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INFRASTRUCTURE INVESTMENT OPPORTUNITIES IN THE NEW EU MEMBER STATES: THE ROLE OF REGIONAL POLICIES

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Abstract

Infrastructure development is a priority on policy agendas in the EU and worldwide, because of the very high investment needs in basic infrastructure, especially in lagging behind regions and countries. The paper provides a descriptive analysis of the infrastructural gaps in EU transition economies at national and, as far as possible, regional level for some infrastructure sectors: transport, telecommunication, environment and energy. The analysis suggests that, on average, internal divergences in the infrastructures' endowment are present between the urbanised capital cities regions and the peripheral and rural areas, in all the Member States; yet, the density and quality of such endowment is significantly higher in the Western countries and limited in the Eastern ones.

JEL codes: H54, O18, R11, R58

Keywords: Infrastructure, regional policy, EU new member states

Introduction

Infrastructure development is a priority on policy agendas in the EU and worldwide. Governments at different levels (supra-national, national, regional and local) invest a large share of their funds for infrastructure projects in transportation, energy production, telecommunications, water and sanitation. It is estimated that half of public investment in the EU member states is for infrastructure, the largest proportion being in the Cohesion Countries and New Member States (NMS)[1].

Investment needs in basic infrastructures are still very high, especially in lagging behind regions and countries. A recent OECD study estimates that, in order to cope with infrastructure investment needs to 2030, annual investments in transport, energy, water and telecommunications should be roughly equal to 2.5% of world GDP[2].

Traditionally, different endowments in basic infrastructures (as well as other ingredients such as factors of production, natural resources and technology) between regions or countries have been seen as the cause of disparities in economic performance. Justification of public funding for infrastructure stems from the expectation that they foster economic growth by enhancing factor productivity, and promote convergence in income distribution and living standards.

Literature shows that although this holds true at an aggregate level (at the country level and with an aggregate measure of infrastructural endowment, see for example Barro, 1990, Aschauer, 1989 and other papers cited by Del Bo in a earlier chapter), if the regional dimension, typologies of infrastructures and conditions or nature of investments are considered, a different picture emerges. Evidence is not conclusive on this point, also due to the lack of homogeneous data at the regional (NUTS2[3]) and sectoral/industry level. In terms of data availability, the most comprehensive picture can be gathered for transport. In this field, many studies show for example that different effects in terms of regional growth are recorded if core/peripheral or urban/rural typology of regions are encountered.

This chapter contributes to this debate by providing a descriptive analysis of the infrastructure gaps in the NMS at the national and (as far as possible) regional level for some infrastructure sectors (transport, telecommunications, environment and energy) and discussing policy challenges in the light of the potential offered by the Structural Funds. The analysis shows that wide gaps do exist between the EU member states and that regional gaps in the NMS are not wider than those in some EU15 countries; in other words, the greatest divergence can be detected not in the extent of regional gaps, but in the national averages, with the first being significantly lower than the latter.

The chapter is organised as follows: in the second section a literature review on the conceptual models related to infrastructure and growth, the regional disparities in the EU and the Cohesion Policy actions and funding of infrastructure at the national and regional level are presented. In section 3 the current infrastructural endowments in the NMS are discussed and, as far as possible, broken down at the regional level, in transport, telecommunication, environment and energy. Conclusions are drawn in the fourth and final section.

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[1] Up to 2% of GDP on average in the period 2000-2005 (see EIB, 2007). As a matter of comparison in China, Thailand and Vietnam total infrastructure investment exceeds 7% of GDP (see the EC, 2008).

[2] OECD, 2007.

[3] EUROSTAT and other European Union bodies use three levels of Nomenclature of Territorial Units for Statistics, also called NUTS, to refer to macro-regional (NUTS1), regional (NUTS2) and district (NUTS3) level in each member states.

2. Infrastructure and regional disparities in the EU

2.1 Theoretical background

A vast literature shows that, at an aggregate level, infrastructures are a key driver of economic growth[4]. In theoretical growth models infrastructural endowments are a growth factor of the aggregate stock of capital (either private or public) in the aggregate production function[5]. Different channels of influence, either direct or indirect, link infrastructure endowment to economic growth, mainly through productivity effects on the other factors (more efficient transportation services enable entrepreneurs to cut production costs, access to broadband connections improve the performance of human capital etc.).

However evidence is often mixed in terms of magnitude and direction of effects. Infrastructures have different nature, features and operate in different market conditions[6]. Quality and maintenance of infrastructural investment, the way infrastructures are managed and priced, or the level of maintenance cost over capital expenditure are also relevant aspects influencing the final effects on growth.

Andraz and Pereira (2007) suggest that, even if infrastructures financed by public investments are public goods which become available simultaneously to all industries, their marginal effect is different for each industry. They estimate that, at the aggregate level, public investments occurred in Portugal between 1976 and 1998 positively affected output and employment and crowded in private investment. However, through separate models the authors find out that some industries actually benefited the most from public investments. These were Construction, Transportation and Finance, both in absolute terms and relative to their size.

The complexity of the relationship between infrastructure and economic development is confirmed also if considering the impact of the trans-European transport network (TEN-T). An analysis carried out by TRT (2006) highlights that the local impacts of the TENs network are highly differentiated across regions and measures the effects in terms of cohesion (GDP growth and employment) in the short (2005-15), medium (2005-30) and long period (2005-50). While the most developed European Central countries (France, Germany and the Benelux) benefit immediately from the TENs, effects are uncertain for the peripheral and less developed areas: they are expected to be positive by 2030 for Greece, Ireland and Eastern Europe countries and no real advantages are estimated in the short or longer terms for Finland, Sweden and Italy.

Location theory and new economic geography put emphasis on divergence forces of agglomeration effects and spatially unequal distribution of resources. According to this approach, regional features do matter in shaping the effects of infrastructures, which may even be detrimental for poor or peripheral regions, as TRT and other contributions on transport and telecommunication projects suggest (De Rus et al., 1995; Martin, 1997). The argument is that basic transport infrastructure not only increase accessibility of core regions from peripheral ones (better access to input factors for firms from peripheral regions for example) but, the opposite also occurs, with negative effects on peripheral regions being exposed to higher competition (firms from core regions can now supply peripheral entrepreneurs with local supply being crowded out).

Again, the results of a simulation model by Spieckermann and Wegener (2006) applied to South East Europe confirms the need for a spatially-differentiated transport policy which adopts differentiated development model according to the phase of development of each country and region. Such a strategy would imply strengthening existing or emerging polycentric structures (disregarding the economically most successful large agglomerations), in the already highly-developed and urbanized EU15, through the improvement of accessibility of medium-level central places and compensating for the accessibility deficits of rural and peripheral regions. However, in the still-urbanizing EU12, accession countries and Western Balkans, it may be justified, over a transition period of ten to fifteen years, to enhance the growth dynamics of these countries via fast and efficient transport connections between their capital cities and the major agglomerations and economic centers in Western Europe[7]. Similar results (but for high/low-density regions) are found also by Rothengatter and Schaffer (2004), who consider also the quality of transport system.

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[4] For a comprehensive literature review of infrastructure and growth see Gramlich (1994) for theoretical foundations and Straub (2008) for a survey on empirical works.

[5] The other factors being labour, non-infrastructural capital stock, technology, institutions and environment. This traditional model implies that infrastructures are pure public goods, while other formulations consider that rather services produced by infrastructures are included in the production function.

[6] For example, the public good nature of some types of infrastructure is relevant to detect if public capital is cause or effect of development (see Biehl et. Al, 1986).

[7] After that period, however, the risk of the over-dominance of these cities will have to be reduced by a shift in the focus of transport investments first to medium-sized cities and, later, as in the OMS, to rural and peripheral regions.

The link between infrastructure and growth performance at regional level is particularly relevant in the framework of EU cohesion policy, whose aim is to reduce regional disparities by promoting convergence mainly in terms of regional per capita GDP (the distance of regional GDP from the EU average being the basis for eligibility to different priorities of Structural Funds). However, evidence on the effectiveness of Structural Funds support to infrastructure for promoting regional growth is still debated. Despite several empirical works confirm a positive link between infrastructure and regional growth (see, among others, Biehl ,1986; Rapún, Gil and Pascual, 2000; Basile *et al*., 2001) some others are rather critical on the potential of Structural Funds in reducing disparities in regional income levels in the long-run (see Boldrin and Canova, 2003 and Puga, 2002). These contributions focus mainly on regional disparities in the EU27 and how to reconsider regional policies in the light of agglomeration forces affect the uneven distribution of growth effects.

2.2 Regional disparities in the NMS

The accession of Estonia, Latvia, Lithuania, Poland, Czech and Slovak Republic, Hungary, Slovenia in 2004 and Romania and Bulgaria in 2007, former transition economy countries, inevitably increased the differences inside the European Union, under a cultural, social, political and economic point of view. These countries are characterized by a higher rate of inflation, and lower levels of GDP per capita. As a consequence, the whole Union's average of GDP per capita fell by around 7% in 2004 and by 10% in 2007, compared to the average of EU15 in the same year[8]. Between 2005 and 2008, among the NMS, Slovenia has the highest average of per capita GDP, corresponding to 88.86% of EU27 average, but still below the average of the Old Member States (124.22% of EU27average). The most recent members, Romania and Bulgaria, have the lowest value: respectively 40.4% and 37.13% of EU27 average.

The NMS have a potential growth that is estimated at around 4% per year for the next decade. Real GDP growth between 2005 and 2008 shows clearly that the NMS contribute at raising the EU average, that is around 3.8%. The highest value is registered in Slovakia, with an average growth close to 8%. Only Hungary, after a period of growth at 4%, in 2007 and 2008 experienced a rate lower than 1%, reducing its average and placing it close to the level of the Old Member States (2.46%).

These high growth rates suggest that a catching up process is underway. However, at regional level the picture can be quite different, since some regions grow faster than others. In particular, some regions of Bulgaria, Hungary, Poland and Slovak Republic in the period 2003-2005 have grown much more slowly than the others and they place below the total European average. The growth rate in these countries is driven by some specific fast-growing regions, with others lagging behind. In all cases, the capital city is located in regions with the highest growth, while the most peripheral areas are the least developed ones.

An analysis of the variance (ANOVA[9]) inside each European country shows the highest variability of the GDP growth between 2003 and 2005 in Bulgaria (6.4%), Slovakia (3.7%), Hungary (2.4%) and Romania (2.3%); Poland and Czech Republic have a reduced internal growth variability, that is similar to the Old Member States (OMS)' regions (below 1.5%). The comparison of the whole group of the NMS to the OMS highlights that the GDP growth variance of the first is higher (respectively 3.17% and 1.27%). The F-test rejects the hypothesis that the groups (countries)' averages are the same, which means there is a significant[10] difference among the countries' average GDP growth: actually, for example,the gap between the Italian and the Slovak growth rate is higher than 7 percentage points.

Also considering the GDP per capita distribution, regional gaps can be detected, with the NMS placing below the European average of EUR 20,670.37 per capita (PPS), with few but predictable exceptions: in Czech Republic, Hungary and Slovak Republic the regions corresponding to the areas where the capital cities of Prague, Budapest and Bratislava are placed stand out from the others. This confirms that in the New EU Member States, the level of development and wealth is widely differentiated among the regions: in Bulgaria, for example, some regions grow very fast, at more than 7% rate, dragging the national growth and contributing at raising the total European average, while others are almost stagnant. It is worth to point out that higher national averages of per capita GDP correspond to higher regional gaps within the country: Bulgarian regions have the lowest per capita GDP and there is no significant difference among them, while Czech Republic, that has higher per capita GDP, also has the deepest regional gaps.

The ANOVA confirms that among the NMS, Slovakia and Czech Republic have the greatest regional variability in terms of GDP per capita PPS, followed by Hungary. However the variance in the OMS group is bigger than in the New ones. Per capita GDP in

[8] EUROSTAT data.

[9] The ANOVA calculates and compares the variance between and within different groups, which, in the specific case, are the European countries and their regional sub-divisions, and it tests (through a Fisher Test) whether the means of different groups are significantly different. The analysis of variance is carried out only on countries with regional divisions (NUTS2): among the NMS there are Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia; among the OMS Austria, Belgium, Denmark, Finland, France, Italy, Netherlands, Spain, Sweden, United Kingdom are considered.

[10] The level of significance is 1%.

Bulgaria and Poland, that is among the lowest in the whole Europe, is even the less differentiated among their regions. As with the GDP growth, the F-test rejects the hypothesis of significant similarities among the groups (countries).

What emerges from this simple analysis is that development gaps in Europe are present both at the national, between the OMS and the NMS, and at regional level, between each country's regions: the GDP growth is more variable in the group of the NMS, while per capita GDP variability is higher in the Old EU countries. However, even if in some cases the regional divergences are big, the distances at country level are even bigger, both for GDP growth and per capita GDP.

2.3 Infrastructure and EU Cohesion Policy

Structural Funds budget for the period 2007-2013 is around EUR 350 billion; it accounts for more than one third of the total EU budget and it is its fastest-growing component. EUR 70 billion are addressed to the Cohesion Fund, which supports transport and environment projects (including energy) in countries with a per capita GDP below 90% of the EU average. While Cohesion Fund is planned and managed at national level, the other financial instruments (European Regional Development Fund, ERDF and European Social Fund, ESF) are regional tools[11].

Notwithstanding the emphasis put by the Lisbon strategy on the so-called soft measures, such as support to R&D activities, innovation, technology transfer and entrepreneurship, filling in the infrastructure gaps is still considered a top priority, especially for lagging behind regions, NMS and accessing countries. As put forward in the EC new growth and jobs agenda "growth and jobs are determined by framework conditions such as the endowment of infrastructure of various kinds — physical, in the form of transport and telecommunication networks, human, in the form of the skills and know-how of the work force, and social, in the form of care and other support services" (European Commission, 2007, p. 60).

A large share of Cohesion Policy budget is spent in infrastructure, especially transport (road, rail, waterway, airport, port, urban transport) and environment (energy, water, sewage and waste treatment). Less significant in financial terms at an aggregate level, but still noteworthy in some regions, are telecommunication (telephone, broadband networks, ICT) and social infrastructure (health and education). Major efforts in infrastructure development are concentrated in the NMS. In the period 2007-2013 half of the total Structural Funds were directed towards the NMS, which dedicate 60% of total expenditure to infrastructure programmes. In the previous programming period (2000-2006), a much lower amount of Structural Funds was assigned to these countries since they joined the EU only in 2004[12]. Nevertheless, the share going to infrastructure is higher than what the other members received (37% versus 26%[13]). These data confirm the EU commitment in promoting development and growth especially in the lagging behind countries, in order to achieve economic, social and territorial cohesion. Poland is the country that receives the largest amount of Structural Funds, being programmed over EUR 65 billion in 2007-2013, 61% of which is directed to the infrastructure sectors. The prevalence of infrastructure investment on other sectors is peculiar of the NMS[14]. A part from Poland, also Bulgaria, Estonia, Hungary, Latvia, Malta, Romania and Slovakia addresses more than 60% of total Structural Funds in infrastructures. Among the Old Member States, Spain, Italy, Germany and Greece, receive the largest amount of funds (more than EUR 20 billion), but only Greece dedicate more than 60% of EU funds to infrastructure sector (the other share are respectively 47%, 38% and 23%).

In the period 2000-2006, the share of Structural Funds allocated to the NMS is only 37%. However, if we consider also the Cohesion Funds, the total funds exceed EUR 48,355 million, whose 78% is dedicated to infrastructures.

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[11] This was less so in the period 2004-2006 for the EU12, when the decentralisation process was still at a very early stage. Practically this meant that, for example in Poland, Structural Funds funded seven different Operational Programmes (planning documents setting priorities and implementation procedures) all of them managed at national level. They focussed on: business competitiveness, human resources, transport, food sector and rural development, fisheries, integrated regional programme and technical assistance. In the period 2007-2013 the situation is different: in Poland four programmes are managed at national level (innovation, infrastructure and environment, development of Eastern Poland and technical assistance), and sixteen at regional level.

[12] Before 2004 a large share of funds was coming from the instruments of Pre-accession.

[13] DG REGIO data

[14] The only exception is Greece which, even if it is an old member country, still gives much importance to infrastructures.

3. Infrastructural endowment in the New EU Member States

The present section describes the European infrastructural gaps at country and, whenever the data are available, at regional level. This kind of gap, even if not completely, contributes at explaining the differences in per capita GDP. The analysis will focus on infrastructure capacity in three sectors: transport, telecommunication and environment (environment protection and energy). The descriptive analysis of transport, telecommunication and environment infrastructure endowment has two objectives:

illustrating the existing investment needs and the actual allocation of EU funds in the most important infrastructure sectors;

carrying out an illustrative analysis on the infrastructure endowment, comparing the extent of cross-country divergences with the regional gaps in the NMS and in the OMS.

3.1 Transport

Transport infrastructures have always been one of the biggest components of government investment in Europe. In the period 2000-2006, more than EUR 47 billion were committed by the European Commission only for transport infrastructures through the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), on a total of EUR 157 billion[15]. In the current period the amount has significantly risen: the programmed investments of Structural Funds between 2007 and 2013 amount at more than EUR 75 billion in transport, 50 billion of which (67%) directed to the NMS. In all the New Members, transport is the field that receives the highest share of funds on the total of infrastructures, ranging from 56% of Poland to 42% of Latvia; the only exceptions are Estonia and Hungary, where transport infrastructures occupy the second places (after environmental sector), but with still a high share: respectively 40% and 36% on total infrastructural SF funds.

The Commission recognizes the need to optimize the transport system in order to meet the demands of enlargement and suitable development, from an economic, social and also environmental point of view. In 2001, the European Commission set clear policy guidelines to govern transport infrastructure investment up till 2010 (EC, 2001), which include:

- improving quality and safety of all the transport modes;
- paying attention to environmental protection, reducing noise and pollution;
- promoting inter-modality;
- building the trans-European transport network and improving access to outlying areas.

After the accession to the EU and the elimination of borders, in the Eastern European Countries new traffic patterns and national priorities appeared. There is a considerable need for transport investment in the New EU Members, in terms of rehabilitation of existing network, upgrading or new construction. The infrastructures are generally in bad conditions, due to lack of periodic maintenance, but also the absence of renewal and replacement of assets reaching the end of their economic life.

ESPON (2005), in its evaluation study on European transport services and network, calculates the multimodal potential accessibility indicator for all the regions of the European Union. This indicator is a measure of transport infrastructure endowment and it takes into account roads, railways, ports and airports infrastructures. The results show that in 2001 regions with clearly above EU average accessibility are mainly located along the so-called Blue Banana[16]. There are highly accessible regions also in other countries, such as Madrid, Barcelona, Glasgow, Copenhagen, Oslo, Rome, and Naples. Their accessibility is ensured above all by airport connections. In the OMS, also many regions with a very low accessibility level, with no good access to international flight service, are present. For what the NMS are concerned, nearly all regions have below average accessibility, with the exception of the capital cities regions. Again, international airports seem to play an important role in multimodal accessibility in Europe, especially for the regions with the capital or other main cities.

[15] DG REGIO data.

[16] Term coined by Roger Brunet in 1989. It indicates a corridor stretching approximately from North-West of England to Milan, passing by the Benelux countries and the Rhine's basin.

Analysis of the 2007-2013 allocation of Structural Funds in transport sector highlights that precise priority in the transport sector has been given to promote the trans-European transport (railways and motorways) network, while in the NMS the Commission funds also national, regional and local roads.

Yet, the full exploitation of the benefits coming from trans-national corridors and internal transport network may be prevented by the existence of regional infrastructure gaps inside each country and urbanisation differences.

3.1.1 Motorways and roads

Jevčák and Keereman (2008) report that in the NMS there are on average around 30% fewer roads per square km than in the OMS. Motorways represent only 1% of total road infrastructures, half than the share of the rest of Europe.

The motorway network is generally more developed in the OMS. The lengths of motorway related to the total surface of the country reaches its highest value in Benelux and Germany. All the NMS have fewer kilometers of motorways respective to their area. Poland and Romania, which have the largest territory among the NMS, are placed at the bottom of the ranking; anyway, also smaller countries like Czech Republic and Slovakia have relative few motorways. Slovenia is the only exception, placing above both the European and the EU15 average, mainly because of its peculiar geographical position: situated at the border of Italy, Austria, Hungary and Croatia, Slovenia is the natural "bridge" between Western and Central-Europe and Balkans; hence, a good motorway network is required to transport people and freight throughout the continent. In addition, its small size contributes at raising the density indicator.

Apart from geographical reasons, in general it can be pointed out that while in the OMS almost every city is connected by motorways, in the NMS motorways link a limited number of centres, usually those where productive activities are concentrated. In Poland this is particularly clear: three separate high-speed roads serve the cities of Cracow and Legnica in the South, Poznan and Lodz in the Centre, and Grudziadz and the principal port of Danzig in the North.

The same can be referred of the other NMS: during the pre-accession period, the length of motorways increased, but they were concentrated in few areas, either around capital cities or in transit routes to the west. In Czech Republic there is a road concentration around Prague and in Jihovychod in the South, at the border of Austria and Slovakia. In Romania, virtually all the motorways are in the surrounding of Bucharest.

The infrastructure endowment of primary and secondary roads is more homogeneous. Apart from Malta, Belgium and Netherland, where the road density is very high (respectively 9.8, 4.7 and 3.2 km/km^2) mainly for geographical reasons (small dimensions and central location in the Union), the most of the NMS have a road network as dense as the other European members, with an approximately average of 1.5 km/km^2). There is not a clear distinction between the Old and the NMS, indicating that the European road transport gap is mainly a motorway matter, at least under the density perspective. If we consider the quality of roads, in the NMS these are generally poor, suffering a lack of maintenance over many years (EC, 2004 and EIB, 2000). Most of the investment activity in Bulgaria and Romania, for instance, took place in the 1970s and 1980s and backlog of maintenance is particularly acute in certain case.

To sum: even if some countries seem to make some efforts to increase their road and motorway network (namely Hungary and Czech Republic) also taking advantage from the Structural Funds, on the whole the quantity and quality of road infrastructure is still below the standards of the rest of the EU.

A regional analysis of the NMS at the NUTS2 level and the ANOVA show the existence of the widest transport infrastructure gaps in Czech Republic, Hungary, Romania and Slovakia. The case of Slovakia is particularly visible and pronounced: the region of Bratislava has got the highest density of motorways in the NMS (0.05 km per squared kilometer), but it is also largely above the EU15 and EU27 averages (around 0.02 km per squared kilometer). However, Slovakian variance is exceeded by Germany, United Kingdom, Netherlands, Austria, Portugal and Spain's one. The variance in the group of the 15 OMS is much higher than in the NMS group. This suggests that, even if in the NMS regional gaps do exist in the density of road transport, these gaps are not in general deeper than those in the OMS.

The density distribution of other roads is more homogeneous in the NMS regions, like at national level. They are all below the EU15 and EU27 average (around 1.5 km per squared kilometer) with few cases of outsiders: the region of Slaskie in Poland, near Cracow, has 2 km of roads per squared kilometer, and the region of Bucharest in Romania with the national highest density not only in motorways but also in other roads, with 5.60 kilometers of roads over an area of one squared kilometer. Among the New members, Romania has the highest variance, but this value is lower than the variability in Austria and in the United Kingdom: in particular, the United Kingdom density of roads has a variance that is more than double the Romania's one. Again, the variability in the group of the

NMS is lower than in the OMS. The F-test rejects the hypothesis that the national average density of motorways and road are similar.

To sum up, the data show a general underdeveloped motorway and road network in the New EU Member States as respect to the Union average and a strong relation between the density of transport infrastructure in physical terms, especially motorways, and the economic importance of a region, within a single country.

Since it could be expected that the infrastructural endowment depends not only to the territorial dimension but also to the degree of urbanization[17], the ANOVA has been repeated after comparing the transport endowment to the regional population size and the main results do not change: as expected, motorways and other roads are more concentrated in the urbanized regions of all the European countries.

3.1.2 Train

Railways are a significant mode of transport in the South-Eastern European countries. They provide key connections to neighboring countries, particularly towards the West of Europe. Rail density, related to the country area, is generally high, as compared to the EU 15 and EU27 average and, unlike the road transport, no clear gap between Western and Eastern Europe can be highlighted. While Estonia has got a low railway density, Czech Republic occupies the highest-ranking, even above Belgium and Germany. Hungary, Slovakia, Poland and Slovenia are above the European average too. However, the overall standard of the rail network in the New Member Countries is poor and reflects decades of low investments[18]. The proportion of electrified railway lines and double-track lines is below the EU27 average (42%) for the three Baltic Countries, Czech Republic, Hungary and Romania; Slovenia and Slovakia are close to EU27 average, while Poland and Bulgaria are even above the EU15 average of 53%, with respectively 59% and 68% of electrified rail lines on the total. The highest values correspond to countries where, in the last years, recent investments in the railways sector have been taking place.

The European Commission is supporting investment in order to improve the railway quality and to promote the creation of an intermodal transport network, since improvements in the road network, which are undoubtedly required, will tend further to encourage the use of car, leading to increase congestion and environmental pollution.

From the ANOVA for the rail sector it emerges a less degree of dispersion in respect to the motorways and other roads. In Bulgaria, Hungary and Slovakia no internal gaps in the density of railway lines are shown. In Poland, Romania and Czech Republic, the regions of Slaskie, Bucharest and, above all, Prague have a greater density of train lines, which is higher than elsewhere, not only in the NMS but also in the whole Europe. The concentration of transport is higher in correspondence with the national productive centres: actually, the urbanisation indicator is positively linked to the density of railways in Europe and especially in the NMS. In general, there is significant difference among the national density of railways (confirmed by the F-test), with variability in the NMS group higher than in the rest of Europe.

To summarize, from the description of the investment needs in the transport sector, it emerges that:

- the New European Member States have a motorways and road network's density lower than the rest of Europe, while their railways network is relatively more developed;
- inside the NMS there are regional differences in the density of motorways and railways infrastructures, which mainly reflect the level of urbanisation and productivity of a region, while the other kinds of roads are more homogenously spread over the national territory;
- the inter-regional transport gaps within the NMS are not systematically higher than those in the OMS.

Telecommunication

Investment in telecommunications services in South-Eastern Europe are needed both to extend the service towards universality and also to modernise and upgrade the quality of existing services.

The ICT sector not only is the second largest economic sector and a major generator of new jobs and business worldwide, but it also forms the basis of the emerging global "knowledge economy", seen as the main driver of economic growth in the twenty-first century. The modern infrastructures can generate new business opportunities in local environments, can increase the competitive abilities of

[17] An indicator has been elaborated by the Authors, which classifies the NUTS2 regions into four groups, according to the percentage of population living in sizeable cities or rural and peripheral areas.
[18] EIB, 2000; ECORYS, 2005

existing lines of business and create new lines and better-paid jobs and can have a positive effect on the local community's awareness of development and business opportunities. At least in principle, improving the level of telecommunication infrastructures can be a determinant factor in reducing the gap between the developed and less-developed areas in each country. Rural, peripheral and outermost regions can exploit the opportunities that ICT offers to reduce the problems of remoteness which they suffer from.

Technological innovations, especially wireless telecommunications and the web-base Internet, supported by policy reform, are rapidly making ICT affordable and accessible to all nations and regions. The European Union assists the NMS in developing and using telecommunication and information technology sector by:

- building ICT infrastructures (telephone and broadband network) and expanding ICT access for under-served populations,
- promoting legal, policy and regulatory reform to foster liberalization of telecommunication,
- promoting competition and private investment,
- supporting the ICT services and applications for citizens and businesses, especially Small and Medium Enterprises (SME).

Moreover, in Czech Republic (the only one among the NMS) the Structural Funds are also directed towards the promotion of the trans-European information and communication technologies.

The analysis of the allocation of Structural Funds for the 2007-2013 programming periods shows that Slovakia and Poland are the New Member Countries addressing the highest percentage (15% and 9%) of Structural Funds to the information society sector, corresponding to about EUR 11 million and EUR 37 million.

However, as in transport sector, also in ICT a number of evident regional disparities can be listed in terms of communication infrastructures, affordability of access to networks, quality of ICT services and Internet usage (EC, 2004). These disparities can be specified at three levels: between West and East Europe, with the NMS having a generally lower rate of penetration of new technologies; between the NMS, where the ICT development levels are different, with Romania far below the average; and within single countries, between urbanised and peripheral areas.

Telecommunication services and accessibility to ICT network can be measured by the number of main telephone lines and the number of mobile subscriptions in relations to the population size. In the NMS, the number of fixed lines is below EU27 average of 39% and EU15 average of 46%, varying from 19% in Romania to 35% of Estonia. Bulgaria, which joined the Union in the same year than Romania, has a better telephone access, around 31%. These values, which are relative to 2006, have risen significantly since the Nineties; anyway, it is reasonable to think that this growing trend is coming to an end, as the mobile lines develop.

Actually, in 2006 the number of subscriptions to cellular mobile service as a percentage of population does not show evidence of any marked discrepancy in Europe. Estonia, Czech Republic and Lithuania have a higher share of mobile subscription than the EU15 and EU27 averages (both around 107%), respectively of 110%, 124% and 139%. Bulgaria is at the EU27 average while the other NMS have a lower share of mobile subscription, but still at high levels (more than 8 people to 10), similar to some of the most developed countries, such as France, Belgium and Germany. The extensive use of the mobile telephones in some degree offsets the use of fixed lines.

In Slovenia, Estonia and Slovakia, 60% of households with members aged 16-74 years have internet access, between EU15 (66%) and EU27 (58%) averages. The remaining NMS are still lagging behind, with a share between 45 and 50%; the percentage is much lower in Romania and Bulgaria (less than 30%). These generally low proportions in part reflect the technical difficulty of gaining access to the Internet in these countries. The extent of the increase, however, may well depend on both the spread of broadband and the services available on the Internet. Although the proportion of households with access to the Internet may not have a direct impact on economic performance, indirectly it tends to reflect the technical abilities of people and their receptiveness to the new technology, both of which can be important in economic development (EC, 2004).

The number of enterprises having access to Internet, instead, can be considered more directly related to the economic performance, since Internet allows undoubted advantages, like the reduction of communication costs and opportunities deriving from the e-commerce. Ninety six percentage of Slovenian enterprises has access to Internet, a value that is among the highest in Europe and above the EU 15 and EU27 average (91% and 88% in 2008); since 2004, Romania, Bulgaria, Hungary and Latvia have significantly increased the share of enterprises using Internet, but they are still placed below the average, between 67% and 92%. Slovakia experienced the fastest growth (35%), passing from the bottom to the top of the European ranking in only 4 years.

Eurostat offers few telecommunication indicators at regional level: since these are indicators of accessibility, they only indirectly refer to telecommunication infrastructures.

The analysis of the variance shows that the European highest variability in accessibility is in Romania (63.9%, while the lowest one in Slovakia, 4.7%): this is determined not only by the scarce number of regions it is divided in, but also by recent investments to enlarge the Internet access over the territory. The variable in the other NMS has a high variance too (27.8% in Bulgaria, 36.7% in Hungary and 46% in Czech Republic[19]), similar to the one in some OMS, like the United Kingdom (58.3%), Spain (41.8%), Italy (33.1%) and Portugal (31%). There is significant cross country difference among the percentage numbers of households with Internet access. However, within each group (NMS and OMS) the variance is similar.

Eurostat (2009), in addition to the North-South and latitudinal patterns of Internet access, highlights the existence of a third pattern at regional level: households in urban regions tend to have higher Internet access rates than households living in rural regions. At EU27 level, 65% of households in densely populated areas have access to Internet, against only 51% of households in thinly populated regions. This is confirmed by the analysis of indicators: the regions of Prague (Czech Republic), Bucharest (Romania), Budapest (Hungary) and Bratislava (Slovakia) are above their national average and for the former two ones, the gap is significant.

Environment

The Lisbon Strategy remarks the importance of achieving sustainable development, as a factor to make Europe the most dynamic and competitive knowledge-based economy in the world, with more and better jobs, greater social cohesion and respect for the environment. Infrastructures that help the environmental improvement and protection are unanimously considered by the European countries an important element in regional development for several reasons[20]. In the NMS, the environment protection sector[21] usually receives the second largest amount of funding by the European Commission, behind the transport sector. The only two exceptions are Estonia and Hungary, whose share of Structural Funds for the environment protection (on the total of infrastructure investments) are respectively 36% and 40%, more than for transport (32% and 36%).

The broad objectives of the Member States' Environmental Strategy or Investment Plans include: ensuring quality and quantity of the drinking water, reducing the creation of waste, lowering industrial and private emissions of pollution to water, land and air. The Drinking Water Directive (98/83/EC), the Urban Waste Water Treatment Directive (91/271/EEC), the Landfill Directive (99/31/EC) and the Directive on Electricity production from Renewable Energy Sources (2001/77EC) drive the investments related to water supply, waste water treatment, municipal solid waste management and renewable energy sources. Actually, these are the subsectors to which the 2007-2013 allocation of Structural Funds gives priority both in the Old and in the New Member States

The European Commission (EC, 2004) reports that water is scarce and in a number of regions the amount of clear water abstracted annually is at or above critical levels, so threatening local eco-systems, agriculture, electricity generation and tourism. Progress has been made in respect of water supply. In 2007, Hungary and Bulgaria abstract around 800 m^3 of fresh surface and ground water per capita, like Italy and Spain. Czech Republic and Romania abstract lower amounts (respectively 190 and 275 m^3 per capita), but the big challenge regards Poland, where, even if the water demand is expected to increase, its supply is only around 300 m^3 per capita, below EU27 average, approximately 550 m^3/year/per capita[22]. In Romania only 49% of total population is connected to public water supply, in Lithuania and Estonia the share is 76%[23], in Poland and Slovakia it amounts at 86%; only Bulgaria, Czech Republic and Hungary have more than 90% of population connected to public water supply.

As for the infrastructures in the water sector, most of the projects related to waste water treatment are driven by the need to comply with the EU Directives. The Urban Waste Water Treatment Directive requires investments to create new sewage treatment plants and to upgrade the quality of the existing ones. The implementation of such projects will contribute to the reduction of surface water pollution from municipal waste water, to the extension of wastewater services in urban and rural area, and to the construction, renovation and upgrading of wastewater plants, pumping stations and sewerage networks. In countries where the production intensity has fallen and the treatment efficiency increased, such as Poland, Latvia and Estonia, a decline in the volume of wastewater requiring treatment can be expected. In the other NMS, like Slovakia, obsolete public utility network and facilities will need to be replaced or upgraded to comply with the EU performance criteria.

The investments related to Municipal Solid Waste cover initiatives for the expansion and building of waste collection and sorting facilities, composting sites, incineration plants and for the upgrading of the existing landfills. The Landfill Directive, but also the

[19] Not available NUTS2 data for Poland.

[20] Summarized in EC, 2004.

[21] The list of the European fields of intervention (EC Regulation N° 1083/2006) splits the "Environment protection and risk" sector to the "Energy" sector. We use this distinction also to analyse the allocation of funds, since they both are referred to the general category of Environment.

[22] EUROSTAT data.

[23] A similar share can be referred also to Latvia, even if official data are missing.

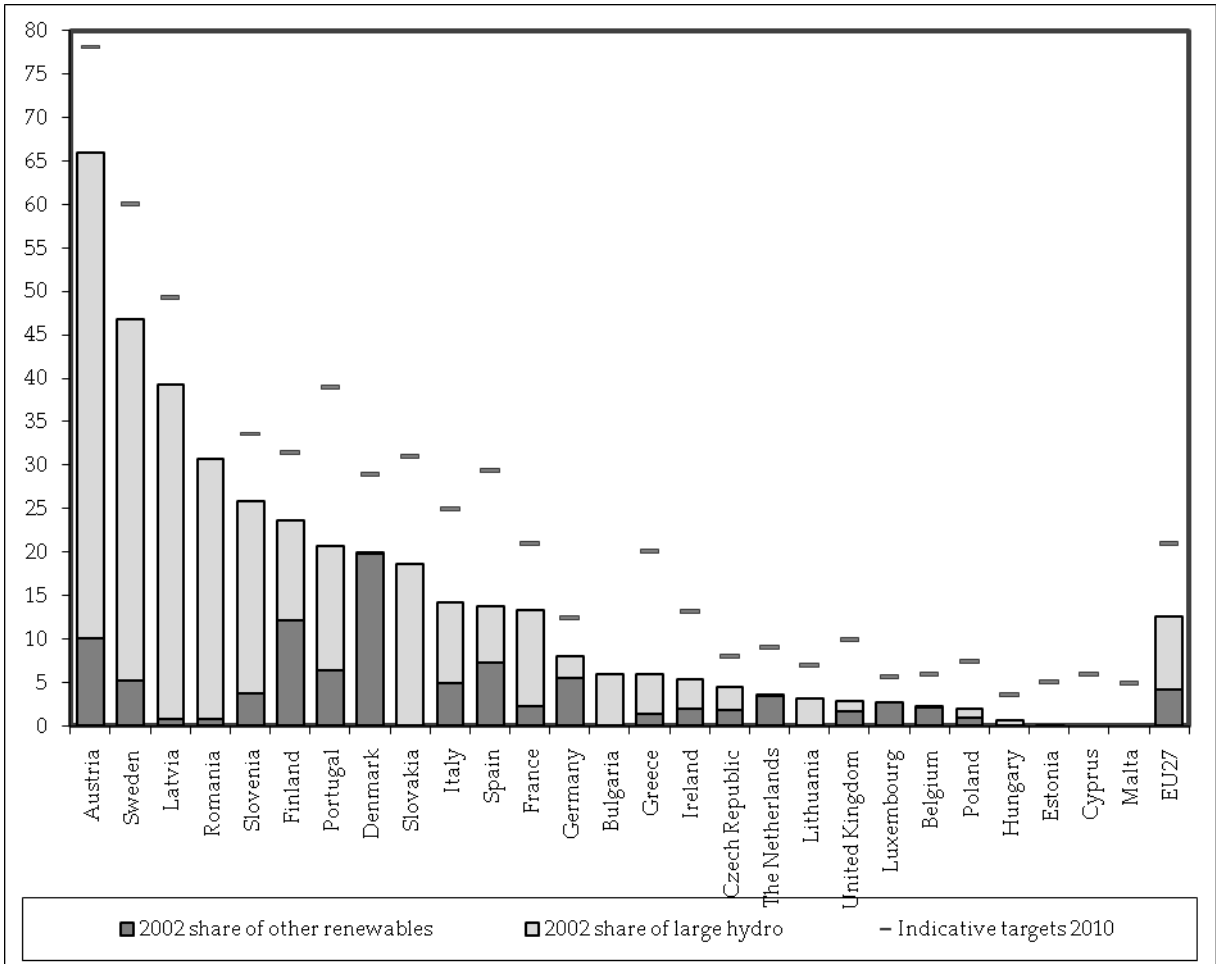
directives[24] on packaging waste, end-of-life vehicles, incineration of hazardous waste, waste electrical and electronic equipment set objectives and benchmarks.

Among the NMS, Estonia has the highest level of municipal waste collected (536kg per capita); in line with the EU27 average (524 kg per capita). These values are expected to raise due to the increase in quantity of development-related waste, that is construction and demolition waste, and of household waste, as a consequence of rising incomes and the creation of wealth. The need to expand the overall capacity of waste collection must face also the need to upgrade or close non-compliant landfills and of investing in waste sorting, treatment and recycling activities.

Finally, implementation of Directive 2007/77/EC has been a key driver behind the development of electricity produced from renewable energy sources. Investments in this sector vary across the member states, depending on the particular natural potential for renewable resource. The objectives set by the Directive concern the increase of the capacity for production of heat and electricity from renewable energy source, increase of the utilization of waste heat and energy saving, increase of public and industrial energy efficiency, decrease of energy consumption for heating and replacement of fossil fuels with green energy sources.

Figure 1 presents an overview across EU27 for the share of electricity produced from renewable energy sources in total electricity consumption, distinguishing between electricity generating from pumping in hydropower plants and other renewable energy sources. In 2002, Latvia, Slovenia and Slovakia have the highest share of renewable energy source of electricity consumption (EC, 2005), respectively amounting at 48%, 32% and 20%. The greatest part relates to electricity generated from pumping in hydropower plants. The other NMS's share is below 9% and below the EU27 average of 12.7%. The European Commission (EC, 2005) states that the likelihood of meeting national targets by 2010 differs between member states: while Slovenia is considered likely to meet target through extensive use of biomass and wind power, Poland is very unlike to meet the 7.5% target.

Figure 1. Share of renewable electricity in gross electricity consumption in the EU27 in 2002 (%; including 2010 indicative targets)



Source: European Environment Agency, http://www.eea.europa.eu

[24] Directive 94/62/EC, Directive 2002/96/EC, Directive 94/67/EC, Directive 2002/96/EC.

4. Concluding remarks

The objective of this chapter was twofold: from one side, identifying the typologies and extent of gaps existing in the EU member states, particularly in the NMS, both in GDP and in infrastructures endowment; from the other, giving a concise descriptive analysis of the infrastructural investment needs in the New EU Member States.

Wide gaps do exist between the OMS and the Central and Eastern European countries, in terms of GDP growth, per capita GDP, density of road, railways, telecommunication and environment infrastructures. While the NMS are growing faster than the European average, their per capita GDP and level of infrastructure is below the EU average.

The analysis of the variance shows that internal gaps are present, between the urbanised capital cities regions and the peripheral and rural areas of each country. The internal divergences in the NMS are not deeper than those in the OMS, while the cross country variability is much more significant. This suggests that, on average, the infrastructures' endowment in all the European members is not homogenous at regional level; yet, the density and quality of such endowment is significantly higher in the Western countries and limited in the Eastern ones.

These results hold true at the same time for per capita GDP, transport and telecommunication infrastructures. For what the environment (environment protection and energy) sector is concerned, the NMS have still much to do to comply with the EU Directives in the fields of water supply, waste water treatment and renewable energy. However, since regional data are not available, conclusions over the kinds and level of regional gaps cannot be derived.

From a preliminary, illustrative and not comprehensive review of the allocation of Cohesion Policy funds for the period 2007-2013, it emerges that higher priorities have been given to the allocation of Structural Funds in the NMS to transport and environment sectors, by promoting the trans-European transport network[25] and the use of renewable energy sources[26]. The findings of the present study could be further developed, by comparing the types and extent of regional and national gaps with the actual allocation of Structural Funds at sectoral and sub-sectoral level, in order to verify whether they are consistent with the intention to favour the convergence in Europe.

[25] In Objective 2 countries, instead, in 2007-2013 eligibility is given only to the funding access to the trans- European corridors

[26] No clear priorities can be detected in telecommunication.

References

Alegre, J.G., A. Kappeler, A. Kolev and T. Valila (2008), 'Composition of government investment in Europe: some forensic evidence', *EIB Papers*, 13 (1).

Andraz, J.M. and A.M. Pereira (2007), 'Public Investment in Transportation Infrastructures and Industry Performance in Portugal', *College of William and Mary Department of Economics Working Paper* 45.

Applica, Ismeri Europa and Wiiw (2008), Ex post evaluation of Cohesion Policy Programmes 2000-2006 financed by the European Regional Development Fund in Objective 1 and 2 regions, Work package 1, Task 5, Final report, available at http://ec.europa.eu/regional_policy/sources/docgener/evaluation/expost2006/wp1_en.htm.

Aschauer, D.A. (1989), 'Is public expenditure productive?', *Journal of Monetary Economics*, 23, 177-200.

Barca, F. (2009), 'An agenda for a reformed cohesion policy – A place-based approach to meeting European Union challenges and expectations', Independent Report prepared at the request of Sanuta Hubner, Commissioner for Regional Policy, available at http://ec.europa.eu/regional_policy/policy/future/pdf/report_barca_v0605.pdf.

Barro, R.J. (1990), 'Government spending in Simple Model of Endogenous Growth', *Journal of Political Economy*, 98(5), S103-125.

Basile, R., S. De Nardis and A. Girardi (2001), 'Regional inequalities and cohesion policies in the European Union', *ISAE Istituto di Studi e Analisi Economica working paper* 23, Rome.

Biehl, D. (1986), 'The contribution of infrastructure to regional development', report produced by the Infrastructure Study Group for the European Community, Bruxelles.

Boldrin, M. and F. Canova (2003), 'Regional policies and EU enlargement', *CEPR Discussion paper* 3722.

Button, K. (1998), 'Infrastructure investment, endogenous growth and economic convergence', *The Annals of the Regional Science* 32(1), 145-162.

Cappelen, A., F. Castellacci, J. Fagerberg and B. Verspagen (2003), 'The impact of EU regional support on growth and convergence in the European Union', *Journal of Common Market Studies*, 41, 621-644.

De Rus, G., C. Romàn and L. Trujillo (1995), 'Convergencia en infraestructuras de transporte', *Economistas*, 64, 563-570.

Del Bo, C. (2009), 'Recent advances in public investment, fiscal policy and growth', *Departmental Working Papers 2009-25*, Department of Economics, Business and Statistics, University of Milan Italy

Del Bo, C. and M. Florio (2008), 'Infrastructure and growth in the European Union: an empirical analysis at the regional level in a spatial framework', *Departmental Working Papers 2008-37*, Department of Economics, Business and Statistics, University of Milan Italy.

Dvornik, D. and D. Sabolic (2007), 'Telecommunication liberalization and economic development in European countries in transition', *Technology in Society*, 29(4), 378-387.

ECORYS (2005), Strategic Evaluation on Transport Investment Priorities under Structural and Cohesion Funds for the Programming Period 2007-2013, synthesis report, 2005.CE.16.AT.014, Rotterdam, available at: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/rado_en.htm.

ESPON (2005), *Accessibility, Transport and Communication Network – Thematic Study of INTERREG and ESPON activities*, final report, available at http://archive.interact-eu.net/download/application/pdf/1068941

European Commission (2001), *White paper – European transport policy for 2010: time to decide*, COM(2001)370, 12/09/2001, available at http://ec.europa.eu/transport/strategies/doc/2001_white_paper/lb_com_2001_0370_en.pdf.

European Commission (2004), *A new partnership for cohesion – Convergence, competitiveness, cooperation*, third report on economic and social cohesion, February 2004, Brussels.

European Commission (2005), Strategic Evaluation on Environment and Risk Prevention under Structural and Cohesion Funds for the period 2007-2013, Directorate General Regional Policy, Synthesis report 2005.CE.16.0.AT.016.

European Commission (2007), *Growing Regions, growing Europe - Fourth Report on economic and social cohesion*, fourth report on economic and social cohesion, May 2007, Brussels.

European Investment Bank (2000), 'Basic Infrastructure Investments in South-Eastern Europe – Regional Project Review', *Regional Funding Conference for South-Eastern Europe*, 29-30 March 2000, Brussels, available at http://ec.europa.eu/enlargement/archives/seerecon/infrastructure/documents/bii_see.pdf.

Eurostat (2009), 'Information society', in *Eurostat regional yearbook 2009*, Office for Official Publications of the European Communities, Luxembourg, available at http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-HA-09-001/EN/KS-HA-09-001-EN.PDF.

Gramlich, E. (1994), 'Infrastructure Investment: A review Essay', *Journal of Economic Literature*, 32(3), 1176-96.

Jevčák, A. and F. Keereman (2008), 'Challenges for public investment in New EU Member States', in Schwarts Gerd, Ana Corbacho and Katja Funke (eds), *Public Investments and Public-Private Partnership – Addressing infrastructure challenges and managing fiscal risks*, Washington D.C., USA: IMF Publications.

Martin, P. (1997), 'Can regional policies affect growth and geography in Europe?', *World Economy*, 21(08), 757-774.

Mrak, M. and V. Rant (2006), 'Challenges of EU and NMS in financial perspective 2007-2013: convergence and absorption of available resources', paper presented at the Fourth Milan European Economy Workshop.

OECD (2007), *Infrastructure to 2030 Volume 2 – Mapping policy for electricity, water and transport*, available at http://www.oecd.org/dataoecd/61/27/40953164.pdf.

Petrakos, G., D. Kallioras and A. Anagnostou (2007), 'A generalized model for regional economic growth in the European Union', *DYNREG Working Paper* 12.

Puga, D. (2002), 'European regional policies in light of recent location theories', *CEPR Discussion Paper* 2767.

Rapún, M., C. Gil and P. Pascual (2000), 'Infrastructure and growth in the European regions', *ERSA Conference Paper* ersa00p309.

Rothengatter, W. and A. Schaffer (2004), 'The impact of transport infrastructure and other immobile production factors on regional competitiveness', *Transportation Research Board Annual meeting Paper 06-0868*.

Skoric, M. (2006), 'Culture and Communication Technology Development in Central and Easter Europe: revisiting the "fault line" thesis', Paper presented at the annual meeting of the *International Communication Association*, Dresden International Congress Centre, Dresde, Germany, 16 June 2006.

Spieckermann, K. and M. Wegener (2006), 'The role of transport infrastructure for regional development in South East Europe', *SEER South-East Europe Review for Labour and Social Affairs*, (01), 51-61, available at http://www.boeckler.de/pdf/seer_2006_01_spiekermann_wegener.pdf

Straub. S. (2008), 'Infrastructure and growth in developing countries: recent advances and research challenges', *The World Bank Policy Research Working Paper* 4460, Washington, DC.

The World Bank (2008), *The Growth Report – Strategies for sustained growth and inclusive development*, Commission on Growth and Development, available at http://www.growthcommission.org/index.php?Itemid=169&id=96&option=com_content&task=view.

TRT Trasporti e Territorio srl (2006), *The Impact of Trans-European Networks on cohesion and employment*, final report of the study IP/B/REGI/ST/2005_105 requested by the European Parliament's Committee on Regional Development, available at www.trttrasportieterritorio.it/.../European.../The%20Impact%20of%20Trans-European%20Networks%20on%20Cohesion%20and%20Employment.pdf

Zsoldos, I. and A. Zaradornova (2008), 'New EU Member States – A Fifth BRIC?', *Global Economics Paper* 173, Goldman Sachs Economic Research.