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## Article

# Brain circulation and spatial mobility of knowledge in Southeast Europe

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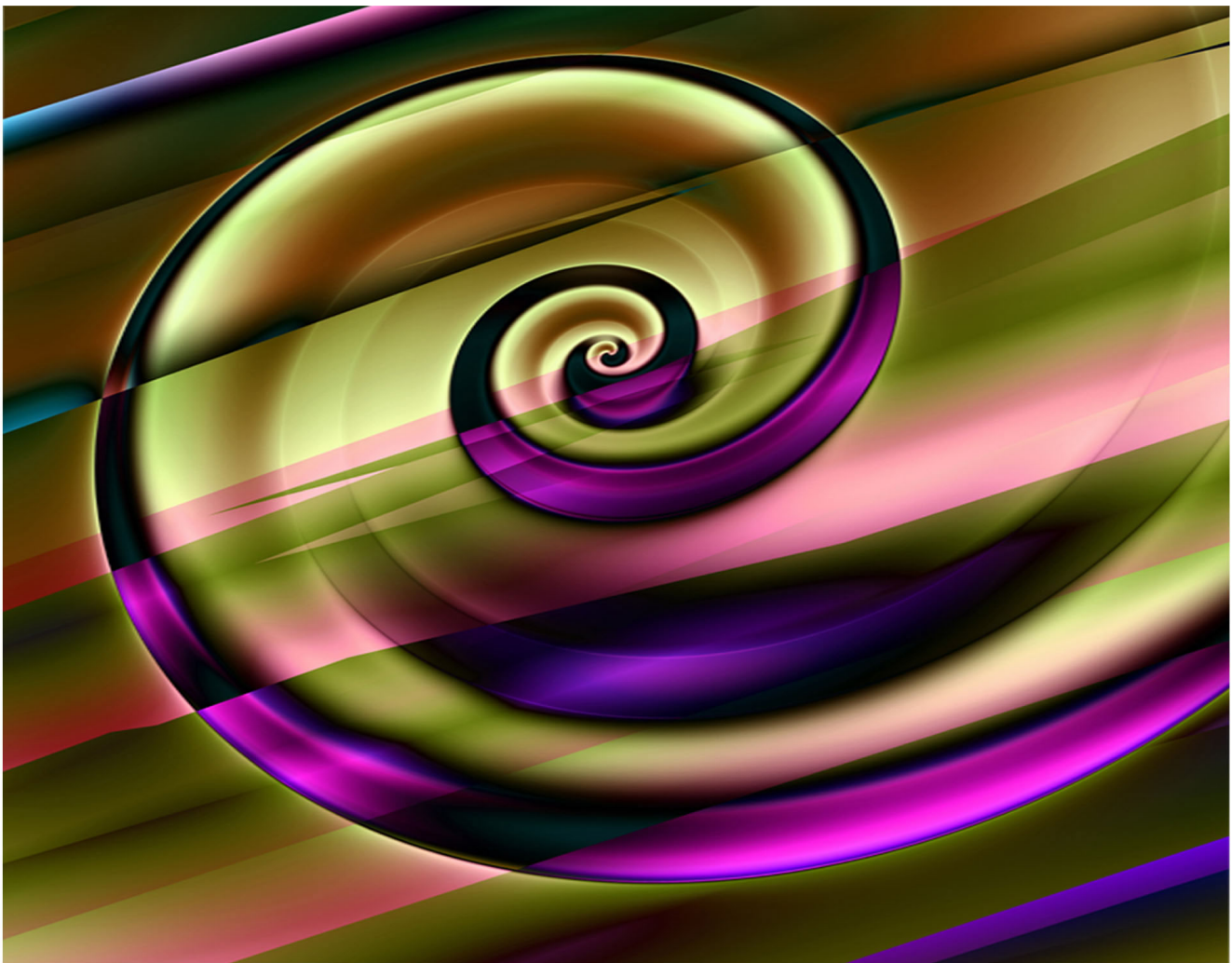
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## **Brain Circulation and Spatial Mobility of Knowledge in Southeast Europe**

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### **Abstract:**

The correlation among agglomeration, externalities, and human capital growth is a question that requires extensive empirical and analytical investigation. This article hypothesizes that entities that cluster in geographic space take advantage of external economies and develop more rapidly than do isolated entities. In geography of innovation stickiness, knowledge spillovers are major drivers of technological progress and economic growth. This in turn, might incentivize intellectual mobilization of the Southeast European countries' highly skilled Diaspora by creating opportunities for emergence of a brain circulation network.

Over the past twenty years, the number of researchers and scientists in the countries of Southeast Europe (SEE) has seriously decreased. Many highly educated Southeast Europeans leave their countries in search of a better life. They are attracted to career opportunities, higher salaries, and better overall conditions abroad. This paper gives an overview of the main theories underpinning spatial mobility of knowledge, brain drain and brain circulation in developing countries. It also provides an analytical snapshot of the brain drain trends in the SEE, focusing on Macedonia, the brain drain leader in the region. In the end, it proposes public policy mechanisms for intellectual mobilization of the SEE highly educated Diaspora by envisioning the creation of a brain circulation network that will foster a regular set of interactions, collaborations, joint grant proposals, joint research projects, co-authorships,



visitor exchange, joint ventures and alike, between the highly educated Diaspora and their counterparts in the countries of origin. This will provide expatriates with the opportunity to transfer their expertise and skills to the country of origin, without necessarily returning home permanently. In this way, the SEE countries will have access to the knowledge and expertise of the expatriates, and to the knowledge networks that they form in the host countries.

**Keywords:** agglomeration economies, human capital, brain circulation, brain drain, brain gain, Diaspora, innovation policy, economic growth, science policy, technology transfer.

## 1 Introduction

The correlation among agglomeration, externalities, and human capital growth is a question that requires extensive empirical and analytical investigation. This article hypothesizes that entities that cluster in geographic space take advantage of external economies and develop more rapidly than do isolated entities. In geography of innovation stickiness, knowledge spillovers are major drivers of technological progress and economic growth (Dumais et al., 2002). This in turn, might incentivize intellectual mobilization of the Southeast European countries' highly skilled Diaspora by creating opportunities for emergence of a brain circulation network that will foster a regular set of interactions, collaborations, joint grant proposals, joint research projects, co-authorships, visitor exchange, joint ventures and alike, between the highly educated Diaspora and their counterparts in the countries of origin. This will provide expatriates with the opportunity to transfer their expertise and skills to the country of origin, without necessarily returning home permanently. In this way, the countries of origin, i.e. SEE countries, will have access to the knowledge and expertise of the expatriates, but also to the knowledge networks that they form in the host countries.

Human capital formation and generation has been a challenge to most of the developing countries in terms of achieving economic and social growth. Human capital is inevitably linked to issues of innovation, successful technology transfer and economic growth. The most persistent challenge in this respect has been the phenomenon of high brain drain rates, i.e. scientists leaving their native countries in search for better life and professional fulfillment. In SEE countries this problem has been pervasive for years. This paper tries to build on the existing human capital and innovation literature and to come up with creative solution to the problem by proposing a brain circulation model.

## 2 Spatial mobility of knowledge transfer and the ability to absorb new technologies

Innovation, unlike other parts of the value chain, is immobile, and exclusively occurs within the innovative agent. The main reason for this is the cognitive complexity of the innovation process. This in turn, has traditionally motivated the innovating firms to locate innovation activities in one place, in a process known as innovation stickiness. However, due to the globalization of capital, goods, services and knowledge, recent empirical research has pointed out that the innovation, as part of the value chain, has also become integrated in the global economic flows. New horizontal and democratic relationships, instead of vertical integrative processes, are taking place between innovative agents (Arora et al., 2001). This has transformed the geography of innovation (Ernst, 2002). Today, instead of having several eminent innovation centers on global level, there are numerous dispersed innovation loci (Cantwell, 1995).

There are four key factors affecting the globalization of innovative activities: (i) institutional transformation through liberalization; (ii) development of general purpose technologies (for instance, information and communication technologies); (iii) transformation of markets, competition and industrial

organization (in particular the vertical specialization through creation of networks); and (iv) adjustment of the corporate strategies and the business models to the changes in the global environment (Ernst, 2003). Differences exist with respect to levels of innovativeness between different industries. For instance, technology intensive industries, such as the electronics industry, biotechnology, chemical and pharmaceutical industries, go through rapid internationalization of their R&D activities (Reddy, 1997).

Both the neoclassical growth theory (Solow–Swan growth model, exogenous growth model) and the endogenous growth theory are based on the same premise that the relatively high levels of poverty faced by developing countries are, in part, result of the differences in the pace of technological development between the North and the South. The proponents of the neoclassical theory assert that technology per se is a universally accessible and applicable good, and that differences with respect to the levels of technological development come as a result of differences with respect to ownership of goods, such as plants or roads. The proponents of the endogenous growth theory assert that differences in ownership of ideas and the level of ability to absorb new technologies are the main reasons for the existing developmental gap between the North and the South. Accordingly, the public policies should be focused on finding the right equilibrium between the technology acquired and the level of skills needed for its absorption and diffusion, i.e. the appropriate level of human capital (Archibugi and Pietrobelli, 2003).

One of the main benefits of globalization is the creation of the possibility for developing countries to tap into the technological achievements of the developed world. The economic, political, legal and cultural integration has resulted in increase of the total factor productivity and per capita income of the developing countries. Empirical studies show that developing countries that import technologies from the developed world experience rapid increase of total factor productivity (Coe and Helpman, 1995). However, the term “developing countries” covers a wide array of countries, and the results of the aforementioned studies are applicable exclusively to the emerging upper middle income countries, such as Brazil, China and India. It is unclear whether the results of these studies can be extrapolated to middle income countries, most of which are faced with poverty issues (Stankovic et al., 2012).

The distribution of per capita incomes between countries will ascend without change in its scope, only if distribution of technological absorption ability is constant, i.e. all countries are capable of accepting the new technologies on equal footing. To influence distribution, the technologically inferior countries should accelerate their technological development in terms of achieving higher technology growth rate than developed countries. In the long run, this is only possible if the technologically inferior countries substantially enhance the quality level of their educational and scientific systems. The supply of highly educated staff in technologically inferior countries affects the extent and scope of the sophistication of the technology that can be absorbed and used by the local economy. At the same time, the scope and level of sophistication of new technologies injected into the local economy affect the creation of demand for highly educated staff. Globalization benefits might serve as a generator of technological development in the technologically inferior SEE countries (WEF, 2011).

The global economic environment is experiencing a number of important changes that accompany the technological development of technologically inferior countries. Globalization affects the increase in the overall technological intensity of goods and services, thus making technology a key factor for the competitiveness of the countries. Also, the complexity of global competition contributes to the emergence of differentiated products and manufacturers, which in turn implies the need for accelerated innovation in certain industrial sectors. Furthermore, at a time when the technological intensity of goods and services increases, and their life cycles are reduced, research and development (R&D) costs are on a constant rise. Large multinational corporations are faced with pressures to globalize their R&D activities, as a high added value, within their corporate networks. This may create the opportunity for accelerated technological development of developing countries (Cantwell & Santangelo, 1999).

Such technological changes lead to creation of specialized types of corporate R&D units. Products and services have become modular as a result of the standardization of matrices of their components (Prencipe et al., 2003). For instance, the development of information and communication technologies

enables businesses to allocate different tasks globally through intra-company information networks. The emergence of new technologies that do not require large industrial experience and whose R&D can be easily globalized and separated from the production process (e.g., microelectronics, biotechnology, software development) provide opportunities for technological development of developing countries that have abundant and well-trained scientific and research staff in these areas. The process of modularization of R&D in these industries creates fertile ground for division of R&D activities into basic and advanced. Certain basic activities can be performed in low-cost countries, and thus contribute towards their technological development (Reddy, 2000). Of course, this low-cost strategy, undertaken by certain developing countries, cannot generate sustainable economic growth in the long run (Bell, 1987).

Innovation and technical change play an increasingly important role in the development of the competitiveness of firms and economic growth in developing countries (Aghion and Howitt, 1998). The modern theories of economics of innovation and technological change include the spatial context within the innovation matrix. Geographic space is increasingly emerging as a key factor in explaining the origin and diffusion of innovation and technology transfer. The geography of economics is based on the so-called spatial concentrations (Krugman, 1991) which are valid for both production and innovation activities (Feldman, 1994). The models of knowledge production can be implemented more effectively in spatially clustered observation units than in units that are analyzed in isolation without taking into account the context of space. The main objective of the economic literature that deals with the study of spatial innovation is to (i) study and understand the mechanisms that encourage spatial clustering of innovative activities (clusters give rise to research parks / parks of knowledge) (ii) understand the mobility of knowledge and the transfer of technology and (iii) understand the increased ability for technological absorption of entities that share the same geo-economic space.

Spatial clustering and creation of geo-economic space are problems closely related to the issues of technology transfer and knowledge spillovers. The knowledge generated in research laboratories, and its spillover into the geo-economic space, represent an important source of technology (Jaffe, 1989). However, despite the important role of the geo-economic space in determining the degree of success of a technology transfer project, there is a dearth of research articles studying the interaction and relationship of the transfer of technology, knowledge spillover and geo-economic space. Some analyze the actual mechanism through which technology and knowledge are transferred between individuals (Grossman & Helpman 1991), while others (Krugman, 1991) point to the fact that the empirical measurement of knowledge is a difficult undertaking because of its invisible, i.e. tacit flows (Polanyi, 1967). The analysis of this problem encompasses several issues: What are the effective mechanisms for technology and knowledge transfer in general? How could we measure the impact of technology and knowledge in the context of geo-economic space? Are technology and knowledge spillovers geographically limited?

The creation of technology parks, technological and industrial zones and business incubators only confirms the importance of geo-economic space for successful technology transfer. Numerous examples from the developed countries' practice confirm this observation, such as the Silicon Valley in California, the Research Triangle Park in North Carolina, and the Route 128 near the Massachusetts Institute of Technology (MIT) in Boston, Massachusetts. Alfred Marshall coined the concept of "industrial district", which represents a spatial concentration of firms in same or similar industry (Marshall, 1890). The term "agglomeration economy" pertains to economies of scale that are considered as inputs and external factors to a firm, but internal factors to the region in which the firm operates in synergy with other firms having similar activity. Because of the spatial concentration of firms in the industrial district such inputs are easily available to the firm. The increase of number of firms coming from the same or similar industrial sector in the region generates increase in the number of workers who migrate to the region, and who possess the qualifications required to perform the activities of the firms operating within the region. This process generates a positive communication loop, since migration of skilled workers attracts more companies from the same or similar industry in the region. This inevitably reduces the price of the highly skilled labor in the region (Marshall, 1890).

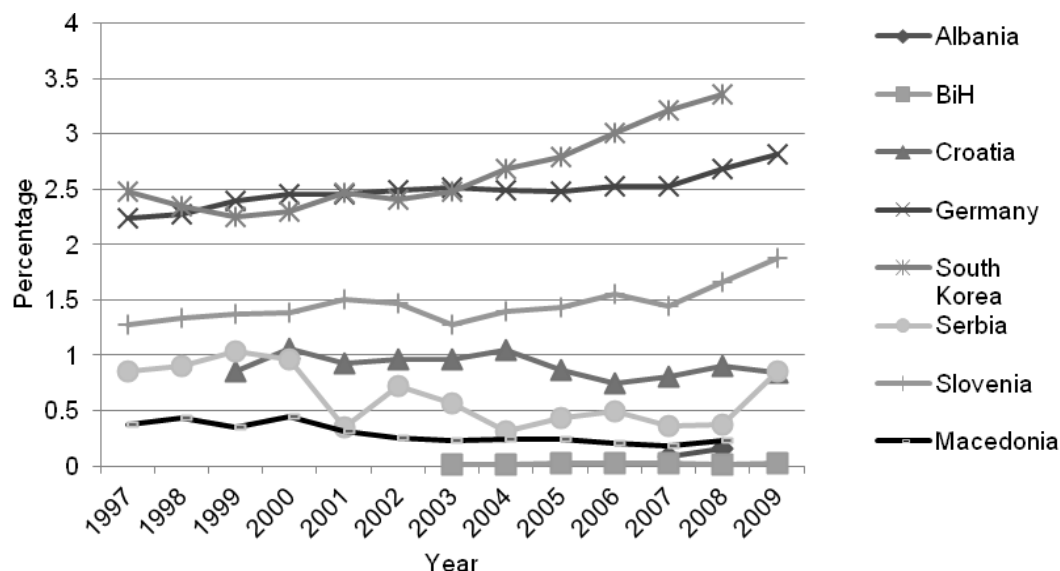
The modern economic thought has started examining the new economic geography (Krugman, 1998), and has scrutinized the phenomenon of industrial clustering. Knowledge as an input is important for the overall success of high-tech industrial districts. Studies in this regard start to pay attention to the dynamics of industrial districts at the expense of studying the conditions that dictate the equilibrium of the industrial districts. These studies find that industrial districts have certain trajectory of development. Consequently, the location of industrial districts does not come as a result of the invisible hand of efficiency, but rather as a result of a set of factors that are associated with transiency and serendipity. In order to study the functioning of an industrial district, it is necessary to know its history.

### **3 Dynamics of high – tech districts in Southeast Europe: case study of the Republic of Macedonia**

The first known usage of the term “Southeast Europe” was by Austrian researcher Johann Georg von Hahn (1811–1869) as broader term than the traditional Balkans (Hösch et al., 2004). Highly heterogeneous and distinctly colorful, the countries of Southeast Europe frequently produce more history than they can handle. Despite the cacophony of complexity, the countries’ commonalities have resulted in their joint treatment, exemplified in a multitude of political and socio-economic transnational cooperation models (e.g., SEE Cooperation Initiative, SEE Cooperation Process, SEE Media Organization, Stability Pact for SEE, etc.).<sup>i</sup> Accordingly, this article analyzes some common aspects of R&D, innovation, technology transfer and brain drain in SEE countries. Macedonia is used as a case study. Further in-depth studies may be employed to additionally probe the specifics of individual SEE countries with respect to the issue of brain drain.

The dissolution of the past regimes, weak economic structure, low level of production, low performance results of the educational system, high level of public debt, high unemployment level, low contribution of SMEs to innovation, and the lack of motivation, commitment and trust, had enormous negative impact on human capital development in the SEE countries. Two contemporaneous processes have been taking place, one associated with “external” brain drain, i.e. experts leaving the country for better professional fulfillment abroad, and the other associated with “internal” brain drain, i.e. specialists leaving their professions for better paid jobs in the private and/or informal sector of the economy (UNESCO, 2004). The educational and scientific systems of the SEE countries generally share low level of investments in R&D undertaken by the private sector, the academia and the public authorities. This is a result of several intertwined structural problems, including but not limited to budgetary constraints imposed by restrictive monetary and fiscal policies, de-industrialization, high transaction costs of societal transition, external accounts imbalances, low national investment and savings rates, and limited FDI inflows (UNESCO, 2004). In contrast, developed countries invest substantially more in R&D. This article uses the economies of South Korea and Germany for comparative purposes. For example, both South Korea and Germany invest substantially more in R&D in comparison to the majority of SEE countries (2.5-3.5% of GDP, Figure 1). Of the SEE countries, Slovenia invests reasonable amounts in R&D (1.5-2.0%); the other countries significantly lag behind, with markedly less than 1% investment (Figure 1).

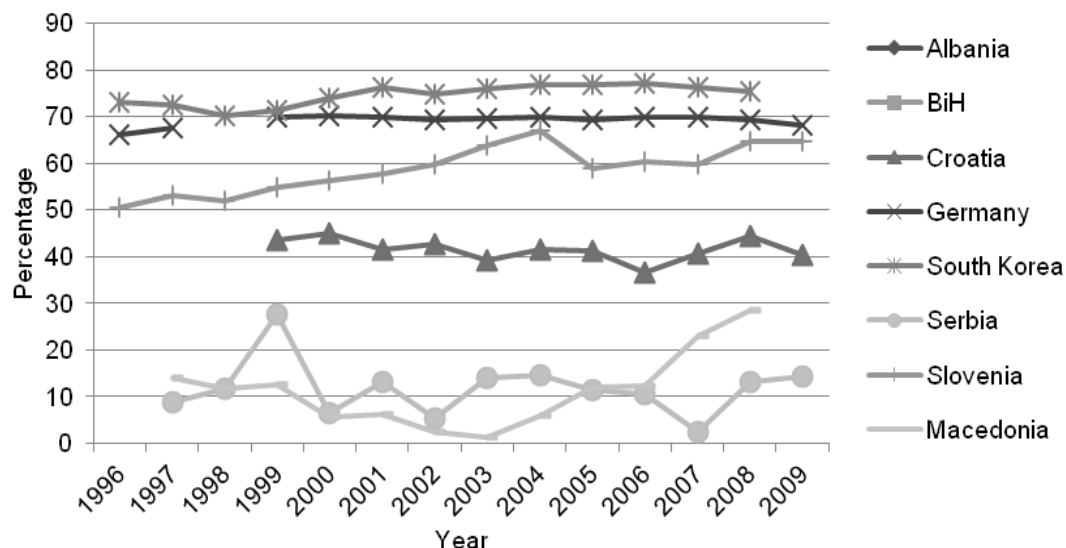
**Figure 1** Gross expenditure on R&D (GERD), percentage of GDP



Source: UNESCOstat (2011)

In developed countries, the private sector is the key innovation catalyst, and holds the highest percentage (70-80%) of the total GERD, i.e. gross expenditure in R&D (Figure 2). In contrast, the private sector in SEE countries invests significantly less in R&D (40% in Croatia; less than 20% in each of Serbia, Bosnia & Herzegovina, Albania, and Macedonia). In SEE countries, academia and the public authorities have substantially higher investments in R&D when compared to investments of the private sector.

**Figure 2** GERD in the private sector, percentages

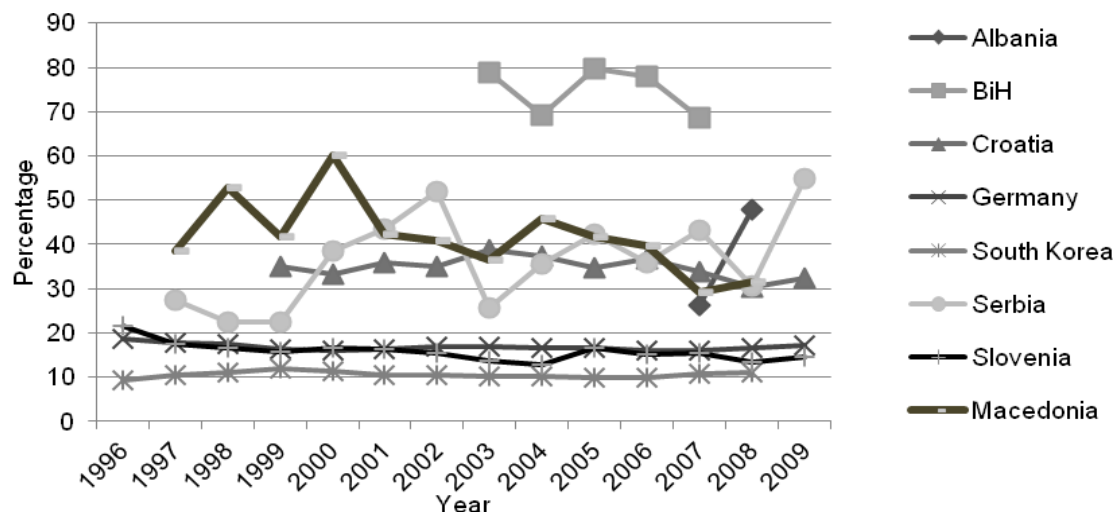


Source: UNESCOstat (2011)

In contrast, in SEE countries, the academia and the public sector have relatively substantially higher investments in R&D when compared to the private sector investments (Figures 3, 4).

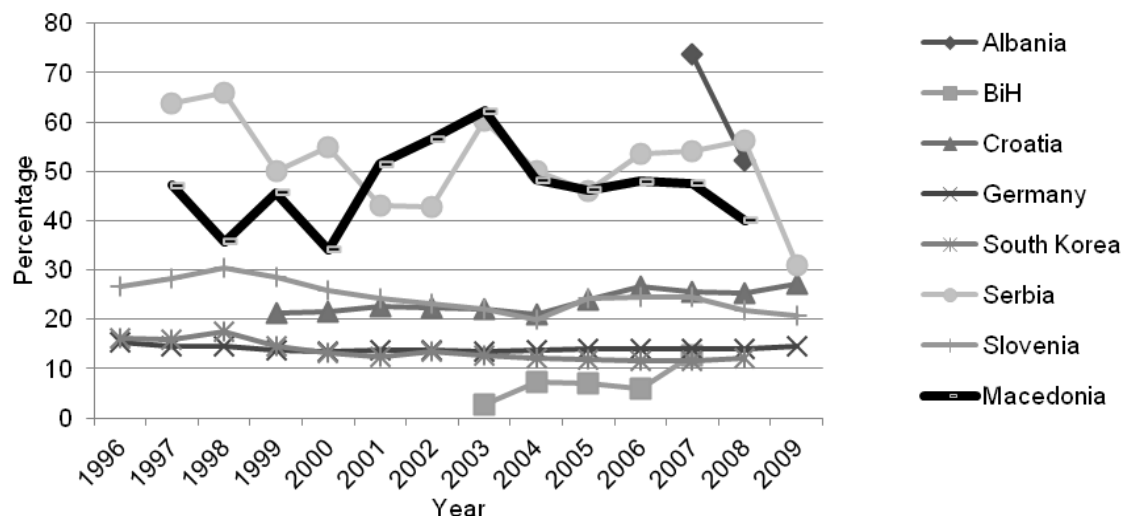


**Figure 3** GERD in the academia, percentages



Source: UNESCOstat (2011)

**Figure 4** GERD in the public sector, percentages



Source: UNESCOstat (2011)

The triple helix model of innovation incorporates the notion of agglomeration economies. This model argues that competitiveness is derived from the ability to continuously learn and innovate in order to reproduce distinctive organizational competences over time. It emphasizes the changing nature of institutional and organizational contexts of innovation and the strategic role of management in determining how individual actors adapt, integrate, and reconfigure internal and external organizational skills, resources, and functional competences in response to these changes (Porter, 1996).

The triple helix develops according to four dimensions (Etzkowitz, 2004). The first dimension represents the internal transformations in each of the helices. Universities should not only be teaching and doing research but should also be trying to capitalize the knowledge they produce, which implies a new

model of knowledge production (Gibbons et al., 1994). Lateral ties among firms based on strategic alliances should be developed within individual industries. The government should be taking the role of a venture capitalist as well. The second dimension concerns the influence of one helix upon another. A very successful example in this regard is the US Bayh-Dole Act of 1980, which instituted industrial policy through which the federal government encouraged academia to assist industrial innovation. This was done through granting the academia the rights to inventions created by federal research grants (Etzkowitz, 2004). The third dimension is the generation of a new overlay of institutional structures stemming from the interaction among the three helices. Small and large firms, universities and other research organizations, local, regional and national governments get together to brainstorm new ideas and attempt to fill in gaps in the innovation systems. One of the most representative examples of this third dimension of the Triple Helix is the Research Triangle Park (RTP) in North Carolina. RTP was founded by the government, university and business leaders as a model for research, innovation and economic development. It was established as a place where educators, researchers and business collaborate as partners with the objective to change the economic conditions of the region and the state. It was named according to the geographic location of the region's three most regarded educational and research universities – the University of North Carolina at Chapel Hill, Duke University, and North Carolina State University. In addition to the research capacity, the region possesses a network of organizations, institutions and companies that work together reflecting the spirit of cooperation and learning. Companies represented in the RTP include IBM, Cisco Systems, Ericsson, BASF, etc. Due to the positive impact on society, RTP is a model of high-tech district for innovation, education and economic development that has been applied around the world (Weddle et al., 2006). The fourth dimension of the triple helix model consists of a recursive effect of the trilateral networks on the spirals from which they emerge and on the wider society. The interaction of universities with industry and government is transformed when the capitalization of academic knowledge displaces distance and inherent public nature of knowledge. This, in turn, is seen as the result of the practices of industrial science, internal entrepreneurial dynamics within academia, and government policies (Etzkowitz, 2004).

The fourth dimension of the triple helix innovation model has been built around sustainable collaboration between the private sector and the academia. It is assumed that one of the main preconditions for this is the existence of second stage agglomeration economies through establishment and growth of high-tech districts. Our survey "Technology Transfer in the Republic of Macedonia" was conducted online, via a software platform Qualtrix. It covered 51 high-tech domestic and foreign owned firms in Macedonia. It researched the perception of the firms' managers with respect to the technology transfer climate in Macedonia. The survey results show that 31% of the surveyed managers answered that their firm has never been involved in technology transfer. Almost 52% of the survey respondents, whose firm participated in technology transfer, answered that the technology was transferred to the firm by another entity. Out of those, 100% answered that the transferring entity was a foreign firm. There was no mention of technology transfer to/from universities, governmental institutes, or other domestic firms. This lack of public-private partnerships is indicative of the low research culture within the Macedonian business community. It seems that the firms' managers perceive the option of technology transfer from a foreign firm as the sole option available. Hence, it will be very difficult for the public policy stakeholders in the research and scientific area to put the triple helix innovation model on the agenda and entice the private sector to stimulate its own R&D involvements.

A large number of survey respondents (92.59%) believe that the government should make bigger budgetary allotments to the R&D endeavors undertaken by the business sector. Moreover, high is the number of respondents (81.48%) who claim that the state does not support public-private partnerships. Thus, the business sector representatives observe and acknowledge the lack of a link between the public authorities and the business sector in the innovation model of Macedonia. This is also the case when asked about their perception of the role of the Macedonian academia in generating and sustaining the innovation process wheel. Most of the respondents agreed that there is a need for establishing technology transfer offices under the auspices of the Macedonian universities, which will serve as an initial block of

the Macedonian triple helix innovation platform. Much remains to be done in the area of raising the general awareness, and more specifically the awareness of certain groups of stakeholders, in order to generate and maintain viable triple helix innovation links.

#### **4 Legal infrastructure and dynamics of high – tech districts**

Gilson (1999) has developed an interesting argument that has raised the theory of spatial character of industrial districts to a new level. He asserts that the dynamics of high-tech industrial districts is primarily dependent on the legal infrastructure. The efficiency of knowledge transfer mechanisms is influenced by two types of legal norms: the first type of legal norms pertains to intellectual property, and the second type of legal norms pertains to workers' mobility, due to the fact that tacit knowledge is most effectively transmitted through movement of workers from one firm to another (Gilson, 1999).

The geographic vicinity impacts the nature of knowledge by making it susceptible to the law of increasing returns. In today's global economy, information, due to the nature of information and communication technologies, has lost its geographic anchor. In the long run, this will lead to elimination of agglomeration economies based on knowledge. As knowledge becomes ubiquitous input there will be less industrial clustering. However, the paradox lies in the following: in reality the industry clustering has not lost its importance. This dilemma can be solved by drawing a differentiation line between the notion of knowledge and the notion of information. The key to this puzzle lies in the tacit nature of knowledge. Even though the changes in information technology have made the costs of transferring information inelastic with respect to location, the process of transferring tacit knowledge in a form of know-how and know-why is always dependent on geographical proximity (Audretsch and Feldman, 1996).

In general, there are three types of Marshallian externalities (intra-industry economies of localization). The first type refers to economies of specialization. A localized industry might give rise to many specialized local suppliers of industry specific intermediate inputs and services. This will lead to creation of greater variety at lower cost. The second type refers to labor market economies. Localized industries attract and retain pools of workers with similar skills. This in the long run affects the employment rate and wages in the localized industry. The third type refers to knowledge spillovers. Innovative information flows more easily among agents within the same area due to social bonds that foster reciprocal trust and frequent face to face contacts. This fosters more innovation opportunities and greater innovation diffusion.

The life cycle of the industrial district consists of several intertwining factors, i.e. (i) knowledge as an input that generates Marshallian market factor externalities, (ii) technological externalities, and (iii) the causal relationship between the location of the industrial district and its historical circumstances. Numerous examples from developed countries' practice confirm the observation that there is a strong correlation between the location of high-tech districts and the location of university campuses (Audretsch and Feldman, 1996). However, even these empirical observations cannot explain why, for example, Stanford led to the creation of Silicon Valley, and why Harvard and MIT have prompted the creation of the Route 128, and some other universities have failed to do so. The reasons for this are multi-layered. The presence of successful university campus contributes to the creation of high-tech industrial districts. However, this does not necessarily suffice. To create and sustain a successful industrial district, all the stakeholders of the innovation system should form viable and sustainable triple helix relationships. This way, the benefits of the innovative activity taking place within the industrial district would be able to penetrate the entire local economy.

Tacit knowledge transfer is a decisive factor with respect to the success of a technology transfer project. Agglomeration economies are considered an important factor in the initial stages of the technology development and commercialization. The geographic clustering of high-tech activities in the industrial district occurs within initial stages of the technology transfer. On the other hand, tacit



knowledge plays a smaller role in the later stages of technology development and transfer. When the technology reaches its mature phase, most of the technical aspects of production are standardized, and the nature of demand is well known. The costs of transmitting information and knowledge in the geographical space become trivial. Standardization results in decreased impact of agglomeration economies based on knowledge, and acts as a centrifugal force (driven by lower costs of land and labor, available outside the industrial district). This generates geographical dispersion of production, exemplified by the production of semiconductors in the Silicon Valley (Arthur, 1990).

Part of the Silicon Valley's development is due to the specific culture and social structure that spur rapid transfer of workers from one organization to another. Workers in Silicon Valley firms have entrepreneurial spirit and choose to work in small, highly innovative start-ups, rather than in large, robust and inert corporations. On the other hand, the business culture of the Route 128 differs significantly from that of the Silicon Valley. This is due to the conservative social mores and traditions of New England which influenced the formation of the local labor market and the trajectory of the entrepreneurial development. Stability and loyalty to an organization are the highest ethical values in the Route 128 (Saxenian, 1994).

The biggest part of the intellectual property of a high tech firm has informal character and is contained in the human capital of the company. For instance, the technological knowledge generated in the Silicon Valley is implicitly and continuously gained through relentless networking of entrepreneurs, researchers and manufacturers. This type of knowledge can be transmitted easily provided that the recipient and the provider of knowledge are in geographical proximity to each other. The easiest way to transfer this type of knowledge is through movement of labor within the geographical cluster. Employers are keen to protect their intellectual capital, which mainly consists of trade secrets and tacit knowledge, and the most effective tool for this is limiting the transfer of manpower from one firm to another. Because of all this, the individual efforts of the employer to protect its intellectual property rights are in direct conflict with the collective efforts of a society to generate second-degree agglomeration economy through knowledge spillovers in the public domain.

The establishment of an adequate legal infrastructure that will regulate this conflict is one of the key factors which determine the high tech cluster success. The legal systems of California and Massachusetts do not differ substantially with respect to their trade secret laws. In both states, the trade secret law effectively inhibits labor mobility within an industrial district. The key difference between the Silicon Valley and the Route 128 lies in the way non-compete agreements have been treated by the legal system. These contracts, unlike the trade secret law, do not prohibit publication and use of technological knowledge, but rather block the mechanism for technological knowledge spillovers. They prevent high tech firm employees to move easily to another firm, or to establish their own, by bringing in the specific technological knowledge gained by working for their previous employer. These restrictions last for a limited period of time, usually one to two years, and are territorially restricted to a particular jurisdiction (usually the ban applies to work in a specific geographic cluster). These contracts are effective because of the nature of the technological knowledge created in high-tech industries, which has short life spans due to the speed of innovation. Such knowledge loses the competitive edge and becomes obsolete in one to two years. This acts as an inhibitor to the employees' mobility within the respective industry. It is precisely the existence of these agreements and their (non)enforcement by the judicial system that contributes to the creation, or the absence of second degree agglomeration economy [1]. The legal system of Massachusetts recognizes non-compete clauses, unlike the Californian under which these contracts are null and void. Gilson argues that it is this difference that enabled the Silicon Valley to develop further and to generate a second cycle of technological development (Gilson, 1999).

It would be interesting to apply the research findings of the Gilson's study to the analysis of the nature of technological industrial development zones in Macedonia. According to the Law on technological industrial development zones and the Government's innovation strategy these zones are envisaged to turn into high-tech industrial districts. Non-compete agreements are regulated by the

Macedonian Labor Law, and they impact the formation of high-tech industrial districts, *ceteris paribus*. Macedonian Labor Law (2005) sanctions anti-competitive behavior of the employees that might be proven harmful to the employer's interests. In the course of employment, the employee cannot, without prior consent of the employer, engage in same or similar activities to the business activities carried out by the employer. If the employee in the course of the employment acquires technical and business know-how, the employer can restrict his mobility by inserting a non-compete clause in the employment agreement. Implemented after termination of the employment, the clause is valid for a period of two years in cases where the employment agreement has been terminated on the basis of mala fide or fault of the employee. Such provisions of the Labor Law are similar to the provisions governing non-compete agreements in Massachusetts.

Assuming that technological industrial development zones in Macedonia are envisaged as hubs that would generate first cycle of agglomeration economy, and thus lead to technological development at local level, these provisions of the Labor Law inhibit the possible turn of the industrial district into high tech industrial cluster susceptible of generating second cycle of agglomeration economy. This disincentivizes dispersion of the generated technological knowledge into the wider context of the national economy. Under the current Labor Law regime even if the technological industrial development zones reach the first stage of agglomeration economy, in the long run this would only lead towards technological discontinuity in the national economy. The analysis does not take into account the rudimentary entrepreneurial and innovative culture in Macedonia, the undeveloped system of local networks of suppliers and distributors, as well as the low levels of human capital. All these factors are important for the further absorption and diffusion of technologies and innovations arising from technological industrial development zones in the country (OECD, 2011).

## **5 Theories of Brain Drain in the Context of Small Developing Countries**

The term "brain drain" refers to the international transfer of human capital, i.e., large-scale migration of highly educated labour force from developing to developed countries. For instance, until 2000, twenty million highly educated immigrants lived in the OECD countries, an increase of 70% in ten years. For unskilled immigrants, the comparable relative increase in migration was 30% for the same period of time.

The reasons behind brain drain are twofold: on one hand, globalization generates agglomeration of human capital in places where it is already in abundance; on the other hand, host countries gradually impose conditions to filter highly educated immigrants through selection policies (World Bank, 2008). Two concepts prevail in the theoretical discussion about the impact of highly educated migration on the economic development. The first concept refers to brain drain as a phenomenon that negatively impacts the sending country's human capital accumulation and fiscal revenue (Grubel and Scott, 1966; Bhagwati and Hamada, 1974). Proponents of this view accentuate the need for implementation of restrictive public policies targeted at restricting highly educated labour mobility. The second concept focuses on the nature of highly educated Diaspora which acts as a powerful force in promoting economic development through a variety of instruments, such as remittances, trade, foreign direct investment (FDI), and knowledge transfer. Indeed, globalization has drastically improved access of technological latecomers to advanced technologies, helping low-income countries to raise per capita income (Mayer, 2000), exemplified in the rapid development of high-tech companies in India and China as a result of their Silicon Valley Diaspora (Saxenian, 2002a).

Migration, if certain conditions are met, can lead to human capital accumulation and influence the net increase of the educational level of the sending country (Beine et al., 2001, 2008). Yet only a handful of studies examines the impact of highly educated migration on the economic development, or engages in the analysis of empirical data pertaining to high human capital emigration rates in small developing countries (Benhabib and Spiegel, 1994; Docquier and Marfouk, 2004; Beine et al., 2001, 2008; Gibson

and McKenzie, 2010). The previous research does not clarify whether it is common for highly educated immigrants, coming from countries that face high brain drain rates, to engage in knowledge transfer, trade and FDI. Accordingly, it is unclear whether the experience of the Chinese and Indian information and communication technologies (ICT) companies is (an exception to) the rule. Moreover, these few studies provide no empirical data about the brain drain effect on the fiscal system, nor do they measure the size of the benefits for the migrants themselves in the process of emigration (Gibson and McKenzie, 2010).

Docquier and Marfouk (2004) try to create a statistical matrix for assessment of the emigration rates by educational level (primary, secondary, and tertiary) for all countries in the world. Their estimates on the emigrants who had completed tertiary educational level might be taken as a measure of brain drain. However, one of the caveats associated with this measure is the fact that it can be too wide for developed countries, where the highly educated account for one third of the total working population. This measure is more appropriate for developing countries, where the share of highly educated population generally accounts for only about 5% of the total labour force. Due to impossibility of accurate data collection, the South-South migration is not taken into account. This could lead to underestimation of the migration rates in some developing countries that can also be considered significant migration destinations.

Docquier and Marfouk's (2006) definition of immigrants as foreign-born workers does not consider the fact whether the education was gained in the home or in the host country. This can lead to overestimation of brain drain and construct a false picture of the variations of this phenomenon across the analyzed countries (Rosenzweig, 2005). To rectify this, Beine et al. (2007) use the age at which immigrants enter the host country as an indicator of where the education was acquired. Their results lead to minute corrections in the ranking of countries according to brain drain intensity, and indicate a strong correlation between corrected and uncorrected results. In general, the size of the country and the emigration rate are inversely correlated, i.e., the average highly educated emigration rates are seven times higher in small countries in comparison to those in large countries (Docquier and Marfouk, 2006). Highest emigration rates have been observed in middle-income countries, where people have both the motive and the financial means to emigrate.

Knowledge is unevenly distributed; it is typically located in clusters. This results in stratification and differentiation of centre and periphery, where underdeveloped peripheral countries (i.e., SEE countries from the point of view of this article) and regions become impoverished in terms of human capital. The peripheral countries do not achieve high incomes at the expense of developed central regions, which in turn benefit from disproportionately increased revenues. As a consequence, the North-South development gap constantly increases. Less developed regions have a shortage of highly educated staff that would otherwise enable higher capital profitability. Capital circumvents these regions, and thus the average productivity remains low. This in turn encourages more talented people to leave, perpetuating the brain drain phenomenon in a vicious circle, in a phenomenon known as the "Mezzogiorno effect" – named by the region of Southern Italy where it is ubiquitous.

In the context of SEE countries' relatively high rates of highly educated emigration and also in the context of formulating sound brain circulation public policies, several questions resonate: What is the starting point of the "Mezzogiorno effect", and whether SEE countries, through implementation of targeted public policies, can affect their qualification as a periphery or centre? Should SEE countries undertake public policies aimed at generating indigenous human capital by subsidizing education and scientific research? Should they undertake public policies aimed at attracting and importing of human capital that has already been created abroad, and funded by another country (Lucas, 1990)?

Brain drain for one country equals brain gain for another. High brain drain rate negatively impacts the sending (i.e., home) country in several aspects. First, it might lead to increased global level inequality (Bhagwati and Hamada, 1974), creating substantial losses in the economy of the home country. It might also generate deficit in certain professions, making distinct professional profiles emigrate in disproportionately large numbers. This might be exacerbated by different types of governmental public

policy measures aimed at prevention of brain drain, such as discouraging professional programs for acquisition of easily mobile skills, e.g. nurses (Poutvaara, 2004). These public policy measures are presumably focused on creating professionals who will be unable to leave the country easily (e.g., lawyers). However, in the long run this might lead to hyperinflation of those professions, leaving the problem with the deficit professions unsolved.

The relative degree of possibility to emigrate affects the decision as to whether people will invest in acquiring tertiary education diploma. If a certain type of education is an immigration card, this will act as an additional stimulus for investment in human capital. Uncertain emigration prospects when deciding about entering tertiary studies may influence the decision to (not) invest in acquiring new skills and competences. In the short term, this is beneficial for the sending country in terms of not losing additional human resources (Mountford, 1997; Beine et al., 2001). In this respect, countries combining relatively low levels of human capital and low rates of highly educated emigration evidence net profit. However, most developing countries record huge losses in human capital in the form of brain drain. Only a handful of large developing countries net insignificant benefits in terms of balancing low human capital levels and low highly educated emigration rates (Beine et al., 2008).

### *5.1 Potential benefits of brain drain*

#### *5.1.1 Remittances*

There are two motives behind remittances: altruism and exchange (Beine et al., 2006). Altruism is usually directed at immediate family members, whereas remittances, most often motivated by exchange, represent compensation for services done on behalf of immigrants by someone in their native country. Such transfers are intrinsic to temporary migration, signalling the willingness of immigrants to return home. It is unclear whether highly educated migrants transfer more funds than less educated ones. The former can transfer larger amounts in order to repay for funds invested in their education. On the other hand, they often emigrate with their family, severing their ties with the native country. In this respect, Faini (2006) found that – at aggregate level – brain drain migration generates less income from remittances.

#### *5.1.2 Return migration and brain circulation*

These phenomena are rare among highly educated persons who left their country, unless the return is not preceded by considerable growth of the national economy (Milio et al., 2012). For instance, less than one-fifth of Taiwanese and South Koreans with doctorates in engineering who completed their studies at US universities in the seventies chose to return to their home countries. However, after two decades of rapid economic growth in Taiwan and South Korea, the share of students returning upon graduation increased to two-thirds. The same trend has been observed with Chinese and Indian students who graduate in the USA and return home, suggesting that the return of highly qualified persons is a consequence rather than the cause of economic growth (Commander et al., 2003).

#### *5.1.3 Diaspora externalities*

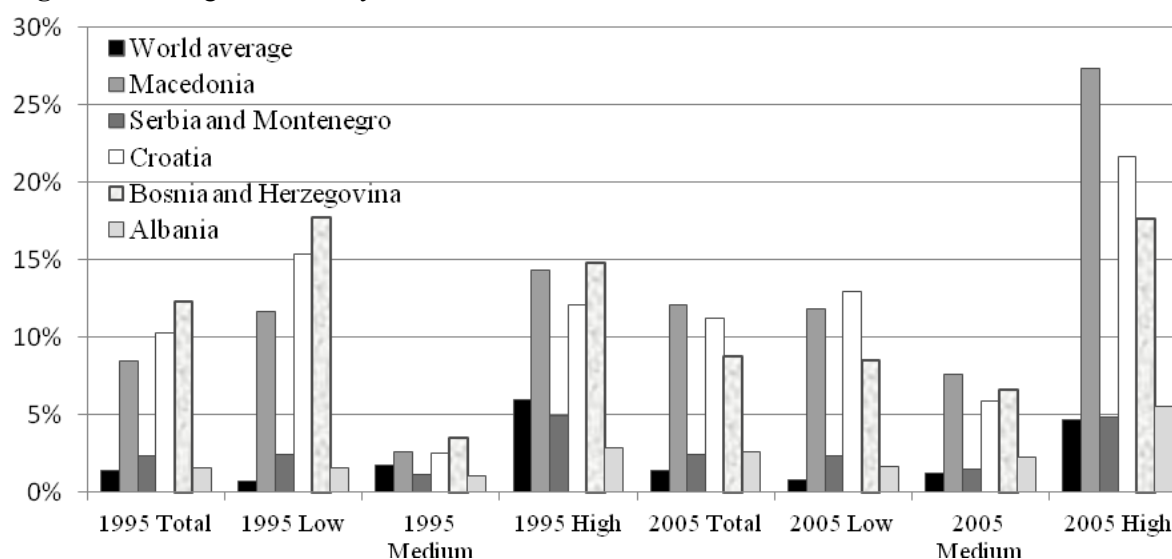
A significant number of social studies stress the potential of Diaspora externalities. Mobility of highly educated migrants might contribute towards reducing transaction and other types of information costs, and thus facilitate trade, FDI and technology transfer between the host and the home country (Rauch and Casella, 2003; Kugler and Rapoport, 2006).

Human capital formation and accumulation have created challenges to most of the developing countries in terms of striving to achieve economic growth. Human capital is inevitably linked to issues of innovation, successful technology transfer, and economic growth. The most persistent challenge in this respect has been the phenomenon of high rates of brain drain, i.e. droves of scientists leaving their native countries in search for better life. In SEE countries this problem has been pervasive and ubiquitous for years. This paper tries to build on the existing human capital and innovation literature and to come up with a creative solution to the problem by proposing a brain circulation model for SEE countries.

## 6 Brain drain trends in SEE countries

Even though most SEE countries have undertaken education strategies and action plans geared towards increasing the tertiary enrolment rates, this has not resulted in substantial decrease in their brain drain rates. On the contrary, brain drain rates have been relentlessly increasing, with Macedonia leading the SEE pack (Figure 5, Table 1); Croatia and Bosnia & Herzegovina (BiH) follow suit. Interestingly, Albania and Serbia have much lower brain drain rates, which have remained relatively stable over time and are comparable to the world average. Bulgaria and Romania, members of the European Union, also experience relatively lower brain drain. Because Macedonia has such high rate of brain drain, it is useful to scrutinize this country's socio-economic milieu, the composition of its emigrants, migration flows, and remittances.

**Figure 5** Emigration rate by educational level 1995–2005, selected SEE countries



Source: Docquier et al. (2011)

**Table 1** International skilled migration, estimates controlling for age of entry, percentages

Country	Brain drain 0+ years age		Brain drain 12+ years age		Brain drain 18+ years age		Brain drain 22+ years age	
	1990	2000	1990	2000	1990	2000	1990	2000
Albania	17,4	14,3	17,3	14,1	17,1	13,9	16,1	13,2
Bosnia & Herzegovina		23,9		23,2		22,9		21,9
Macedonia		29,1		26,9		25,9		24,1
Croatia		24,1		22,1		20,7		18,9
Bulgaria	4,0	6,8	3,9	6,6	3,8	6,5	3,7	6,2
Serbia & Montenegro		13,7		13,3		12,9		12,3
Romania	9,1	11,9	8,7	11,4	8,2	10,8	7,7	10,2

Source: Beine et al. (2007)



Among the SEE countries, Macedonia is an example of a small, landlocked developing country experiencing very high rates of brain drain. Partial data on the extent of the Macedonian brain drain can be obtained from the World Bank KAM (Knowledge Assessment Methodology) database and through the World Economic Forum (WEF, 2010). This data has been obtained through a survey which measures the perception of the respondents about the extent of the brain drain in the country. In this respect, Macedonia is ranked on the bottom of the list, being a country with one of the highest brain drain rates worldwide. The data in Table 2 gives a partial overview of the scope and structure of the Macedonian brain drain. In 2000 the emigration rate of tertiary educated labour force reached remarkable 29.1%.

**Table 2** Migration flows 2000-2010, Macedonia

<i>Emigration, 2010</i>
Stock of emigrants: 447.1 thousands
Stock of emigrants as percentage of total population: 21.9
<i>Skilled emigration, 2000</i>
Rate of emigration of tertiary educated population, as percentage of total population: 29.1
Emigration of doctors: 91 or 2.0% of doctors educated in the country
<i>Immigration, 2010</i>
Stock of immigrants: 129.7 thousands
Stock of immigrants as percentage of total population: 6.3
Females as percentage of immigrants: 58.3
Refugees as percentage of immigrants: 1.0

*Source:* World Bank (2011a)

To complement the data given in Table 2, it is also useful to conduct an assessment of the international immigration rates by education level. Looking at the SEE country with the highest rate of brain drain, Macedonia, it becomes evident that the highest relative increase in emigration is found in the group of highly educated individuals (Docquier et al, 2011). In a period of ten years, from 1995 to 2005, the tertiary emigration rate nearly doubled (Figure 5).

Remittances sent by migrants have become a massive financial resource flow for some developing countries, with World Bank's estimates of over \$300 billion received annually. Accordingly, data on the amount of inward and outward remittance flows and related data in Macedonia are presented in Table 3 and Figure 6.

**Table 3** Inward and outward remittance flows, Macedonia.<sup>ii</sup>

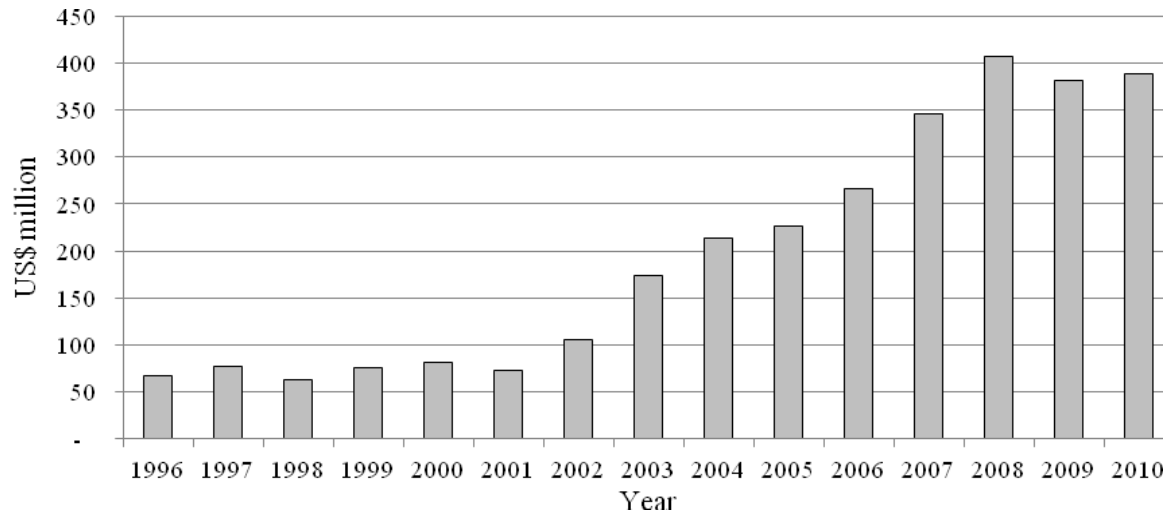
<i>US \$, million</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>
<i>Inward remittance flows</i>	174	213	227	267	345	407	401	414
Worker's remittances	146	161	169	198	239	266	260	
Employees' compensation	28	52	57	69	106	140	121	
Migrants' transfers								
<i>Outward remittance flows</i>	16	16	16	18	25	33	26	
Workers' remittances	15	15	14	16	22	28	22	
Employees' compensation	1	1	2	2	3	5	4	
Migrants' transfers								

*Source:* World Bank (2011a)

Over the past decade, remittances in Macedonia have experienced constant growth (e.g., in 2003 they amounted to only \$US 174 million, while in 2010 they amounted to \$US 414 million; see Figure 6). Nevertheless, if other categories of inflows are taken into account it becomes clear that remittances do not play major role in total inflows, i.e. their share is only 5% compared to the exports' share of 62%. For instance, in 2008 net FDI inflows reached \$US 0.6 billion, net ODA (Official Development Assistance) was \$US 0.2 billion, total international reserves were \$US 2.1 billion, and exports of goods and services reached \$US 5 billion (Ratha et al., 2011). The data pertaining to remittances does not reveal the educational level of the senders of remittances. Considering that Macedonia is a multiethnic society, as well as the long and intense immigration tradition of Macedonian Albanians, it would be informative to perform the brain drain analysis on a micro level, to determine which segment of the Macedonian immigration population constitutes the brain drain, and to determine to what extent the highly educated Diaspora invests back in the home country.

Considering that remittances have a minute share of total inflows in the Macedonian GDP<sup>iii</sup>, it becomes clear that from 1995 onwards the highly educated individuals leave the country with their families, while severing their ties with their home country and investing back very little or not at all. Unfortunately, reliable evidence about the extent, chronology and intensity of the brain drain in SEE countries does not exist, which hampers the generation of a comprehensive matrix of similar data for all SEE countries. Likewise, the data in Table 3 is analytically limited due to the difficulty of measuring the exact amount of inward remittance flows as a result of the existence of informal channels of sending money. Moreover, the data analysis does not provide information on the impact (positive as brain gain / negative as brain drain) of temporary or permanent migration on human capital.

**Figure 6** Migrant remittance inflows - workers' remittances, compensation of employees, migrant transfers, credit (US\$ million), 1996 - 2011, Macedonia.



Source: World Bank (2011b)

## 7 Intellectual mobilization of the SEE highly educated Diaspora: brain circulation public policy mechanisms

This article addresses questions related to brain gain, geography of economics and innovativeness of high tech districts in SEE countries, with special reference to Macedonia. It builds on the theory that the formation and maintenance of high – tech districts can trigger formation of brain circulation networks. Public policy makers in collaboration with the academia and the private sector should develop long-term innovation strategies that will focus on coherent development of capabilities for absorption and diffusion of new technologies among innovative agents. The successful implementation of these strategies would generate the spiral effect of multiplication of technological benefits to the local economy and creation of technological continuity in the local economy (endogenous growth theory, Romer, 1990). Inevitably, these strategies should take into account the theories that deal with the impact of geo-space on the success rate of innovative technology transfer. This could lead to an increase of the competitive technological advantages of the private sector and the local economy in general (Porter, 1990).

### *7.1 Knowledge economy variables relevant for brain circulation*

We have selected a number of KAM (Knowledge Assessment) variables that we believe are of particularly high significance for brain circulation.<sup>iv</sup> KAM variables are normalized on a scale of 0 to 10 relative to other countries in the comparison group:

- (i) Human Development Index (HDI). This index provides information on the human development aspect of economic growth. It is based on three indicators: (i) longevity, which is measured by life expectancy at birth; (ii) educational attainment, which is measured by a combination of adult literacy rate and the combined gross primary, secondary and tertiary enrolment ratio; and (iii) the standard of living, which is measured by GDP per capita in the UNDP Human Development Report (UNDP, 2010).
- (ii) Control of Corruption. This indicator corresponds to “graft” measures of corruption, i.e. corruption measured by the frequency of “additional payments to get things done” and the effects of corruption on the business environment, as described in the Worldwide Governance Indicators of the World Bank (Kaufmann et al., 2010).
- (iii) University-Company Research Collaboration. This indicator is based on the statistical score on a 1-7 scale of a large sample group in a particular country responding to the question on the extent of company-universities collaboration in research and development activities, where 1 = minimal or nonexistent, 7 = intensive and ongoing (WEF, 2011).
- (iv) Availability of Venture Capital. This is based on the statistical score on a 1-7 scale of a large sample group in a particular country responding to the question of whether entrepreneurs with innovative but risky projects can generally find venture capital in their country, where 1 = not true, 7 = true (WEF, 2011).
- (v) Patent Applications Granted by the USPTO. This indicator shows the number of U.S. patent documents (i.e., utility patents, design patents, plant patents, reissue patents, defensive publications, and statutory invention registrations) granted (USPTO, 2013; Jaffe et al., 1993).
- (vi) High-Technology Exports as % of Manufactured Exports. High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery (DDP, 2013).
- (vii) Firm-Level Technology Absorption. This indicator is based on the statistical score on a 1-7 scale of a large sample group in a particular country responding to the question of whether the companies in the country are: 1 = not able to absorb new technology, 7 = aggressive in absorbing new technology (WEF, 2011).



- (viii) Public Spending on Education as % of GDP. This indicator consists of public spending on public education plus subsidies to private education at the primary, secondary, and tertiary levels (DDP, 2013).
- (ix) Brain Drain. This parameter is based on the statistical score on a 1-7 scale of a large sample group in a particular country asked to rate whether the country's talented people: 1= normally leave to pursue opportunities in other countries, 7= almost always remain in the country (WEF, 2011).
- (x) Difficulty of Hiring Index. Applicability and maximum duration of fixed-term contracts and minimum wage for trainee or first-time employees. Higher values indicate more rigid regulations (World Bank, 2010).

Table 4 shows data for the above KAM variables across several different SEE countries. While the list of variables is not inclusive, it points toward the major issues that influence brain drain / brain gain.

**Table 4** Values for selected KAM variables in several SEE countries

	<i>Macedonia</i>	<i>Croatia</i>	<i>Serbia</i>	<i>Albania</i>	<i>BiH</i>	<i>Bulgaria</i>
Human development index, 2010	7.71	9.86	3.68	4.38	3.61	1.81
Control of corruption, 2009	5.62	5.82	5.21	4.18	4.52	5.41
University-company research collaboration (1-7), 2010	5.27	4.66	5.27	0.15	1.98	1.98
Availability of venture capital (1-7)	5.42	2.44	3.21	2.44	1.37	5.42
Patents granted by the USPTO, avg. 2005-2009	3.36	6.71	5.07	2.4	3.63	6.64
High-tech exports as % of manuf. exports, 2009	3.59	7.18	n/a	2.44	3.59	6.03
Firm-level technology absorption (1-7), 2010	1.91	3.44	0.53	3.44	1.53	1.53
Public spending on education as % of GDP, 2009	n/a	7.43	7.43	n/a	n/a	4.59
Brain drain (1-7), 2010	1.07	1.22	0.46	2.98	0.46	1.07
Difficulty of hiring index,	7.87	1.77	0.92	3.4	2.13	6.1

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2010

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*Source: World Bank (2013)*

## 7.2 *Brain circulation public policy implications for SEE countries*

The return migration flows are primarily influenced by public policy measures undertaken by governments in order to influence the mobility of highly educated migrants (Johnson and Regets, 1998; Saxenian 2002b). Government programs targeting brain circulation influence the nature and intensity of exchange relationships between highly educated migrants, sending countries and destination countries (Saxenian, 2002c). Due to the mostly transient and “fluid” character of the Diaspora networks, it is extremely difficult to measure and assess the impact of these networks on the economic growth of the sending country (Meyer, 2001). For Diaspora networks to serve as hubs for knowledge and expertise transfer and dissemination, certain preconditions in the sending country should be met, such as adequate legal, economic and political infrastructure and human capital, and most important of all, supportive governmental public policies. These policies can aim towards establishment of industrial clusters linked to science and university parks, as in the case of India (Saxenian, 2011), establishment of innovative start-ups by entrepreneurial returnees, and promotion of activities undertaken by expatriates acting as “transnational professional communities” between the sending and the destination country (Saxenian, 2002b). Many authors find positive correlation between the incoming FDI from the USA and number of tertiary graduates residing in the USA (Javorcik et al., 2006; Kugler and Rapoport, 2007; Docquier et al., 2011). However, these effects cannot be extrapolated to all developing countries, since, as already pointed out, certain preconditions should be met (Skeldon, 2009).

There are several public policy mechanisms that can be deployed by the SEE countries in order to discourage high brain drain rates. These involve policies aimed towards: (i) return of migrants into their home country; (ii) restriction of international mobility of own and foreign highly educated citizens; (iii) recruitment of highly educated international migrants; (iv) reparation of the human capital loss; (v) Diaspora options, or resourcing of expatriates; and (vi) retention via development of adequate educational sector policies aimed towards economic growth. Out of all of these public policy measures, only public policies aimed at attracting migrants to return to their home country, public policies influencing formation of Diaspora networks, and retention public policies are viable options in terms of brain circulation. Most often, governments undertake a mélange of these public policies, linking the technological growth with retention policies, e.g. Asian countries, and/or Diaspora networks, e.g. South American countries (Lowell and Findlay, 2002).

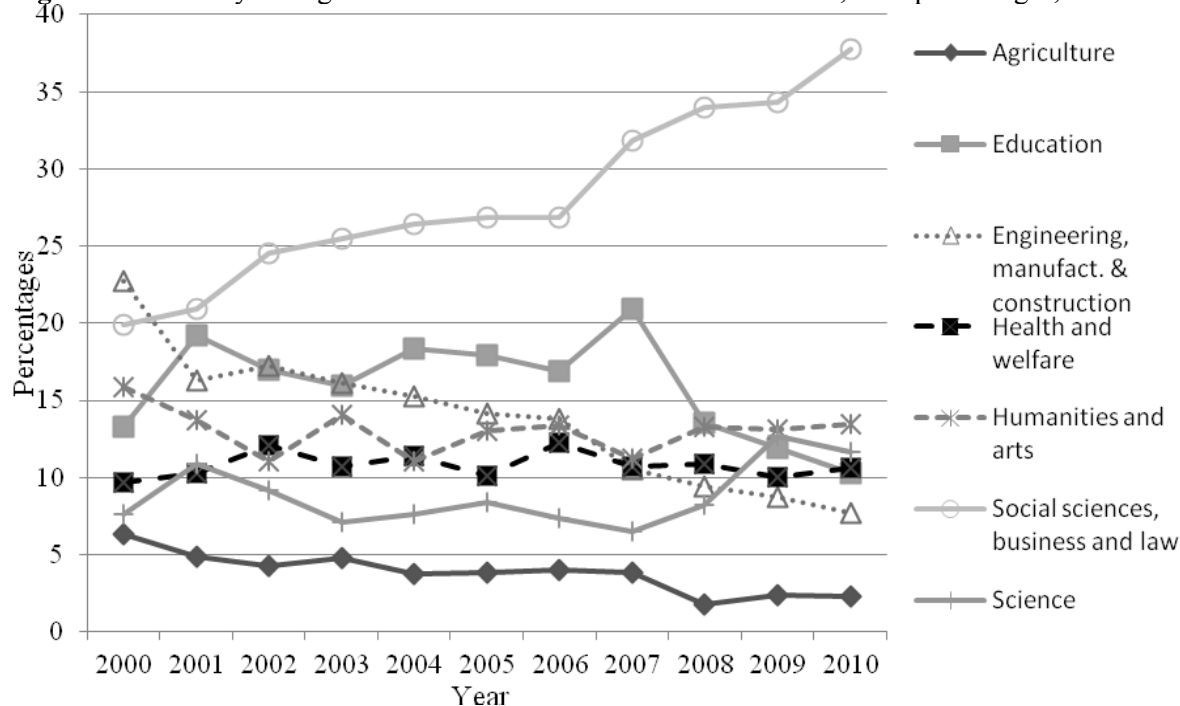
Intergovernmental organizations also influence mobility of highly educated personnel on international level. For example, the European Union encourages greater mobility of researchers and scientists through programs such as Socrates/Erasmus and FP7 Marie Curie actions (Ackers, 2005). As well, universities, research institutes, and scientific and research parks are instrumental in attracting and retaining highly educated professionals in their home country. The Western Balkan countries are presently developing a joint platform of R&D for innovation; accordingly, the Government of Macedonia is developing new laws and implementing policies aimed at fostering innovation and R&D environment. These and similar international efforts should hopefully create fertile conditions for increased engagement of the academic and scientific Diaspora.

In recent years, the SEE countries have achieved certain progress in the area of human capital development by enacting and implementing national strategies and actions plans pertaining to innovation, science, and higher education (OECD, 2010). Despite the encouraging reforms in this field, the SEE countries’ governments face number of challenges. The brain drain generates a gap between the supply and the demand of certain skills, and leads to distortions in the highly educated population labour market. This is one of the main reasons why the private sector encounters difficulties with recruitment of highly

skilled personnel in certain professions. The lack of coherent, holistic and strategic public policy approach sustains the vicious brain drain cycle in these countries. For instance, the National Program for the Development of Education in Macedonia 2005 - 2015 is in discrepancy with other national strategies, such as those for investment and for innovation. This is a consequence of the fragmented and *ad hoc* cooperation between governmental institutions responsible for creation of public policies in the field of human capital development. One possible public policy instrument in this regard would be the implementation of a holistic, inclusive approach to education, science, technological development and innovation. Creating and sustaining substantial, and not only formalistic, institutional ties is essential in this regard.

Highly educated and skilful workforce contributes to the development of innovative capacities of the private sector, of the academia, and of the society as a whole. The number of students enrolled in tertiary education can be used as an indicator of the human development potential of one country. For example, in Macedonia, the number of students enrolled in tertiary education in the three-year period between 2006 and 2009 recorded an increase of 35% (UNESCOstat, 2011). Enrolment numbers of students represent the input in the educational system. On the other hand, the number of tertiary education graduates is a measure of the output of the educational system, and indirectly indicates the efficiency of one country's educational system in generating human capital. Thus, this indicator is far more relevant for analysis of the relationship between the educational system and the human capital formation and accumulation. For instance, the data in Figure 7 indicates that the number of graduates in Macedonia is relatively low or decreases in all sectors, apart from social sciences, where it records rapid growth. These figures should be analyzed simultaneously with the data pertaining to brain drain. The increased relative number of social sciences graduates, the increased volume of brain drain, and the lack of highly educated workforce in the field of technical sciences – lead to the suggestion that a large number of science and technology graduates leave the country whenever they have an opportunity to do so.

**Figure 7** Tertiary graduates in different sectors, percentages, Macedonia



Source: UNESCOstat (2011)

High brain drain rates represent net transfer of human capital, in the form of educational costs, from low-income to high-income countries. Brain drain rates in certain small developing countries amount to over 60% (World Bank, 2008). Emigration of the highly educated workforce strata which directly contribute to production, e.g. engineers and scientists, might result in reduced innovation and technology transfer rates in the domestic economy (Kapur and McHale, 2005). The emigration rates of scientists, engineers and doctors are, in general, higher than the emigration rates of the labour force that has non-technical university education (e.g. lawyers). For example, the emigration rate of individuals with tertiary education in India is 4%, however the emigration rate of individuals graduating from the prestigious Indian Institutes of Technology was in the range of 20 to 30% in the 1980s and 90s (Docquier and Marfouk, 2004). When local conditions and opportunities are limited, certain levels of emigration rate can be positive for the sending country, due to the possible positive effect of technology transfer from the Diaspora. However, certain preconditions need to be fulfilled in order for positive externalities of brain drain to occur. If the sending country represents relatively small economic market (as in the case of all SEE countries), it is very likely that the brain drain will cause significantly adverse labour market changes that will affect all sectors of the local economy. The likelihood that a young man who earned his doctorate in the USA will remain there after completing doctoral studies decreases with the increase in the average per capita income in the home country. However, this is not the sole factor affecting the decision to return. This decision is influenced by other factors such as quality of living conditions, density of research networks, and size of the host country Diaspora. Factors that could positively affect the decision to return to the home country are family proximity, cultural familiarity, and the desire to participate in the technological progress of the home country.

Due to the alarmingly high rates of brain drain, the SEE governments should formulate public policies aimed towards encouraging the so-called brain circulation. The brain drain is a complex issue that occurs as a result of a variety of mutually overlapping factors, out of which the most important is the level of economic development of the home country. For instance, the economic development of the country is the main reason for the return of South Korean highly educated immigrants to their home country. However, the lack of opportunities for economic development is not the only obstacle to the return migration. The 2005 study of the Albanian Institute for International Studies, Tirana, pointed out the fact that the young educated Albanians do not return to their home country due to the inappropriate business practices of the employers in terms of recruitment and selection, nepotism and lack of transparency in the public administration and in the academia (OECD, 2010).

The so-called brain circulation paradigm goes beyond the classic brain drain-brain gain dichotomy, and relies on notions such as globalization and transnationalism (Gaillard and Gaillard, 1997). The brain circulation paradigm is based upon several preconditions, the most important being the possibility for brain exchange between countries, increase in temporary migration flows, and increase in return migration flows (Milio et al., 2012).

“Piloting Solutions for Alleviating Brain Drain in South East Europe” financed by UNESCO and Hewlett-Packard is one of the pioneering brain circulation projects in SEE (Gabaldón et al., 2005). This project was designed to support research and reduce brain drain by creating opportunities for advancement of young SEE scientists in their home countries. Universities from the SEE countries received assistance in the form of grid technologies and start-up capital for financing scientific cooperation and exchange with their counterparts in the Diaspora. Since all SEE countries share similar socio-economic conditions, the regional approach to brain circulation will be an effective public policy instrument. Therefore, it would have been beneficial if the activities of the above mentioned project became sustainable in the long run. Another effective public policy in this regard would be the creation of Diaspora knowledge networks (e.g. similar to the Colombian Red Caldas).

We perceive the highly educated Diaspora as an opportunity that takes a different approach to the brain drain because it perceives the brain drain not as a loss, but a potential gain to the home country. We see the highly educated SEE expatriates as a pool of potentially useful human capital for the countries of origin. The challenge lies in mobilizing these brains in order to involve them in promoting the economic growth of the region, i.e., in building a sustainable brain circulation network. SEE countries can benefit from other countries' successful experiences, e.g. India, where the partnerships between the private sector and the academia, twinning project with technology institutes from the USA and the technology transfer led by the Silicon Valley Diaspora have greatly influenced the rise of Bangalore as one of the world's IT centers. Institutional factors play a major role in brain circulation. Looking at the examples of India, China, and other countries, returning migrant communities are not replicating Silicon Valley around the world. It is more appropriate to see the emerging regions as hybrids, combining elements of the Silicon Valley industrial system with inherited local institutions and resources (Saxenian, 2005). Universities, together with the public sector should motivate talented lecturers and students to spend short periods of research and study abroad. Also, the institution of exchange programs is an excellent means of encouragement of highly educated Diaspora scientists to return to their home country and provide lectures or engage in collaborative projects with their counterparts.

## 8 Conclusions

A number of highly educated Southeast Europeans have recently left their countries in search of a better life. They are attracted to career opportunities, higher salaries, and better overall conditions abroad. To mitigate and reverse this process, the SEE countries' governments should play a proactive role by fostering the process of brain circulation through the adoption of a public policies aimed toward creation of high tech districts. This is critical especially for the smaller SEE countries, and is ever so important in light of the new research and innovation program of the European Union, Horizon 2020, which advocates scientific collaboration and formation of research and development consortia, not only between the academic institutions, but also between the academia and the private sector. All these endeavours need to rely on stable long-term strategies to promote economic growth and democracy in the SEE countries, leaving no way to nepotism and corruption, two of the main culprits for the long socio-economic status quo of the SEE countries (Quaked, 2002). The main preconditions for brain circulation can be found in the "well developed scientific infrastructure, higher investments in the science sector, and the stability of a consolidated democratic government that assures human rights and academic freedoms" (Horvat, 2004). *Sapienti sat.*

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## Notes

<sup>i</sup> See, e.g., "The South East Europe Transnational Cooperation Programme", available at <http://www.southeast-europe.net/hu/> (accessed on January 25, 2013).

<sup>ii</sup> Remittances are defined in the Balance of Payments Manual of the World Bank, 5th edition. See <http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1199807908806/MacedoniaFYR.pdf> (accessed on January 25, 2013); see also <http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1181678518183/metasheet.pdf> (accessed on January 25, 2013).

<sup>iii</sup> Macedonia's GDP is approximately \$10.5 billion (2012 estimate). See

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<https://www.cia.gov/library/publications/the-world-factbook/geos/mk.html> (accessed on January 25, 2013).

<sup>iv</sup> *See* Knowledge Assessment Methodology 2012. KAM is an interactive benchmarking tool created by the World Bank's Knowledge for Development Program. The KAM consists of 148 structural and qualitative variables for 146 countries to measure their performance on the four Knowledge Economy (KE) pillars: (1) Economic Incentive and Institutional Regime, (2) Education, (3) Innovation, and (4) Information and Communications Technologies; available at [www.worldbank.org/kam](http://www.worldbank.org/kam) (accessed on January 25, 2013).