities the future may bring [Simme, Martin, 2009]. The following characteristics of the urban economic resilience can be also helpful [Barnett, 2001; Alberti et al., 2003; Foster, 2007; Simme, Martin, 2009; Hill, Clair, Wial et al., 2010]:

- the ability of a local socio-economic system to recover from a shock,
- the ability of a city to anticipate, prepare for, respond to and recover from a disturbance,
- the ability of a city’s economy to maintain or return to a pre-existing state in the presence of some type of exogenous shock, that means to return to its previous: level of growth, rate of output, rate of employment or level of population,
- the ability of a city to recover successfully from a shock to its economy that either throw it off its growth path or has potential to do it.

There are few very interesting aspects in the resilience concept for analyzing and planning a city’s development. First, it is claimed that a city’s economy that is hardly affected by a shock is much more likely to recover and quickly, than a city’s economy that is severely weakened. Second, the resilience concept investigates not only into the problems of a local economy’s stability, but also into the issue of sensitivity or vulnerability of a city’s economy to shocks. Third, it is particularly interesting if the concept refers to ability of local economy to retain its structures, or to the ability of a local economy to change its structures rapidly as a response to a shock. And fourth finally, it is also useful to answer

the question how to assess the degree of a city's economic resilience or vulnerability to a shock?

If we combine these aspects one can notice the urban economic resilience refers to the extent that a city is able to maintain socio-economic structure of accumulation or to the extent that a city is able to make a rapid transition from one socio-economic structure of accumulation to another. According to this, the urban economic resilience is unlikely to be invariant over time. It may depend on the nature of shocks and changes over time as a socio-economic structure of a city evolves.

These considerations make two basic approaches for the researches on the urban economic resilience, which are [Simme, Martin, 2009; Hill, Clair, Wial et al., 2010]:

- economic equilibrium approach,
- evolutionary approach.

First, economic equilibrium approach emphasizes the notion of ability of a system – like a city's economy – either to return to a pre-existing equilibrium [Pimm, 1984], or to move quickly to a new one. It is more traditional approach liked also with ecological literature sometimes called 'engineering resilience'. It is focused on the stability of a system near an equilibrium or steady state, and returning to a pre-existing equilibrium (before the turbulence). It is also explained as ability of a system (like a city) to absorb and accommodate perturbation without structure transformation or without collapse. That means that shocks move a city's economy off its equilibrium growth path, but with the assumption of self-correcting forces that bring it back onto the path. Mind that in the equilibrium approach – the problem is that if the urban economic resilience is defined as the ability to return to equilibrium after a shock, and thus it is difficult to reconcile the approach with the idea of urban development. Because the more resilient is a particular city the less it would change over time.

Second, evolutionary approach assumes that cities are examples of complex adaptive systems. They are living, dynamic, connected, and open. They constantly evolve in many and varied ways to both internal interactions and the influence of external factors [Batty, Barros, Alves, 2004]. The evolutionary approach – in contrast to economic equilibrium approach – is based on 'ecological resilience' that is focused on the issue whether disturbances cause a city to move into another path of development. So, the resilient urban economy would be one capable to absorb and accommodate extreme shocks without any significant change of structures, or that one which is able to create new socio-economic structures with success in a quick way. According to this, there is no single equilib-

rium state or path, but several possible states and paths, and a city's economy can be shifted from one such equilibrium to another by shocks. The resilient economy would be one that adapts successfully, resumes, or still improves its long run equilibrium path. Non-resilient economy would be one that fails to transform itself successfully and instead becomes 'lock-in' outmoded structure with lowering its growth-path.

2. Evolutionary approach – some detailed investigation

Linking the urban economic resilience concept with the evolutionary approach opens few research perspectives that allow for further investigations and studies. These are [Simme, Martin, 2009]: Darwinism, Path Dependency Theory, Complexity Theory, Panarchy Model.

Darwinism emphasis the notions of variety and adaptability. *Variety* in an urban context can be seen as structural and sectoral heterogeneity in human capital or companies' behaviors. *Adaptability* in an urban dimension can be perceived as potential of local actors (like firms, institutions) to adjust to changing circumstances in an appropriate way. It is expected that variety and adaptability influence the urban economic resilience in several ways:

- High degree of local sectoral or functional variety is often claimed as a condition for resilience. That means cities having a more diversified economic structure are less prone to shocks, or at least more able to recover from them.
- Sectoral variety also determines innovative activity among local firms, although there is discussion whether a diversified industries structure is more favorable to innovation than specialized one.

Path Dependency Theory focuses on: historical continuity, 'lock-in' and new path creation. Standard path-dependency concept assumes the notion of 'lock-in'. This is the process whereby an urban economy becomes 'lock-in' in a particular trajectory of economic development [David, 2005]. Imparting the 'shock' into the path-dependency concept makes few interpretations:

- First: an urban economy is resilient if it is able to maintain its 'lock-in'. Thus, it is a positive attribute of a city's economy. This approach is related to *positive lock-in*.
- Second: 'lock-in' has a negative attribute as holding back the adaptation processes of a city's economy. So, path-dependency undermines the urban economic resilience – *negative lock-in*.

According to *Complexity Theory* a city's economy represents complex adaptive systems with emergent patterns, behaviors and organization. These systems are characterized by several features [Martin, Sunlay, 2007] like:

- *degree of connectivity* – it refers to functions and relationships that are distributed across the system elements;
- *boundary* between a complex adaptive system and its environment; it is neither fixed nor easy to identify making its operational closure difficult;
- *non-linear dynamics* because of the complex feedbacks and the self-reinforcing interactions among elements – with the results often characterised as path-dependence;
- *self-organization* – that means there are tendencies for the macro-scale structures and dynamics to emerge spontaneously out of the micro-scale behaviors of system elements.

The self-organization imbues complex system with the potential to adapt its structure and dynamics to response to changes from external environment or internal shifts.

Panarchy Model links resilience with the 'adaptive cycle'. It posits a four phase process of continual adjustment in ecological, socio-economic and environmental systems. Each phase of the model is characterized by varying levels of three dimensions [Pendell, Foster, Cowell et al., 2008]:

- the potential of accumulated resources to a system,
- the internal connectedness of system's actors or elements,
- the resilience, perceived as measure of system's vulnerability to shock – with high resilience associated with phases of creative and flexible response.

The adaptive cycle model applied to the urban economy might have the form of two loops [Pendell, Foster, Cowell et al., 2008]:

- *exploitation to conservation* – relating to the emergence, development and stabilization of a particular economic structure and growth path;
- *release and reorganization* – relating to eventual rigidification and decline of a structure and then growth path, and the opening up of new potential types of activities and growth sources for exploitation.

In the *exploitation phase* a city's growth develops, human and knowledge capitals are accumulated. New local industries exploit comparative advantages. As growth continuous – in *conservation stage* – the connectedness among elements of a city's economy increases and the pattern of development becomes rigid. So, the resilience to potential shocks decreases. If shock appears the *release phase* will come. Structural decline and loss of growth momentum are likely to follow. Companies close or move out of a city, and the degree of con-

nectedness decreases. Old patterns of production and institutional forms unravel and resources are released. The resilience is low but may increase. If *reorganization phase* would appear, the connectedness of system elements will be low, the potential for creation of new paths will be high, the trajectories of development will be open and thus resilience will be high. If, in this stage, new forms and activities as well as new technologies are introduced and start to be exploited, new comparative advantages appear, and new round of urban growth and accumulation will be set in motion. Creative and flexible response to shock depends on – among many others – innovative capacity of local firms, entrepreneurial capabilities and new firm formation, institutional innovation, access to investment capital, including venture capital, as well as willingness of workers to re-skill.

3. Researches on the urban economic resilience

Only few researchers use the notion of resilience to the urban or the regional development problems. Among them they are: Hill [Hill, Clair, Wial et al., 2010], Wial, Wolman [Hill, Wial, Wolman, 2008], Gerst, Doms and Daly [2009], Hassink [2010]. Among others the resilience notions is used in application to different aspects of a socio-economic development. For example:

- Gleaser and Saiz [2004] run researches on importance of human capital in a region's resilience. According to them human capital along with educational attainment or skills of a region's workforce is major driver for growth and resilience.
- Briguglio [Briguglio, Cordina, Bugeja et al., 2006] investigated the concentration of a nation's exports in a few industries. According to him that kind of concentration inhibits resilience and suggests similar hypothesis for relation between regional export industries and resilience,
- Duval [Duval, Elmeskov, Vogel, 2007] made researches referring to public policies that restrict firms' ability to lay off or reassign workers. That kind of restrictions make shocks less severe, but also make them last longer. Policies that inhibit layoffs or promote unionization have similar effects.
- Feyrer [Feyrer, Sacerdote, Stern, 2007] run research on counties that experienced automotive and steel industry job losses in late 1970s and early 1980s in the U.S. According to him employment and population of these counties grew slightly a few years after a shock, but then failed to growth during approximately two decades after shock. Counties with dominance of automo-

tive or steel industry where more shock-resistant if located near large metropolitan areas.

- Christopherson and Clark [2007] claim that the growth and the regional resilience may be inhibited by a domination of: regional labor markets, suppliers, R&D pipelines or the channels of informal business association and communication by a few large vertically integrated firms.
- According to Nunn [2009] region-specific institutions, behavioral norms, knowledge, and technology have long-lasting impacts on the economic development of countries and regions – as well as on their resilience.
- Desmet and Rossi-Hansberg [2009] conveyed researches on regional resilience. According to them the regional economies can be renewed if their firms can introduce new goods or services for export or use new technologies to produce such goods and services after experiencing a shock in relatively quick way.
- Gerst [Gerst, Dooms, Daly, 2009] – prepared the study that explores the different path of development in IT centres localized in urban areas in the U.S. (after the IT bust in 2000). The research revealed that the impact of decline and the path of recovery varied considerably, showing differences in the urban economic resilience. IT centres specialized in IT services performed better than those in manufacturing because of their highly educated labor force. Some IT centres, specialized in IT services, even maintained growth due to their adjustment to changes in demand.
- Kolko and Neumark [2010] run the study on economic shocks to regional and industry employment. According to them level of employment is less likely to decline in locally owned chains of firms.

Direct reference to the concept of the urban economic resilience one may find in Hill's research on the urban economic resilience in metropolitan areas of the U.S. [Hill, Clair, Wial et al., 2010]. According to him, cities that experienced employment shocks recover to their pre-shock employment rate, but not to their pre-shock employment levels within eight or fewer years [Hill, Clair, Wial et al., 2010]. Metropolitan area's industry structure affects the probability that region will experience a downturn (old structure – higher probability of downturn). Durable goods manufacturing make a metropolitan area more susceptible to the economic downturns because of a cyclical demand for durable goods which makes employment in that sector vulnerable to economic shocks. It could be resilient again in case of eventual rise of demand for such type of goods.

Health care and public administration make a city less vulnerable to shock. Similarly, large number of major diversified export industries makes a metropol-

itan area less likely to experience downturn. Thus less concentrated a city's export sector the more protected is a city from economic shocks. Areas with more flexible labor markets may be likely to recover their employment after a shock. But large share of population with low levels of education are more susceptible to downturns – it could be resilient if after a shock, pre-shock demand for low qualified workforce will return.

One can also find the examples of research networks, projects institutions aimed at examining the resilience concept in regional and urban context. For instance: *Building Resilience Regions* – the research network establish in 2006 by MacArthur Foundation [Building Resilience Regions, 2006]; *Stockholm Resilience Centre* – organized into themes that address different issues of resilience, adaptation, vulnerability and transformation [Stockholm Resilience Centre, 2010]; *World Bank's Cities Alliance* [World Bank Cities Alliance, 2010]; *Resilience Alliance Initiative for Transitioning Urban Systems Towards Sustainable Future* – the research network established in 2007 by CSIRO Canberra, Arizona State University, Stockholm University [Resilience Alliance Initiative for Transitioning Urban Systems towards Sustainable Future, 2007].

In recent years, especially in the period 2015-2016, the new research has emerged on the concept of resilience. One of the examples is presented by Martin et al. [2016], who proposes clarifying approach to measuring resistance and recoverability from economic shocks, along with defining the role of industrial structures in forming these kinds of reactions. Another example of measuring resilience in the case of Wales under the base of employment volume is presented by Sensier and Artis [2016]. The evolutionary perspective is further explored by Martin and Sunley [2015] who highlight the need to take into regional studies aspects referring to: more holistic and systematic ontology, 'deep contextualization' in evolutionary analysis, examine the degree to which spatial economies can construct their own environments. The findings referring to Polish context in regions transformation, i.e. Małopolska region, one can also find in Domański et al. [2008].

4. Empirical elaboration – preliminary studies on the urbane economic resilience in selected Polish and Czech cities

4.1. Methodological remarks

Preliminary the urban economic resilience can be assessed by comparison of popular dynamics indexes referring to the cities development in aspects such as number of: population, employment, unemployment, companies, small and

medium size companies, as well as level of taxes income or volume of production. This preliminary assessment of the urban economic resilience one can find in works of Hill [Hill, Clair, Wial et al., 2008] and in the studies referring to a city's resilience indexes [Strengthening Local Economies, 2011]. Comparison of the values of such indexes looks to be more useful in an empirical research if the indexes cover one or more decade, and they are linked with cities having different development history, like these for example with post-industrial 'background', and those without it. Because of the internal and external challenges which occur in them probably in different way. Especially in the post-industrial cities, the urban economic resilience concept along with its preliminary assessment helps to understand serious problems of adaptation arising from features of this kind of areas like [Lever, 1987; Drobniak, 2012a]:

- release of large number of low qualified workforce,
- factories closedown,
- income polarization,
- living conditions polarization along with unequal assess to public services,
- de-urbanization,
- decrease of tax revenues,
- ghettoization,
- loss of the socio-economic importance of a city in a country and abroad,
- leaving of the post-industrial areas unused in a city's centre and its other districts.

Tracking the values of the indexes along with the cities' backgrounds allows in consequence for quick assessment of a particular city's economic resilience level and for drawing conclusions about the factors determining it.

Presented empirical research is based on few case studies, which focus on assessment of the urban economic resilience level in the selected post-industrial cities (Katowice, Bytom, Wałbrzych, Ostrava, Karvina) in relation to few Polish cities which have had different conditions of economic development in last 15 years (e.g., not linked with an industrial origins). Among comparative cities the following were identified: Wrocław and Kraków. Focusing on the post-industrial cities in comparison to other, vibrant cities, which are often showed as the examples of dynamic growth, it will allow for better understanding of the notion of urban economic resilience.

Empirical study includes the following research tasks:

- Synthetic description of the socio-economic background of analyzed cities.
- Identification of the analyzed cities development paths by calculation of the indexes covering selected typical socio-economic potentials of a city like:

population level, employment level, number of individuals running firms, budgets' revenues from companies' profit taxes. The Hill approach was used in that part of the research [Hill, Clair, Wial et al., 2010].

- Formulation of the conclusions concerning to level of the urban economic resilience with application of the research findings from Simme and Martin investigations [Simme, Martin, 2009], in the light of the evolutionary approach and the adaptive cycle model.

4.2. Socio-economic background of the analyzed cities

Katowice (population of 306 thousand of inhabitants in 2010), as the capital of the Silesia Region (NUTS2 level, 4.6 million of inhabitants), is having the highest population and service sector potentials of the Upper Silesian Agglomeration (also called Silesia Metropoly)¹. The Agglomeration remains the largest urbanized and industrialized area in Poland, numbering around 2 million inhabitants. Its rapid social and economic growth in the twentieth century was associated with a development of heavy industry, mainly mining and metallurgy sectors.

In the case of Katowice and the Agglomeration processes of restructuring of heavy industry left their indelible 'mark' on the social and economic structures. The effects of structural changes in 1995-2010 were manifested i.a. in the level of unemployment, the number of companies, population's potential, and the size of investment [Drobniak, 2003]. The scale of these effects was also different in relation to individual cities and towns of the Agglomeration. Some of them, like Katowice, grown up to be leaders of change in terms of development of the service sector, attracting foreign direct investment, creation of new businesses and jobs. In other cities and towns (like for example: Bytom) the processes of restructuring traditional industries have had such a large socio-economic impact that the processes of their redevelopment – even now – are relatively weak [Suchaček, Wink, Drobniak, 2012].

Significant changes, which certainly influenced the dynamics of development of Katowice, in recent years are: financial crisis from 2008 resulting in decline of the foreign investors' interest of the city, rejection of the candidature of Chorzow (neighboring town belonging to the Agglomeration) for EURO 2012, and also the rejection the application of Katowice into the European Capital of Culture 2016.

¹ The city's residents constitute approximately 16% of the Agglomeration's population, and the potential of service sector is approximately 30% of the overall services' sector potential within the Agglomeration.

Bytom it is one of the oldest towns in the Upper Silesia Agglomeration and Silesia region, boasting a 750-year-long history. Despite that fact, Bytom is a classic example of a post-industrial city. Not so long ago, Bytom was perceived as a town of coal and steel. These two heavy industries played an essential role in the life of the local community and represented decisive factors for its economic welfare. However, economic transformations in 1990s exerted a substantial impact on the town's current situation. The restructuring efforts deployed at the traditional economy sectors, notably coal mining and steel industry, have definitely closed this chapter in Bytom's history. At the moment, out of seven coal mines and two ironworks, only one coal mine operates. Consequently, the economic base of the town has been destroyed and, what important for the town development, it is still not recover (after 15 years from the 'start-up' of restructuring). Bytom is trying to change its image from the town of coal and steel to the town of services, especially those connected with the culture industry.

Wałbrzych is about 120 thousand inhabitants town in the Lower Silesia Region (NUTS2 level, 2.9 million of inhabitants), which along with other 15 towns and villages forms an urban functional area called Wałbrzych Agglomeration (about 290 thousand of inhabitants). The town in XX century was labeled the centre of mining in this part of Silesia. Due to an economic unprofitability all mines operated in the Wałbrzych's area were closed in the middle of 1990s causing excessive growth of unemployment, decay of the economic base and extreme social problems referring to crime, poverty and polarization of living conditions. Socioeconomic collapse of the area has taken such proportions that Wałbrzych began to be perceived in notions of 'a valley of poverty'. For example in the first decade of the XX century the unemployment rates of the area significantly exceeded 20%-25%, and the local authority was involved in corrupt systems along with fraudulent of local elections.

Contemporary socio-economic background of Ostrava is strongly determined by its industrial heritage linked with coal mining, metallurgy and machinery industry. This heavy industrial lineament was a reason of relatively mono-economic structure measured by the number of employment in industry – not only for Ostrava but also for its region. In 1990s deep restructuring of traditional industries caused extensive drop in the Ostrava's number of workplaces. New services sector started to develop, but despite of the positive shifts in the economic structure guided by services, including those based on information and culture, Ostrava and its region still strongly dependent on metallurgy, chemical industry, machinery industry, energy supply, and construction. This post-industrial picture of the city is on the one hand positively reinforced by its appli-

cation to the European Capital of Culture, new international road and train connection, inflow of direct foreign investment and on the other hand negatively by the social and environmental problems.

In contrast to Ostrava, where all coal mines were closed, Karvina is an example of the town in Ostrava Agglomeration where this kind of economic activity is dominant. Karvina town, similarly like Katowice city, undergone dynamic urbanization and industrialization processes. Because of excessive development of the coal mining industry its population grew from 8.9 thousand at the end of XIX century to nearly 80 thousands in 1970s. There are still four mines operated in Karvina area grouped within the Association of Ostrava-Karvina Mines – the only company extracting hard coal in Czech Republic – which employs over 17 thousand workers.

Wrocław and Kraków are perceived as two examples of Polish cities, with dynamic economic growth, increasing population (or keeping the number of population on a stable level at least), attractive real estate market, easily attracting the foreign direct investors, and moreover with low level of unemployment. Both cities are the capitals of NUTS regions (Lower Silesia in the case of Wrocław, and Małopolskie Region in the case of Kraków). Both are also perceived as big cities in Polish typology of urban areas. That is: Wrocław about 620 thousand inhabitants and Kraków about 740 thousand inhabitants. Moreover, in terms of population Karków 'broke' Łódź city and has become the second largest city in Poland during last 15 years. Wrocław successfully has applied for the European Capital of Culture for 2016.

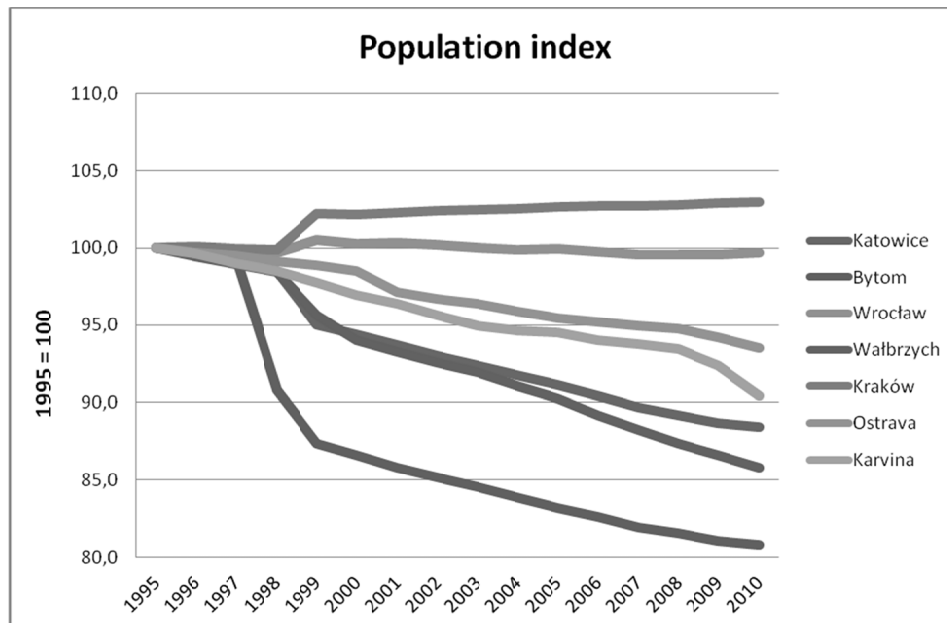
4.3. Examining the urban economic resilience

Let's have a look briefly at the **population** historic trends of examined cities and towns (see the Figure 1). The basic index measuring a city's urban resilience is based on dynamics of a particular city population in relation to a given period. Because of data accessibility the population indexes of surveyed cities and towns cover the period from 1995 to 2010. In 2010 the population indexes in towns and cities like: Bytom (80.8 in 2010), Wałbrzych (85.8), Katowice (88.4), Karvina (90.5), Ostrava (93.5) clearly show that all post-industrial areas lost their human potential in contrast to cities which economic base is more diversified and has not industrial character. According to the adaptive cycle model all the post-industrial examples are in the release phase which is attributed by the firms' closedown, unravel of old patterns of production and disengagement of

resources. In some of the surveyed post-industrial areas loss of human potential is strongly significant and exceeded 15% of its level form 1995 (Bytom, Wałbrzych). These are examples of towns where the old industrial economic base connected almost exclusively with mining ‘disappeared’. And it was not rebuild by a new sector or the sectors with comparable size.

Another two examples of the post-industrial cities, that are Katowice and Ostrava, look to be less ‘injured’ by shocks caused by the mines closedown than Bytom and Wałbrzych. Of course they are affected by shrinking human potentials’ problems, but negative population dynamics is lower (than in Bytom and Wałbrzych). In both cases the cities benefit from their administrative functions (self-government, education, culture, health care), which characterize relatively low level of vulnerability to the economic shocks. Their efforts connected with applications to the European Capital of Culture, with strong involvement to change their image as well as attractiveness may indicate their entrance into reorganization phase (according the adaptive cycle model).

Figure 1. Population index of surveyed cities and towns (1995-2010)



Source: According data of Central Statistical Office in Warsaw and Czech Statistical Office.

And finally Wrocław and Karków. The population index of Kraków showed increase during whole surveyed period (1995-2010). The city is probably within another exploitation phase according to the adaptive cycle model. It is surprising especially during the last years of financial and economic crises in many parts of the world, but Kraków looks to be 'shock-resistant'. Because of the strong cultural, educational and administrative assets Kraków appears as not only the capital of Małopolskie Region, but also as the economic centre of south-western part of Poland influencing also on migration from the post-industrial Silesia Region. Its economic base was always (and still is) highly related to the resilient functions connected with higher education, specialized administrative and health care functions, small and medium sized companies. Entrepreneur spirit linked with high value of social and creative capitals as well as inhabitants' providence also make Kraków the city of magnet, which successfully attracts external businesses and people.

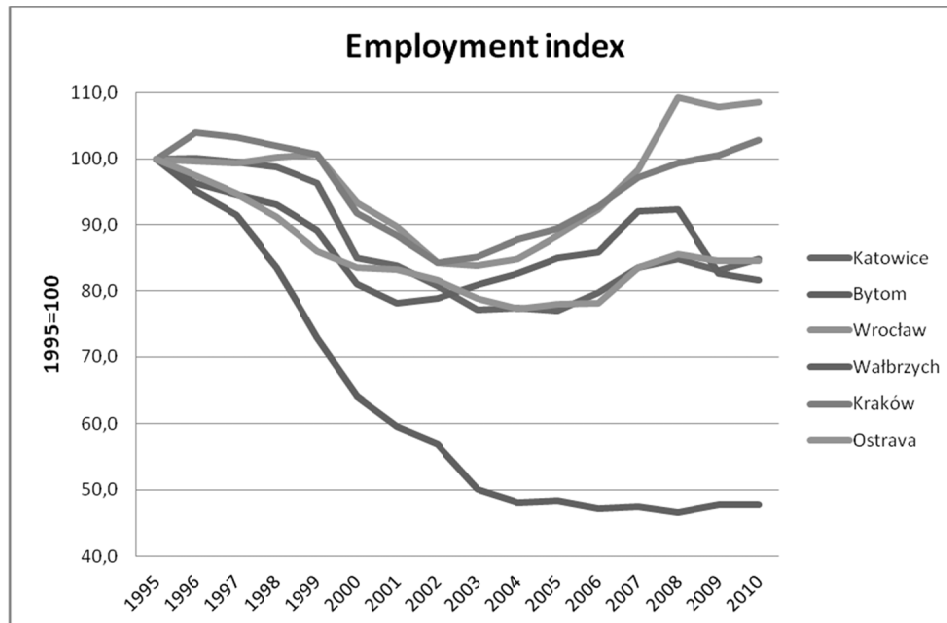
Wrocław is similarly diversified, but not to such extent like Kraków. After the Second World War it was settled by refugees from the eastern parts of Poland (these parts were incorporated to the Soviet Union). The third generation grew up in Wrocław and it started to perceive it like its own city. Population index for Wrocław shows, its human potential slightly changes over the surveyed period, but these changes not exceeded 0.5%. According to the urban economic resilience concept one must say the city characterizes relatively stable population level despite of de-urbanization processes that have appeared in Poland. In last decade significant number of the foreign direct investment has been located in Wrocław and its surroundings, and also the city has benefited from direct, quick motorway connection with Germany.

The urban economic resilience of surveyed cities and towns is more clearly visible by the value of the employment index² (see Figure 2). All cities and towns are the subject of employment fluctuation over last 15 years. But only in the case of Kraków and Wrocław employment levels in 2010 exceeded their values from 1995, which indicates good level of their urban economic resilience. The group of post-industrial cities and towns is not so succeeded. Among them the worst case is Bytom, which lost more than 50% of its workplaces and it was not able to recover them during the surveyed period (not resilient). The number of workplaces in Wałbrzych increased indeed from 2001 to 2008, but then declined to about 80% of its level from 1995 (not resilient). The trends of the em-

² Because of lack of empirical evidence of employment for Karvina, the town was not taken into analysis.

ployment level in Katowice and Ostrava are almost identical from 2000. Both cities were losing workplaces by whole decade from 1995 till 2004. After this period their number of workplaces started to grow, and began to stabilize at around 85% of their capacity from 1995 (low resilience – they have not bounced back to their previous levels).

Figure 2. Employment index of surveyed cities and towns (1995-2010)

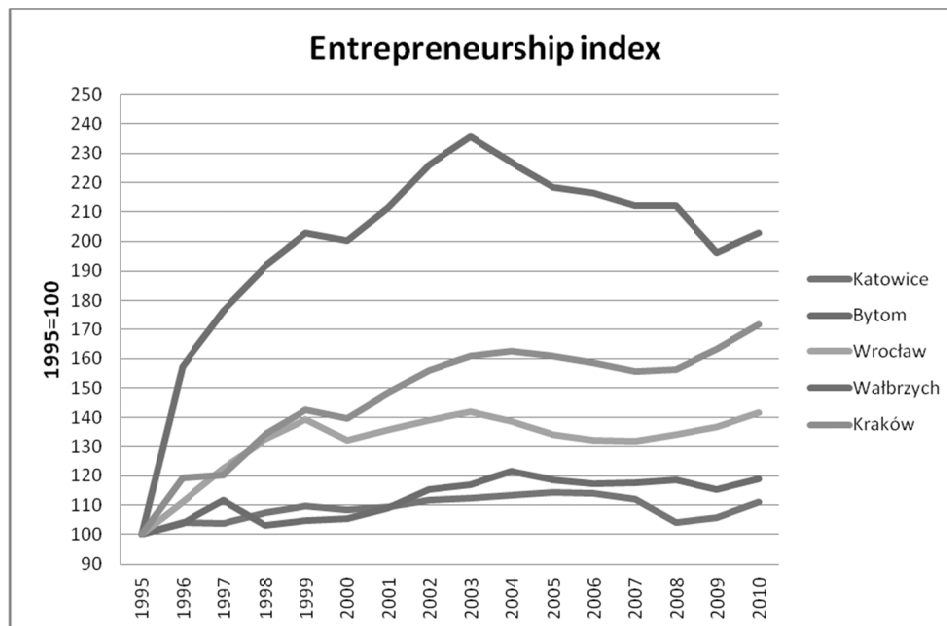


Source: According data of Central Statistical Office in Warsaw and Czech Statistical Office.

Another index depicting the urban economic resilience refers to entrepreneurship level in the surveyed cities and towns (see Figure 3). It is based on the number of individuals running their own firms as indicator showing the basic economic viability of a given city. Regarding Polish cities, the value of entrepreneurship index in all cases recorded an increase. The post-industrial cities and towns like Katowice (111) and Bytom (119) are characterized by significantly lower level of entrepreneurship's potential increase in comparison to Kraków (172) and Wrocław (142). This means less resilient reaction of the local entrepreneurship capital to changes occurring during surveyed period in the post-industrial cities, than in those with not "industrial heritage". But, the real surprise is the uncommon level of entrepreneurship index in Wałbrzych, the town where the economic base linked with mining was completely collapsed. Detailed reflections associated with Wałbrzych and its entrepreneurship's potential indi-

cate that after closing down all mines operated in Wałbrzych area relatively large part of its population was deprived of the economic base, and was 'forced' to entrepreneurial behaviors to earn a living. But these assets of entrepreneurial capital are running out (drop of the entrepreneurship index in year 2003-2009).

Figure 3. Entrepreneurship index of surveyed Polish cities and towns (1995-2010)



Source: According data of Central Statistical Office in Warsaw.

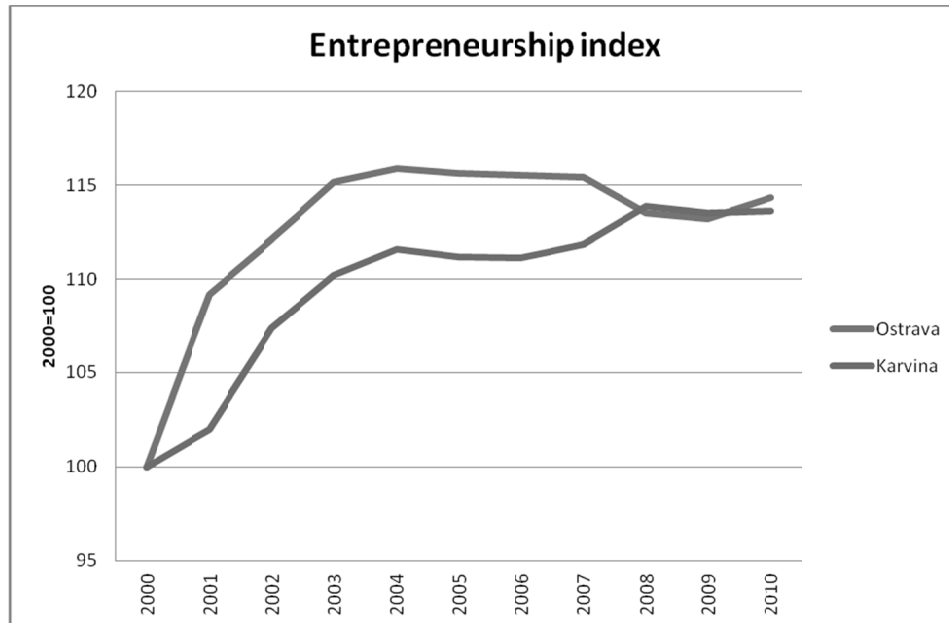
In the case of Ostrava and Karvina³, their indexes of entrepreneurship are quite similar to Polish post-industrial cities like Katowice and Bytom. The level of entrepreneurship both in Ostrava and Karvina rose to 114 (2000-2010). The decline in entrepreneurship indexes for Ostrava and Karvina is reported (higher than in surveyed Polish cities) in years 2008-2009 (the financial crisis impact).

And last empirical 'glance' on the urban economic resilience of the surveyed cities, which refers to their financial potential. This time resilience of the cities was measured by the inflow of income taxes from companies (located in the particular city) to the cities' budgets. This kind of index is relatively good approximation of economic condition of firms – especially when the volume of production, sale or a given city's GDP cannot be obtained or measured. More-

³ Both cities were analyzed separately from Polish cities because of lack of data referring to period from 1995-1999.

over, to compare inflows of taxes in different periods, all money values were discounted by the Poland's inflation rates to the year 1995.

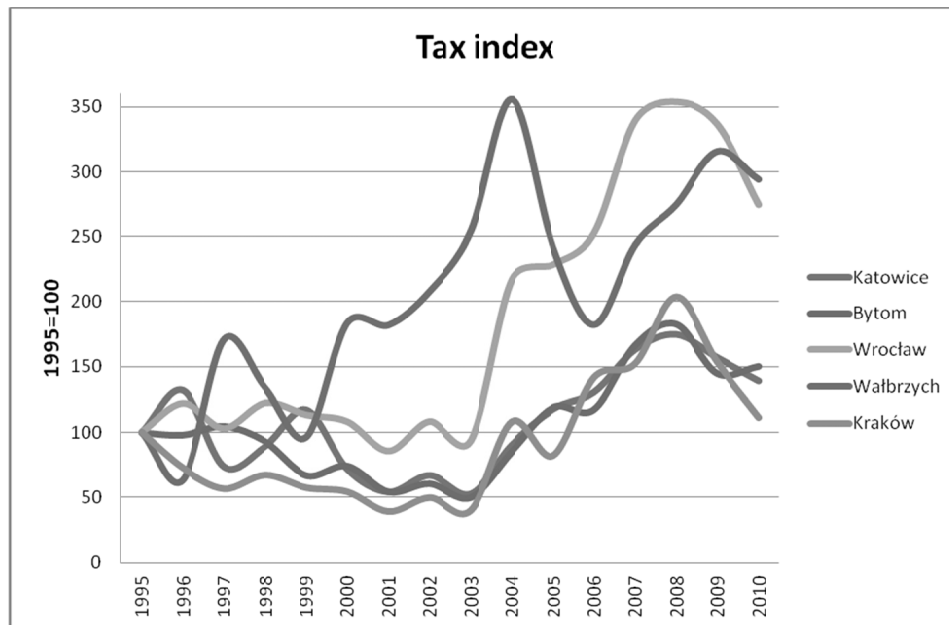
Figure 4. Entrepreneurship index of surveyed Czech cities and towns (2000-2010)



Source: According data of Czech Statistical Office.

The dynamic of economic profitability of companies (measured by income taxes), which operate in the surveyed cities⁴, has changed considerably in the period from 1995 to 2010 (see Figure 5). As it was shown, profitability of local economic base fluctuates more frequently than any other value of indexes presented in the paper.

⁴ To provide comparability of income taxes inflows to the cities' budgets the analysis was limited only to Polish towns and cities.

Figure 5. Tax index of surveyed Polish cities and towns (1995-2010)

Source: According data of Central Statistical Office in Warsaw.

In fact, until 2003 the inflows from companies' income taxes were decreasing in all cities. After this, in the period from 2004 to 2008, the tax inflows as well as companies' profitability 'erupted' to the level of 204 in Krakow and huge 354 level in Wrocław. That was the result of a good worldwide conjuncture and the first EU accession years' effect. Companies operated in the post-industrial cities like Katowice and Bytom also benefited from these effects, but not to such an extent like Wrocław. Unfortunately, the obvious effect of financial crisis of 2008-2009 in quick way decreased the inflows from companies' income taxes.

The case of Wałbrzych preliminary looks to be a different story. The value of inflows from companies' income taxes fluctuated considerably over the whole surveyed period – especially in years 1995-1999 and 2004-2006. The tax index is calculated only for limited liability companies and joint-stock companies. In vast majority these kinds of entities operate in Wałbrzych conditions in the local special economic zone (automobile industry mainly). Their production is focused on international markets and they respond quickly to changes in the global economy. Moreover, the way of calculation profits as well as value of profit taxes in conditions of Polish special economic zones is a subject of different regulations.

5. Evaluation of results and discussion

According to the empirical evidence it should be noted that, generally the post-industrial cities ‘tolerate’ changes in worse way than those without industrial label. This group of cities is characterized by lack or low level of the urban economic resilience. Katowice, Ostrava, Bytom, Karvina and Wałbrzych – all they were losing their inhabitants and workplaces in years 1995-2010. Even in the favorable circumstances (like the effect of first years after accession to the EU and good conjuncture on the international markets) their development dynamic and growth paths measured by companies’ profitability and entrepreneurship potential were weaker than in Kraków and Wrocław.

The economic shock referring to collapse or significant reduction of traditional economic base in the post-industrial cities means – according to the adaptive cycle model – they are in the phase of release. But their socio-economic structures are still inert to some extent. So, their resilience is relatively low, but may increase. Ostrava and Katowice, probably because of the stable regional administrative function, good transport connections, and relatively strong educational and cultural institutions, are trying to enter into reorganizational phase of the adaptive cycle model. But the distance between them and the development leaders like Kraków and Wrocław, perceived as dynamic of growth paths, is still a big gap.

The values of tax income index confirm that the urban economic resilience is a changing feature. Even companies located in such attractive, vibrant cities like Kraków and Wrocław could suffer from the external economic shocks like the financial crisis in years 2008-2009. In the case of Kraków the inflow from companies’ taxes dropped to the level of 110 from 204⁵ in years 2008-2010. In this context, Wrocław looks to be more resilient. Its tax inflows dropped in the same period from 354 to 274 (100 is a real value of tax inflow in 1995).

Taking in mind findings from the evolutionary approach, it must be noted that two types of economic shocks, e.g., the political along with the economic system transformation at the beginning of 1990s, and the collapse of the mining industry in mid 1990s which experienced the post-industrial cities, did not shift their economies from one equilibrium to another. Empirical evidence shows that their economies are still in the release phase of adaptive cycle model, and they should be characterize as non-resilient. The post-industrial cities’ level of population and employment are still far away from their levels from 1995. They

⁵ 100 is a real value of tax inflow in 1995.

failed to transform themselves successfully during last 15 year – in categories of the urban economic resilience – and instead some of them are ‘lock-in’ in out-moded structure (like Karvina and Bytom). In these cases ‘lock-in’ holds back the adaptation processes.

Conclusions and references

The urban economic resilience concept formulates relatively new question in the local development studies, i.e.: how a city’s economy should develop to successfully cope with external and internal changes? Thus, the urban economic resilience concept seems to be the useful attempt for explaining processes of a city’s transformation in complex way under the conditions of changeability of the external factors impacting on an urban economy. Moreover it offers few interesting research approaches embedded in the economic theory and the theory of adaptive systems.

It justifies the application of other urban economic development concepts, like creative city, smart growth, competitive city, etc., which under the specific internal and external conditions as well as on different stages of a city’s transformation may substantially determine an urban growth, making a city ‘resilient’ or ‘shock resistant’.

Also it can be perceived as the effective frame for the urban policy formulation both at different levels of a self-government and for different cities’ types (referring to their stage of transformation and development). Therefore it may be used as the theoretical background for strategies, programs and projects aimed at creation of a ‘resilient’ or a ‘shock-resistant’ city in turbulent environment. In this context the concept is particularly useful for the post-industrial cities coping with large number of the socio-economic and environmental problems of transformation and experiencing external shocks more severely than other urban areas at the same time.

As Wink noted [2012] the urban economic resilience also allows for identification of cities’ types in the frame of their vulnerability to shock. According to him one can distinguish:

- *untouchable or insensitive cities* which have relatively ‘closed’ economic structure, and thus they are insensitive to the effects of economic shocks (‘city-island’);
- *open cities* with relatively open local economy linked with the global economy; this kind of cities are sensitive to the global conjuncture, but simultane-

ously they bounce back to their previous path of growth in a quick way ('roller-coaster city');

- *overtaking cities* which local economies are able to overtake economic shocks by creation of changes in a forward-way to shocks ('vanguard-city').

After the presentation of empirical studies this typology can be supplemented by another category, i.e. 'sunken-cities'. They are characterized by: loss of their local economy relationships with regional, national and global economy, and long term gradual disappearance of the socio-economic potentials. No doubt Kraków and Wrocław are the examples of 'vanguard-cities' in Poland's conditions. The examined post-industrial cities in Poland and Czech Republic unfortunately fit to the categories of a 'roller-coaster city' and a 'sunken-city'.

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**TEORETYCZNE I EMPIRYCZNE ASPEKTY REZYLIENCJI MIEJSKIEJ
– PRZEGLĄD DOKUMENTÓW ORAZ WYNIKÓW
DLA MIAST POLSKICH I CZESKICH**

Streszczenie: Artykuł poświęcony koncepcji ekonomicznej prężności/rezyliencji miejskiej. Cel artykułu obejmuje rozpoznanie teoretycznych i metodologicznych koncepcji związanych z rezyliencją miejską, rozpatrywanych w kategoriach ekonomicznych, a także próbę ich zastosowania na rzecz szybkiej oceny rezyliencji w wybranych miastach Polski i Czech. Po prezentacji definicji rezyliencji dokonano przeglądu podstawowych podejść do jej analizowania. Uzupełnieniem artykułu są badania empiryczne wybranych miast Polski i Czech w kontekście próby diagnozy poziomu ich rezyliencji w ostatnich 15 latach.

Słowa kluczowe: prężność/rezyliencja, ekonomiczna prężność miejska, adaptacyjny model cyklu, podejście równowagi, podejście ewolucyjne.