Articles

Urban Sprawl in Eastern Europe. The Sofia City Example

Marin Geshkov*

Summary:

The urban sprawl has been defined as an excessive conversion of rural land into urban land, or excessive increase of the city beyond the optimal city size. Urban sprawl became a hot topic firstly in United States where the problem of low-density city emerged in the late 70's and early 80's. In Europe urban sprawl wasn't an issue until very recently due mostly to the structure of the European cities, which traditionally are much more concentrated and densely populated in contrast to the US cities. However, today we can observe European cities showing signs of urban sprawl, such as excessive decentralization, road congestion, lack of open space, overpopulation, etc. The purpose of our study is to examine whether there are signs of urban sprawl across the cities in Eastern Europe, analyzing data for capital of Bulgaria - Sofia. The paper will be organized in the following way: Section 1 – An Introduction, Section 2 – Review of the optimal city size theory, Section 3 – Data and empirical research and Section 4 - Conclusion.

Key words: urban sprawl, decentralization, overpopulation

JEL Classification: R2, R4, R5

1. Introduction

1.1. Definition, Criticism and Measurement of Urban Sprawl

1.1.1. Definition

Urban sprawl is a contentious issue, involving various and conflicting views on such fundamental matters as its definition, measurement, and causes. In their contribution to this literature economists emphasize the theoretical and empirical analysis of the causes of urban sprawl.

In general, economists distinguish two types of statements. Positive statements are descriptive. They describe the world the way it is. Normative statements are prescriptive. They make a claim about the way the world ought to be. In the urban economics literature, we find both positive and normative definitions of urban sprawl. According to the normative definition, urban sprawl is the excessive decentralization of population and employment from the central city to the suburbs (Mills, 1999; Brueckner, 2000). According to the positive definition, urban sprawl is simply the decentralization of population and employment from the central city to the suburbs. This process is also called decentralization and suburbanization (Mills and Hamilton, 1994, p. 81).

There are other definitions of urban sprawl in the literature on urban economics as well. Glaser and Kahn (2004) view urban

* Assistant-Professor, PhD, Department of Industrial Business, UNWE, email: marin_geshkov@yahoo.com

sprawl as relatively low-populated residential and employment areas combined with low-density suburbanization in the urban fringe. Nechyba and Walsh (2004) interpret urban sprawl as planned communities that have their own downtowns near a lake or a park, or as interspersed residents among rural areas. Urban sprawl could be also viewed as an excessive spatial increase of the particular city beyond its optimal city size. Here optimal city size is the size of the city that maximizes residents' utility.

1.1.2. Criticism

Over the years, urban sprawl has generated a great deal of criticism from economists and planners. According to John Osborn, British urban planning advocate, as discussed in Williams, Burton, and Jenks (2000), urban sprawl has two downsides: it is economically wasteful and socially disadvantageous. It is economically wasteful because transportation improvements have allowed city residents to move farther from the city center at the expense of long and costly daily commutes, as opposed to the situation in more compact cities. Economists argue that this problem is caused by congestion externalities and subsidization of auto transportation (for a review of auto externalities, see Parry, Walls and Harrington, 2007). Urban sprawl is socially disadvantageous because movement of city residents to the suburbs worsens local community life by making access to the countryside more difficult for those people who are left in the central city (see also Nechyba and Walsh, 2004).

Other researchers criticize sprawl on different grounds. For example, Brueckner (2000) names three major drawbacks of urban sprawl: loss of open space, traffic congestion, and racial segregation as in the U.S. As a result of sprawl, open space is gradually replaced by urban structure. Recent studies in urban economics (Geoghegan, Wainger, and Bockstael, 1997; O'Sullivan, 2006) find that the market price of a house increases at a decreasing rate with the amount of open space. Therefore, open space is most valued in direct proximity to the house and less valued farther from the house. Acharyi and Bennett (2001) show theoretically that in suburban residential areas, the price of housing increases as the amount of open space surrounding the house increases. Therefore, households value open space, and the loss of open space is a negative consequence of urban sprawl.

Another consequence of urban sprawl is that people live farther out and drive more often and for longer distances. By using their automobiles more frequently, residents of the urban area create traffic congestion (Kahn, 2000).

Finally, sprawl exacerbates income segregation because different income groups cannot travel equal distances. Low income groups live in areas closer to downtown which is served by public transportation. Higher income groups live in areas farther from downtown accessible only by automobile. This income segregation exacerbates racial segregation in the U.S., because lower income groups are predominately black.

Bertaud (2004) claims that urban sprawl is a reason for inadequate transportation systems. He examines the issue of providing mass transit in low density cities. Bertaud compares Barcelona, Spain, to Atlanta, Georgia—two cities almost equal in population but highly different in their concentration of people (Barcelona has a population density of 171 people per hectare compared to 6 people per hectare for Atlanta). According to him, "to duplicate the accessibility and ridership of the Barcelona system, Atlanta would have to build an additional 3,400 kilometers of

metro tracks and 2,800 stations," while "in contrast, the Barcelona system has just 99 kilometers of tracks and 136 stations" (O'Sullivan, 2006, p. 149). Bertaud's conviction is that urban sprawl makes it impossible to create a well-functioning mass transportation system.

1.1.3. Measurement

Urban sprawl is often measured by the density gradient, which represents the percentage decrease of population density with distance from the urban area center. Over time or cross-sectionally, a smaller density gradient means greater decentralization. Mills (1972, p. 35) finds that the density gradients of U.S. urban areas in his sample decreased significantly from 1880 to 1963, which indicates that urban sprawl has been occurring for many years.

Another measure of urban sprawl is the spatial size of the urban area: other things equal, the bigger the urban area, the lower the average population density, and the greater the sprawl. Regarding spatial size, O'Sullivan (2006, p. 145) notes, "between 1950 and 1990 the amount of urbanized land in the United States increased by 254 percent while the urban population has increased by only 92 percent."

1.2. Causes of Urban Sprawl

The first general equilibrium analytical model of urban structure is provided by Wheaton (1974). Wheaton derives many properties of his model, among which is that the spatial size of the urban area is directly related to the urban area's mean income and population and inversely related to the cost of travel within the urban area and to the value of rural land adjacent to the urban-rural boundary. Wheaton's model does not contain a housing sector, but Brueckner (1987) synthesizes the simulation models of Mills (1972) and Muth (1975), which do contain a housing sector, with the theoretical model of Wheaton, and obtains the same results.

Population growth and rising real income increase the demand for housing, and a greater quantity of housing is a better buy farther out. The land price decreases with distance from the center of the urban area because of the demand for accessibility to the central business district (CBD). For a given quantity of housing, then, housing price also falls with distance from the CBD. People choose where to live in an urban area by trading off the decrease in housing expenditure against the increase in commuting cost with distance. As long as the decrease in housing expenditure (the marginal benefit of distance) is greater than the increase in commuting cost (the marginal cost of distance), households will move farther from the CBD. When these quantities are equal, the household has found the optimal distance. Increased demand for housing upsets this equilibrium because it induces the household to purchase more housing, which, since housing price falls with distance, is a better buy farther out. This causes the urban area to expand spatially.

Lower real transportation cost allows people to commute longer distances at the same total cost, which also encourages suburban living. According to Glaser and Kahn (2004), automobiles have been the primary reason for urban sprawl throughout much of the twentieth century. Nechyba and Walsh (2004) show that, for the period 1910–1920, the number of car registrations increased dramatically, from half a million to more than eight million. Glaser and Kahn (2004) point out that by 1952 a majority of U.S. residents had at least one car. From 1964 to 2000 the number of people commuting to work increased by 24 percentage points, from 64 percent in 1964 to 88 percent in year 2000. Undoubtedly,

the rise of automobile transportation is an important reason for sprawl.

Finally, higher rural land values impede urban development because urban land use must command a higher value to allow buyers to outbid rural land users. These predictions have empirical support (Brueckner and Fansler, 1983; McGrath, 2005).

In addition to the fundamental causes discussed above, economists identify market and government failures as contributing sources of urban sprawl. The following is a brief discussion of them.

Failure to Account for the Social Costs of Road Congestion (Brueckner, 2001). Auto commuters pay the private cost of operating and maintaining their cars, and they pay partial costs of road use through taxes. They do not, however, pay the full cost of congestion. That induces households to occupy residences farther from the CBD than they would if they paid the full costs of commuting, which leads to excessive spatial expansion of urban areas.

Failure to Account for the Social Value of Open Space (Brueckner, 2001). As already noted, households value open space, but open space, such as parks within urban areas and rural land outside of urban areas, is a public good, and, as such, exhibits the free-rider problem. Thus, a household chooses to live at the urban fringe, causing a conversion of open space to urban use, and does not consider the effects of its action. Consequently, too much open space is converted to urban use.

Failure to Account Fully for the Infrastructure Costs of New Development (Brueckner, 2001). When a new residential area is developed, the cost of public infrastructure, such as roads, sewer systems, schools, and recreation centers, is mostly paid through the property tax. This results in a government failure because developers and home buyers do not bear the full cost of converting the open space into land available for urban use. The infrastructure cost imposed on home owners by local governments through the property tax generally does not cover the marginal infrastructure cost but the average, which is generally less than the marginal. Homeowners with equal assessed values pay the same tax regardless of whether the house is located in newly developed areas or in already developed areas. As a result, developers would bid higher prices for undeveloped land than normally, which leads to converting more rural land into urban use. Thus, people living in high density, already developed areas subsidize residents living in low-density, suburban areas. This is an argument for impact fees, which have become more prevalent as well as higher in recent years (Brueckner, 1997).

Transportation Subsidies (Brueckner, 2005a). Brueckner points out that for transportation and location decisions to be efficient, residents should pay the full cost of transportation. In reality, however, individuals do not bear the full cost of transportation because of transportation subsidies. The fact that residents underpay the cost of traveling allows residents to commute longer distances and seek living in city suburbs, thus contributing to sprawl. Su and Desalvo (2008) empirically test the effect of transportation subsidies on urban sprawl, showing that the urban area contracts with public transit subsidies and expands with auto-subsidies.

Mortgage Subsidies. In the U.S. mortgage interest is deductible from income for the purpose of federal and state income taxes, which lowers the cost of home ownership, and which, for reasons discussed above, encourages people to locate in the suburbs of urban areas. Williams, Burton, and Jenks (2000) argue that, through their generous mortgage insurance and loan programs,

both the U.S. Federal Housing Administration (FHA) and the U.S. Veterans Administration (VA) create incentives for urban sprawl. For example, the FHA provides federal guarantees to private mortgage lenders by lowering the minimum down payment to just 10 percent and extending the pay-back period from 20 to 30 years. The VA offers low-interest mortgages without down payment to all qualified veterans.

The Property Tax. Brueckner and Kim (2003) advance the idea that the property tax is a source of sprawl. Property taxes are usually lower in the suburbs than in their central cities. Therefore, land in the suburbs is developed less intensively than land in the central city, which contributes to the spatial expansion of the city. Brueckner and Kim provide numerical examples that confirm the suggestion that the property tax may encourage urban sprawl. O'Sullivan (1985) analyzes the spatial effect of property taxes using a model including both business and residential property, finding that an increase in property taxes reduces employment in both central and suburban sectors causing the urban area to shrink in size. Arnott and MacKinnon (1997) use general equilibrium simulation of the spatial effects of the property tax and find that an increase in the property tax shrinks the size of the urban area. The results are disputed by Pasha and Ghaus (1995) who note that they might not hold in a more general model. Most recently Song and Zenou (2006) and Su and DeSalvo (2008) find empirically that property taxes contracts the urban area.

Federal Spending. Persky and Kurban (2003) contend that spatially dispersed federal spending could lead to urban sprawl. For example in Chicago, U.S.A., they find that government spending to alleviate poverty and support the elderly affects residential location decisions. In fact, they show that land use in the outer fringe of Chicago increased by 20 percent because of federal spending.

Land-Use Controls. Cities and counties employ a variety of land-use controls, including minimum lot-size zoning, maximum lot-size zoning, population density controls, rent control, building height restrictions, urban land-use boundaries, land-use management districts, watershed protection policies, land-purchase programs, differential property tax assessments, transferable property rights, etc. These land-use controls are intended to achieve various, and sometimes conflicting goals, such as reducing or eliminating urban sprawl (e.g., urban land-use boundaries, maximum lot-size zoning, population density controls), ensuring adequate housing for the poor (e.g., rent control), aesthetics (e.g., building height restrictions), environmental improvement (e.g., watershed protection), etc.

Although there are numerous papers addressing land-use controls, most are theoretical, and the empirical ones generally deal with the effect of land-use controls on housing prices (for a review, see Fischel, 1985). So far, only one paper deals with the empirical effect of land-use controls on urban sprawl (Brueckner, 1998). In a sample of Californian cities, the more stringent are land-use controls directed at controlling urban sprawl, the more effective such controls are in controlling sprawl. Therefore in some cases we could consider land-use controls as a reason for urban sprawl.

2. Review of the optimal city size theory

There have been many discussions among urban economists considering the optimal size of the city. In his article Optimum city size: Fact of fancy (1979),

Malcom Getz is trying to answer the question whether there is an optimal city size for a particular city and if there is, how to define it. Optimal city size is commonly defined in the urban literature as the city size which achieves the highest level of optimal welfare for the city residents. In order to find an answer to the question the author raises in his article, Malcom Getz develops the theory of hierarchy and hinterland. According to that theory, the economy is composed of myriads of production activities, and each of those production activities has different economies of scale. In other words, the city can be viewed as a set of various kinds of businesses and for some businesses technological change and economic opportunity create advantages for large-scale production of goods and services, but not for all. Hence different businesses that operate in the city have different economies of scale and we can conclude that the size of the city optimal for one business might not be optimal for another. Therefore, the author concludes, instead of defining a single optimal city size, it is more likely to define an optimum distribution of city sizes, where each city size is optimal for a particular business. According to Malcom Getz, since each city serves its hinterland, there is a relationship between the size of the hinterland and the scale of activities within the city. Thus smaller towns would support smaller businesses such as food shops and vehicle service stations. Those businesses have normally lower production scale and require lower market areas. On the other hand bigger businesses, that have larger production scale and require larger amount of inputs for production as well as require larger market area, would be supported by progressively larger towns. Malcom Getz states that only largest cities with the largest market areas would be suitable in providing services that involve the largest scale economies such as: investment banks, business services, and wholesaling functions. As the city grows up in size, it faces an increasing marginal cost, which rises progressively as more and more businesses open within the city limits. Therefore according to the author it is more economically effective for the city to specialize in few businesses and be smaller in size, rather than support a larger scale of businesses and support a larger city size, which is unavoidably related to a larger marginal cost. Advantages and disadvantages of city size might occur for both production and consumption. Therefore the author continues with detailed discussion of the effect of city size on production and consumption. Different cities may differ in their sizes as well their productivity. The reason for productivity variation across the cities comes from the fact that different cities support different kinds of businesses. We could distinguish a single firm cities and cities with large number of firms. The single firm cities are cities that generally are dominated by a single firm business. For example, we can distinguish cities that exist around steel or coal mining, government centers, etc. However, most cities are not dominated by a single firm. Therefore using as single firm town model is not feasible in deriving the optimal city size. In most cases a city, which starts as a single-firm town, gradually expands and attract other businesses that are co-related to the main firm in service, distribution, marketing and other types of activities. For example, a large mining firm would attract a number of small input transportation firms as well as a number of output distribution firms. A big single firm that has been located initially in the city will need a various public services, such as water and sewage, public transportation, etc. Thus

the presence of a single large firm in the city would generate appearance of a large number of small scale businesses around the big firm. On the other hand, the expanding market of the big firm more likely will attract a competitive firms and this will cause the city to expand in size and an appearance of agglomeration economies. Further, Malcom Getz points out that there are other city attributes that could affect productivity along with the size of the city. For example, a firm may value the public services in the city. If we presume that a respective city has better public services such as water and sewage, as oppose to the neighboring city, we could expect firms that value the public services to concentrate in the respective city. Similarly, some firms may value the climate in a particular city as oppose to another. The author continues his analysis by stating that when we estimate the effect of city size on firms' productivity, we should look not only the static but also the dynamic aspects of this effect. As dynamic aspects of the city the author points out the technological rate of change, which varies across the cities as well as knowledge spillover, which happens to be different in different cities and could be related to the city size. Malcom Getz states that there is no clear answer to the question to what extend dynamic aspects of the city affect the firms' productivity. It is also difficult to estimate the impact of city size on innovation. Next the author extends his discussion by examining the relationship between consumption and city size. According to the author, one of the main determinants of the human welfare are the environmental factors. Environmental factors cannot be purchased at the market and vary from city to city. Thus it is possible in the future the city's optimal city size to be determined primarily by the environmental factors. Next, the author looks at the relationship between quality of life and family earnings. He postulates that family earnings vary broadly across the cities and that could be viewed as a one of the reasons for the differences in quality of life. Other effects such as crime, environmental quality, variance in a commuter travel time and a variety of consumer opportunities also differ with the city size. However, variation in family earnings associated with climate and region is small. Malcom Getz also finds variation in human amenities based on city size. Finally, the author looks at the relationship between city attractiveness and firm's productivity. Malcom Getz postulates that in order to keep an optimal city size city prices have to be adjusted in way consumers to receive higher wages for living in less attractive cities. Next the author analyzes the optimal city policy in achieving optimal city size. The size of the city will be optimal if we manage to achieve a proper allocation of resources within the city and therefore each economic unit bear the full consequences of its decision. If we have a spillover from some consequences to another, such as presence of externality for example, this will lead to misallocation of resources. Since spillovers are more common in the large dense areas, we can conclude that large unregulated markets are less likely to allocate resources efficiently in urban areas. Therefore, the city has to administrate the policy, which will control the city for various kinds of market failure and keep the optimal city size. The city administration will achieve the control of various kinds of market failure through adjustment of market prices in way each economic agent to bear the full consequences of its allocation. For example, to control road traffic and road congestion the city could impose taxes and shares on the road users in a way these taxes to bear not only the individual

cost of the traveler but also the charge, which reflects the extra travel time cost that the individual traveler imposes on other participants on the road. The city municipality could also impose charges on air pollution emitters, and in that way the polluters will pay a pollution tax for polluting the city environment. Thus through pollution tax the city municipality will decrease pollution in the urban environment. However, Malcom Getz finds that the relationship between city size resulting from full social cost pricing, i.e. from charging for pollution, congestion, etc., and the market equilibrium in the absence of such pricing is ambiguous. Further, the author looks at the findings of other urban economists, related to the relationship between externality pricing and optimal city size. George Tolley (1974) claims that appropriate pricing of various kinds of externalities will encourage more efficient use of urban space and in some cases the efficient city can be larger than the efficient market size. James Henderson (1977) assumes on the other hand that optimal city size for the city using congestion taxes is generally larger as opposed to the city using gasoline excises to finance street constructions. Edwin Mills and David de Farranti study the relationship between different market failures such as pollution, traffic congestion and etc. and concludes that optimal city size may be larger or smaller than the optimum if all externalities are appropriately priced. It is a general conclusion in the urban literature that market equilibrium city size may differ from the optimum as well as the optimum can be larger or smaller than the equilibrium depending upon specific characteristics of the market failure. Further Malcom Getz postulates that controlling the city size by appropriate pricing of different kinds of externalities is very difficult, since it is almost impossible to place the right value of each externality. Hence, it is almost impossible to achieve the right allocation of resources in the city by appropriate pricing of externalities. According to the author, it is more likely to have the opposite effect, namely instead of achieving the right distribution of resources by appropriate pricing of various kinds of externalities, the city municipality could control the human welfare by gentle manipulation of city size. Since it is impossible to impose the correct value of each externality and therefore is impossible to charge different individuals with different price for the externalities that they cause, it might be more appropriate to push city size to some target city size that would improve human welfare above a current level. Further, the author suggests that if there is a proper estimation of the relationship between city size and human welfare, than the city municipality could develop taxes and subsidies mechanism, which would enable achieving the optimal city size. As city increases in population over one million, this will increase consumer amenities, opportunities and worker's productivity, but will also create problems such as pollution, traffic congestion, etc. Therefore, the optimal city size appears to be a function of two inputs: increasing opportunities, worker's productivity and amenities on one side and increasing traffic congestion pollution and etc. on the other. Thus, in calculating optimal city size we have to compare the rate of increasing opportunity, worker's productivity and amenities on one side and the rate of increase in traffic congestion, pollution and etc. on the other with the city expanding in population. Urban studies show that for the small and medium size city with population up to 250,000 as the city expands, the rate of increase in opportunities, worker's productivity and amenities exceeds the rate of increase in traffic congestions and pollution. Therefore, if city is small or

medium in size, it could continue to increase in population until reaching the optimal city size. In the bigger cities with population above 1000 000, we observe the exact opposite picture. As city expands in size, the rate of increase in traffic congestion and air pollution exceeds the rate of increase in worker's productivity, opportunities and amenities. Therefore these kinds of cities must be discouraged from additional growth, since they already are beyond the optimal city size. What might be the appropriate mechanism to encourage or discourage a city to expand? Malcom Getz postulates that one possible mechanism could be a financing scheme including subsidy and payroll tax. For example, a certain subsidy provided by local government and attached to the worker's wage might attract workers from other cities to migrate and encourage the growth of a given city. Similarly, a payroll tax attached to the worker's wage might reduce the worker's earning and discourage workers from other cities to migrate to a given city, even more – it might encourage some of the workers already working in that given city to quit their jobs and leave the city, which will reduce its size. In that way we have a direct relationship between city size and quality of life. By controlling the quality of life through payroll tax the local government controls the city size. Lastly Malcom Getz analyses the effect of federal expenditure programs on the size of the city. According to the author federal expenditures are distributed differently among the cities of the country. Generally the larger cities receive a bigger proportion of government expenditures compared to smaller cities. Hence present federal taxes and expenditures most likely affect the size distribution of the city. If geographic impact of federal policies could be estimated, then the government could distribute the federal expenditures more precisely and use this mechanism to encourage or discourage the growth of a respective city. In their paper "One or Infinite Optimal City Sizes? In Search Of An Equilibrium Size For The Cities (2013)", the authors Camagni, Capello and Caragliu develop a model of the optimal city size. In their paper, the authors support Malcom Getz's idea that there is not one unique city size, i.e. one city size might work well for one city but might not work well for another. To determine what might be the optimal city size for a particular city according to the authors, we have to take under consideration various kinds of factors that affect the size of the city. Here, in determination of the optimal city size, Camagni, Capello and Caragliu (2013) discuss two types of approaches: traditional approach and non-traditional approach. Traditional approach starts with looking at the role of the city population over the city productivity. As we discussed above, the main advantage of the big cities is the agglomeration economies that these cities achieve through spatial expansion. A cross-sectional study, which has been performed by Marelli (1981) and encompasses 230 cities, show that larger cities have greater factor productivity as oppose to smaller cities, but this trend holds up to a certain urban size, after which factor productivity shows decreasing returns. Further, Camagni, Capello and Caragliu discuss environmental cost and agglomeration economies as factors that influence the size of the city. In big cities we have higher degree of social conflicts as well as higher environmental costs, which could lead to some of the city population leaving the city and consequently the city size to decrease. On the other hand agglomeration economies, which are typical for big cities, tend to increase workers' earnings and thus create a workers' flow from neighboring cities to a

given city, causing that given city to increase in size. Also, the authors consider the effect of urban diversity on the city productivity. The survey the authors conducted of urban literature shows that there is a clear correlation between urban diversity and city's productivity. To support their view, the authors refer to Chinitz (1961) study. Chinitz compares productivity of New York City and Pittsburgh, two relatively equal in size cities at that time. One of the main differences between these cities however is the city specialization. While New York was a city with a large scale of urban diversity, Pittsburgh was specialized in monopolistic sectors. Chinitz discovers that in urban diversified cities productivity is a function of urbanization advantages, while productivity of specialized cities is a function of economies of scale. The Chinits study proves that cities with urban diversity have in general larger productivity as oppose to those specialized in monopolistic sectors production. Another advantage of the big city, according to Camagni, Capello and Caragliu, is human capital and local synergies as source of learning. The authors share the notion that large cities can be generators of new ideas and learning processes due to larger and more variable human capital, typical for bigger cities. In other words, larger cities support larger population (human capital), that is a source of fresh ideas and innovations for the firms. A presence of new ideas and various kinds of innovations undoubtedly increases productivity in a larger city and gives comparative advantage of larger cities as oppose to smaller cities. Lastly, the authors discuss amenities as a source for attractiveness. In general, bigger cities have more urban amenities as oppose to smaller cities. Amenities as theaters, operas, museums, etc. are always present in big cities and indisputably although intangibly raise the standard of living in the bigger cities. The ampleness of amenities that can be found in bigger cities undoubtedly provides a comparative advantage of bigger cities as oppose to smaller cities. Next, Camagni, Capello and Caragliu review the non-traditional approach in determination of optimal city size. The major part of the non-traditional approach is the assumption that instead of having one optimal city size, we have an efficient city size interval. In other words, depending on specific economic function related to a specific demand capacity and minimum production size, each city has a minimum and maximum city size. Therefore the optimal city size will be in the interval between minimum and maximum city size. The higher the production capacity, the bigger the optimal city size of the city is (Camagni et.all, 1986). Further the authors analyze city networks as a source of increasing productivity of the city. In the more traditional models the city productivity is related to the city size, therefore determinants such as transportation cost and economies of scale, which affect city size, affect city productivity as well. However, in the city networks model new forces affect city productivity. Such forces are economies of horizontal and vertical integration as well as various kinds of network externalities. These forces provide the opportunity of the city to reach higher productivity through a network integration – in economic, logistic and organizational fields .Thus through network integration the city can increase its productivity without necessarily increasing their city size (Camagni, 1993). Urban form and sprawl is another issue discussed by Camagni, Capello and Caragliu. According to the authors, the urban form is optimal if this urban form allows cities to grow with minimum social and environmental costs and the maximum social and economic

benefits. The more compact the urban form is, the lower the social and environmental costs are. Generally a more dispersed urban form increases environmental cost related to higher mobility on private cars within the urban perimeter. Other than that a more dispersed urban form could be a reason for increasing social segregation and limitation of inter-personal interaction. Dispersed urban forms gradually became common in many advanced and developing countries. In his study (Camagni, 1999), the author finds that urban sprawl has become a serious problem in the last decades for European cities. According to Camagni, in for the period from 1975 to 1990 population in the observed 22 French urbanized areas has increased by 25%, while the territory of those urbanized areas has doubled for the same period. Another consecutive study (Camagni et al, 2002) deals with the collective cost that the urban sprawl has been generating in the Italian area of the Lombardy region. Camagni et al, 2002 shows the wasteful character of the urban sprawl in 186 observed municipalities, in terms of land consumption, public cost for infrastructure and collective environmental cost linked to urban mobility. Next, Camagni, Capello and Caragliu develop a model for equilibrium city size. In this model, the location choice of single individuals (firms) is driven by utility (profit) maximization, which is achieved when marginal location costs are equal to marginal location benefits. In their model of equilibrium city size the authors construct urban total cost function, which is a function of various components including urban sprawl, as well as benefit function with the main components size, diversity and amenities. Camagni, Capello and Caragliu assume a closed city model, i.e. people can freely move within the urbanized area in order to look for better living conditions. Therefore, the equilibrium size of the city will be achieved at a point where marginal location costs are equal to the marginal benefits. At an equilibrium point a city will achieve maximum city size and at the same time utility of individuals and firms' profits will be maximized. Further, the authors develop the spatial-equilibrium model to evaluate the optimal city size. According to Camagni, Capello and Caragliu, the optimal city size of the city is a function of city-specific characteristics. For example city characteristics such as amenities, human capital, industrial diversity and etc. tend to increase marginal benefit and push the marginal benefit function up. On the other hand elements, such as urban sprawl, traffic congestions, social conflicts, poverty, crime, etc. tend to push up marginal location cost function, which supposedly will reduce equilibrium city size. Next, the authors conduct empirical testing of their empirical findings. For the purpose of their empirical analysis, Camagni, Capello and Caragliu use 59 Large Urban Zones in Europe. The data, collected by the authors, encompass the main characteristics of the urbanized area such as urban amenities, proxied by inflow of tourists in the metropolitan area, externality stemming from a diversified labor, agglomeration economies measured as population density of the urbanized area, city-networks, and high-level urban functions measured as share of labor force engaged in high profile professions such as legislators, senior officials, managers and professionals. Finally, Camagni, Capello and Caragliu use two types of urban cost for traditional and for non-traditional approach respectfully. The urban cost for traditional approach includes pure location cost associated with urban size as well as social distress cost associated with urban life. For non-traditional approach the urban cost

includes the cost coming from urban sprawl such as, congestion cost, externality cost, pollution cost etc. For the purpose of empirical estimation, Camagni, Capello and Caragliu use OLS regression to regress equilibrium city population on main characteristics of urbanized area. The authors use total of six regression models. Camagni, Capello and Caragliu start with the simple model when they regress equilibrium city size on one or two city characteristics and then gradually extend the model to include all city characteristics as regressors in the last 6th model. The first model presented a simple regression where the equilibrium city size is explained by the land rent, whereas land rent stands for all costs of advantages of the city. The results from the model show a significant positive relationship between land rent and equilibrium city size. Further, the authors extend the first model by including conventional and unconventional costs of urban size. The results from the second model show expected negative and significant signs for the conventional and unconventional costs, while land rent continues to keep the positive sign. In the third model, Camagni, Capello and Caragliu, include density as an evidence for agglomeration economies. Results from the third model indicate that higher densities are linked to a source of higher equilibrium size. The authors deepen their analysis by better identifying agglomeration economies. For that purpose in the fourth model the authors substitute density with diversity and amenities, and accompanied density with diversity and amenities in the fifth model. The results from the fourth and the fifth model show that both amenities and diversity are significant and relate positively to the equilibrium city size. Finally, Camagni, Capello and Caragliu create a sixth model, which include the all city characteristics that could affect equilibrium city size. The authors add to all city characteristics previously included in model five two additional unconventional variables, namely city networks and high level urban functions. Additionally, the sixth model includes two dummy variables. The first dummy variable is denoted as a variable for small countries and allows control of two different modes of development where small countries are recognized as an urban system with smaller cities. The results show that smaller countries have cities with smaller equilibrium city size. Secondly, Camagni, Capello and Caragliu include in the sixth model a dummy for financial cities. The empirical testing of all six models prove that the best prediction of equilibrium city size could be reached by using the sixth model, therefore the authors chose the sixth model on which to expand their analysis. Further, the authors use the sixth model to predict the optimal size of a particular city. Camagni, Capello and Caragliu compare the population predicted by the model to the actual population of each of the urbanized areas used in their study. This allows for identifying those cities from the data set, which actual city size is below theoretically-determined equilibrium city size. The authors also prove that some cities with good urban governance, effective marketing and symbolic effects linked to political and economic power and control may afford to have a city size beyond the theoretical equilibrium city size. In conclusion, the authors point out that the main purpose of the article is to develop a model of equilibrium city size with main goal to asses determinants of the city size mentioned in both neoclassical and non-conventional approach. The theoretical model developed by Camagni, Capello and Caragliu was tested on 59 functional urban areas. The authors found that there is not

an exclusive city size, i.e. there is a particular optimal city size for a particular city. According to the authors, optimal city size of a particular city is exactly the size where city will achieve full economic efficiency. However, Camagni, Capello and Caragliu discovered that there are cities that achieve full economic efficiency having a size larger than the optimal city size predicted by the model. This could be explained by good governance and the model could suggest future strategies for more efficient urban planning as well as solid economic and social vision.

3. Data and empirical research

The goal of our study is to examine whether there are indications of urban sprawl in the cities in Eastern Europe. For the purpose we concentrate on the capital of Bulgaria, Sofia. The general definition of urban sprawl says that urban sprawl is an excessive conversion of rural land into urban land. This definition could be interpreted also as a substantial increase of population of the city for a relatively short period of time or as a substantial increase of housing in the city for a relatively short period of time. We could also consider increase of travel time for individuals, increase of traffic congestion, pollution, etc. as other signs of urban sprawl. Finally, urban sprawl could be detected if we have housing development beyond the city urban growth boundary normally designated as a city beltway. Thus our study will concentrate on searching for and analyzing the above mentioned signs of urban sprawl in Sofia city. The data that we use for our analysis are city–based data on population, housing, transportation, etc. We obtain these data from the data base of the Bulgarian National Statistical Institute and the World Bank-Sofia, Bulgaria.

The analysis of the data presented in table 1 shows a substantial increase of housing in Sofia city in the recent years. For the period 2010-2012 the total housing has increased from 98152 in 2010 up to 101891 in 2012 or increase of 3.8 %. For the same period we observe increase of the total number of various kinds of apartments. The total number of two bedroom apartments has increased from 217754 in 2010 to 249579 in 2012 or increase of 14.6%. The number of three bedroom apartments has increased from 172964 in 2010 to 208022 in 2012 or increase of 20.2%. Four bedroom apartments also show an increase for the observed three-year period. The number of four bedroom apartments increase form 38128 in 2010 to 47361 in 2012 or increase of 24.2%. Finally, we observe increase of the number of five and six

Table 1. Population in Sofia (2010-2012)

Year	2010	2011	2012
Total Housing	98152	101816	101891
One bedroom	94098	82352	82412
Two bedroom	217754	249381	249579
Three bedroom	172964	207806	208022
Four bedroom	38128	47292	47361
Five bedroom	7942	10835	10854
Six+ bedroom	5743	10760	10764

Source: http://www.nsi.bg

bedroom apartments. The number of five bedroom apartments has increased from 7942 in 2010 to 10854 in 2012 or 36.6%. The number of six + bedroom apartments shows an increase from 5743 in 2010 to 10764 in 2012, which is an increase of 87.4%. As we see from the data given in table 1, for the last couple of years there has been a substantial increase in housing .leading to an intensive conversion of rural land to urban land. For example we could mention the entirely new district called "Manastirski Livadi", which has been built for the short period of time between years 2004-2008, converting a large amount of rural land into urban land. The examples of additional converting of rural land into urban land, which has happened in the last five to six years, can be observed in the most parts of the city such as "Borovo" and "Mladost" districts.

Table 2. Population in Sofia (2007-2012)

Year	2007	2008	2009	2010	2011	2012
Population	1 240 788	1 247 059	1 249 798	1 259 446	1 296 615	1 302 316

Source: http://www.nsi.bg

Table 3. Average commuting time to work in min. (2007-2012)

Year	2007	2008	2009	2010	2011	2012
Average commuting time to work in min	30	33.5	37.8	43.4	47.8	53.5

Source: http://data.worldbank.org/

Table 4. Average commuting distance to work in km.(2007-2012)

Year	2007	2008	2009	2010	2011	2012
Average commuting distance to work in km	5.5	5.8	6.2	8.4	9.3	10.6

Source: http://data.worldbank.org/

The data, presented in table 2, shows that for the period from 2007 to 2012 the population of Sofia city has increased by 4.95 % from 1 240 788 in 2007 to 1 302 316 in 2012.

With regard to average commuting time data in table 3 evidence that for the observed period from 2007 to 2012 average commuting time has risen from 30 min in 2007 to 53.5 min in 2012 showing an increase of 78.3 %.

Average commuting distance to work gradually has increased form 5.5 km in 2007 to 10.6 km in 2012 or an increase of 92.7 %.

The results, given in tables 1-4, show that for the period 2007-2012 Sofia has increased spatially beyond optimal city size. Thus, today Sofia could be viewed as a modern sprawled city.

4. Conclusion

Urban sprawl has been defined as an excessive conversion of rural land into urban land, or excessive increase of the city beyond the optimal city size. Urban sprawl became a hot topic firstly in the United States, where the problem of low-density city emerged in the late 70's and early 80's. In Europe urban sprawl wasn't an issue until very recently due mostly to the structure of the European cities, which traditionally are much more concentrated and densely populated in contrast to the US cities. However, today we can observe European cities showing symptoms of urban sprawl, such as excessive decentralization, road congestion, lack of open space,

overpopulation and etc. It is affecting cities in Eastern Europe and signs of the process are already present in the capital of Bulgaria - Sofia. We pointed out that commuting time, as well as commuting distance, had increased significantly in the period 2007-2012. The number of new buildings as well as the number of new two, three and four bedroom apartments had increased as well. Finally, we observed a substantial increase of population happening in the last decade. These are evidences, showing that Sofia is on its way to turn into a sprawled metropolitan area. To curb this tendency, local government should implement and further increase growth control measures, advisably by a thorough city and regional planning.

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