ROMANIA WEST REGION COMPETITIVENESS ENHANCEMENT AND SMART SPECIALIZATION

Territorial Assessment:

Profile, Performance, and Drivers of Growth in the West Region

March 2013

Intermediate Report

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Executive Summary

Part 1: Regional Profile

The West Region is one of eight development regions of Romania. It comprises four counties – Arad, Caras-Severin, Hunedoara, and Timis – and encompasses 12 municipalities, 30 cities and 281 communes. While the region is a recent creation, three of its four counties (excluding Hunedoara) are part of the historical Banat region, providing a distinct cultural tradition that has long shaped the development path of the region.

Significant agricultural land and an endowment of minerals, including coal and metals established the region's industrial and commercial base, from which it continues to benefit today. While the West has the lowest population density of any region in Romania, it is also among the most urban regions in the country, a unique situation that contributes both to the region's strong urban dynamism and the lack of economic opportunities in its rural areas.

Human capital has benefited from positive net migration over the past decade (the only region outside Bucharest to achieve this), driven by dynamic economic growth and also by the strength of the region's universities. Indeed, over the past decade the West has virtually eliminated its gap with the EU in terms of tertiary enrolment. This suggests that over the next generation, the average education level of the region's workforce will converge with Europe. However, the West still trails well behind Bucharest in this regard, and shows weaknesses in the quality of its secondary education and the scale of its second-stage tertiary (research) population. This contributes to the region's relatively weak innovation capacity.

In addition, the West continues to face a problem of older worker retrenchment due to restructuring in traditional industries like coal and metals (particularly in Hunedoara and Caras-Severin) as well as younger workers that leave school without qualifications. Participation rates among workers with the lowest education levels is less than half that of those at the highest(tertiary) levels in the West Region, while unemployment rates are almost four times higher.

In understanding the West Region's productive system today and the ways in which it may evolve in the coming years, four features stand out:

- Increasingly strong specialization in medium technology, light manufacturing: Manufacturing accounts for 40 percent of output in the region and 48 percent of employment compared to 28 percent and 36 percent, respectively, for Romania as a whole. The automotive sector increasingly dominates: with just 1 percent of the plants and 0.1 percent of all firms in the West Region, the motor vehicles sector (NACE 29) accounts for 11 percent of all employment, 13 percent of all output, and 44 percent of all exports. At the same time, the size and growth of the services sector in the region is below national trends.
- 2. Increasing integration with regional value chains, leading to low local value addition: Across its key sectors, the West Region has become a supplier to European regional production networks. This has not only contributed to significant investment and job creation, but has played an important role in integrating the West Region ever more

tightly into the European economy. A natural result of this fragmentation of production and of task specialization is a decreasing share of value added in output.

- 3. Increasing dominance of foreign direct investment (FDI) with weak links across firms and to local suppliers: Firms with foreign ownership account for almost one quarter of all businesses in the West, around half of output and employment, and more than 90 percent of exports. While this raises some risks for the region, there is no evidence of 'footloose' activity among foreign investors, although there is some concern that they are crowding out the domestic sector, mainly through their dominance in the high skill end of the labor market. Moreover, the potential for 'spillovers' of technology and knowledge from FDI is significantly constrained by the lack of supply links with local SMEs.
- 4. *Emerging cross-sectoral links*: A number of new sectors for the West Region have emerged in activities related to the automotive sector, most interestingly in electronics, software, and ICT services.

Finally, like all regions in Romania, the West suffers from weaknesses in institutions, not least of which is the lack of policymaking authority at the regional level. While there has been significant increase in stakeholder participation in the development process, mainly through EU related initiatives, it is not clear that there exist significant representative stakeholder groups that are contributing in an active way to shape the development process in the region. For example, getting foreign investors and local SMEs to recognize mutual interests has been difficult.

In this context, the region experienced rapid economic growth before contracting sharply during the crisis period at the end of the decade. Growth during this period delivered rising real wages, supported by commensurate improvements in productivity. However, economic expansion has not generated employment gains, and has exacerbated existing spatial inequalities within the region. Fundamentally, the West Region faces a dual challenge. On the one hand, in Caras-Severin, Hunedoara, and parts of Arad, the challenge is one of generating and capturing employment opportunities by exploiting regional assets more effectively and improving access to opportunities elsewhere in the region and the country. By contrast, in the Timis-Arad agglomeration, it is addressing shortages and mismatches in the labor market, which underscores the importance of upgrading competitiveness in order to deliver the value added commensurate to support continued wage pressure.

Part 2: Growth Drivers for the West Region

Part 2 of the report benchmarks West Romania's regional economic growth drivers against regional economic growth drivers in the European Union in order to obtain relevant policy conclusions regarding the right mix of regional policies for promoting economic growth. The core of the study is based on an empirical investigation including two panel data models which evaluate regional economic growth drivers across the EU-27, and the NUTS-2 level regions of Romania and Bulgaria. West Romania's current situation is then benchmarked against the drivers of regional development in the EU-27 and in Romania and Bulgaria.

The empirical analysis involves an extended growth framework, focusing on variables group around three main types of determinants: physical infrastructure stock and investment; human-capital and innovation-related regional factors; and different aspects of regional institutions.

The results of the analysis are summarized in the table below. At lower levels of development, such as those found in Romania and Bulgaria, the factors which seem to drive economic growth differ considerably from those at higher levels of development, as represented by the regressions including the EU as a whole. At an initial stage regional economic growth is driven by a good endowment of human capital and innovation, as well as by good infrastructure conditions. Improvements in infrastructure and institutional conditions in these environments are crucial for economic growth. In particular, improvements in road infrastructure, in the local rule of law, and reductions in corruption have been among the most important drivers of economic dynamism in Romania and Bulgaria. As the level of development is increased and we include the whole of the EU in the analysis, the beneficial effects of infrastructure endowment and new investments wane, and economic growth is the result of greater levels of overall investment, better endowments in human capital and innovations.

		Romania and
	EU	Bulgaria
Infrastructure (levels)	ns	+***
Infrastructure(change)	ns	+***
Roads (level)	ns	+***
Roads (change)	ns	+***
Air Transport (level)	+*	+*
Air Transport (change)	ns	ns
Innovation and human capital (levels)	+***	+***
Innovation and human capital (change)	+***	_**
Higher ed (level)	+***	+***
Higher ed (change)	ns	_***
LLL (level)	+***	ns
LLL (change)	+***	+***
R&D (level)	ns	ns
R&D (change)	ns	ns
Patents (level)	ns	_**
Patents (change)	ns	ns
Institutional quality (levels)	_***	ns
Institutional quality (change)	+***	+***
Corruption (level)	_***	ns
Corruption (change)	+***	+***
Rule of Law (level)	_**	ns
Rule of Law (change)	+**	+***
Governement Effectiveness (level)	_*	ns
Governement Effectiveness (change)	ns	+**
Governement Accountability (level)	ns	+***
Governement Accountability (change)	+**	ns

Effect of the main policy parameters on regional GDP per capita growth: Summary table for the panel data analysis (1996-2009)

Notes: *,**,*** illustrate the 10%, 5%, 1% significance levels, respectively. The accronym "ns" indicates non-significant coefficients.

Summary

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The analysis presented in this report suggests that fundamental improvements to the competitiveness of the region will be needed to meet future growth challenges, most importantly in addressing human capital and innovation, and in improving institutions, but also in some targeted, short-term infrastructure investments. The West will also need to make investments to support the business environment both in leading and lagging parts of the region. Following is a brief summary of the recommended focus areas:

Infrastructure:

While the West region does not face a major infrastructure deficit, strategic investments in infrastructure, particularly in transport infrastructure, will be critical in addressing both parts of the strategic challenge. Three main types of connective infrastructure need to be considered:

- 1. Infrastructure to support the productive capacity of the Timisoara-Arad agglomeration
- 2. Infrastructure to facilitate connectivity between Timisoara-Arad and more peripheral parts of the region
- 3. Infrastructure to improve the region's connectivity with Bucharest

Human capital and innovation:

Despite education and skills often being perceived as a source of comparative advantage for the region, in fact the region faces important shortcomings at all levels of training and skills development. In particular, focus should be places on:

- 1. The link between tertiary education and the workforce
- 2. Lifelong learning
- 3. Improving the regional innovation system

Institutions:

The findings of Part 2 of this report suggest that low institutional capacity does not necessarily mean a strong handicap for future development. Lack of improvement in the quality of institutions, by contrast does. A sustained effort to address these barriers will be needed for the region to experience both sustainable levels of development. This will require:

- 1. Support to building local institutional capacity
- 2. Support to developing a 'thick institutional' setting to enable active engagement and bottom-up development

Regional Business Environment:

In addition to these core pillars of the development strategy, the West Region will need to invest to improve the business environment in both leading and lagging parts of the region. Among the priorities here are:

- 1. Building a competitive services sector
- 2. Facilitating links between foreign investors and the local economy
- 3. Support to building the capacity of local SMEs.
- 4. Promoting entrepreneurship in lagging areas

Finally, it is important to consider that all these interventions need to be carefully put together in a development strategy that is comprehensive and well-timed. This will not only address some of the basic problems of the region, but also enhance its capacity to adopt new technology, to develop all types of innovations, to retain and attract talent, and to attract new investment, setting the bases for sustainable growth in West Romania.

Introduction

Context: Economic Performance of the West Region

As the West Region develops a strategic plan for the future, it can be instructive to look back on its performance over the past decade. This brief introductory section will show that the West Region experienced rapid economic growth before contracting sharply during the crisis period at the end of the decade. Growth also delivered rising real wages, supported by commensurate improvements in productivity. However, economic expansion has not generated employment gains, and it has exacerbated existing spatial inequalities within the region.

The West Region is the second leading region in Romania, with a GDP per capita 13 percent above the national average, although still far below that of Bucharest. In the context of strong national growth, the West was the fastest growing region in the country over the 2000 to 2007 period and, along with Bucharest the fastest growing over the entire decade. In fact, relative to comparator regions in Europe, the West Region has been a clear winner over the past decade (Table 1). Overall, the growth performance of the West Region contributed to significant convergence with the European Union (EU) average; however, the gap with Europe remains substantial, with per capita GDP (at purchasing power standard) still less than half the EU average.

	GDP per purchas	r inhabitant (ing power st	Euro, at andard)	G	irowth (CAGR	:)
	2000	2007	2010	2000-07	2007-10	2000-10
WEST	5,100	12,000	12,900	13.0%	2.4%	9.7%
North West	4,600	10,000	10,200	11.7%	0.7%	8.3%
Centre	5,100	10,500	10,900	10.9%	1.3%	7.9%
Bucharest-Ilfov	10,700	23,000	27,100	11.6%	5.6%	9.7%
Romania	5,000	10,400	11,400	11.0%	3.1%	8.6%
"Peer Regions"	9,850	14,017	14,333	5.2%	0.7%	3.8%
"Similar Regions"	5,910	10,430	10,920	8.5%	1.5%	6.3%
RCI_Medium	9,341	13,648	13,733	5.6%	0.2%	3.9%
RCI_Intermediate	17,494	22,451	21,295	3.6%	-1.7%	2.0%
RCI_High	24,422	31,420	30,572	3.7%	-0.9%	2.3%
EU 10	9,130	15,640	15,480	8.0%	-0.3%	5.4%
EU27	19,000	25,000	24,500	4.0%	-0.7%	2.6%

Table 1. GDP per capita: levels and growth (2000-2010), at purchasing power standard

Source: Calculations based on data from Eurostat: Gross domestic product (GDP) at current market prices by NUTS 3 regions – purchasing power standard per inhabitant [nama_r_e3gdp]; Note: North West, Centre, and Bucharest-Ilfov are chosen for purposes of national comparison with the West Region; Various aggregations of European regions were also constructed for purposes of comparison. A description of these aggregations is provided later in this section of the report.

This rapid growth also translated into rising living standards in the region, through growth in real wages. Over the decade the West experienced faster growth in wages than in all peer regions, including Bucharest. The average compensation per worker in the West Region grew by 13 percent annually between 2000 and 2009 versus 12.2 percent for

Romania as a whole and less than 11 percent for a set of similar regions in Europe; wage growth in the West was more than 5.5 times the EU-27 average1.

The rise in wages has been supported by commensurate improvements in productivity. Indeed, the significant GDP per capita convergence of the West (and of Romania as a whole) toward the EU average has been a function of rapid productivity catch-up, which in turn has been driven by strong investment. Over the decade, the West experienced the highest growth in output per worker among the comparator regions, coinciding with one of the highest levels of growth in gross fixed capital formation (Figure 1). Despite this, in 2009 fixed capital stock per worker in the West stood at only 57% of the EU average and output per worker was still only one quarter of the EU average. This suggests that substantial scope remains for further productivity improvements, and thus continued high economic growth.



Source: Calculations based on data from Eurostat: Gross fixed capital formation by NUTS 2 regions [nama_r_e2gfcf]; Employment (in 1000 persons) by NUTS 3 regions (nama_r_e3empl95); Gross value added at basic pricesby NUTS 3 regions (nama_r_e3vabp95)

These substantial productivity gains help explain why the region experienced growth that was not only jobless but actually coincided with significant declines in overall regional employment. But it does not help explain how falling employment levels could coincide with a very tight regional labor market.

Table 2 highlights the West's low unemployment rate (along with North West and Bucharest) relative to European peers, as well as its fall in employment levels. While the comparator group of similar regions also experienced strong employment decline over this period, it came with a high and growing unemployment rate, at more than twice the level of the West.

Finally, the experience of the region over the past decade has been far from uniform. Existing spatial inequalities in the region widened substantially, with Timis County capturing a large share of the growth and other counties lagging further behind2.

¹ Data Source: Eurostat

Indeed, Table 3 illustrates neatly the fundamental dual challenge that the West Region faces. On the one hand, in Caras-Severin, Hunedoara, and parts of Arad, the challenge is one of generating and capturing employment opportunities by exploiting regional assets more effectively and improving access to opportunities elsewhere in the region and the country. By contrast, in the Timis-Arad agglomeration, it is addressing shortages and mismatches in the labor market, which underscores the importance of upgrading competitiveness in order to deliver the value added commensurate to support continued wage pressure.

	Une	mployment	rate	Employ	ment growth	(CAGR)		
	2000	2007	2011	2000-07	2007-11	2000-11		
WEST	7.6	5.6	5.7	-0.8%	-0.7%	-0.7%		
North West	7.0	4.3	5.2	-1.7%	-1.6%	-0.8%		
Centre	7.4	8.5	11.1	-1.7%	-0.2%	-1.7%		
Bucharest-Ilfov	6.6	4.1	5.4	0.9%	1.3%	0.9%		
Romania	7.0	6.4	7.4	-1.4%	-0.2%	-1.0%		
"Peer Regions"	12.0	8.0	9.2	0.3%	-0.2%	0.3%		
"Similar Regions"	12.2	8.4	11.0	-0.9%	-0.3%	-0.9%		
RCI_Medium	13.2	8.9	12.1	0.7%	-0.5%	0.3%		
RCI_Intermediate	10.3	8.4	11.3	2.5%	-0.7%	1.4%		
RCI_High	5.7	5.5	7.1	1.8%	-0.3%	1.1%		
EU 10	12.4	6.7	11.1	0.5%	0.2%	0.3%		
EU27	9.2	7.2	9.6	0.7%	0.0%	0.0%		

Table 2. Unemployment rates (ages 15 and over) and growth rates of employment (ages 15-64), 2000-2011

Source: Eurostat: "Unemployment rates by sex, age and NUTS 3 regions (%) [lfst_r_lfu3rt]"; "Employment by sex, age and NUTS 2 regions (1 000) [lfst_r_lfe2emp]"

	GDP per inhabita to West Reg	nt (PPS) indexed ;ion average	Unemployment r and a	ate (age 15 years bove)
	2000 2010		2000	
Arad	106	92	6.8	8.1
Caras-Severi	80	75	10.6	6.9
Hunedoara	86	74	8.4	7.8
Timis	116	136	6	2.2

Table 3. Summary of Economic Performance across Counties in the West Region

Source: Calculations based on data from Eurostat: Gross domestic product (GDP) at current market prices by NUTS 3 regions [nama_r_e3gdp]; Population on 1 January by broad age groups and sex - NUTS 3 regions [demo_r_pjanaggr3]; Unemployment 15 years or over from "Unemployment rates by sex, age and NUTS 3 regions (%) [lfst_r_lfu3rt]"

Note: Unemployment rates at the county level are not available from Eurostat after 2008.

² Note that a detailed analysis of the issue of spatial inequalities in the region is available in another report that is part of this study (*see the report "Economic Geography Assessment: Territorial Development Challenges in the West Region"*).

Overview and Structure of this Report

This report – Territorial Assessment: Profile, Performance, and Drivers of Growth in the West Region – is part of a wider study being carried out by the World Bank under the Romania West Region Competitiveness Enhancement and Smart Specialization project. The main objective of the overall task is to develop an in-depth competitiveness and smart specialization assessment of services and goods producers in the West Region, and to identify policy measures, interventions and smart specialization niches that can help nurture their growth potential. Recommendations from the wider task are expected to provide the basis for the design of the instruments to be financed in the 2014-2020 programming period from EU Structural Funds, among other sources.

The Territorial Assessment presented in this report aims to set the stage to the more detailed competitiveness analytics carried out in other reports prepared for the project. It provides an introduction to the West Region, highlighting recent performance and focusing on the key challenges the region is likely to face in maintaining the levels of growth that will be required to achieve convergence with European levels of development in the medium term. It looks at the competitiveness of the region from various perspectives: its subregional units (counties), its sectors, its firms, and its workers. These are all important channels through which policy intervention may work to shape overall regional competitiveness.

This report is organized in two parts. Part 1 provides a profile of the West Region, describing its primary endowments (including physical and human capital assets), its economic structure, and its institutional context. This profile of the region is set against a national and European context, in order to highlight where performance and endowments in the region differ significantly from that of peer regions. Part 2 of the report evaluates the determinants of growth in European regions, assessing the contribution of factors like human capital endowments, infrastructure, and institutions. It then uses the results of this analysis to assess the West Region's future growth prospects, by benchmarking the region's performance in factors that appear to be critical determinants of growth for a region at the West's stage of development.

PART 1: TERRITORIAL PROFILE OF THE WEST REGION

1.1. Profile of the West Region

1.1.1. Introduction, Data Sources, and Methodology

This section of the report provides a brief introduction of the West Region, including a basic profile of the region's location and geography, its people, its institutions, and its position in the Romanian national context. The purpose of this section is not to provide a thorough assessment; indeed, ADR West has carried out several studies in recent years that include exhaustive profiles of the region (see for example, ADR West, 2010), which are recommended for a more detailed picture. Instead, the intention is to provide a common understanding of the situation in the region and to set the stage for further analysis carried out in Part 2 and in the other reports of this study.

The data presented in this section comes from two main sources: Eurostat and the Romanian National Institute of Statistics (INS). Among the sources used from INS, data on firms and sectors come primarily from the Business Registry or the Structured Business Survey (SBS).For many of the tables and figures presented in this section of the report, comparisons have been made to regions in Romania and elsewhere in Europe. Several aggregations of European regions have been created for this purpose. These include the following³:

- *"Peer regions"*: An aggregate of 11 European regions identified as peers by West Region Development Agency.
- *"Similar regions"*: An aggregate of 10 European regions with the most similar economic structure to Romania West, as defined in the regional competitiveness report "Beyond Ourselves" (ADR West, 2010).
- *"RCI_Medium", "RCI_Intermediate", "RCI_High"*: Aggregates of regions based on their classification in the European Regional Competitiveness Index (Annoni & Kozovska, 2010)
- *"EU-27"* and "EU-10": Aggregates of all regions in the EU and regions in the newest 10 member states, respectively (note that Romania is excluded from these aggregations).

Much of the analysis presents data separately for the periods 2000-2007 and the period since 2007. This was chosen to reflect the pre and post Accession periods, but also to take into account the fact that the latter period has been strongly impacted by the global economic crisis and the subsequent Euro area crisis.

Note that this report focuses primarily on the region as the unit of analysis, although in some cases intra-regional differences are highlighted. While significant disparities exist across counties in the region, assessment and discussion of these differences is the subject of another report in this study (see the report "Economic Geography Assessment: Territorial Development Challenges in the West Region").

³ Detail on the specific regions included in each aggregation is provided in Annex 1.

1.1.2. Endowments: People and Place

Introduction

The West Region is one of eight (NUTS-2 level) development regions of Romania, which were established in 1998 to coordinate regional development during the country's accession to the European Union. The region comprises four counties – Arad, Caras-Severin, Hunedoara, and Timis – and encompasses 12 municipalities, 30 cities and 281 communes, over an area of 32,034 km2. The West Region borders Hungary and Serbia, as well as the North West, Centre, and South West regions of Romania. With the Carpathian Mountains establishing a natural border on the south and the east, the region has long oriented to the west. Indeed, while the West Region is a recent creation, three of its four counties (excluding Hunedoara) along with small parts of Serbia and Hungary are part of the historical Banat region. The distinct cultural identity of Banat, characterized historically by its relative modernity and multiculturalism, has long shaped the development path of the region, and continues to do so today.



Source: Map Copyright ADR West

Physical Endowment

The Banat Plain, which makes up the western half of the West Region, includes rich agricultural land that has supported diverse agricultural activities, including cereals, horticulture, and animal production. However, the share of the region's land area that is utilized for agriculture is the lowest among all regions in Romania4. This is partly a function of the topography of the region, but may also reflect that since Accession, investors

⁴ Source: Eurostat; calculated as the ratio of "utilized agricultural area (UAA)" to "total area", 2009.

(mainly foreign) have purchased significant tracts of agricultural land, particularly in the western and southern parts of Timis County, much of which is not under cultivation.

The mountainous eastern and southern portions of the region once held substantial reserves of coal, particularly around the Jiu Valley at the southern end of Hunedoara County, which fuelled the development of the mining and metallurgy industries in Hunedoara and Caras-Severin. This was complemented by non-ferrous minerals, further north around Brad (Turnock, 2001). While mining remains important in the region today, even the remaining coalpits struggle to remain economically viable.

These natural endowments, however, established the region's industrial and commercial base, which contributed over time to the infrastructural endowments from which the region benefits today. For example, ironworks, which developed in Resita out of the coal sector as early as the late 18th century (Turnock, 2001), facilitated industrialization throughout Banat, establishing the engineering and metal industries. This is partly responsible for the establishment in the West Region of one the densest rail networks in the country. And combined with the competitiveness of the agricultural sector to the West, it helped faciliate the development of urban centers like Timisoara and Arad.

People

With 1.9 million inhabitants (2011), the West Region contains just under 9 percent of the national population, and is the least populated region of Romania – around 30 percent less populated than the average region in Romania. This is primarily a function of low density. Relative to peer regions both in Romania and across Europe, the West Region has by far the lowest population density. As Figure 3 shows, there is strong relationship between population density and economic density across European regions. While the West outperforms expectations in terms of economic density, its low population density may represent a barrier to growth.



Source: Calculations based on data from Eurostat: Population on 1 January by broad age groups and sex - NUTS 3 regions [demo_r_pjanaggr3]; Area - NUTS 3 regions [demo_r_d3area]; Gross domestic product (GDP) at current market prices by NUTS 3 regions [nama_r_e3gdp]

That said, a unique aspect of the region is that while it has relatively low density of population, it is also among the most urban regions in Romania. What this means is that there are large parts of the region with very few people, while the population is concentrated in a small set of towns and cities (Figure 4). This is evident from Figure 5, which shows population in the West region highly concentrated in the county seats, along with a few additional agglomerations, most notably around the city of Arad and at the border with the South West region, including the towns of Petrosani, Lupeni, and Vulcan^{5.}



Figure 4. Density and Urbanization Rates in Romanian Counties

Source: World Bank, 2012

⁵ Note that a more detailed discussion of differences in density within the region can be found in the report "Economic Geography Assessment: Territorial Development Challenges in the West Region".



Source: Institute of National Statistics: population by siruta as of July, 2011; Map copyright ADR West

As is the case in Romania as a whole, the population of the West Region has been in decline for more than a decade. Between 2002 and 2011, the region lost more than 44,000 people, or 2.3 percent of the population. This decline was faster than the Romanian average, and faster than its peer. Only three other regions – South West Oltenia, South Muntenia, and South East – experienced equal or greater population decline over this period



Source: Calculations based on data from Eurostat: Population on 1 January by broad age groups and sex - NUTS 3 regions [demo_r_pjanaggr3]

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But this picture of aggregate decline is not as straightforward as it appears. First, the declining population in the West region as a whole is really a story of significant decline in lagging counties of Caras-Severin and, especially, Hunedoara. In fact Timis is experiencing growth on par with Bucharest, and Arad's rate of decline is slightly below the national average. Second, it is primarily a story of migration. Rather it is one of structural change – specifically a lower birth rate. In this regard the population dynamics of the West Region are very much part of the wider trends in Romania as a whole. But even here, there are some specific regional differences. The right hand graph in Figure 7 shows the West region growing slightly above the national rate in terms of working age population, but well below it in terms of the population under the age of 15, and also over the age of 65. This has implications for the future labor market, unless the region manages to become a major destination for internal migration.

The West is also the only region outside of Bucharest with a significantly high ratio of female to male population of working (and also childbearing age) – the ratio is above the Romanian average in all counties but Caras-Severin, but especially driven by Timis, where there are 4 percent more women than men of working age.



Source: Calculations based on data from Eurostat: Population on 1 January by broad age groups and sex - NUTS 3 regions [demo_r_pjanaggr3]

The demographic situation in the West Region is also shaped by migration patterns, which have had an important impact across Romania during the past decade. In 2012, around 1.6 million Romanians (8 percent of the total population) were officially classed as migrants, either inside or outside the country; unofficially, it is estimated that up to 3 million Romanians are working abroad or migrating between employment in Romania and Western Europe (World Bank, 2012). In fact, migration outside of the country (almost exclusively to the West) is much more prevalent than internal migration – for every Romanian moving elsewhere in the country, three are moving abroad. In this context, given the West Region's location and its cultural links to Hungary and Germany, it is hardly surprising that students and young workers in the region might be inclined to seek opportunities in Europe. Indeed, Figure 8 illustrates that the West Region (and particularly Timis) is a significant contributor of migrants both within and outside of the country. But the West, and again Timis in particular, also has substantial in-migration, particularly because of its large university population. Overall, the West Region had a positive net

migration over the past decade – the only region outside Bucharest to achieve this – with large in-migration to Timis offset somewhat by high outmigration from lagging areas of the region like Hunedoara.



Figure 8. Migration by Romanian Counties



Figure 9. Crude Rate of Net Migration (2002-2010)

Source: Eurostat Demographic balance and crude rates by NUTS 3 regions [demo_r_gind3]

Skills

The West Region is considered to have a relatively highly skilled population, due in part to the prominence of its universities.

Figure 10a. confirms that the educational attainment of the region's economically active population is slightly higher than in peer regions. It also has a higher share of the population with a tertiary education than any other region outside of Bucharest, although

it still trails far behind the capital on this measure, and well behind European averages. Among the population of 20-24 years of age (Figure 10b), the West far outperforms most peers in university enrollment, although it is striking just how strong of a magnet Bucharest has become for the country's university population. In a European context, over the past decade the West has virtually eliminated its gap with the EU in terms of tertiary enrolment. This suggests that over the next generation, the average education level of the region's workforce will converge with Europe.

Figure 10. a.) Distribution of Economically Active Population (Aged 25-64) by Educational Attainment (2009); b.) Students in Tertiary Education as share of Regional Population Aged 20-24 (2000 v 2011)



Source: Calculations based on data from Eurostat: a) Economically active population by sex, age, highest level of education attained and NUTS 2 regions (1 000) [lfst_r_lfp2acedu]; b) Persons aged 25-64 and 20-24 with upper secondary or tertiary education attainment, by sex and NUTS 2 regions (from 2000 onwards) - % [edat_lfse_13]

But while the West Region has clear strength in tertiary education in the Romanian context, its advantage in upper secondary and post-secondary (non-tertiary) education is far from apparent. Enrollment rates in secondary education are only moderately ahead of the national average. Of more concern, is the relative performance of its students in upper secondary education. Table 4 shows that over the most recent two years, every county in the West Region performed in the bottom quartile of Romanian counties in the first presentation of the baccalaureate examination6. While leading counties in the North West like Cluj and Bihor ranked 3rd and 5th respectively (out of 42 counties), Timis and Arad ranked 34th and 36th.

⁶ There is a second presentation of the exam in the Autumn of each year

Rank	NUTS3	Region	2011	2012	Avg
1	RO221	BRAILA	57.0	60.0	58.5
2	RO215	SUCEAVA	65.0	47.0	56.0
3	RO113	CLUJ	54.1	54.3	54.2
4	RO126	SIBIU	53.8	51.7	52.7
5	RO111	BIHOR	50.4	53.4	51.9
6	RO222	BUZAU	53.2	50.2	51.7
7	RO223	CONSTANTA	57.6	45.2	51.4
8	RO116	SALAJ	57.2	42.5	49.9
9	RO213	IASI	41.9	56.1	49.0
10	RO316	PRAHOVA	51.0	45.5	48.2
11	RO122	BRASOV	45.9	49.8	47.8
12	RO212	BOTOSANI	56.0	38.9	47.5
13	RO114	MARAMURES	46.4	48.0	47.2
14	RO124	HARGHITA	64.0	30.3	47.1
15	RO415	VâLCEA	54.4	38.3	46.4
16	RO125	MURES	46.3	46.0	46.1
17	RO317	TELEORMAN	46.0		46.0
18	RO216	VASLUI	43.3	48.2	45.7
19	RO211	BACAU	45.6	45.4	45.5
20	RO214	NEAMT	44.5		44.5
21	RO115	SATU MARE	43.0		43.0
22	RO121	ALBA	38.4	47.0	42.7
23	RO112	BISTRITA-NASAUD	41.9	41.8	41.8
24	RO226	VRANCEA	38.7	43.5	41.1
25	RO321	BUCURESTI	42.0	39.0	40.5
26	RO411	DOLJ	39.7	40.9	40.3
27	RO315	IALOMITA	40.2		40.2
28	RO312	CALARASI	40.9	37.2	39.0
29	RO225	TULCEA	37.0	41.0	39.0
30	RO123	COVASNA	44.3	32.4	38.4
31	RO423	HUNEDOARA	39.0	36.9	38.0
32	RO224	GALATI	30.0	45.1	37.5
33	RO311	ARGES	36.4	38.0	37.2
34	RO424	TIMIS	31.8	42.2	37.0
35	RO313	DâMBOVITA	35.0	38.7	36.9
36	RO421	ARAD	34.4	39.1	36.8
37	RO314	GIURGIU	20.0	42.3	31.2
38	RO414	OLT		30.0	30.0
39	RO412	GORJ	34.9	25.0	30.0
40	RO413	MEHEDINTI	27.5	30.9	29.2
41	RO422	CARAS-SEVERIN	24.8		24.8
42	RO322	ILFOV	24.4	14.7	19.5

Table 4. Percentage of Students Passing the Baccalaureate Examination (2011 and 2012)

Source: http://www.gandul.info/news/rezultate-bacalaureat-2012-harta-rusinii-pe-judete-o-comparatie-intre-rezultatele-la-bac-de-anul-acesta-si-cele-de-anul-trecut-9830731

As noted previously, the West Region is recognized as having a strong set of universities and hosts a large student population, particularly in Timisoara. As Table 5 shows, the West is particularly well represented in terms of the number of tertiary institutions and faculties that it hosts. However, although it also has a fairly large population of students in the first stages of tertiary education, the West does not stand out as having any particular advantage over peer regions. What is very clear from Table 5 is that Bucharest is far and away the main center of tertiary education in the country.

But the West's performance falls off considerably is in the advanced stages of tertiary education, where the relative levels of its research student population is only half that of the North West and one quarter that of Bucharest. Taken together this suggests that the region is in broadly a good position in terms of producing (theoretically) trained workers for high skill professions, but may be less competitive in the higher end of research and innovation.

	Tertiary II	nstitutions Faculties		High skill students (level 5A)		Advanced research students (level 6)		
	Total	per m population	Total	per m population	Total	per m population	Total	per m population
West	14	7.3	79	41.3	92,419	48,290	2,179	1,139
North West	17	6.3	97	35.7	114,473	42,124	6,554	2,412
Centre	13	5.2	75	29.7	120,125	47,618	2,267	899
Bucharest	34	15.0	166	73.2	366,663	161,709	10,563	4,659
Romania total	108	5.0	624	291	969 990	45 297	28 963	1 353

Table 5. Tertiary Education Infrastructure as of 2010

Sources: Institutions and Faculties from Institute of National Statistics; Student figures from Eurostat; "High skill students" defined as "First stage of tertiary education, programmes that are theoretically based/research preparatory or giving access to professions with high skills requirements(level 5A)"; "Advanced research student" defined as "Second stage of tertiary education leading to an advanced research qualification (level 6)"

These trends in education follow through to the labor market, where the West has a comparative advantage in highly skilled workers (those with a tertiary education). Like much of Romania, however, the West faces a problem both with older workers retrenched due to restructuring of traditional industries like coal and metals (particularly impacting Hunedoara and Caras-Severin) as well as younger workers that leave school without qualifications. Participation rates among workers with the lowest education levels is less than half that of those at the highest(tertiary) levels in the West Region, while unemployment rates are almost four times higher (Figure 11). This is broadly in line with the experience of peer regions.



Figure 11: Economic Activity (Participation) and Unemployment by Level of Educational Attainment - West Region (2009)

Source: Calculations based on data from INS: Activity, employment and ILO unemployment rates, at territorial level, by educational level, by sex and area, in 2009; Note: Calculated for population aged 15 to 64

Across the wider labor market, the West has experienced relatively less decline in economic activity rates than some Romanian peers, but it trails far behind Bucharest and

European peers (see Table 6). In addition, while long term unemployment remains a problem among the unskilled and those in the traditional heavy industries, it declined from a rate of 3.6 percent in 2002 to 2.1 percent in 2009 – this remains, however, well above the levels of the North West (1.4 percent) and Bucharest (0.4 percent)7.

Finally, one notable feature of the labor market in the West Region bears mentioning. While unemployment rates are slightly higher in urban areas than in rural areas in the region (and substantially higher among the lowest skilled), long term unemployment is largely a rural phenomenon. In fact, the West is the only region outside Bucharest-Ilfov where long term unemployment rates are higher in rural than in urban areas.

	2000	2007	2011	Change: 2000 2011
WEST	61.0	53.9	52.5	-8.5
North West	63.0	52.4	53.6	-9.4
Centre	59.8	51.5	49.6	-10.3
Bucharest	54.5	54.6	57.4	2.9
Romania	64.4	54.8	54.3	-10.1
"Peer Regions"	55.4	53.4	54.4	-0.9
"Similar Regions"	60.1	54.5	53.8	-6.3
RCI_Medium	55.1	53.4	53.6	-1.4
RCI_Intermediate	54.8	56.4	56.6	1.9
RCI_High	59.5	61.4	61.3	1.8
EU 10	57.3	56.6	56.8	-0.5
EU 27	56.7	57.4	57.6	0.9

 Table 6. Economic Activity Rate (population aged 15 years and over)

Source: Eurostat: "Economic activity rates by sex, age and NUTS 2 regions (%) [Ifst_r_lfp2actrt]". 15 years and over

1.1.3. The Productive System

An important part of the fabric of any region is its productive system – i.e. the sector and nature of activities that take place in the region, and their interrelationship. While productive systems are not inherent endowments of any territory, in reality they tend to be enduring and play a significant role in shaping the development paths of regions. In this context, the West Region's current industrial structure can be traced back through its long history as an engineering center. As far back as the late 18th century, Caras-Severin was established as a center for ironworking. As noted by Turnock (2001), this industrial base contributed to urbanization, electrification, and the development of a dense railway network. Its proximity to the agricultural areas on the Banat plain also contributed to the development of the region as a center for food processing.

⁷ Source: Institute of National Statistics

Box 1. Productive Systems and the Evolution of Regional Economies

A region's past pattern of specialization plays an important role in shaping its future trajectory. But this is not to say that regions are simply path dependent. Shifts in sectoral specialization clearly happen, but this generally evolves over time and from existing areas of expertise (Arthur, 1994). For example:

- The British Midlands (especially Birmingham and Coventry) specialized in the manufacture of coaches and bicycles in the 19th century; from this expertise the region emerged as a leading center for the newly emerging automotive industry in the 20th century (Boschma & Wenting, 2007), and since then have evolved to more specialized engineering activities, including aerospace.
- New York's position as the world's leading financial center evolved over a period of almost 200 years, leveraging its initial locational advantage as a major port. The need to share risk of sea voyages established a market for financial services in the city from its early days. And while nearby Philadelphia was originally the main financial center in the US, the emergence of New York as the main center for business trade and investment to England kicked off a process of ever-increasing agglomeration, which facilitated lower transaction costs and improved information flows, both critical for financial services. (Glaeser, 2005)

Within this process of evolutionary change, there are possibilities to shift specialization relatively rapidly. The birth of new industries (for example, the internet, biotechnology, nanotechnology, etc.) offers a "window of locational opportunity" for regions to capture new economic activities (Storper & Walker, 1989). Locations that are well endowed with the knowledge and skills from related industries (like the case of the West Midlands above) are most likely to be successful in sustaining the development of these new industries. Research on how cities and regions have taken advantage of new opportunities and succeeded in "reinventing" themselves suggests that, in addition to leveraging endowments, two factors are critical:

- 1. **A highly educated population**: Both quantitative studies (c.f. Glaeser & Saiz, 2004) and case studies of successful city-regional reinventions like **Boston** (Glaeser, 2005) highlight the role of cities that manage to attract highly educated and highly skilled workers.
- 2. An adaptive institutional environment: Substantial research has highlighted the importance of regional social capital, networked structures of industrial organization, and "institutional thickness" in facilitating processes of economic adaptation (c.f. Amin & Thrift, 1994; Maskell & Malmberg, 1995). Regions such as Emilia-Romagna in Italy and Jutland in Denmark are often highlighted as successes in this regard.

In understanding the West Region's productive system today and the ways in which it may evolve in the coming years, four features stand out:

- 5. Increasingly strong specialization in medium technology, light manufacturing
- 6. Increasing integration with regional value chains, leading to low local value addition
- 7. Increasing dominance of foreign direct investment (FDI) with weak links across firms and to local suppliers
- 8. Emerging cross-sectoral links

Specialization in manufacturing

The economic engines of the West region today are low and medium technology manufacturing activities. Overall, manufacturing accounts for 40 percent of output in the region and 48 percent of employment compared to 28 percent and 36 percent, respectively, for Romania as a whole. Relative to 20 and even 10 years ago, the big shift in the region has been away from mining and heavy metals-related industries and toward light manufacturing. The automotive sector is most dominant, with the overall cluster (including related metal structures, electrical equipment, textiles, and machinery, among others) accounting for 15 percent of all employment in the region – as much as the wholesale and retail sectors combined. Textiles, agri-food, ICT (including hardware, software, and services), and furniture, along with mining, are the other large, 'basic' sectors (Box 2), whose performance determines the health of the regional economy.

Some of the sectors with the longest tradition in the region, like textiles and mining, remain important employment generators, despite no longer deliver substantial output (see Table 7). For example, employment intensity in the West region's textile sector is twice that of most other main sectors; it is even higher in mining.

Box 2. Using Economic Base Analysis to Identify Regional Growth Engines

Economic base analysis is designed to analyze the broad economic structure of the local economy. It does this by dividing the economy into two sectors: 1) the basic or export sector (which includes all output—goods and services—sold outside the borders of the city or region), and 2) non-basic sector (which includes all output that is sold within the local economy, for example, output from local grocery retailing, hairdressing, restaurants, and other local services). Economic base analysis originates from economic base theory, which stipulates that inflow of money generated from the export sector is the main source of growth in an economy. These "economic engines" determine the rate of employment and employment growth of the non-basic sectors serving local consumption.

Economic base analysis can be conducted to understand the relative importance of the basic sector in a local economy. Carrying out this analysis involves constructing a base multiplier, which is the ratio of the total employment (or output) in the local economy to the basic employment (or output) in the economy.

Source: Cities Alliance, 2008

Within the national context, West Romania is specialized in almost all of these basic sectors, despite the fact that most of them are also sectors on which Romania as a whole is strongly specialized. Across all but one of the region's top 10 sectors (NACE 2-digit), the region's location quotient8 is greater than 1.0 (the threshold that indicates specialization) – from 1.4 in rubber and plastics to 2.0 in electrical equipment, 3.3 in computer, electronic and optical equipment, and 3.4 in automotive. The apparel sector

⁸ The location quotient measures a location's relative specialization in a specific activity – it is calculate by taking the share of the location's economic activity (employment(or output) in a specific sector divided by the share of national economic activity (employment or output) in that sector; any result greater than 1.0 indicates relative specialization.

(NACE 14) is the only important basic sector in the region, in which the region is not specialized (location quotient of 0.8)⁹.

	Emplo	yment	Output			
Sector / Cluster	Total	% of West region	Total (RON m)	% of West region		
Automotive*	56,550	15%	11,259	18%		
Retail trade (NACE 47)	35 <i>,</i> 586	10%	5,624	9%		
Construction*	31,214	8%	5,625	9%		
Textiles*	24,991	7%	2,129	3%		
Agri-Food*	22,779	6%	4,088	6%		
Wholesale trade (NACE 46)	21,759	6%	9,642	15%		
Land transport (NACE 49)	17,544	5%	2,811	4%		
Mining (NACE 5-9)	10,976	3%	704	1%		
ICT*	10,228	3%	1,451	2%		
Furniture (NACE 31)	6,225	2%	898	1%		

Table 7. Top 10 Sectors and Clusters in the West Region (2010)

Source: Calculations based on data from Business Registry

* Indicates cluster as defined by ADR West; other sectors are defined by NACE codes given in parentheses Shaded sectors/clusters indicates those that are mainly 'basic' sectors (i.e. output is mainly exported from the region); non-shaded are primarily 'non-basic' sectors (i.e. output it mainly sold locally).

One issue for the region is the increasing dominance of the automotive sector. With just 1 percent of the plants and 0.1 percent of all firms in the West Region, the motor vehicles sector10 (NACE 29) accounts for 11 percent of all employment, 13 percent of all output, and 44 percent of all exports. Automotive is now more than three times the size of the next largest basic sector, and is one of few sectors experiencing strong growth relative to the national economy (Figure 12)11. This concentration on automotive is not inherently a problem. Regional economies tend to be much more specialized than national ones. And evidence of increasing links between automotive and other manufacturing and services sectors in the region (see later in this section) suggests a possible pathway to diversification. However, concentration does raise the risk of volatility, which may explain why the region has tended to experience sharper growth and decline than other parts of the country.

The possible flip side of the region's strength in manufacturing is its relatively underdeveloped services sector. This is important not only because the services sector is an important source of growth in its own right, but also because a deep and competitive services sector is critical to underpinning competitiveness in the manufacturing sector, both through efficiency of inputs and in facilitating innovation.

Output, exports, and especially employment in the services sector in the West Region is far below the national average (Figure 13). This relative underdevelopment exists across the services sector, but some subsectors show particularly low employment

⁹ However, in textiles (NACE 13) the West Region's location quotient is 1.5, indicating specialization, so the region remains specialized in the textiles cluster overall.

¹⁰ Note that we refer here to the motor vehicles sector (NACE 29) while the figures shown in Table 7 refer to the wider automotive cluster.

¹¹ Between 2008 and 2010, the automotive sector (NACE 29) expanded output in the West region by 84% versus a Romanian national average of 52%, and expanded employment by 35% versus only 2% nationally.

contributions in the West compared to the national average – these include: building construction, civil engineering, architectural and engineering activities, employment activities, and security. They also include important inputs critical to high value adding sectors like scientific research and market research. On the other hand, key inputs like transport and utilities do not appear to be underrepresented in the region, nor do other high end business services like consulting and legal and accounting services. Moreover, looking at the evolution of the services sector in West Romania, some positive developments appear. While almost all services sectors have been growing in employment across Romania as a whole in recent years, the West Region has experienced mixed performance, but most importantly those sectors experiencing strong growth include critical high skill and enabling service sectors like "head office activity and management consulting", "human health activity", "scientific R&D", and "office administration and business support".



Figure 12. Shift-Share Decomposition of Employment Growth (2008-10)

Source: Calculations based on data from Structured Business Survey; NACE 2 digit classification of sectors Note: Blue bubbles indicate manufacturing activity; Green bubbles indicate service sector activities; Red bubbles indicate utilities; and Yellow bubbles indicate primary sector activities; activities above the x axis are growing in Romania as a whole (activities below the y axis are declining in Romania); activities to the right of the y axis are growing in the West Region faster than in Romania as a whole (activities to left of the y axis are growing slower in the West Region than in Romania as a whole)





Source: Calculations based on data from Structured Business Survey Note: Excludes Wholesale and Retail Trade



Figure 14. Shift-Share Analysis of West Region Highlighting the Services Sector (2008-2010)

Source: Calculations based on data from Structured Business Survey; based on NACE 2-digit classifications Note: Green bubbles indicate service sector activities; activities above the x axis are growing in Romania as a whole (activities below the y axis are declining in Romania); activities to the right of the y axis are growing in the West Region faster than in Romania as a whole (activities to left of the y axis are growing slower in the West Region than in Romania as a whole)

Regional Value Chain Participation, with Declining Value Addition

The West Region's growth performance over the past decade is inextricably linked to wider regional and global forces in the manufacturing sector, specifically, the "second unbundling" of global production (Baldwin, 2012), where individual manufacturing tasks are separated and geographically dispersed over wide ranging global production networks. These trends have facilitated the emergence of a major automotive supply sector in West Romania, which has leveraged its location, relatively low wages, and engineering skills to attract first tier suppliers to European (particularly German) automotive manufacturers. In the textile, apparel, and footwear sectors, too, the West Region has become a supplier to regional production networks based in Italy, Germany, and elsewhere. This has not only contributed to significant investment and job creation, but has played an important role in integrating the West Region ever more tightly into the European economy. A natural result of this fragmentation of production and of task specialization is a decreasing share of value added in output. Globally, the value added share of trade declined by up to 10 percentage points between 1990 and 2009, a rate more than twice as rapid as in the previous 20 year period (Johnson & Noguera, 2012).

Figure 15 highlights both the low levels of value addition on the West region and the significant differences that exist across sectors. What is perhaps most striking is how rapidly value added share of output has declined. In automotive for example, value added share fell from almost 29.6 percent to 23 percent in only three years between 2008 and 2010; in textiles the fall was more dramatic – from 48.6 percent to 32.9 percent over this period. Of course, this reflects structural changes in the activities taking place in the region rather than declining value added within individual firms.



Figure 15. Value added share of output in the West Region's strategic clusters (2008 and 2010)

Source: Calculations based on data from SBS

As noted above, declining value added at a sectoral level is a global trend and is not inherently problematic, so long as net value added is growing in aggregate terms. This has been the case in the West Region, particularly in the automotive sector. Declining value added share of output may, however, raise some concerns. First, if the nature of activities being carried out in the region is being hollowed out to specialize in increasingly commoditized activities, like simple labor assembly or cut-make-trim in apparel, the basis for regional competitiveness will increasingly become cost driven. Under this scenario, delivering increasing wages (and therefore converging to European average living standards) would become unsustainable. On this, the situation in the West is mixed – certainly significant activities in automotive and textiles is based primarily on low wage assembly activity; however, in both sectors there are examples of many firms that are contributing high skills and technology (Box 3). A related concern is that, where the value added contribution of a unit or location to overall output is low, it is less likely the business will be fully embedded in the local economy, particularly if it is foreign-owned. The concern is that such firms may be more likely to close or move out of the region

Box 3. High Value Added Manufacturing in the West Region

Continental purchased the existing Siemens VDO business in 2007, operates both manufacturing and R&D in the West Region. While production activities include substantial use of imported inputs, they also require significant technology and rely on a highly skilled workforce in the production of a range of electronics, including instrument and cluster display systems, airbag control units, and electronic parking brakes. In addition, Continental employs a large number of highly skilled researchers in its R&D center in Timisoara.

Cottontex is a textile and apparel company established in Timisoara in 1995 through foreign investment from Italy. While they initially produced basic items like cotton t-shirts and bags, as well as embroidery and silkscreen printing, over the years they invested in technology and design capabilities. Today, they are among the leading European companies producing specialized apparel for the cycling market, where production involves the use of highly technical fabrics and complex (non-sewing) manufacturing techniques.

Dominance of FDI and Weak Territorial Linkages

This shift toward value chain participation is linked to another trend in the West Region's economic structure – the increasing importance of foreign-owned firms. Due to its location and traditional links to Western Europe, the region has always been attractive to foreign investors. As a result, when Romania began the process of accession to the European Union, the West benefited significantly from the rush of foreign investment into the country. Component suppliers linked to Germany's automotive sector, in particular, made heavy investments in the West during the early part of the 2000s. This was based primarily on a simple strategy of leveraging the wage advantages of Romania while remaining as close as possible to Germany and to other parts of the sector based in Central Europe. Over the decade, the growth of the automotive sector in the West became almost exclusively a story of foreign investment. Today, more than half of automotive firms in the region (115 in total) have some foreign ownership. But more importantly these firms dominate the landscape, accounting for 90 percent or more of value added, employment, and exports.

While the automotive sector is an extreme case, foreign firms predominate across many sectors in the region. They account for 50 percent of firms in the textile cluster and almost 40 percent of firms in the ICT cluster. Overall, firms with foreign ownership account for almost one quarter of all businesses in the West, around half of output and employment, and more than 90 percent of exports. It is worth noting, however, that despite these trends, the West Region remains only the fourth largest

recipient of foreign investment in the country, behind Bucharest, Centre, and South Muntenia¹².

Foreign ownership in the region's key sectors brings with it both opportunities and risks. The main risk is that foreign firms are likely to be 'footloose', that is they are more likely close plants and leave the region if conditions are no longer profitable or if other regions open up that offer better conditions (e.g. lower wages). This has long been a concern in labor intensive assembly industries worldwide, particularly apparel. To date there is no evidence to suggest that foreign-owned firms in the West region have been particularly footloose. In fact, Figure17 indicates that fully foreign-owned firms were significantly less likely to close through the crisis than were domestically-owned firms or firms of partial foreign and domestic ownership.

Moreover, in the automotive sector in particular, there are a number of examples of major foreign investors deepening their links to the region, rather than retrenching. Companies like TRW and Yazaki, and Continental have expanded from their initial investment and now operate multiple facilities in the region. Yazaki has made the West Region its supply base for all of Europe, and they, along with Continental and other investors, have complemented labor intensive assembly operations with investments in R&D center.



Figure 16.Scope of Firms with Foreign Ownership in the West Region (2010)

Source: Calculations based on data from Business Registry

Note: Foreign firms include firms with any share of foreign participation, so includes both fully foreign-owned firms and firms with both foreign and domestic capital (the Business Registry does not indicate ownership shares, only "100 percent foreign", "100 percent local", and "mixed".

¹² Source: BNR; regional share of FDI stock at December 31, 2010.





Source: Calculations based on data from Business Registry

Notes: "2006 and 2007 Cohorts" refers to the firms that started (as evidenced by being recorded in the Business Registry for the first time) in the respective years; "Survival" refers to the share of those firms that remain listed in the Business Registry as of 2010; "Partly Foreign" indicates that the firm has both foreign and Romanian capital.

A second risk is that foreign owned firms 'crowd out' the local industry. This may happen by outcompeting local firms in their traditional domestic market, by capturing scarce financing from local banks, or by attracting the most skilled labor available in the market. There is no evidence to suggest that the first two of these are relevant in the West Region: foreign investors are focused almost exclusively on already established export markets; and they are financed from sources outside of Romania. However, there is reason to believe that the high demand for skilled labor from foreign firms and the opportunities they can offer, may have negative implications for domestic firms. In particular, in the technical and managerial jobs, foreign firms are able to offer young Romanians the credentials of a foreign firm, the experience of learning in leading edge environment, and the potential to gain employment experience and opportunities abroad.

But foreign owned firms can also bring significant benefits to the region, over and above the employment they create. This comes from the "spillover" of knowledge and technology into the regional economy. As foreign firms are almost inevitably more productive and more technologically advanced than those in the domestic market, spillovers can play a critical role in improving the competitiveness of firms in the region. These spillovers occur through three main channels: through human capital (i.e. through workers), through supply relationships, and through competition and demonstration effects (via market competition and joint activities). While the region benefits from the spillovers through human capital – Romanians account for the vast majority of the workforce of foreign-owned firms, including in management and technical positions – supply chain linkages between the foreign and domestic sector are very weak. This is confirmed by both foreign investors and Romanian firms in the auto sector. A number of factors contribute to this, including scale economies, the difficulty for small local suppliers to meet international quality standards, and the fact that many purchasing decisions at the

foreign-owned firms are taken not in the West Region plant but at the corporate headquarters.

Cross-sectoral links

Finally, one of the more interesting developments in the West Region's economic structure is the possible emergence of stronger cross-sectoral links, where the presence of one sector benefits from the expertise of another. Here the automotive sector plays a critical role, not only because of its dominant position in the region, but because it is traditionally a bridge across a number of sectors, including engineering, metals, and electronics (Box 4). The West Region's automotive cluster touches a number of activities beyond the core (NACE 29) motor vehicle sector, including part of the region's textiles, metals, plastics, rubber, machine tools, and most importantly electronics sectors. Beyond the core motor vehicles sector, the automotive cluster contributes close to another 15,000 direct manufacturing jobs, making the 'non-core' part of the automotive cluster still larger than any other manufacturing sector in the region.

Perhaps most interesting is the relationship between the automotive and the ICT sector in the West Region. One of the largest investments made in the West Region was by Siemens, later taken over Continental Automotive. This investment in 2000 established an R&D center for automotive software and hardware, covering applications including software development and testing for a wide range of vehicle systems. This automotive investment can be seen as one of catalysts of the development of the ICT sector in West Romania. Not only did it put the region on the map for ICT, but it provided a base of skilled and trained programmers to future investors, as well as launching entrepreneurial startups. One foreign ICT firm in the sector noted that they chose to locate in Timisoara specifically to access the Continental labor force.

Box 4. The Automotive Sector in the 'Product Space'

According to Hausmann and Klinger (2007), the ease with which an economy can move to producing new exports depends on its existing set of knowledge and capabilities. The hypothesis is that countries or regions that build up competence in producing a certain good can redeploy their human, physical and institutional capital more easily if they seek to produce goods that are "nearby" those that they are producing already. Proximity between products is computed from the pair-wise likelihood that a country exports a product given that it also exports another product. The network of these probabilities across products can be mapped to create the "product space".

The center of the product space is where the densest networks of interrelationships exist. As the product space map below shows, at the center sits the automotive and related machinery sector (blue dots circled in red), which shows strong links not only with machinery and metals, but with electronics, rubber, plastics, chemicals, and a range of other key sectors



1.1.4. Institutional Context

Regional economies, increasingly integrated into national and global trade, capital, and labor markets, are constantly being reshaped by an array of economic, social, and political forces. Yet a region is not simply a stage on which these forces play out – how its individual and institutional actors anticipate and respond to change shapes its development path. Therefore, the institutional arrangements and the nature and extent of social networks within regions are critical determinants of a region's capability to adapt and evolve.
Within the West Region (as in all regions in Romania), the main source of political power rests with the elected county and local (city) councils, and with the individually elected council president (or mayor, in the city councils). County councils play an important role in local economic development, with responsibility for the administration of public funds and power over key issues like land development, roads, and other infrastructure. The degree to which county councils are competent, forward-looking, and responsive to the needs of their electorate can play an important role in determining the development path of a region. Indeed, across Romania effectiveness of local councils varies.

As noted at the beginning of this report, the West Region is institutionally defined as a development region in Romania, with its primary responsibility for coordinating regional policy, particularly within the structures of European funding. In this context the West Regional Development Agency acts as a planning and implementation coordination agency. As an RDA it operates as a non-profit institution, formed by the voluntary association of its counties. It is governed by a Regional Development Council, which includes representation from each of the county and city. There is, however, no real regional political structure and few decisions on regional policy can be taken at this level. Instead, regional policy in Romania is determined at the national level. There exists a single national regional development program, not eight regional programs. This remains a contentious issue in Romania and is linked to demands for greater regionalization. Among the many potential benefits of regionalization would be to enable regions to develop context-specific strategies. For the West Region, the lack of effective regionalization is particularly problematic, given the very different context of the region and the fact that it is relatively disconnected from the power networks in Bucharest. Thus, there is always at least a perception that region is not being given its proper consideration by decisions taken in Bucharest.

Another aspect of the institutional environment at the regional level is the nature of the networks and communities that participate in the regional development process. The degree to which communities are active and engaged is critical, but just as important as the depth of participation is its diversity. Active communities representing entrenched single interests can contribute to regional stagnation. Instead, the existence of networks that 'bridge' across constituencies has been found to be an important source of regional adaptability (Sabatini, 2006; Uslaner & Conley, 2003). Within the West Region, there has been significant increase in stakeholder consultation through the strategic planning processes involved in the Regional Operational Program and the Regional Innovation Strategy, as well as in the development of cluster initiatives and the delivery of European funding programs.

However, it is not clear that there exist significant representative stakeholder groups that are contributing in an active way to shape the development process in the region. One of the challenges is how the process can be made relevant to all stakeholders. For example, in the economic sphere alone, getting foreign investors and local SMEs to recognize mutual interests has been difficult, as can be seen in the rather lukewarm support for cluster initiatives.

References

ADR West. (2010). Beyond Ourselves: Regional Study. Timisoara.

- Amin, A., & Thrift, N. (Eds.). (1994). *Globalization, Institutions and Regional Development in Europe*. Oxford: Oxford University Press.
- Annoni, P., & Kozovska, K. (2010). *EU Regional Competitiveness Index: RCI 2010*. European Commission, Joint Research Centre. Luxembourg: European Union.
- Arthur, W. (1994). *Increasing Returns and Path Dependence in the Economy*. Ann Arbor: University of Michigan Press.
- Baldwin, R. (2012). Trade and industrialisation after globalisation's 2nd unbundling: How building and joining a supply chain are different and why it matters. *CEPR Discussion Papers 8768*.
- Boschma, R., & Wenting, R. (2007). The spatial evolution of the British automobile industry: Does locatoin matter? *Industrial and Corporate Change*, *16*(2), 213-238.
- Cities Alliance. (2008). Understanding your local economy: A resource guide for cities. Washington, D.C.: World Bank.
- Glaeser, E. (2005). Reinventing Boston: 1630--2003. Journal of Economic Geography, 5(2), 119-153.
- Glaeser, E. (2005). Urban Colossus: Why Is New York America's Largest City? FRB New York - Economic Policy Review, 11(2), 7-24.
- Glaeser, E. L., & Saiz, A. (2004). . "The Rise of the Skilled City." (2004):. Brookings-Wharton Papers on Urban Affairs 5, 47-94.
- Hausmann, R. a. (2007). The Structure of the Product Space and the Evolution of Comparative Advantage. *CID Working Paper No. 146*.
- Johnson, R., & Noguera, G. (2012). *Fragmentation and trade in value added over four decades.* Boulder: University of Colorado.
- Maskell, P., & Malmberg, A. (1995). *Localised learning and industrial competitiveness.* Berkeley Roundtable on the International Economy. University of California, Berkeley.
- Sabatini, F. (2006). Social capital, public spending and the quality of economic development: the case of Italy,. *FEEM Working Paper 14.06*.
- Storper, M., & Walker, R. (1989). *The Capitalist Imperative: Territory, Technology and Industrial Growth.* New York: Basil Blackwell.
- Turnock, D. (2001). Growth Potential in Romania's West Region. *Geographica Pannonica, 4*, 5-13.
- Uslaner, E. M., & Conley, R. (2003). Civic engagement and particularized trust The ties that bind people to their ethnic communities. *American Politics Research*, *31*(4), 331-360.
- World Bank. (2012). *Competitive Cities: Reshaping the Economic Geography of Romania*. Washington, D.C.: World Bank.

PART 2: GROWTH DRIVERS: AN EMPIRICAL ASSESSMENT¹³

¹³ This section of the report was prepared by Professor Andrés Rodriguez-Pose of the London School of Economics and Tobias Ketterer of the University of Nottingham

2.1. Determinants of Growth in European Regions

2.1.1. Introduction

The objective of Part 2 of this report is to benchmark West Romania's regional economic growth drivers against regional economic growth drivers in the European Union in order to obtain relevant policy conclusions regarding the right mix of economic growth promoting regional policies. The core of the study is based on an empirical investigation including two panel data models which evaluate regional economic growth drivers across the EU-27, and the NUTS-2 level regions of Romania and Bulgaria. West Romania's current situation will then be benchmarked against the drivers of regional development in these two spaces. In line with the existing literature on regional economic growth stimuli, our analysis aims to provide theory-based empirical results suitable for policy advice.¹⁴

2.1.2. Analytical Framework, Methodology, and Data

The first stage of the analysis looks at the drivers of economic growth both in: i) the regions of the EU-27, representing conditions in a relatively advanced economic space; and, ii) the NUTS-2 level regions of Romania and Bulgaria, representing conditions in the least developed regions of the EU.

In order to analyze the impact of different regional parameters on economic growth, we employ, in a first step, a standard neoclassical Solow-Swan growth model with physical and human capital (Solow, 1956; Swan, 1956, Mankiw et al., 1992) as our benchmark investigation framework.15 Details of the empirical estimation framework are provided in Annex 2.

In the context of this analytical framework and in line with the existing literature on regional economic growth determinants, we first estimate a standard economic growth model, before considering an extended growth framework in which we distinguish between different indicators for a region's physical infrastructure stock and investment, human-capital and innovation-related regional factors, as well as between several different measures of a region's institutions. The extended growth framework is estimated by successively inserting the independent variables in the empirical analysis. We use a standard pooled OLS estimation technique with fixed effects. In order to address endogeneity concerns, due to reverse causality or simultaneity, we introduce all independent variables with a one-year lag structure and provide further empirical results by additionally employing a heteroscedasticity-robust system 'Generalized Method of Moments' (GMM) estimator. Full details of the estimation technique are included in Annex 2.

¹⁴ For a relatively recent review of empirical studies on regional growth drivers, which also considers the impact of the EU's structural funds, see Mohl and Hagen (2010).

¹⁵ Mankiw, Romer and Weil (1992) augment the Solow (1956) growth framework into a theoretical and empirical model which includes human and physical capital. The Solow-Swan-type growth framework used in this analysis may later (if needed) also be extended to a spatial model of economic growth (cf. Ertur and Koch, 2006).

The analysis is based on regional NUTS-2 level16 data covering the whole of the EU and the period between 1996 and 2009. For countries without an adequate regional structure (i.e. Estonia, Latvia, Lithuania, and Luxembourg) country-wide statistics were used. Moreover, some individual regions and countries were excluded due inadequate data availability.17 In total, the dataset contains information on 256 regions in 24 countries. With the exception of the institutional parameters, all variables were extracted from Eurostat's Regio database.18 The institutional variables stem from a newly developed dataset by Charron et al. (2012). These authors construct a 'quality of government' (QoG) index at the EU national as well as sub-national (i.e. regional) level by combining the World Bank's country-level 'World Governance Indicators' (WGI) (Kaufmann et al., 2009) with an EU-wide regional survey based on approximately 34,000 EU citizens.19

The exact definitions of the variables introduced and data sources used in the empirical analysis are detailed in Annex 3.

2.1.3. Estimation of Results

'Classical' standard estimation framework

Results for the standard neoclassical Solow-growth type estimation framework for the European Union as a whole are presented in Table 8, as well as for Romanian and Bulgarian regions only. In this section we first discuss the results for the European sample (representing drivers of economic growth in a more developed environment), before evaluating the findings for Romania and Bulgaria (as an indicator of the conditions which determine growth in less developed regions, such as West Romania).

The estimation results for the EU are in line with the predictions of the neoclassical growth theory and point to a consistently negative and highly significant impact of initial GDP per capita levels. Introducing lagged GDP per capita as one of the regressors provides estimation results for the conditional beta convergence – i.e. evidence on convergence or divergence between poorer and better-off regions. Our findings may therefore, under certain conditions, point to a certain catching-up process of poorer regions on a European-

¹⁶ Nomenclature of Territorial Unit for Statistics (NUTS) as defined by the European Commission.

¹⁷ Denmark, Cyprus, and Malta had to be excluded from the analysis due to missing data. In addition, a number of individual regions where not included in the analysis for the same reasons. These regions comprise Ceuta and Melilla, Canary Islands, all French overseas departments (Guadeloupe, Martinique, Guyane, Réunion), Açores, and Madeira, as well as for North Eastern Scotland (UKM5) and the UK's Highlands and Islands (UKM6).

¹⁸ The motorway data were amended from Crescenzi and Rodriguez-Pose (2012).

¹⁹ The survey – one of the largest ever conducted at a regional (i.e. subnational) level is based on around 200 participants per region and consisted of 34 quality of government-, and demography-related questions, amongst others on education, health care, and law enforcement – services often provided by local or regional authorities. The survey includes 16 questions aimed at evaluating the citizens' experience and perception of the local institutional quality, focusing on three general public services that are administered or financed in a considerable number of countries at a regional (i.e. sub-national) level: education, health care, and law enforcement. For more detailed information on the survey as well as the construction of the indices see Charron et al. (2012).

wide sub-national level. Moreover, lagged regional population growth rates also follow the predictions of the neoclassical Solow growth framework by showing a statistically significant and negative impact on current economic per capita growth, suggesting declining living standards in regions with substantially increasing population numbers. Productive capital stock investments, measured as regional gross fixed capital formation, show, in two of the three specifications, a statistically significant positive effect on economic growth rates, underlining the importance in Europe of investments in productive capacity (i.e. physical capital). In the same context, the length of existing regional motorways and other roads per square kilometer, introduced as a special from of (infrastructure) investment, does not appear to have a consistent effect on economic per capita growth rates in the European Union as a whole.20

Regional human capital endowment, by contrast, is highly significant in all model specifications. This highlights an important positive influence of human capital and education on a region's future growth prospects. Finally, the regional institutional quality variable, measured by a regional index developed by Charron et al. (2012), shows a positive, however not significant impact, in the Driscoll-Kraay regressions and a statistically significant negative influence when estimated with OLS and GMM.

The estimation results when regions in Romania and Bulgaria alone are considered are also broadly in line with the theoretical predictions of the Solow growth framework. Initial (i.e. lagged) regional GDP per capita levels tend to suggest a certain convergence process by reporting a statistically significant and negative effect on current economic growth in most specifications. Investments in a region's productive capital stock are, however, not shown to exert any statistically significant impact on regional per capita growth in all model specifications. Regional population growth rates report positive coefficients, which are however not statistically significant at the usual thresholds. The regional education variable, measuring the tertiary education employment ratio, is statistically highly significant in most model specifications and highlights the important influence of education and human capital for economic growth in both countries. Likewise and in contrast to the EU-wide regression analysis, investments in regional road and motorway infrastructure also seem to be a crucial factor in promoting regional economic growth in both countries, as illustrated by the positive and statistically highly significant impact of the roads and motorway variable in all model specifications. Moreover, the institutional environment including aspects such as the efficient and non-bureaucratic provision of public goods and services, an independently functioning legal system, as well as low levels of local corruption, play a more crucial growth-promoting role in these two countries than in the EU as a whole, as shown by the positive and highly significant coefficients of the 'quality of government' index variable (the only exception being the pooled OLS regression analysis).

²⁰ While the pooled OLS report a slightly significant negative effect of the motorway and roads variable, the Driscoll-Kraay and GMM specifications report positive coefficients which are, however, not significant at the usual levels.

	Regions in the European Union			Regions in Romania and Bulgaria			
	Pooled OLS	Driscoll- Kraay	System- GMM	Pooled OLS	Driscoll- Kraay	System- GMM	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	
Initial GDP per capita	-0.011***	-0.113**	-0.028***	-0.063*	-0.346***	0.000	
Investment (gross fixed capital	(0.003)	(0.051)	(0.006)	(0.030)	(0.084)	(0.028)	
formation)	0.005** (0.002)	-0.007 (0.007)	0.015*** (0.006)	-0.004 (0.014)	0.000 (0.019)	-0.015 (0.018)	
Population growth	-0.182* (0.101)	-0.782** (0.311)	-0.524** (0.237)	1.710 (1.099)	1.372 (0.982)	0.732 (0.695)	
Motorways and other roads	-0.001*	0.002	0.003	0.085***	0.689***	0.073***	
Tertiary	(0.001)	(0.008)	(0.002)	(0.020)	(0.185)	(0.019)	
education employment	0.015*** (0.002)	0.026** (0.009)	0.029*** (0.005)	0.085*** (0.016)	0.142* (0.067)	0.047*** (0.014)	
Institutional quality Index							
(QoG)	-0.044*** (0.015)	0.003 (0.086)	-0.076*** (0.028)	0.012 (0.053)	0.830** (0.333)	0.083* (0.045)	
Constant	0.189*** (0.021)	-	-	0.379 (0.290)	-	-	
Observations R-squared	2944 0.483	2944 0.497	2944	154 0.469	154 0.605	154 -	
Number of NUTS-2 regions	246	246	246	14	14	14	
AR (3) test statistic: p- value	-	-	0.046	-	-	0.529	
AR (4) test statistic: p- value	-	-	0.799	-	-	0.016	
AR (5) test statistic: p- value	-	-	0.755	-	-	0.161	
Number of	-	-	176	-	-	117	

Table 8. Standard Solow-Swan-type growth framework. Panel data analysis for regions in the European Union and in Romania and Bulgaria (1996-2009)

Notes: *,**,*** illustrate the 10%, 5%, 1% significance levels, respectively. The standard errors are listed in parentheses. Investment is proxied by regional gross fixed capital formation as a percentage of GDP. All independent variables are included with a one year lag. Natural logarithms have been taken for most regressors apart from the population growth variable. The GMM calculations were done using the first-step version of xtabond2 by Roodman (2009). All regressions include constant time dummies.

'Classical' extended estimation framework

In order to provide a more precise picture of the factors driving regional economic growth in the EU-27 and in Romania and Bulgaria, we estimate an extended Solow-type growth model following model (6), with the different composite indices included in levels and in growth rates, as well as the decomposition of each of the infrastructure, institutional quality, and innovation and human capital indices into its main components. Table 9 to Table 14 report the results for the extended growth model. Table 9 to Table 11 show the estimations for the 246 EU regions included in the analysis, with the decomposition of the innovation and human capital (Table 9), infrastructure (Table 10), and institutional (Table 11) indices presented in turn. Table 12 to Table 14 follow the same logic applied to regions in Romania and Bulgaria. In order to avoid any endogeneity concerns we use the heteroscedasticity-robust system GMM estimation techniques in all regressions.21 The findings in this section are interpreted paying special attention to the components included in the composite indices.

The estimation results for the European Union are displayed in Table 9 to Table 11. Table 9 shows the results with the human capital and innovation-related index decomposed into its individual elements. All model specifications displayed in Table 9 tend to corroborate previous findings by showing results which are broadly in line with the predictions of the theoretical framework. The initial GDP per capita variable is statistically highly significant and shows a consistently negative impact on current economic growth in all specifications. The impact of regional population growth rates, as well as of regional gross fixed capital formation also tend to support the previous findings of the standard growth model by reporting highly significant negative and positive coefficients, respectively. The regional infrastructure composite index tends to be positively associated with economic growth in some specifications, but is, with one exception, never significant. Increasing regional infrastructure, by contrast, is most of the time negatively associated with growth and this association is significant in the (columns 4 and 5, Table 9). Institutions, represented by our 'quality of government' index, shows, as in the analysis presented in Table 1, a negative connection with growth which is statistically significant in two out of the five specifications presented in Table 9. However, while the level for institutions is negative, changes in institutional conditions are positively and significantly associated with regional economic dynamism in the EU. The findings for the EU as a whole that institutional levels are negatively associated with growth can be explained by the fact that the richest regions are also those with high institutional quality and (as per convergence) these are growing relatively slower. This may imply the existence of a threshold in the relationship between the quality of institutions and economic development. Additional regressions (not reported here but available upon request) based on theoretical equation (4) – i.e. with regional level of per capita income as dependent variable - support this conclusion by showing a highly significant positive impact of the level of the institutional quality index and its constituent components on the level of regional per capita income.

The human-capital and innovation index shows, as expected, a highly significant positive impact on economic per capita growth (column 1, Table 9), both in terms of levels

²¹ All independent variables were classified as endogenous in all regressions and the fourth and third lag were employed as (internal) instruments for the endogenous variables.

as well as annual changes. Decomposing the index into its constituent elements highlights that a good endowment in higher education and the presence of a high percentage of those employed engage in life-long learning are fundamental forces behind regional human capital related growth factors (columns 2 and 3,Table 9). R&D expenditure as a percentage of nominal GDP, together with the number of patents per million inhabitants are, in contrast, less likely to encourage growth of GDP per capita across European regions (columns 4 and 5,Table 9). This coincides with Rodríguez-Pose and Crescenzi (2008), who indicate that the returns of R&D inputs are highly dependent on the social economic conditions, in general, and the educational endowment, in particular, of any given European region.

Table 10 and Table 11present the findings when decomposing the constructed composite infrastructure and institutional indices respectively, for the EU-wide sample. The introduction of the components of the infrastructure and institutional indices in the analysis does not alter their sign and significance of the coefficients of the remaining variables. Regional growth in the EU in recent years remains dominated by overall levels of investment and changes in the endowments of human capital, with improvements in institutional quality significantly contributing to growth. Population growth is always negatively associated to regional growth and there has been a convergence between lagging and core regions. Regional infrastructure endowment and its rate of change tend, by contrast, to play a negligible role on economic growth.

Table 10 assesses the impact of different types of infrastructure on regional growth during the period of analysis. The results, once again, underline the robustness of previous findings. The infrastructure index displays a coefficient, which suggests no significant positive impact of infrastructure conditions on regional economic growth (Table 10, column 1). When the infrastructure index is decomposed into its constituents, the airpassenger population ratio, when expressed in levels, is positively and significantly associated with economic growth (Table 10, column 2). The remaining infrastructure variables are, however, not significant. Neither the growth of air passengers relative to the total population, nor the regional endowment of motorways and roads, nor the growth of this variable are connected in any way to regional economic growth (Table 10, columns 2) and 3).

Table 11 further analyses the influence of different institutional measures on regional GDP per capita growth in the EU. Although most institutional variables such as corruption, the rule of law, the effectiveness of regional governments, and the accountability and voice indicator show negative coefficients when expressed in levels (which also tend to be significant in some specifications), the growth rates of these institutional parameters report, in most specifications, a highly significant and positive impact on regional economic growth. This implies that, given a certain level of development, growth is more affected by improvements in institutional conditions then by the overall quality of institutions.

Table 9. : Standard Solow-Swan-type growth framework: The impact of human capital and innovation-related variables on regional per capita growth in the (1996-2009). Panel data analysis for regions in the European Union

Variables	(1)	(2)	(3)	(4)	(5)
Initial GDP per capita	-0.021*** (0.005)	-0.031*** (0.007)	-0.044*** (0.008)	-0.032*** (0.009)	-0.041*** (0.012)
Investment	0.026*** (0.007)	0.021*** (0.006)	0.023*** (0.007)	0.029*** (0.006)	0.005
Population growth	-0.427** (0.183)	-0.500** (0.229)	-0.585** (0.236)	-0.610*** (0.224)	0.151 (0.270)
Level of infrastructure index	-0.003 (0.002)	0.006** (0.002)	0.002 (0.002)	-0.001 (0.002)	0.001 (0.002)
Growth of infrastructure index	-0.001 (0.006)	-0.003 (0.010)	0.002 (0.011)	-0.019* (0.011)	-0.022** (0.009)
(QoG)	-0.060** (0.023)	-0.080*** (0.029)	-0.022 (0.031)	-0.001 (0.024)	-0.031 (0.028)
Growth of institutional quality (QoG)	0.596*** (0.104)	0.391*** (0.138)	0.207 (0.141)	0.611*** (0.150)	0.607*** (0.126)
Level of innovation &human capital index	0.017*** (0.004)				
&human capital index	0.076*** (0.017)				
Innovation & human capital components Tertiary education					
employment		0.026*** (0.005)			
Change in tertiary education employment		-0.040 (0.026)			
Life-long-learning ratio			0.036*** (0.008)		
Change in Life-long-learning ratio			0.011*** (0.003)		
R&D expenditure				-0.005 (0.010) 0.000	
Patents-population ratio				(0.004)	-0.004
Change in the patents-					(0.003)
population ratio					0.003 (0.002)
Observations R squared	2602	2942	2994	2654	2867
N-squared Number of NUTS-2 regions	- 246	- 246	- 248	- 248	- 241
AR (3) test statistic: p-value	0.150	-	-	-	-
AR (4) test statistic: p-value	0.217	0.812	0.865	0.934	0.572
AR (5) test statistic: p-value	0.077	0.404	0.522	0.244	0.544
Number of instruments	256	180	180	193	215

Notes: *,**,*** illustrate the 10 percent, 5 percent, 1 percent significance levels, respectively. The standard errors are listed in parentheses. Investment is proxied by regional gross fixed capital formation as a percentage of GDP. All independent variables are included with a one year lag. Natural logarithms have been taken for most regressors apart from the population growth variable. The GMM calculations were done using the first-step version of xtabond2 by Roodman (2009). All regressions include constant time dummies.

Table 10. The impact of infrastructure variables on regional per capita growth in the European Union (1996-2009). Panel data analysis

Variables	(1)	(2)	(3)
Initial GDP per capita	-0.021***	-0.026***	-0.022***
	(0.005)	(0.007)	(0.006)
Investment	0.026***	0.023***	0.028***
	(0.007)	(0.008)	(0.008)
Population growth	-0.427**	-0.773***	-0.462**
	(0.183)	(0.186)	(0.193)
Level of innovation &human capital			
index	0.017***	0.008	0.008*
	(0.004)	(0.006)	(0.005)
Growth of innovation &human			
capital index	0.076***	0.038**	0.070***
	(0.017)	(0.016)	(0.017)
Level of institutional quality (QoG)	-0.060**	-0.014	-0.022
	(0.023)	(0.038)	(0.026)
Growth of institutional quality	0 -00***	0.047	0 - 04 * * *
(QOG)	0.596***	0.017	0.591***
	(0.104)	(0.159)	(0.123)
Level of infrastructure index	-0.003		
	(0.002)		
Growth of infrastructure index	-0.001		
	(0.006)		
Infrastructure index components			
ratio		0.002*	
1410		(0.002	
Growth in air passengers-		(0.001)	
population ratio		0.003	
		(0.002)	
Level of motorways and Roads		()	-0.001
,			(0.002)
Growth in motorways and Roads			-0.003
· · · · · · · · · · · · · · · · · · ·			(0.007)
Observations	2602	1500	2602
R-squared	-	-	-
Number of NUTS-2 regions	246	182	246
AR (3) test statistic: p-value	0.15	0.163	0.137
AR (4) test statistic: p-value	0.217	0.017	0.202
AR (5) test statistic: p-value	0.077	0.548	0.079
Number of instruments	256	287	239

Notes: *,**,*** illustrate the 10 percent, 5 percent, 1 percent significance levels, respectively. The standard errors are listed in parentheses. Investment is proxied by regional gross fixed capital formation as a percentage of GDP. All independent variables are included with a one year lag. Natural logarithms have been taken for most regressors apart from the population growth variable. The GMM calculations were done using the first-step version of xtabond2 by Roodman (2009). All regressions include constant time dummies.

Variables	(1)	(2)	(3)	(4)	(5)
Initial GDP por capita	0 021***	0 022***	0 010***	- 0.010***	- 0 02/***
	-0.021	-0.022	-0.018	0.018 (0.00E)	0.024
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Investment	0.026***	0.021***	0.025***	0.026****	0.027***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)
Population growth	-0 427**	-0 463**	-0 448**	-በ 421**	- 0 515***
	(0.183)	(0.180)	(0.181)	(0.176)	(0.185)
	(0.185)	(0.180)	(0.101)	(0.170)	-
Level of infrastructure index	-0.003	-0.003	-0.002*	-0.002	0.004***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Growth of infrastructure index	-0.001	0.000	-0.007	-0.007	-0.006
	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
Level of innovation & human	(0.000)	(0.007)	(0.000)	(0.000)	(0.007)
capital index	0.017***	0.019***	0.011***	0.013***	0.012**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Growth of innovation &human	()	()	()	(,	()
capital index	0.076***	0.056***	0.064***	0.074***	0.064***
	(0.017)	(0.018)	(0.015)	(0.017)	(0.015)
Level of institutional quality (QoG)	-0.060**	. ,		. ,	
	(0.023)				
Growth of institutional quality	()				
(QoG)	0.596***				
	(0.104)				
Institutional index components					
Level of corruption index		-0.061***			
		(0.020)			
Growth of corruption index		0.724***			
		(0.075)			
Level of rule of law index		()	-0.054**		
			(0.021)		
Growth of rule of law index			0.190**		
			(0.090)		
Level of government			(0.000)		
effectiveness				-0.039*	
				(0.022)	
Growth of government					
effectiveness				0.042	
				(0.047)	
Level of government					
accountability					-0.018
					(0.023)
Growth of government					
accountability					0.098**
					(0.048)
Observations	2602	2602	2602	2601	2602
R-squared	-	-	-	-	-
Number of NUTS-2 regions	246	246	246	246	246
AR (3) test statistic: p-value	0.150	0.108	0.146	0.215	0.297
AR (4) test statistic: p-value	0.217	0.227	0.726	0.474	0.363
AR (5) test statistic: p-value	0.077	0.022	0.430	0.285	0.296
Number of instruments	256	256	256	259	256

 Table 11. The impact of institutional variables on regional per capita growth in the

 European Union (1996-2009). Panel data analysis

Notes: *,**,*** illustrate the 10 percent, 5 percent, 1 percent significance levels, respectively. The standard errors are listed in parentheses. Investment is proxied by regional gross fixed capital formation as a percentage of GDP. All independent variables are included with a one year lag. Natural logarithms have been taken for most regressors apart from the population growth variable. The GMM calculations were done using the first-step version of xtabond2 by Roodman (2009). All regressions include constant time dummies.

The results for the sample of Bulgarian and Romanian regions are presented in Table 12 to Table 14. Once again we decompose the composite indices into their individual components and present the respective findings in three separate tables. For all three summary tables, the general findings show that in the case of Romania and Bulgaria – the two poorest countries in the current EU - the determinants of growth tend to vary significantly from those found for the whole of the EU. The first key difference is that the degree of regional convergence uncovered for the whole of the EU disappears. In accordance with a number of analyses on regional convergence across the EU, while there is evidence of regional convergence in the EU, this is not reproduced at the national level (e.g. Rodríguez-Pose, 1999; Puga, 2002). Poorer regions within Bulgaria and Romania have not performed better than core areas, with economic activity being increasingly concentrated in the capital cities of Bucharest and Sofia.

Other important differences relate to the impact of investment, population growth, and infrastructure. Levels of regional investment are not positively associated to greater economic growth. From Table 12 to Table 14 all coefficients related to the overall level of investment are insignificant. Population growth, which was linked to lower levels of growth across the whole of the EU, is not detrimental for economic growth in the two countries which have experienced a significant population loss. In virtually all regressions the coefficients for the level and the growth of the infrastructure index are positive and strongly associated to regional economic growth. Regions in Bulgaria and Romania with a better endowment of infrastructure and which have seen their infrastructure endowment grow have performed better than those still lagging behind in infrastructure endowment.

Our innovation and human capital and institutional quality indices, in contrast, behave in the same way as for the whole of Europe. A better capacity and improvements in human resources and in innovation, together with improvements in institutional quality, present fundamental factors behind regional economic growth both in Romania and Bulgaria, as well as across the whole of the EU (Tables 14 to 16).

			System-GMN	1	
Variables	(1)	(2)	(3)	(4)	(5)
Initial GDP per capita	-0.055	-0.019	-0 039	-0 335***	0.012
	-0.055	(0.013)	-0.033	-0.333	(0.002)
Investment	-0.004	0.004	0.018	-0.014	-0.001
	(0.026)	(0.020)	(0.020)	(0.017)	(0.016)
Population growth	1.596	1.108	-0.09	1.644	0.378
	(1.003)	(0.810)	(0.700)	(1.075)	(0.824)
Level of infrastructure index	0.093***	0.068**	0.015	0.774***	0.027*
	(0.026)	(0.025)	(0.014)	(0.256)	(0.013)
Growth of infrastructure index	0.676***	0.628***	0.534***	-0.174	0.409
	(0.164)	(0.174)	(0.154)	(0.259)	(0.477)
Level of institutional quality (QoG)	0.043	0.083*	-0.022	0.804	0.019
	(0.053)	(0.039)	(0.065)	(0.626)	(0.039)
Growth of institutional quality (QoG)	1.652***	1.548***	1.042***	0.728	1.444***
	(0.303)	(0.239)	(0.211)	(0.653)	(0.256)
Level of innovation &human capital index	0.084***				
	(0.021)				
Growth of innovation &human capital index	-0.175**				
	(0.066)				
Innovation & human capital components					
Tertiary education employment		0.048***			
		(0.016)			
Change in tertiary education employment		-0.165***			
		(0.052)			
Life-long-learning ratio			-0.037		
			(0.027)		
Change in Life-long-learning ratio			0.065***		
			(0.016)		
R&D expenditure				-0.021	
				(0.023)	
Change in R&D expenditure				0.008	
				(0.014)	
Patents-population ratio					-0.013**
					(0.004)
Change in the patents-population ratio					0.007
					(0.004)
Observations	154	154	170	170	164
Number of NUTS-2 regions	14	14	14	14	14
AR (3) test statistic: p-value	0.529	0.538	0.844	0.852	0.828
AR (4) test statistic: p-value	0.011	0.011	0.020	0.035	0.197
AR (5) test statistic: p-value	0.654	0.553	0.274	0.279	0.564
Number of instruments	126	113	129	129	124

 Table 12. The impact of human capital and innovation-related variables on regional per capita

 growth in Romania and Bulgaria (1996-2009). Panel data analysis

	System-GMM		
Variables	(1)	(2)	(3)
Initial GDP per capita	-0.055	-0.131	-0.054
	(0.042)	(0.128)	(0.043)
Investment	-0.004	0.029	-0.003
	(0.026)	(0.030)	(0.027)
Population growth	1.596	-2.323	1.564
	(1.003)	(2.786)	(0.975)
Level of innovation &human capital index	0.084***	0.100	0.084***
	(0.021)	(0.111)	(0.021)
Growth of innovation &human capital index	-0.175**	-0.081	-0.175**
	(0.066)	(0.117)	(0.067)
Level of institutional quality (QoG)	0.043	0.032	0.052
	(0.053)	(0.063)	(0.052)
Growth of institutional quality (QoG)	1.652***	4.928	1.662***
	(0.303)	(9.797)	(0.291)
Level of infrastructure index	0.093***		
	(0.026)		
Growth of infrastructure index	0.676***		
	(0.164)		
Infrastructure index components			
Level of air passengers population ratio		0.010*	
		(0.004)	
Growth of air passengers population ratio		-0.034	
		(0.037)	
Level of motorways and Roads			0.094***
			(0.026)
Growth of motorways and Roads			0.676***
			(0.164)
Observations	154	25	154
Number of NUTS-2 regions	14	7	14
AR (3) test statistic: p-value	0.529	0.133	0.531
AR (4) test statistic: p-value	0.011		0.012
AR (5) test statistic: p-value	0.654		0.656
Number of instruments	126	25	123

 Table 13. The impact of infrastructure variables on regional per capita growth in Romania and Bulgaria (1996-2009). Panel data analysis

Notes: *,**,*** illustrate the 10%, 5%, 1% significance levels, respectively. The standard errors are listed in parentheses. Investment is proxied by regional gross fixed capital formation as a percentage of GDP. All independent variables are included with a one year lag. Natural logarithms have been taken for most regressors apart from the population growth variable. The GMM calculations were done using the first-step version of xtabond2 by Roodman (2009). All regressions include constant time dummies.

	System-GMM				
Variables	(1)	(2)	(3)	(4)	(5)
Initial GDP per capita	-0.055	-0.058	-0.064	-0.017	-0.086*
	(0.042)	(0.043)	(0.042)	(0.011)	(0.040)
Investment	-0.004	-0.01	-0.011	-0.031	-0.024
	(0.026)	(0.026)	(0.026)	(0.025)	(0.024)
Population growth	1.596	1.697*	1.858	0.957	1.627
	(1.003)	(0.943)	(1.273)	(0.823)	(1.155)
Level of infrastructure index	0.093***	0.089**	0.101***	0.094***	0.141***
	(0.026)	(0.033)	(0.028)	(0.024)	(0.019)
Growth of infrastructure index	0.676***	0.572***	0.755***	0.624***	0.524***
	(0.164)	(0.170)	(0.151)	(0.152)	(0.155)
Level of innovation &human capital index	0.084***	0.082***	0.089***	0.080***	0.121***
	(0.021)	(0.021)	(0.022)	(0.017)	(0.019)
Growth of innovation &human capital index	-0.175**	-0.171**	-0.143*	-0.146*	-0.177**
	(0.066)	(0.066)	(0.073)	(0.071)	(0.074)
Level of institutional quality (QoG)	0.043				
	(0.053)				
Growth of institutional quality (QoG)	1.652***				
	(0.303)				
Institutional index components					
Level of corruption index		-0.033			
		(0.102)			
Growth of corruption index		0.731***			
		(0.208)			
Level of rule of law index			0.007		
			(0.038)		
Growth of rule of law index			1.505***		
			(0.345)		
Level of government effectiveness				0.085	
				(0.056)	
Growth of government effectiveness				0.351**	
				(0.149)	0 4 5 0 * * *
Level of government accountability					0.158***
					(0.053)
Growth of government accountability					-0.322
	454	454	454	454	(0.5/1)
Ubservations	154	154	154	154	154
Number of NUIS-2 regions	14	14	14	14	14
AR (3) LEST STATISTIC: p-Value	0.529	0.5//	0.538	0.015	0.021
AR (4) LEST STATISTIC: p-Value	0.011	0.010	0.280	0.015	0.021
AK (5) LEST STATISTIC: p-Value	0.054	0.389	0.043	0.546	0.533
Number of instruments	120	126	126	126	126

Table 14. The impact of institutional variables on regional per capita growth in Romania and Bulgaria (1996-2009). Panel data analysis

Notes: *,**,*** illustrate the 10%, 5%, 1% significance levels, respectively. The standard errors are listed in parentheses. Investment is proxied by regional gross fixed capital formation as a percentage of GDP. All independent variables are included with a one year lag. Natural logarithms have been taken for most regressors apart from the population growth variable. The GMM calculations were done using the first-step version of xtabond2 by Roodman (2009). All regressions include constant time dummies.

When looking at each of our individual indices for Romania and Bulgaria in detail, the coefficients point to a number of interesting findings relative to those reported for the EU as a whole. Table 12 illustrates the findings when decomposing the human capital and innovation index into its individual elements. As in the case of the whole of the EU, the human capital and innovation variables are highly significant and positive when introduced as a composite index and in levels. However, the connection with growth is negative when expressed in growth rates. This result tends to be corroborated when looking at the tertiary education employment variable (column 2, Table 12). Life-long learning ratios are only positive and statistically significant in terms of growth rates, whereas the innovation components of the index (i.e. R&D expenditure and the patent-population ratio) are, as in the case of the results for the regressions for the whole of Europe, not significant with the exception of a significant negative coefficient for the patent variable when expressed in levels (column 5, Table 12). Hence, overall endowment of human capital can be considered as a precondition for economic growth in the two least developed countries of the EU, although improvements in human capital and research capacity to not seem to have a short-term immediate impact.

Infrastructure investment, by contrast, displays a much stronger association with economic growth at these levels of development. As can be seen in the analysis of the different components of the infrastructure index (Table 13, column 1), there is a strong positive and statistically highly significant impact of the infrastructure index variable, both in terms of levels and growth rates. This is confirmed when introducing the air passenger and motorway and roads variables separately. The stock and investment growth rates of motorways and roads, thereby plays a major role on economic growth as illustrated by the highly significant positive coefficients. The air passenger variable, on the other hand, is only significant when expressed in levels (column 2,Table 13).

Finally, Table 14 introduces the findings when decomposing the 'quality of government' index into its individual aspects. The results underscore the importance of improvements in institutional quality as a fundamental source for economic development. Whereas the overall level of the institutional quality index, as well as that of three of its four constituents – corruption, rule of law, and government effectiveness – is not significant in any of the regressions conducted, improvements in overall institutional quality, or in the local rule of law and government effectiveness, as well as reductions in corruption are extremely conducive to economic growth (Table 14, columns 1, 2, 3, and 4). The only exception is government accountability, which is highly significant and positively correlated with economic per capita growth when expressed in levels, but not in growth levels (Table 14, column 5).

2.1.4. Summary

The results of the analysis (summary results provided in Table 15) hint at the need of implementing different development strategies at different stages of development. At lower levels of development, such as those found in Romania and Bulgaria, the factors which seem to drive economic growth differ considerably from those at higher levels of development, as represented by the regressions including the EU as a whole. Taking into account our main variables of interest, at an initial stage regional economic growth is driven by a good endowment of human capital and innovation, as well as by good infrastructure conditions. Improvements in infrastructure and institutional conditions in these environments are crucial for economic growth. In particular, improvements in road infrastructure, in the local rule of law, and reductions in corruption have been among the most important drivers of economic dynamism in Romania and Bulgaria.

As the level of development is increased and we include the whole of the EU in the analysis, the beneficial effects of infrastructure endowment and new investments wane, and economic growth is the result of greater levels of overall investment, better endowments in human capital and innovation capacity, and of improvements in human capital and in institutional conditions.

Consequently, the story which emerges from the analysis is one in which development strategies need to be specifically tailored to the conditions of every territory - that is, the implementation of place-based policies - which will, to a great extent, depend on the stage of development in which any given European region finds itself. Therefore, while investments in infrastructure may play an important role in the early stages of implementation of a development strategy in lagging regions of Europe, in general, and in Romania and Bulgaria, in particular, the returns of such investments are likely to disappear and become inconsequential in later stages of the development process. Human resources and institutions, by contrast, are essential factors for growth and need to be considered at every stage of the development process. In particular, a good endowment of education and skills in the employed population and the constant resort to lifelong learning are essential drivers of economic growth at every stage of development considered. Similarly, lowering corruption and improving the rule of law should feature in every development strategy, in combination with measures aimed at improving government effectiveness in the early stages of development and government accountability once a certain development threshold is reached.

	FU	Romania and Bulgaria
Infrastructure (levels)	nc	
Infractructure (levels)	ns	T _***
Roads (lovel)	ns	T _***
Roads (rever)	ns	T T T
Air Transport (lovel)	.*	
Air Transport (rever)	+	T
Air Transport (change)	ns . * * *	ns . ***
innovation and numan capital (levels)	+***	+***
Innovation and human capital (change)	+***	-**
Higher ed (level)	+***	+***
Higher ed (change)	ns	_***
LLL (level)	+***	ns
LLL (change)	+***	+***
R&D (level)	ns	ns
R&D (change)	ns	ns
Patents (level)	ns	_**
Patents (change)	ns	ns
Institutional quality (levels)	_***	ns
Institutional quality (change)	+***	+***
Corruption (level)	_***	ns
Corruption (change)	+***	+***
Rule of Law (level)	_**	ns
Rule of Law (change)	+**	+***
Governement Effectiveness (level)	_*	ns
Governement Effectiveness (change)	ns	+**
Governement Accountability (level)	ns	+***
Governement Accountability (change)	+**	ns

Table 15. Effect of the main policy parameters on regional GDP per capita growth: Summary table for the panel data analysis (1996-2009)

Notes: *, **, *** illustrate the 10%, 5%, 1% significance levels, respectively. The accronym "ns" indicates non-significant coefficients. The summary table is based on the findings displayed in Table 11-16, which are based on regression analysis using a system-GMM estimation technique.

2.2. Benchmarking the West Region's Performance in Key Growth Determinants

What does the analysis in the previous section tell us about the future growth potential for West Romania?

West Romania is one of the eight NUTS-2 regions in Romania (Table 16). Although by virtue of being located in the west of the country and closer to the markets and more prosperous regions of Western Europe than the rest of Romania, it could be expected that it would be in a better position to achieve sustainable economic development, the region suffers from a number of shortcomings which would need to be addressed in an integrated and place-based development strategy, in order to achieve the greatest returns of any public intervention. In this section we look at these issues in light of the econometric analysis presented in the previous sections. We benchmark West Romania relative to the EU as a whole, to Romania and Bulgaria, and to three comparator Romanian regions (Bucharest, the Centre, and the North West) on each of the indicators that were used in the econometric analysis. The analysis covers the period 1995 through 2009. Detailed descriptions of the individual indicators assessed in this section, along with their data sources are provided in Annex 3 of this report.

Number	Regions at NUTS-2 level	Regions at NUTS-3 level
1	North East	Bacău, Botoșani, Iași, Neamț, Suceava, Vaslui
2	South East	Brăila, Buzău, Constanța, Galați, Tulcea, Vrancea
3	South Muntenia	Argeş, Călăraşi, Dâmboviţa, Giurgiu, Ialomiţa, Prahova, Teleorman
4	South West Oltenia	Dolj, Gorj, Mehedinți, Olt, Vâlcea
5	West	Arad, Caraş-Severin, Hunedoara, Timiş
6	North West	Bihor, Bistriţa-Năsăud, Cluj, Maramureş, Sălaj, Satu-Mare
7	Centre	Alba, Sibiu, Braşov, Covasna, Harghita, Mureş
8	Bucharest-Ilfov	Bucharest, Ilfov county

Table 16. Romania's subnational territorial structure: NUTS-2 and NUTS-3 regions

2.2.1. Infrastructure

We first look at the situation of transport infrastructure that, as we saw in the previous sections, is an essential factor behind economic growth at the lower levels of development. In this respect, West Romania features relatively well in its national context, with an endowment of motorways and roads which is above that of Romania and Bulgaria and very similar to the other Romanian regions considered. However, the gap with the rest of the EU is plainly evident from Figure 18. In 2009 as an average there were more than 1.2

km of motorways and roads per square km more in the whole of the EU than in West Romania. And the gap since 1995 has remained rather stable and even widened since 2004 (Figure 19)



Figure 18. Km of motorways and Roads per square km with West Romania as the benchmark: (2009)

Source: Authors' own calculations based on Eurostat data. The x-coordinate represent the situation in Romania's West-region (with a value of 0.324) which is contrasted against the EU, a sample of Romanian and Bulgarian regions, Romania's North-West, Center and Bucharest region.



Figure 19: Km of motorways and roads per square km: 1995-2009

West Romania is also an average region in the Romanian and Bulgarian context in terms of air transport, proxied by the annual number of passengers passing through its

Source: Authors' own calculations based on Eurostat data

airports. But both the region and the two countries have levels of air transport which are well below the European regional average – the only exception being Bucharest (Figure 20). There has been some catch up in this realm since 2004, but the gap is still substantial. Furthermore, the early lead of the West region in its regional context from 2004 onwards has been now matched by airports in the rest of Romania and Bulgaria (Figure 21).



Figure 20. Number of air passengers ('000) with West Romania as the benchmark: 2009

Source: Authors' own calculations based on Eurostat data. The x-coordinate represent the situation in Romania's West-region (with a value of 981) which is contrasted against the EU, a sample of Romanian and Bulgarian regions, Romania's North-West, Center and Bucharest region.



Figure 21. Annual number of air passengers ('000): 1995-2009

Source: Authors' own calculations based on Eurostat data

2.2.2. Human Capital and Innovation

In terms of human capital and innovation, another crucial factor for economic growth in the short-, medium-, and long-term, West Romania fares similarly as it does for transport infrastructure – better than most of Romania, but well behind Bucharest, Bulgaria, and the EU average. The strength of the region's universities is apparent in the relatively high level of education of the working population in the Romanian context (with particularly strong growth since 2005), from the perspective of future growth, there appears still to be a deficit in the skills composition of the workforce. The percentage of degree holders in employment22 is slightly below the Romanian and Bulgarian average23, 8 points below the European average, and 14 points below the level in Bucharest. Thus, while the West appears to have a well educated population in the current Romanian context, the qualifications of the labor force may represent a handicap for future development (Figure 22). As can be seen in Figure 23, however, there has been significant catch-up in the percentage of university graduates in employment in the region in recent years.



Figure 22. Tertiary-education employment ratio (25+ age group) with West Romania as the benchmark: 2009

²² The percentage of higher education degree holders in employment is defined as the percentage of employed people (aged 25-64) with completed higher (i.e. tertiary) education.

²³ Note, however, that this is driven by a relatively high share of degree holders in Bulgaria (which is close to the EU average); in the Romanian context, the West Region remains one of the leading regions in the country on this measure.



Figure 23. Tertiary-education employment ratio (25+ age group_: 1995-2009

The picture is worse, however, in terms of life-long learning. In a world where the constant acquisition of skills of the labor force is key for innovation, increasing productivity, and economic growth, the percentage of employees engaged in life-long learning activities is shockingly low. Whereas in the whole of the European Union and average of 9.5% of the workforce is involved in training and skilling activities, this percentage drops to less than 1.5% in West Romania. And, in life-long learning, the gap with the EU has grown considerably since the mid-2000s (Figure 25).



Figure 24. Life-long learning ratio with West Romania as the benchmark: 2009

Source: Authors' own calculations based on Eurostat data. The x-coordinate represent the situation in Romania's West-region (with a value of 1.7) which is contrasted against the EU, a sample of Romanian and Bulgarian regions, Romania's North-West, Center and Bucharest region.



Figure 25. Life-long learning ratios: 1995-2009

Given the above mentioned shortcomings in the level of formal education and lifelong training of the labor force, it could be expected that West Romania would struggle in terms of innovation capacity. This is confirmed by both indicators of innovation used in our analysis. Expenditure in R&D as a percentage of GDP is lower in the West region than elsewhere in Romania and Bulgaria and almost 1.5 percentage points lower than in the rest of the EU (Figure 26). At levels of around 0.2% of GDP, it could be safely said that its impact in terms of growth of GDP per capita is likely to be negligible. Some catch up in R&D expenditure relative to the rest of the EU. Especially since 2005 the gap in R&D expenditure relative to the EU average has expanded considerably (Figure 27).



Figure 26. R&D expenditure in per cent of GDP with West Romania as the benchmark: 2009

Figure 27. R&D expenditure in per cent of nominal gross domestic product (GDP): 1995-2009



Source: Authors' own calculations based on Eurostat data

The combination of low levels of expenditure, with limited skills in the labor force, and firms that are, in most cases, far away from the technological frontier presents a panorama which is innovation averse. This is confirmed by our indicator of innovative output: patents per million inhabitants. Here West Romania again ranks below the EU and Romania and Bulgaria as a whole (Figure 28). It also scores below all the other control regions in Romania. Although patents per million inhabitants is a highly imperfect proxy for innovative capacity, the patent count has remained very close to 0 during the whole period of analysis and showing virtually no signs of improvement (Figure 29), representing a clear indication of the very low innovative capacity of West Romania both in absolute and in relative terms.



Figure 28. Patents per million inhabitants with West Romania as the benchmark: 2009

Source: Authors' own calculations based on Eurostat data. The x- coordinate represent the situation in Romania's West-region (with a value of 0.26) which is contrasted against the EU, a sample of Romanian and Bulgarian regions, Romania's North-West, Center and Bucharest region.





Source: Authors' own calculations based on Eurostat data

2.2.3. Institutions

Finally, West Romania does not compare well in terms of citizens' perceptions of the quality of institutions, as measured in the first ever European-wide study perception of governance and institutions at the regional level. Across all measures, while the West rates above Bucharest, it is well behind the EU average and behind the peer regions of North West and Centre.

Box 5: Measuring Institutional Quality - methodology and caveats

The quality of institution indicators presented in this section stem from a new dataset developed by a collaboration between the European Commission (DG-Regio) and the University of Gothenburg (Charron et al., 2012) measuring the 'quality of government' (QoG) the EU national as well as sub-national (i.e. regional) level. The survey – one of the largest ever conducted at a subnational level is based on around 200 participants per region and includes 16 questions aimed at evaluating the citizens' experience and perception of the local institutional quality. The questions focus on three general public services that are administered or financed in a considerable number of countries at a regional level: education, health care, and law enforcement. Rating these services with respect to their quality, impartiality and the presence of corruption, the respondents assigned different scores to each of the 16 questions. The responses were then aggregated from the individual to the regional level and also to the national level. The authors then subdivided the 16 regional scores into four subgroups identifying the residents' perception of (i) the prevalent level of corruption, (ii) the rule of law, (iii) regional bureaucratic (i.e. government) effectiveness, and (iv) the strength of democracy and electoral institutions (i.e. voice and accountability). A list of the 16 questions included in the survey and their division into the four different categories can be found in annex table A4. For more detailed information on the survey as well as the construction of the indices see Charron et al. (2012).

While the survey and the construction of the indicators has been carried out to the highest standards and has been recognized as being robust both by European the academic and policy community, it is important to note two issues that impact the confidence by which we can draw conclusions on the West region.

- i. National v regional institutions: The institutions that are being assessed in the survey are designed to be those that tend to be financed or at least administered at the local level – education, health care, and law enforcement. In a country that is highly centralized, it can be more difficult to disentangle what is national and regional, and therefore survey respondents may, at least in part, be judging the national institutional environment rather than the local one.
- ii. Perceptions: The survey is based on citizens' perceptions of governance quality. Like any survey of perception, it is never possible to say for certain whether differences in perception reflect differences in actual performance. It may well be the case that other factors or characteristics of the region bias survey participants in favor of more positive or negative perceptions on the institutional environment. For example, with higher educational levels or with other petty constraints removed, concerns about governance may be heightened. Thus direct comparisons across regions must be taken with some caution.

The perceived gap in institutional quality is reproduced across all of the institutional indices used in the analysis. As a result, in the overall quality of governance index, West Romania is ranked below not only the EU as a whole, but of the average of Romania and Bulgaria (Figure 31). The scores are also lower than in other regions in

Romania, with the notable exception of Bucharest. More importantly, across all aspects of governance measured in the survey, there has been little convergence to the institutional levels of the rest of Romania and Bulgaria, let alone to the rest of the EU. Institutions can therefore be considered as an important barrier for future economic development, and an issue which would need to be seriously taken into account in any development strategy.

As noted previously in this report, institutional performance at the regional level is strongly affected by national institutions. Moreover, the results presented in this section are based on the perception of citizens about the quality of their own government. It is very likely that regions with better educated citizens may be more critical of their governments than in regions with lower average levels of education, and that wealthier regions may have higher expectations of their government. This may partly explain why leading regions like Bucharest and the West rate relatively worse than other Romanian regions. In any case, regional policy actors in Bucharest and West Romania should be aware that, according to the survey, their citizens are not content with or trusting of the current institutional arrangement. This alone has important implications for future growth potential and for regional development planning.



Figure 30. Quality of Governance Index with West Romania as the benchmark: 2009

Source: Authors' own calculations based on data from Charron et al. (2012). The x-coordinate represent the situation in Romania's West-region (with a value of -2.34) which is contrasted against the EU, a sample of Romanian and Bulgarian regions, Romania's North-West, Center and Bucharest region.





Source: Authors' own calculations based on data from Charron et al. (2012).

PART 3: CONSIDERATIONS FOR POLICY RECOMMENDATIONS

3.1. Highlighting Key Growth Challenges

West Romania is the second richest region in the country, after Bucharest. Over the past decade, the region has experienced rapid economic growth, along with rising real wages. This has been supported through strong productivity gains – among the fastest in all European regions – driven by significant increases in investment. However, despite these developments the picture is not wholly positive: economic expansion has not generated employment gains and it has exacerbated existing spatial inequalities within the region.

As the region looks forward to moving to the next stage of development and matching the living conditions in the richer parts of Europe, it must improve the value addition and innovation of its firms, while also addressing the challenge of jobless growth. Thus, the West Region faces a dual challenge. On the one hand, in Caras-Severin, Hunedoara, and parts of Arad, the challenge is one of generating and capturing employment opportunities by exploiting regional assets more effectively, and improving access to opportunities elsewhere in the region and the country. By contrast, in the Timis-Arad agglomeration, the challenge is addressing shortages and mismatches in the labor market, which underscores the importance of upgrading competitiveness in order to deliver the value added commensurate to support upward wage pressure.

The analysis presented in this report suggests that fundamental improvements to the competitiveness of the region will be needed to meet these challenges. This will require setting up a carefully tailored development strategy, paying special attention to the specific conditions of the region. If the strategy is to be both successful in the short-term, and sustainable in the medium- to long-term, decision-makers in the region – jointly with those in Bucharest and in Brussels – will have to tread carefully and craft development strategies juggling investments aimed at improving infrastructure, human resources, and institutions simultaneously as a way to overcome the barriers to development that the region currently faces. They will also need to make investments to support the business environment both in leading and lagging parts of the region²⁴.

3.1.1. Infrastructure

While the West region does not face a major infrastructure deficit, strategic investments in infrastructure, particularly in transport infrastructure, will be critical in addressing both parts of the strategic challenge. Three main types of connective infrastructure need to be considered:

1. Infrastructure to support the productive capacity of the Timisoara-Arad agglomeration: Among the key issues here will be to improve access to the agglomeration to expand the pool of labor that can commute to businesses in the agglomeration; to improve links

²⁴ For more detailed discussion on the challenges of growing inequalities between leading and lagging parts of the West Region, see the report: *"Economic Geography Assessment: Territorial Development Challenges in the West Region"*

(including, e.g. rail) to allow for more efficient daily exchange between Arad and Timisoara; to improve accessibility to the air transport infrastructure; and to continue investments aimed at improving the wider quality of life of residents in the agglomeration, with the aim of making conurbation increasingly attractive to high skilled workers.

- 2. Infrastructure to facilitate connectivity between Timisoara-Arad and more peripheral parts of the region: Recent investments by some of the existing large automotive companies to establish second plants in Hunedoara and Caras-Severin suggests there may be scope to attract significant labor intensive production in lagging parts of the region. As part of 'two-tier' strategies by some of these multinationals (where they concentrate research and other high skill activities in Timisoara-Arad and shift labor intensive production to other parts of the region) this obviously represents a huge opportunity to address both sides of the regional challenge. Improving transport connectivity of these regions so that shifting managers and engineers back and forth between regional head offices / technical centers and plants will be important to make such a strategy effective. There may also be a need to invest in industrial infrastructure and/or improve the operating efficiency of existing industrial parks.
- 3. Infrastructure to improve the region's connectivity with Bucharest: While the region has long benefited from its westward orientation, the increasing pull of Bucharest in the national context makes it increasingly important for the West to improve its physical connections and its network to Bucharest key to this is addressing the still major transport infrastructure gaps. This issue is discussed further in the "Economic Geography" report.

While tackling infrastructure gaps should be an important part of the region's short term strategy, the returns of infrastructure investment are likely to diminish as region's development increases. Thus infrastructure investment needs to be limited in time, respond to clear criteria of need and development potential, and be matched by similar efforts aimed at the improvement of human capital and at addressing institutional bottlenecks.

3.1.2. Human capital: skills and innovation

Human resources and the skilling of the labor force should also feature prominently in the strategy. The human capital deficit of the region and the low level of constant redeployment of the workforce are important problems not just per se, but also because they limit the innovative and absorptive capacity of the region. Without improving the skills base of the workforce West Romania is bound to be condemned to the ranks of the innovation averse regions in Europe. The implication is that the region's future growth will continue to be determined by the decisions of foreign investors.

The findings of this report suggest that, despite education and skills often being perceived as a source of comparative advantage for the region, in fact the region faces important shortcomings at all levels of training and skills development. In particular, focus should be places on:

- 1. The link between tertiary education and the workforce: The region must do a better job of leveraging its significant tertiary education infrastructure, especially to the insertion of university graduates into the labor force, avoiding common problems of mismatch between educational supply and labor demand and overeducation. This will require investments to improve the links between universities (as well as vocational training facilities) and employers. It may also pay to make strategic investments in promoting disciplines and skills that are likely to be the cornerstones of the region's future economy.
- 2. Lifelong learning: Lack of investment in lifelong learning makes the region's labor force unable to adapt to changing skills requirements resulting from shifts in industry structure and technology. The result is high levels of structural unemployment (and low participation rates) and skills mismatches at all levels of the labor force. Putting in place incentives for individuals to invest in lifelong learning, and ensuring that the infrastructure and services (public and private) are there to support it, will be an important priority for the region.
- 3. *Improving the regional innovation system*: At the highest levels of tertiary education, the West has a significant gap in research capacity; this is aggravated by what employers see as a mismatch between the nature of research and the needs of industry. Addressing these challenges is just one part of a much wider overhaul that is needed in the West's regional innovation system, in order to position the region to compete at the next level. *This issue is discussed further in the "Smart Specialization" report*.

Across all these aspects of human capital development, in contrast to that of basic transport infrastructure, it will be critical that investments are sustained over the long term.

3.1.3. Institutions

Institutions represent the third piece of the puzzle. The findings of Part 2 of this report suggest that low institutional capacity does not necessarily mean a strong handicap for future development. Lack of improvement in the quality of institutions, by contrast does. This has been one of the main problems in West Romania in recent years. The perception is that the region has witnessed little improvement, in key institutional areas. A sustained effort to address these barriers will be needed for the region to experience both sustainable levels of development and continuing convergence towards the rest of the EU. Otherwise weaknesses in institutions and governance will continue to hinder Romania's business environment and seriously undermine the returns of any other sort of development intervention. For the West Region, this will require:

1. Support to building local institutional capacity: The potential for greater regionalization in Romania offers hope to ensure more context-specific strategic planning and service delivery. It also offers the potential to establish a more transparent and open institutional environment. However, it is important not to underestimate the capacity

challenges that will exist in some parts of the region. Working with European partners, the West should invest in ensuring that all parts of the region have the incentive and capacity to develop and deliver strategic plans for growth.

2. Support to developing a 'thick institutional' setting to enable active engagement and bottom-up development: In parallel to building the capacity of the public sector, building an adaptive regional economy will require more active participation by a range of stakeholders from the private sector and civil society. Active public-private dialogue, potentially through regional clusters, can establish and strengthen partnerships between domestic and foreign firms, academics, government, and other regional stakeholders, and facilitate policy reforms and investments. Again, European partners have significant experience in financing and implementing programs to support the development and mobilization of local partners. In addition, through facilitation and support of European partnerships, engaging in cross regional peer-to-peer learning can help in identifying solutions to existing business environment constraints.

3.1.4. The Regional Business Environment

In addition to these core pillars of the development strategy, the West Region will need to invest to improve the business environment in both leading and lagging parts of the region. This will be important not only to facilitate the shift of the region to higher value added activities but, critically, to support the development of domestic firms. Among the priorities here are:

- 1. Building a competitive services sector: As Timisoara looks to become a center for 'command-control' (headquarters, research, technology) and other high skill activities, having a competitive business services sector will become increasingly important, particularly given the distance and poor connectivity with Bucharest, which is the natural base for such activities in Romania. The West will need to have high quality facilities, trained workers, and supporting infrastructure to facilitate the development of this sector.
- 2. Facilitating links between foreign investors and the local economy: Foreign investors dominate the landscape in the West Region, and they operate with few links to local firms. Given the nature of regional and global value chain production, there are limits to how integrated these sectors will be, however, investments to promote greater linkages will be important to embed foreign investors in the region and to take advantage of the technology and knowledge spillovers that they offer. Closely related to this is the opportunity to leverage major foreign-invested clusters to support the development of new industries the best example of this is how the automotive sector has played an important role in supporting the development of the West Region's ICT sector. Regional government may have a role to play here in working with FDI to develop vocational training to build relevant skills, accrediting suppliers on quality, HSE, and other standards, and facilitating the transfer of technology including through technology licensing and support for investment in equipment.

- 3. Support to building the capacity of local SMEs: Increasing links between local firms and foreign investors will require investments to build the capacity of local SMEs, which face considerable shortfalls in size, productivity, and investment capacity. This will require investments in training and skills development but also in supporting firms to meet quality standards, to engage in innovation, and to invest in new technologies. As the report on Firm Competitiveness²⁵ shows, the scope for productivity gains is particularly high in many labor intensive sectors in which the region has comparative advantage, including leather, apparel, furniture, and fabricated metals.
- 4. *Promoting entrepreneurship in lagging areas*: Low rates of business creation, particularly in lagging parts of the West Region underscores the importance of continuing to invest to support entrepreneurship.

Finally, it is important to consider that all these interventions need to be carefully put together in an integrated development strategy. This strategy needs to encompass an adequate mix of actions aimed at the improvement of regional road and infrastructure projects, the active promotion of high quality tertiary education and employment structures, as well as the upgrading of the institutional environment. The timing of each action is also crucial. Invest too early, for too long, or too much on one of the axes – and infrastructure, as the most visible axis, is always a candidate – and the risk of ending up with a strategy that yields scarce returns is high. A comprehensive and well-timed development strategy will, by contrast, not only address some of the basic problems of the region, but also enhance its capacity to adopt new technology, to develop all types of innovations, to retain and attract talent, and to attract new investment, setting the bases for sustainable growth in West Romania.

²⁵ Competitiveness of West Romania Firms: Diagnostics, Challenges, and Opportunities
References

- Arellano, M., Bond, S., 1991, "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", *The Review of Economic Studies*, 58: 277-297.
- Aron, J., 2000, "Growth and Institutions: A Review of the Evidence", *The World Bank Research Observer*, 15, 1: 99 135.
- Barro, R., Sala-i-Martin, X., 2004, Economic Growth, The MIT Press, Cambridge, Massachusetts.
- Barro, R.J & Lee, J.-W., 2001. "International Data on Educational Attainment: Updates and Implications," *Oxford Economic Papers*, Oxford University Press, vol. 53(3), pages 541-63, July.
- Becker, S., Egger, P., von Ehrlich, M., 2010, "Going NUTS: The effect of EU Structural Funds on regional performance", *Journal of Public Economics*, 94: 578-590.
- Breton, T.R., 2002, "Can Institutions or Education Explain World Poverty? An Augmented Solow Model Provides Some Insights", *JSE* 20-2002, November 10.
- Charron, N., Lapuente, V., Dykstra, L., 2012, "Regional governance matters: A study on regional variation in quality of government within the EU", *Regional Studies* (forthcoming).
- Crescenzi, R. & Rodríguez-Pose, A. 2012, "Infrastructure and regional growth in the European Union", *Papers in Regional Science*, Wiley Blackwell, vol. 91(3): 487-513, 08.
- Driscoll, J. C., and A. C. Kraay. 1998, "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data", *Review of Economics and Statistics* 80: 549–560.
- Ederveen S., de Groot, H., Nahuis, R., 2006, "Fertile soil for structural funds? A panel data analysis of the conditional effectiveness of European cohesion policy", *Kyklos*, 59: 17-42.
- Ertur, C., Koch, W., 2006, "Regional disparities in the European Union and the enlargement process: an exploratory spatial data analysis, 1995–2000", *Journal of Regional Science* 40: 723–765.
- Grigorian, D.A., Martinez, A.,2000, "Industrial Growth and Quality Of Institutions: What Do (Transition) Economies Have to Gain From the Rule Of Law?" *World Bank Working Paper, WPS 2475*, World Bank: Washington, D.C.
- Ianoş, I., 2006, Potential, Strukturdynamik, Attraktivität der rumänischen Wirtschaft, pp. 603– 621. In: Kahl, Thede; Metzelin, Michael and Mihai-Răzvan Ungureanu: Rumänien. Raum und Bevölkerung, Geschichte und Geschichtsbilder, Kultur, Gesellschaft und Politik heute, Wirtschaft, Recht und Verfassung, historische Regionen, Wien.
- Kaufmann, D., Kraay, A., Mastruzzi, M., 2009, "Governance Matters VIII: Aggregate and Individual Governance Indicators, 1996-2008", World Bank Policy Research Working Paper No. 4978, World Bank: Washington, D.C.
- Mankiw, N., Romer, P., Weill, D., 1992, "A contribution to the empirics of economic growth", *Quarterly Journal of Economics* 107: 407–437.

- Mohl, P., and Hagen, T., 2010, "Do EU structural funds promote regional growth? New evidence from various panel data approaches", *Regional and Urban Economics*, 40: 353-365.
- Pop-Eleches, G., 2009, From Economic Crisis to Reform: IMF Programs in Latin America and Eastern Europe, Princeton University Press, Princeton, New Jersey.
- Puga, D., 2002, "European Regional Policies in the light of Recent Location Theories", *Journal* of Economic Geography, 2: 373-406.
- Rodríguez-Pose, A. and Crescenzi, R., 2008, "R&D, spillovers, innovation systems and the genesis of regional growth in Europe", *Regional Studies*, 42 (1): 51-67.
- Rodríguez-Pose, A., 1999, "Convergence or divergence? Types of regional responses to socioeconomic change in Western Europe", *Tijdschrift voor Economische en Sociale Geografie*, 90 (4): 363-78.
- Roodman, D., 2009a, "How to do xtabond2: an introduction to difference and system GMM in Stata", *The Stata Journal*, 9(1): 86-136.
- Roodman, D., 2009b, "A note on the theme of too many instruments", Oxford Bulletin of Economics and Statistics, 71(1): 135-158.
- Solow, R., 1956, "A contribution to the theory of economic growth", *Quarterly Journal of Economics*, 70(1): 65-94.
- Swan, T., 1956, "Economic growth and capital accumulation", *Economic Record*, 32: 334-361.
- Wooldridge, J.M., 2002, *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, Cambridge, MA.

Annex 1. Regional Aggregations Used for Benchmarking Comparisons

Comparison with:	Relevant regions		
Counties within the	Arad, Timis, Caras-Severin, Hunedoara		
region			
Region within Romania	RO11, 12, 32		
"Peer regions"	Romania: Poland: PL41, 42, 43, 51, 52		
	Hungary: HU21, 22, 23, 33		
	Czech: CZ02, 03, 04		
EU averages	EU-27 (avg); EU-10 (avg)		
Regions based on	Medium; Intermediate; High: as per European Regional		
European Regional	Competitiveness Index (Annoni & Kozovska, 2010)		
Competitiveness Index			
category			
Regions with similar	Romania: 11, 12, 22, 31, 44		
economic structures	Bulgaria: 34, 42		
(top 10 most similar)-	Slovakia: 03, 04		
	Czech: 06		

Annex 2. Methodological Annex for Part 2 Empirical Assessment

Analytical Framework

We consider a simple model in which regional output is determined by the following production function:

Y(t) = F[A(t), K(t), H(t), L(t)] (1)

where regional output (Y) is broadly determined by a technology parameter (A), regional physical capital (K), regional human capital (H), and the labor force (L). We additionally follow Aron (2000) in assuming that technological progress and technology adoption are likely to be affected by institutional parameters reflecting the quality and efficiency of governments, investment- and business-oriented soft infrastructure, as well as the judicial environment. David (1997) also points out that technological take-up tends to be constrained by 'social capability' and thus the institutional environment which plays a fundamental role in determining why certain development strategies take hold, and others do not. Institutional conditions affect technical progress, the efficiency of investment, and, as a consequence, the responsiveness of output to human and physical capital (i.e. infrastructure, property rights, and education – which all tend to be sensitive to institutions). Institutional parameters may thus be sub-divided into elements focusing on human capital related components and local region-specific legal and governmental aspects (Acemoglu and Dell, 2009) both of which affect technical regional growth parameters.

Taking this into account, we define the technology parameter A(.) as a combination of technological know-how – i.e. productive efficiency T(.), which again is determined by technology adaption choices of profit-maximizing firms, and the presence or quality of local and national institutions, I(.), reflected in the provision of public goods and services, the availability of a functioning legal system, property rights, etc. As a result, we can illustrate the technology parameter as a function G[.], of T(.) and I(.):

A(t) = G[T(.), I(.)] (2)

In line with Grigorian and Martinez (2000) and Breton (2002), we thus augment the traditional Solow-Swan growth framework by considering physical and human-capital aspects á la Mankiw et al. (1992), and institutional regional parameters. We hence assume a simple linear relationship between T(.) and I(.) and substitute equation (2) into equation (1). Considering a constant-returns-to-scale Cobb-Douglas production function we re-rewrite equation (1) as:

$Y(t) = K^{\alpha}(t) H^{\beta}(t) [I(.) T(t) L(t)]^{1-\alpha-\beta}$ (3)

where I(.) denotes a matrix of institutional measures and T(.) a vector of company-based productive efficiency. Following Mankiw et al. (1992) we further assume that different territories (i.e. in our case NUTS-2 regions) may differ in their initial technology level (i.e. in technological effectiveness or institutional background) and that the overall productive

efficiency T(.), is, however, similar across all territories. By computing steady-state values of human and physical capital per effective unit of labor (3) and taking the natural logarithms, we derive the following structural equation for a region's long-run income per capita levels (cf. Mankiw, Romer and Weil, 1992):

$$\begin{split} &\ln\left[\frac{Y(t)}{L(t)}\right] = (4) \\ &\ln T(0) + gt + \ln I(0) - \frac{\alpha + \beta}{1 - \alpha - \beta} \ln(n_t + g + \delta) + \frac{\alpha}{1 - \alpha - \beta} \ln(s_k) + \frac{\beta}{1 - \alpha - \beta} \ln(s_h) \end{split}$$

where Y(t)/L(t)

denotes regional living standards (i.e. GDP per capita), $s_{k,t}$ regional savings or investment, $s_{h,t}$ represents human capital accumulation (i.e. the innovative capacity of a region), n_{it} regional population growth, g the exogenous technology growth rate, and δ the rate of depreciation.²⁶ The model thus predicts higher real income in territories with higher savings- (i.e. investment-) rates, a higher level of innovative capacity, technological progress and better institutional conditions.

Estimation Strategy

In the context of this analytical framework and in line with the existing literature on regional economic growth determinants, we first estimate a standard economic growth model, before considering an extended growth framework in which we distinguish between different indicators for a region's physical infrastructure stock and investment, human-capital and innovation-related regional factors, as well as between several different measures of a region's institutions. The extended growth framework is estimated by successively inserting the independent variables in the empirical analysis.

In order to control for heteroscedasticity, serial and spatial correlation, we employ, alongside a standard pooled OLS estimation technique, a fixed effects (within) regression model with adjusted standard errors by using a non-parametric covariance matrix, as suggested by Driscoll and Kraay (1998). The Driscoll-Kraay estimator takes into account common influences which may impact on our variables of interest and may lead to biased results when ignored.²⁷ Moreover, to control for potentially omitted variables and endogeneity concerns, due to reverse causality or simultaneity, we introduce all independent variables with a one-year lag structure and provide further empirical results by additionally employing a heteroscedasticity-robust system 'Generalized Method of Moments' (GMM) estimator (Roodman, 2009a). The specific estimator chosen is the Arellano-Blundell-Bond

 $^{^{26}}$ More precisely sk and sh denote the fraction of income invested in physical and human capital, respectively. It is further worth noting that several empirical growth studies assume that g and δ are the same for all regions and time-constant. Mankiw et al. (1992) suggests taking a combined value of these two indicators of about 5%.

²⁷ Hoechle (2007:1) highlights that "erroneously ignoring cross-sectional correlation in the estimation of panel models can lead to severely biased statistical results". For a more detailed discussion of the employed estimator see Hoechle (2007).

panel data estimator in its first-step estimation version (cf. Blundell and Bond, 1998). Regarding the specification of the chosen estimator, we classify all independent variables as endogenous and use either the third to fifth or the fourth and fifth lags as 'internal' instruments for the endogenous variables in all model specifications.²⁸

Accounting for physical and human capital, as well as for different levels of innovative capacity and regional institutional quality we obtain the following structural estimation framework for the standard model:

$$\begin{split} &\ln(y_{i,t}) - \ln(y_{i,t-1}) = \\ &\beta_0 + \beta_1 \ln(y_{i,t-1}) + \\ &\beta_2 \ln(\text{investment}_{i,t-1}) + \beta_3 \ln(\text{human_captial}_{i,t-1}) + \\ &\beta_4 \ln(\text{institution}_{i,t-1}) + \beta_5 \ln(n_{i,t-1} + g + \delta) + \gamma_i + \upsilon_t + \varepsilon_{i,t} \end{split}$$

where the index i represents the region with i \oplus [1, 254] and t denotes a time index in a sample covering the period 1996-2009. Real GDP per capita (in PPS) of NUTS-2 region i at time t is denoted by $y_{i,t}$. Regional physical capital (i.e. investment_{i,t-1}) is measured by the level of gross fixed capital formation (in percent of nominal GDP). In the empirical analysis we further decompose the investment variable into a more general indicator of a region's physical capital stock (see below) and into an additional parameter accounting for regional infrastructure investments in the form of roads and motorways.

The human capital parameter (human_capital_{i,t-1}) represents regional education levels. Due to the limited data availability of comparable and high quality human capital measures on an EU regional level, we employ in the standard model (equation 5) the share of employed people with tertiary education as a measure of human capital.²⁹ $n_{i,t-1}$ denotes the population growth rate of the region, while g and δ reflect technological progress and capital depreciation, which we assume to be constant over time and to jointly add up to a value of 5 percent (cf. Mankiw et al., 1992).

But perhaps the greatest novelty of the analysis lies in the introduction of institutional variables at a regional level in the estimating equation. In order to find out whether institutions matter we employ a recently developed index of a region's quality of government.³⁰ The institutional index – reflecting the overall quality of regional government – is further decomposed into four constituent components which include (i) corruption, (ii) the rule of law, (iii) government effectiveness and bureaucracy, as well as (iv) government accountability.³¹ We also add regional fixed effects (y_i) and annual time fixed effects (v_t) to

(5)

²⁸ The selection of the (internal) instruments largely depends on the results of the respective autocorrelation (AR) tests.

²⁹ Barro and Lee (2001) also propose indicators of educational attainment for a country's stock of human capital, whereas Cohen and Soto (2007) use years of schooling as a measure for a country's human capital endowment.

³⁰ The data we use for a regions institutional settings are based on the work of Charron et al. (2012). More information on the construction and characteristics of the 'quality of government' index can be found in section 2.

³¹ Since the employed 'quality of government' index (QoG) and its individual components are adjusted around zero, with positive and negative values reflecting favorable and less favorable institutional

the estimation equation (5) in order to control for regional or time-specific characteristics. $\epsilon_{i,t}$ represents the idiosyncratic error term.

As a way to provide a more detailed explanation of the processes taking place in generating economic growth, we extend the estimated standard growth model, illustrated in equation (5), by including the level and changes of computed innovation, education and investment-related indices, combining several potential economic growth-drivers by means of principal component analysis.³² Principal component analysis can be used to account for potential multicollinearity issues when simultaneously introducing certain potentially correlated explanatory variables. By merging all these regressors into one composite index, our intention is to preserve "as much as possible of the variability of the original indicators" (Crescenzi and Rodriguez-Pose, 2012: 57). The resulting augmented Solow-Swan-type growth model adopts the following form:

$$\begin{split} \ln(y_{i,t}) - \ln(y_{i,t-1}) &= \\ \beta_0 + \beta_1 \ln(y_{i,t-1}) &+ \\ \beta_2 \ln(\text{investment})_{i,t-1} + \beta_3 \ln(\text{infrastructure index})_{\text{level}} \text{ and growth}_{i,t} \\ \beta_3 \ln(\text{human capital index})_{\text{level}} \text{ and growth}_{i,t-1} + \\ \beta_4 \ln(\text{institution})_{\text{level}} \text{ and growth}_{i,t-1} + \beta_5 \ln(n_{i,t-1} + g + \delta) + \\ y_i + v_t + \varepsilon_{i,t} \end{split}$$
(6)

where all parameters are defined as above and the three composite indices account for the stock and investment in regional infrastructure, as well as for the level and change in educational and innovation-related regional attributes. Our infrastructure index has been built combining the length of motorways and other roads (both in km) per square kilometre with the ratio of the number of air transport passengers over regional population. The first principal component of the index represents 52.9 percent of the total variance, whereas the second component accounts for 24.2 percent. Both coefficients of the motorway and air passenger variables are, as expected, positive (table A2 in the appendix). The education and innovation-related composite index combines regional life-long-learning ratios, with total R&D expenditure in all sectors as a percentage of GDP and with the percentage of people employed (aged 25-64) who completed a full cycle of higher education. Accounting for 63.3 percent per cent of the variation, the first principal component again contrasts sharply against the second representing only 19.9 percent of the total variance (Table A3 in the appendix).³³

In order to benchmark West Romania's economic growth drivers against EU-wide growth drivers and regional growth determinants in the 2007 EU-accession countries, we estimate both growth models for the EU as a whole, as well as for regions in Romania and Bulgaria

environments, respectively, we add a 10 in order to be able to include logged variables in our specification.

³² Principal component analysis (PCA) also allows to overcome potential problems of multicollinearity.

³³ Note that when choosing between different factors (i.e. principal components) the Kaiser criterion highlights the need for an Eigenvalue to be larger than 1. In addition, a factor should also explain at least 10% of the total variance. Both criteria are features of the factors chosen above (c.f. Annex Tables A3 and A4).

only.34 By estimating models which exclusively focus on Romanian as well as Bulgarian NUTS-2 regions we take into account the limited number of observations and time series data. We consider the combined estimation procedure as more appropriate especially given the similarity of these two countries regarding their political and economic legacies: a geographical position in the South Eastern margin of Europe, a past characterized by a long period under Soviet influence, borders with former Yugoslavia, which entailed considerable political and economic costs in the 1990s, the transformation from an agrarian to a centrally-planned industrial economy under communism leading to a legacy of inefficient and energy-intensive industries in both states even compared to other Central and Eastern European standards, as well as prevalent structural problems and sluggish economic growth drivers in the two states which joined the EU in 2007, we thus aim to contrast Romania's regional performance against regional growth stimuli in the European Union as a whole.

³⁴ Focusing on Romanian regions alone is problematic especially when using IV-GMM estimation techniques, given the limited number of observations.

³⁵ Pop-Eleches (2009:218) further highlights that "these structural problems were exacerbated by the fact that, unlike Hungary or Poland, the two countries were ruled by hard-line Stalinists (Ceausescu and Zhivkov) who resisted the economic reforms and the political opening under Gorbachev in the Soviet Union [..]. Therefore, Romania and Bulgaria embarked on the difficult path of democratization and marketization with less developed civil societies and political parties, fewer Western-trained specialists and less hope of Western assistance, poorer populations, and more distorted economies." Pop-Eleches (2009:218) concludes that "not surprisingly, post-communist reforms in Bulgaria and Romania turned out to be more contorted than in their Central European neighbors[..]."

Annex 3. Supporting Data Tables for Part 2 Assessment

Variable	Exact definition	Data source	
Dependent variable	Annual growth rate of regional GDP (PPS) per capita	Eurostat' Regio Database	
Internal Factors			
Investment and Infrastructure			
Gross fixed capital formation	Gross fixed capital formation in per cent of nominal GDP	Eurostat' Regio Database	
Motorways and other roads	Kms of motorways and other roads per square kilometre	Eurostat' Regio Database	
Air transport passengers	Total number of air transport passengers in thousand standardized by regional population size	Eurostat' Regio Database	
Human capital, innovation and o	demography		
Tertiary education employment	Percentage of employed people (aged 25-64) with completed higher education (ISCED-97 levels 5 and 6).	Eurostat' Regio Database	
Life-long-learning ratio	Participation of adults aged 25-64 in education and training in per cent.	Eurostat' Regio Database	
Patent applications	Number of patent applications per million of inhabitants	Eurostat' Regio Database	
Total R&D expenditure	Total R&D expenditure (in all sectors) in per cent of GDP	Eurostat' Regio Database	
Population growth rate	Annual growth rate of the total regional population	Eurostat' Regio Database	
Regional institutional measures			
Control of corruption	Index evaluating corruption in the public school and health care system, and other public services	Charron et al. (2012)	
Rule of law	Constructed index measuring residents' perception of the objectivity and confidence in the police and in regional law enforcement	Charron et al. (2012)	
Government effectiveness	Index measure identifying the quality and impartiality of regional health care and education services	Charron et al. (2012)	
Government accountability	Composite index analysing the perceived honesty of elections and the effectiveness of the media as a watchdog for public sector corruption	Charron et al. (2012)	
Quality of Government Index	Regional quality of government index constructed combining all the previous four indicators	Charron et al. (2012)	

Table A3.1: Description of Variables

Notes: The dataset spans the time period 1995 to 2009 and includes 254 EU regions pertaining to 24 European countries. Malta and Cyprus had been excluded from the analysis. All Danish regions as well as the French overseas departments (Guadeloupe, Martinique, Guyane, Réunion), the Ciudad Autónoma de Ceuta (ES), Ciudad Autónoma de Melilla (ES) and North Eastern Scotland (UKM5) and Highlands and Islands (UKM6) were also excluded mainly due to missing data.

Annex Tables A3.2: Results of the Principal Component Analysis for the Infrastructure Index

Eigenanalysis of the correlation matrix: Infrastructure Index

EU				
Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.058	0.117	0.529	0.529
Comp2	0.942		0.471	1

Principal component's coefficients

EU		
Variable	PC1	PC2
Motorway & Roads	0.7071	0.7071
Air passengers	0.7071	-0.7071

Annex Tables A3.3: Results of the Principal Component Analysis for the Education Index

Eigen-analysis of the correlation matrix: Human capital and innovation index

EU				
Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.89835	1.30298	0.6328	0.6328
Comp2	0.595373	0.0890982	0.1985	0.8312
Comp3	0.506275		0.1688	1

Principal component's coeffici	ents		
EU			
Variable	PC1	PC2	PC3
Tertiary education employment	0.5951	-0.0948	-0.7981
Life-long-learning	0.5639	0.7568	0.3306
R&D in percent of GDP	0.5726	-0.6468	0.5038

Principal component's coefficients