Clusters and the New Growth Path for Europe

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Abstract

This paper outlines elements of a conceptual framework that clarifies the role that clusters play relative to government policies and actions of individual companies in supporting the emergence of 'High Road'-strategies that lead to better New Growth Path-related outcomes. It then focuses on creating a new set of data that can start shedding light on the empirical relevance of this framework.

The first main section of the paper draws on a new set of employment and wage data across European clusters. The data is used to analyze whether cluster presence is significantly correlated with higher wages, which as an indicator of higher productivity, are likely to signal the presence of 'High Road'-strategies. We then take a closer look at the scale of the relationship relative to location-specific and other effects. We find cluster presence to be significantly related to higher wages, with the effect being moderate but meaningful. This suggest that cluster presence enhances the ability of economic activities to deliver high performance, but is unlikely to be able to substitute weak business environment conditions.

The second section then deploys a wide range of regional performance data collected for the European Competitiveness Index and the European Cluster Observatory. We create indicators for New Growth Path performance and its main dimensions, and classify European regions by their performance patterns. This provides critical insights into the compatibility of the different economics, social, and ecological objectives pursued. We then relate these outcomes to the presence of strong cluster portfolios and strong business environment conditions. Both are most strongly associated with stronger economic outcomes, with lower impact on other dimensions of the New Growth Path.

The third section creates a new dataset of cluster initiative intensity at the regional and cluster category-level. It also classifies close to 1000 cluster initiatives in Europe by their engagement in New Growth Path-related activities. We then deploy this data to test the impact of cluster initiatives on regional New Growth Path-performance.

Overall, we find evidence consistent with clusters playing a role in making 'High Road'-strategies more likely to emerge. We also find evidence that European regions differ in their strategies towards these goals, with some being able to pursue all three dimensions in parallel. Cluster initiatives widely engage in New Growth Path-related activities, indicating their potential as a tool in mobilizing joint action in these areas.

Contribution to the Project

This paper provides the factual background to evaluate the role of clusters and cluster-based policies in an overall growth strategy aligned with the objectives set in the WWWforEurope project for a New Growth Path. The paper starts out with a conceptual framework that clarifies the role of clusters in enhancing the likelihood of 'High Road' strategies being adopted. In its first empirical part, it looks at the empirical relations between the presence of clusters and narrow economic outcomes, in particular wages. In the second part, it develops an empirical classification of regions by New Growth Path objectives, and relates these performance patterns to the presence of clusters and other factors. In the third part, it generates a new dataset on the presence of cluster initiatives and their engagement with New Growth Path related activities, and analyzes their impact on regional performance outcomes.

Keywords: Clusters, competitiveness, economic growth path, economic strategy, European economic policy, globalisation, industrial policy, new technologies, SMEs

Jel codes: D04, L16, L52, R58

Clusters and the New Growth Path for Europe

By Christian Ketels and Sergiy Protsiv[1]

1. Introduction

The WWW for Europe-project aims to develop a set of policy recommendations that can put Europe on a growth path that is more economically sustainable, more socially inclusive, and more environmentally sound than in the past. These policy recommendations are ground in the analysis of current economic dynamics and practices to draw lessons from parts of the European economy that are already close to the intended growth path. The present chapter on clusters is part of that broader analysis.

Clusters, geographical concentration of economic activities in related fields connected through different types of linkages and spill-overs, have been known since the early description by Alfred Marshall (1890/1920). They were rediscovered in the early 1990s, when researchers from different perspectives recognized that such clusters were a feature of the modern economy as well. Michael Porter approached the topic from the perspective of a management scholar and industrial economist: he recognized that successful firms in many industries tend to co-locate in specific regions. The presence of these clusters seemed to contribute to the companies' success and to the economic health of the regions they were located in (Porter, 1990/1998). Paul Krugman, Anthony Venables, and others associated with the New Economic Geography had an international trade background: equipped with new imperfect competition models that captured spill-overs and linkages they were interested in why economic activity agglomerates and how this will affect differences in economic performance across locations (Fujita et al., 2001). Giacomo Becattini had a more sociological approach: he was interested in the ability of Italian industrial districts to create high levels of flexibility in local systems of small companies collaborating based on deep social ties (Becattini, 1990). Regional economists had, of course, never lost sight of the role of regional specialization patterns and started to put these observations more into the context of linkages within a region: they were interested in localized learning processes, lock-in and diversification patterns, and many other aspects of regional economic profiles and performance (e.g., Piore/ Sabel, 1984; Scott/Storper, 2003).

The traditional analysis of clusters is concerned with the questions of why these particular types of agglomerations occur in equilibrium, and what their presence implies for economic performance, in particular for prosperity differences across locations. The New Growth Path-related analysis moves beyond the focus on per capita GDP usually considered in these models. In the first step, the focus of this paper, we want to understand whether the presence of clusters makes it more likely that the broader welfare objectives of the New Growth Path are going to be achieved. In a second step, which will be the focus of a companion paper, we will look at the role policy can play in either making the

[1] The authors would like to thank Mercedes Delgado (Temple University) and two referees for their valuable comments.

emergence of New Growth Path-contributing clusters more likely or enhancing the chances that clusters will make a positive contribution to the broader welfare objectives of the New Growth Path.

Outline of the conceptual framework

Most of this paper has an empirical focus, looking at cluster presence, cluster initiative activity, and the broader set of outcomes that the New Growth Path is concerned about across European regions. We start with an analysis of whether cluster presence is associated with higher wages; a key contributor to both narrow and broad measures of prosperity. We then broaden the perspective from clusters to regions, and look at the role of clusters in regions' performance on the broader prosperity measures of the New Growth Path. Finally, we ask how the presence of cluster initiatives affects the impact of clusters on New Growth Path outcomes.

Before discussing the data and our analytical approach, we first need to ask what conceptual reasons there might be for cluster presence to have a positive impact on the achievement of New Growth Path objectives.

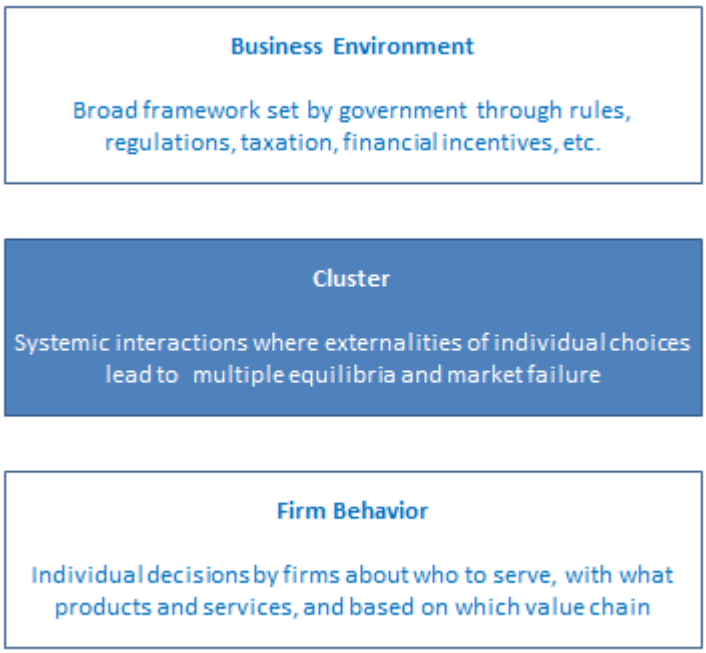
It is useful to recall that at a theoretical level it is straightforward to design a system in which the broader set of economic, social, and environmental objectives of the New Growth Path are achieved. Government policy can be used to change relative prices, for example putting a higher cost on the use of environmental resources. It can implement policy rules and regulations to make sure decisions are made with a full recognition of effects over time and risks, for example adopting appropriate fiscal policy rules and financial market regulations. And it can use redistribution, investments into skills, etc., and regulations to lower market entry barriers for socially exposed groups. How effective and feasible these tools are depends on the potential trade-offs between the different objectives in the New Growth Path, the specific design of the policy tools used, the power of different interest groups, and the global market environment in which these tools are implemented. Evidently, all of these pose significant challenges – otherwise locations would easily adopt a policy framework that supports the New Growth Path objectives.

Another perspective that has gained significant traction in the public debate is the focus on firms' individual behavior. The literature on corporate social responsibility develops the argument why firms should behave more strongly in ways aligned with what is in the context of this project described as the objectives of the New Growth Path. The motivations given for why firms should do this ranges from a moral imperative to a practical 'license to operate'-requirement to a defensive set of actions to avoid the negative attention of pressure groups and more broadly public opinion. More recently, the idea of corporate shared value (Porter/Kramer, 2006) has aimed to focus on the type of activities that both support societal objectives and are in line with the fundamental profit objectives of firms. Efforts to make firms' operational practices and products more environmentally sustainable often also lead to higher productivity. Investments into the local workforce and local suppliers are beneficial for prosperity and social inclusion and strengthen the competitiveness of the firm. And the development of products

and services to meet unmet needs especially in the lower strata of society also enhance prosperity for lower-income groups while providing profit opportunities (Prahalad, 2006).

For the analysis in this chapter, both the general framework and the patterns of individual behavior by companies are assumed to be given. Instead, the focus is on the systemic interactions between the behavior of individual firms, driven by externalities and linkages between firms. They question is whether the presence of clusters and of cluster initiatives as a platform for collective action make it more likely that outcomes consistent with the New Growth Path objectives are achieved.

Exhibit 1



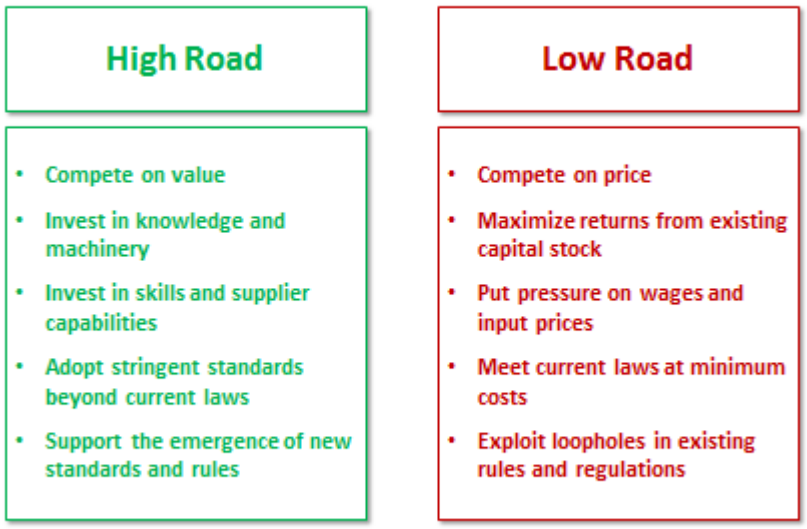
High road, low road, and the role of clusters

Clusters and cluster initiatives will have an impact on New Growth Path-consistent outcomes, if they increase the likelihood that the systemic interaction between firms leads to an equilibrium where such behavior is individually optimal. The key underlying hypothesis is that companies face a choice on how they decide to compete in the market place - there are different 'paths' that companies and regional economic systems can take as they compete (Aiginger):

- The 'high' road focuses all efforts on enhancing the value of products and services for a marginal cost that is lower than the additional value created. This can be achieved through investments in innovation, skills, machinery, and the adoption of more stringent quality standards.

The ‘low’ road focuses all efforts on lowering the production cost for a given product or service. This can be achieved through more efficient use of capital (asset sweating), prices pressure on suppliers, wage pressure on employees, and lobbying for less stringent environmental and social regulations.

Exhibit 2



Clusters and cluster initiatives might have an impact on the relative attractiveness of these two options: First, high road strategies might require a larger quantity of local public goods to be present, for example dedicated infrastructure, skill development programs, research facilities, etc. These are becoming more profitable to provide as the local cluster grows. Or they are naturally provided as the cluster grows, for example as a larger cluster attracts a deeper and more specialized labor pool and creates more intense knowledge spill-overs to draw on. All of these, whether they are the result of public investments or natural market processes, are making it more profitable for companies to then engage in a high road strategy, leveraging the local public goods with their own complementary investments in innovation, skills, and ultimately products and services that compete on high value.

Second, high road strategies might require a tighter level of integration with other local partners, for example on collaborative research, value chain coordination to produce new products and services, etc. In a cluster more of these specialized local partners are present. If there is also a cluster organization, the transaction costs of engaging with these partners in coordinated or joint activities will be lower.

Given these dynamics, two scenarios are possible: One in which companies choose to compete on the low road, with competition based on price, exploitation of assets, and a focus on the distribution of

profits. And one in which companies choose to compete on the high road, with completion based on value, investments in capabilities, and a focus on increasing the overall level of profits generated. Importantly, there are externalities in the individual choices that companies make about their competitive stance: the more companies choose to compete on the high road and make the investments that this implies, the more attractive it becomes for others to do the same.

If companies adopt low road strategies, they are more likely to try and limit the impact of higher competition for inputs bidding up costs in clusters. They are also likely to use more standard practices and commodities that require less knowledge and specialization. In most cases, this will limit the forces of agglomeration and will instead drive companies to seek locations apart from their peers to avoid competing for the same inputs. If geographic concentration happens, it is likely to be driven by economies of scale-dynamics, i.e. the benefits of scale in narrow economic activities. New entrants come in to take advantage of the available low costs, and compete as virtual copies of existing firms. China but also the agglomerations in less advanced European regions in textiles, etc. are a good example: There are few knowledge spill-overs and no deepening of the skill base, just a focus on a large number of available workers to keep wages low. Dedicated infrastructure exists but is focused on creating connectivity to integrate local narrow activities into international value chains.

If companies adopt high road strategies, they are more likely to focus on enhancing the ability of the location to support high value. They are more likely to make investments in skill upgrading and research, despite the 'slippage' in terms of benefits this creates through a deeper local knowledge base and richer knowledge spill-overs that benefit other companies as well. They are more likely to collaborate with suppliers, service providers, and research institutions to upgrade overall processes along the value chain and develop new products and services. Geographic concentration happens in the related industries that make up a cluster, with a focus on new entrants exploring new niches or related fields rather than primarily competing head-on with local rivals. There is a dynamic process in which the profile of the cluster adjusts as new technologies and shifting market needs affect the relative importance of different industries within the cluster.

Such multiple equilibrium-scenarios are related to a broader literature on the varieties of capitalism (Hall/Soskice, 2001). They describe different combinations of institutions and economic structures that are all market-driven and inherently consistent but still lead to different types of outcomes on a number of dimensions. A recent variation of this theme is the paper by Acemoglu et al (2012), where they develop a model in which one country is the innovation leader based on high incentives while other countries with weaker incentives develop in its shadow. Interestingly, their model generates higher prosperity and higher equality in the 'follower' countries. The 'leader' country has in equilibrium lower prosperity and lower equality but still has no benefits from deviating from its policy stance as long as no other country switches to the strong incentive regime. While this literature focuses on systemic interactions between choices made in different policy areas, the focus of the present paper is on the systemic interaction between a broad range of actors in the context of clusters.

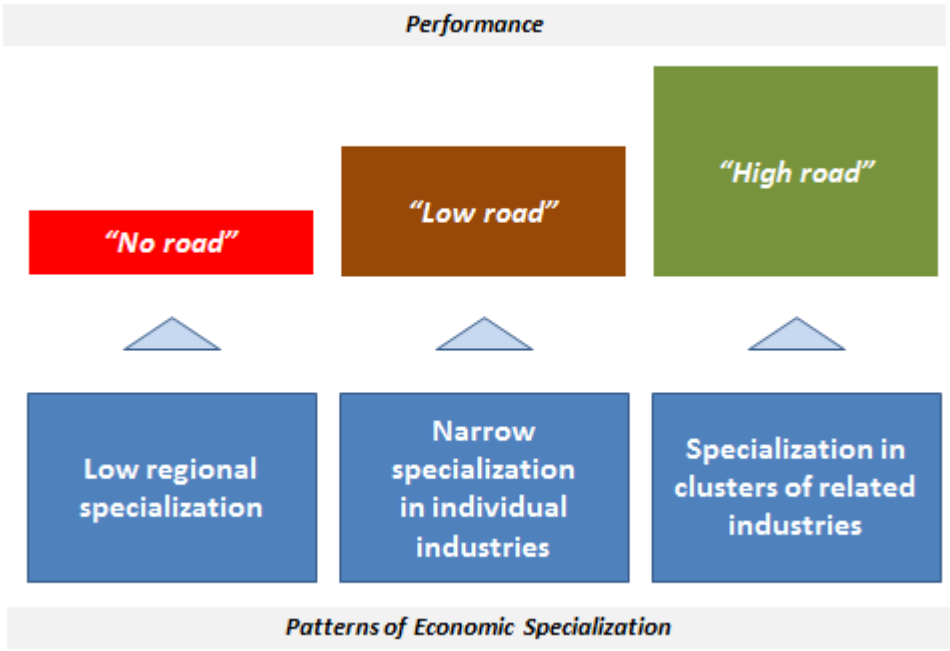
The systemic interaction discussed above leads to three possible scenarios linking patterns of economic specialization to performance outcomes:

- Regions that have no strong patterns of economic specialization, with some presence in a large number of industries. Under the growing intensity of global competition this increasingly leads to low levels of economic performance. With no clusters to build shared assets supporting more advanced ways of competing, this is increasingly a 'no road'.

- Regions that specialize in narrow industries but fail to generate broader positions in clusters of related industries. This allows companies to achieve economies of scale and successfully compete on efficiency and cost. With no clusters to build shared assets supporting more advanced ways of competing, they are, however, likely to adopt 'low road' strategies.

- Regions that specialize in clusters of related industries. This allows companies to enjoy economies of scale and scope, competing on value as much as on efficiency. Clusters enable the creation of shared assets that can support advanced ways of competing on the 'high road'.

Exhibit 3



Are clusters a driver, facilitator, our endogenous outcome?

The discussion so far has developed a hypothesis for why clusters and new growth path outcomes might be related. But are clusters the root cause of these positive outcomes? Do they enhance them? Or are they only a by-product of other factors that ultimately drive high performance? The answer to this question requires a more thorough understanding of cluster dynamics.

The question of what drives cluster development has long been discussed in the literature. One set of factors are the natural dynamics of agglomeration as, for example, discussed in the New Economic Growth literature. With all locations equal initially, the cumulative process of agglomeration then see one location attract the cluster while the other doesn't. In the standard models of New Economic Geography, there is only one sector with spill-overs and forward/backward linkages. This then leads to core-periphery scenarios, with the core achieving high density and higher levels of prosperity, and the periphery having lower density and lower levels of prosperity. In the multi-cluster models that cluster researchers have in mind, locations specialize in different clusters but can in principle all have to same overall level of density and prosperity (the outcomes would then depend on the composition effects driven by the profitability and wage profile of different cluster categories).

Another set of factors to look at the underlying characteristics of different locations, including their geographical location, natural endowments, business environment conditions, and existing portfolio of economic. In a static perspective, clusters are at least in part the reflection of strong (cluster-specific) underlying competitiveness in a given location. Porter's analysis of the so-called 'diamond' conditions provides an instrument to systematically analyze the many factors that matter for a given cluster (Porter, 1990). In a more dynamic perspective, there is also significant path-dependency as the set of existing clusters (and the business environment they are based on) defines which new clusters are most likely to emerge (Boschma et al., 2013).

Clusters as agglomerations of related economic activities are the natural outcome of all of these dynamics, and in this sense endogenous. Some of the factors that drive cluster emergence are also likely to make it more attractive for companies to compete with a high-road strategy: Access to a better skilled labor force, strong research, solid property rights, deep financial markets, and openness to foreign trade and investment are examples of business environment conditions that arguably benefit both. As far as strong underlying competitiveness makes both a high-road strategy and the emergence of clusters more likely, clusters are indicator of conditions that contribute to New Growth Path-consistent outcomes, not their root cause.

However, even for a given set of starting conditions across all of these factors there is huge variety in terms of whether a cluster actually emerges, how quickly that process takes root, and what economic benefits it delivers to companies and the region. The understanding of what turns a promising environment into the successful launching pad of cluster evolution is still weak. One candidate is 'social capital', a factor that the regional science literature has increasingly highlighted as a major driver of performance differences across locations (Rodríguez-Pose/Crescenzi, 2008). Social capital is conceptually a complex term, including the level of trust between and within the private and public

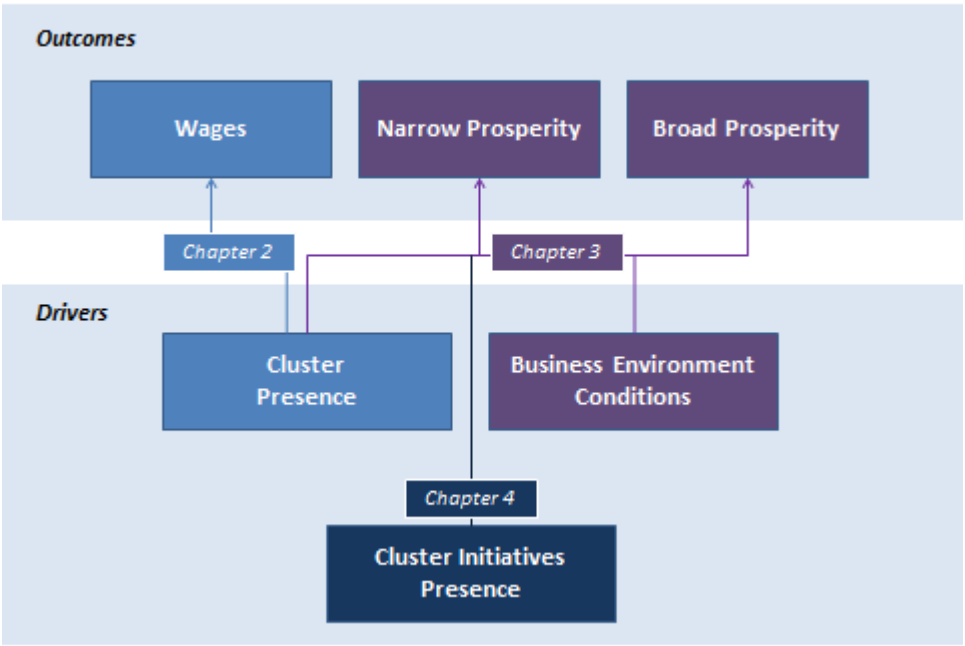
sector and the capacity regional government, but also other public and private organizations in a region. These dimensions of social capital are critical ingredients to overcome collective action problems in clusters. They make it more likely that mere co-location is leveraged through active collaboration and that beneficial local conditions are strengthened through coordinated or joint action. Cluster initiatives are the operational platform for joint action. They can take steps to implement activities that move the entire cluster on a New Growth Path-consistent trajectory.

Research approach in this paper

The conceptual discussion so far has developed a rationale of why clusters and cluster initiatives might be part an economy more likely to be in line with the ambitions set out in the New Growth Path-approach. It has argued that clusters and cluster initiatives are likely to be both indicators and facilitators of a New Growth Path-consistent economy.

The main focus of this paper is on exploring the empirical evidence related to these ideas. The available data is still much more limited than what would be required for any conclusive tests. But we will leverage the emergence of a number of new datasets over the last few years on regional business environment conditions, cluster presence, and cluster initiative presence to undertake a first set of explorative analyses. The emerging results are intended to inform both further conceptual developments and the creation of new data sets to close critical gaps in our understanding.

Exhibit 4



Data

The main source of the cluster- and agglomeration-related data is the Cluster Observatory.[i] The statistical part of the dataset covers all NUTS 2 regions in EU-27 and contains data on employment and, in most countries, wage indicators for each NACE 4-digit industry. As the original data came from different sources largely corresponding to each nation's statistical offices, it is of somewhat varying quality and in some cases the necessary values were estimated based on other available data. We describe the process of data processing further in the text.

The second dataset sourced from the Cluster Observatory is the list of cluster organizations that covers more than a thousand entities across all EU-27 countries. This dataset was partially collected manually and partially contributed to by the organizations themselves via the web site. Furthermore, extensive testing was performed to check if all listed organizations are still functioning by examining their web sites. The dataset is necessarily incomplete as there is no central authority that tracks all cluster efforts. However, it is fairly representative of the general situation and the data that is included is of high quality.

As the New Growth Path performance is the key variable in this analysis, there was a strong requirement for a reliable measure of this performance. As no indicator was readily available, particularly on regional level, we have constructed the composite measures of each of the three pillars (prosperity, social inclusion and environmental sustainability) based on the data available from Eurostat. See section 3b for a detailed description of the creation of these indicators.

Finally, the business environment indicators were used within the framework developed by Orkestra (Franco et al., 2011) as part of the analysis of regional competitiveness. An important source of data for Orkestra's analysis was the database underpinning the European Regional Competitiveness Index (Dijkstra et al., 2013). Most of the constituent variables come directly from Eurostat, though trust-related measures come from the European Social Survey and the patent data was sourced from the OECD.

An overview of the paper: key research questions and analyses

Based on the conceptual discussion and the available data, the remainder of this paper is organized by three key research questions:

1. *Do clusters contribute to higher productivity and wages?*

In this section we test for the correlation between agglomeration at the cluster and industry level as well as locational factors on key economic outcome factors. The hypothesis is that the presence of clusters contributes positively to higher industry-level wages. We also look at the role of other location-specific factors that might influence industry-level wages, and try to assess the relative role of these two sets of drivers.

Our analysis deploys average wages for all combinations of region (NUTS-2) and industry (NACE 4-digit) as the dependent variable. We then test for the impact of combinations of the following drivers: location quotient at the industry level, location quotient of the cluster that the industry is part of (full cluster and cluster excluding the relevant industry), and location and industry fixed effects.

2. *What role do clusters play in regions with stronger New Growth Path performance?*

In this section we take a two-step approach. First, we operationalize the notion of New Growth Path performance at the regional level, and classify European regions based on the indicator system developed. Second, we analyze the presence of clusters across groups of European regions defined by their particular pattern of New Growth Path performance.

Our first analysis deploys a range of indicators widely based on economic performance, social inclusion, and environmental sustainability. Data availability puts constraints on the indicators available, both on the conceptual level and on the level of geographies for which the data available. Despite these limitations, the four indicators in each of the three categories provide in our view a meaningful profile of the underlying issues we intend to measure. We create aggregates within each of the three categories and for the overall New Growth Path performance based on simple averages of the normalized values. Given the structure of the data and the lack of strong conceptual priors about the weight of individual indicators we follow the literature on composite indicators to make this choice. Finally, we use these indicators to group European regions by the specific profile of New Growth Path performance across the three performance categories.

Our second analysis then relates these groups of regions with the presence of specific categories of clusters as well as the overall strength of their cluster portfolios. The presence of individual clusters is measured by their overall location quotients. To measure the strength of the cluster portfolio we employ three different measures: a simple count of strong clusters in the region, where strong clusters are identified by a location quotient cut-off; the share of regional employment in strong clusters; and the share of the regional wage bill generated in strong clusters. We also include our measure of business environment quality as a driver of new growth path outcomes, looking both at its direct effect and its interaction with cluster presence.

3. *Do cluster initiatives contribute to New Growth Path performance?*

In this section we profile cluster initiatives and analyze their relation to New Growth Path outcomes. First, we analyze a unique database of cluster organizations across Europe. Second, we look into the impact that cluster initiative presence might have in explaining prosperity and broader New Growth Path-related outcomes. Third, we explore factors that might predict the likelihood of cluster initiatives to emerge in specific locations.

Our first analysis aims to provide a descriptive view of cluster initiatives across Europe. Each cluster initiative is described by its region, the cluster category in which it operates, and whether or not its activities are related to environmental sustainability or social inclusion. This data allows us to identify regions and cluster categories by the intensity of cluster initiative presence. We also explore possible drivers of the presence of cluster initiatives in particular regions. Drawing on the literature, we focus particularly on a measure of 'social capital', a specific element of overall regional competitiveness that could be particularly relevant for the likelihood of organized collaboration to occur.

Our second analysis then moves towards more formal tests of the impact that organized collaboration in cluster initiatives might have on prosperity and broader New Growth Path-performance. We test our measure of regional cluster initiative presence alongside business environment quality and cluster portfolio strength.

The road not taken: new growth path as a choice of industries and cluster categories

The analytical approach taken here differs significantly from another perspective often heard in the public debate. This perspective is based on the view that the adoption of a new growth path requires at its core a shift in the composition of economic activities. For an economy to be more aligned with social and environmental objectives, so the argument, it needs to get out of sectors like steel and textiles that are viewed to be inherently in conflict with these goals.

This view is related to research arguing that what matters for narrow economic outcomes is which specific clusters/sets of industries are present in a given location, not so much whether there is specialization in any strong cluster (Hausmann et al., 2012, Lin, 2011): because rich locations – in these studies the focus is on countries – are active in certain industries, these are the industries less wealthy location should also aspire to enter. The cluster research found within the US a different pattern: strengths in any cluster is more important for regional wage levels than which particular cluster this strength is in (Porter, 2003).

The composition of the economy is indeed likely to shift over time, driven by changes in consumer preferences, available technologies, and government regulations affecting firm behavior and relative prices. Such changes have led to the emergence of new industries in, for example, wind and solar energy. European countries need to look at the opportunities that these new markets offer. As in other industries, some regions will be better placed than others to attract and grow these new industries. At the level of regions, it then makes significant sense to investigate how individual locations can assess whether they have a set of assets and capabilities that might make them competitive. Ultimately, this will be a market-driven process where some of the locations will end up being the winners. And the regions with appropriate initial conditions will have a much higher chance to be part of that group.

Clusters play an important role in this process. First, there is evidence that if a 'grand challenge' like the need for more sustainable energy production exists, it requires the combination of different types of

knowledge and capabilities to develop a workable solution, not just a 'breakthrough' invention. Clusters tend to provide these dynamic innovation systems in which the related activities are present to develop new ideas for how to leverage research findings, test the economic potential of these new ideas, and bring them to industrial scale. The literature shows how clusters do drive innovation and entrepreneurship (e.g., Delgado et al., 2012; Furman et al., 2002). A good example is German Wind Energy: the initial attempts to create a government-initiated consortium ("Growian") failed to develop an economically viable solution. A later push was then based on creating attractive market conditions for wind energy, leaving it to the market to find the best technological solutions. As a result, a number of dynamics regional clusters developed that were able to provide the most effective solutions and ultimately also gain large export success.

Second, these new clusters are likely to locate in particular regions, strongly driven by the existing business environment qualities of these regions and, importantly, their existing cluster mix. As was discussed earlier, clusters drive the evolutionary path of regional economies, giving rise to new clusters in related fields (Boschma et al., 2013). The clusters serving new markets will those be much more likely to emerge where there is already a base of relevant clusters. Again, German wind energy provides a good example: clusters developed partly in the south of Germany where the existing production technology clusters were located, and partly in the north where the market was close and the maritime and automotive industries provided relevant manufacturing skills.

However, while these new industries will be important for some regions and make a marginal difference overall, they will not replace all existing economic activity. In addition, while the reorientation towards the New Growth Path opens up some markets, especially in terms of new environmental technologies, its ambitions to achieve a more socially inclusive and economically sustainable society have few similar effects. The key challenge is to transform activities within all parts of the economy, rather than shift resources among them and to new sectors. This is why the focus of the majority of this report is on the analysis of the role clusters play within existing industries in enabling competition on the 'high road'.

2. Clusters as the basis of sustainable economic performance

Clusters as regional agglomerations of economic activities in related industries connected through spill-overs and other linkages (Porter, 1990) have to be shown to have an effect on relevant outcomes in order to be relevant for the New Growth Path. In this first section, we start out by looking at the correlation between cluster presence and cluster-level wage, and explore the nature of this relationship relative to other location-specific factors driving outcomes.

a. Existing literature and research approach

Clusters were first introduced described as part of an economic analysis by Marshall (1890/1920) and then translated into the context of modern economies and methods by Porter (1990) and Krugman (1991). There is now widespread agreement that clusters as distinct regional patterns of specialization exist, both in developing and advanced economies. Much of the research is now focused on measuring the relationship between cluster presence and economic performance, tracking whether and how clusters matter.

The existing literature has produced a wide range of results from finding very little if any positive impact (e.g., Chatterji et al., 2013; Martin et al., 2008) to meaningful positive effects (e.g., Porter, 2003; Greenstone et al., 2010; Delgado et al., 2010/2012). While there are some studies for individual European countries, the Europe-wide analyses have so far suffered from gaps in the data, especially on cluster-specific wages and productivity (European Commission, 2007).

The methodological issues of estimating the size of these effects have been a central issue in this debate. Rosenthal & Strange (2004) found that, in general, the elasticity of productivity with respect to agglomeration lies in the range between 3% and 8%, with more recent studies generally finding weaker effects. Many of the earlier estimates used crude measures and did not take into account the endogeneity issues outlined by Ciccone & Hall (1996), as the key predictors such as density could be simultaneously determined with the wages. Combes et al. (2010) accounted for many of these estimation biases, further refining the magnitude of this effect down to 2%. Thus, doubling the density of economic activity would lead only to about a 2% increase in productivity, according to current estimates. The refinement of the estimates in the recent empirical work happened in large part due to the considerable progress that has been made in analyzing more detailed data, with increasing numbers of studies using micro-level datasets on plant or individual level (e.g. Combes et al., 2010; Henderson, 2003; Martin et al., 2011; Mion/Naticchioni, 2009).

The lack of a commonly used empirical definition of clusters is an obvious candidate to explain the diverging results, even before the endogeneity issues. The new research on clusters suggests how this could affect the results (Delgado et al., 2012): the positive effect of clusters on job creation is driven not by the narrow industries in which employment specialization is already high; there convergence effects occur. It is driven by the related industries within the cluster that are still relatively less developed. This

creates an interesting parallel to our conceptual framework in this paper, where the hypothesis is that only specialization in broader set of related activities increases the likelihood of High Road outcomes, while narrow specialization in single industries is more likely to drive Low Road outcomes.

A related literature looks at the channels through which clusters work. Marshall (1890) was the first to argue that clusters emerge because of specific benefits that firms can enjoy from locating close to others engaged in related activities. The conceptual and empirical work on these benefits that drive divergence across regions has focused on three main mechanisms: First, there is the potential to attract more specialized suppliers and interact with them more efficiently (Amiti/Cameron, 2007). Second, there is a labor market that is deeper and provides more specialized skills (Eriksson/Lindgren, 2008; Huber, 2011). And third, there are knowledge spillovers through different channels that one can only tap into locally (Aharonson et al., 2007; Thompson, 2006; Audretsch/Feldmann, 2003). There is significant empirical evidence for each of these sources to matter (Ellison/Glaeser/Kerr, 2010; Dauth, 2010) with their relative weights driven by cluster-specific factors.

Our ambition is to contribute to this literature in two ways: First, we exploit for the first time a data set on cluster presence across Europe that draws on both employment and wage data. This allows us to capture the impact of cluster presence on regional wages across European countries. Second, we compare the strength of the relationship between cluster presence and wage levels relative to other factors, in particular region and industry specific effects as well as concentration in narrow industries. From the perspective of the New Growth Path, a positive relation between cluster presence and wages would be consistent with our hypothesis that clusters enable 'high road'-strategies to be adopted.

b. Cluster presence and cluster wages

In this section we analyze whether the presence of strong clusters supports higher wages in these clusters relative to their peers elsewhere. Our underlying hypothesis is that such higher wages would be consistent with the traditional cluster effects (input market depth, knowledge spillovers, rivalry) and the adoption of High Road strategies.

We draw on the detailed dataset from the European Cluster Observatory. The data covers all NUTS 2 regions in EU-27 countries[ii] and at its base level covers all 4-digit NACE 2.0 industries[iii]. The two key indicators are the number of employees and the average wage in each region-industry pair (see Appendix 2 for more details on the sources of data). We also use the definitions of clusters adopted from Porter (2003) for use with NACE classification in Europe to group the sets of related industries together.

While the employment data is available universally, detailed wage data is trickier to obtain. The data contains 4-digit wage data for 18 out of 27 countries, but the missing countries contain almost all the largest countries in Europe (only the data for France is present among the 6 largest countries). In those countries we used the data available from the Structural Business Statistics section on Eurostat and combined 4-digit data available on the country level with 2-digit data available for regions. Since this

was only done for average wages, we believe that the inferred data capture the phenomenon adequately[iv]. We repeated our analysis on a subset of countries for which we have full data to find largely the same results[v].

Table 1 reports average European wages per cluster category; averages were calculated based on the number of employees per region. The data reveal large differences across cluster categories, even when excluding farming, which has a large share of family employment.

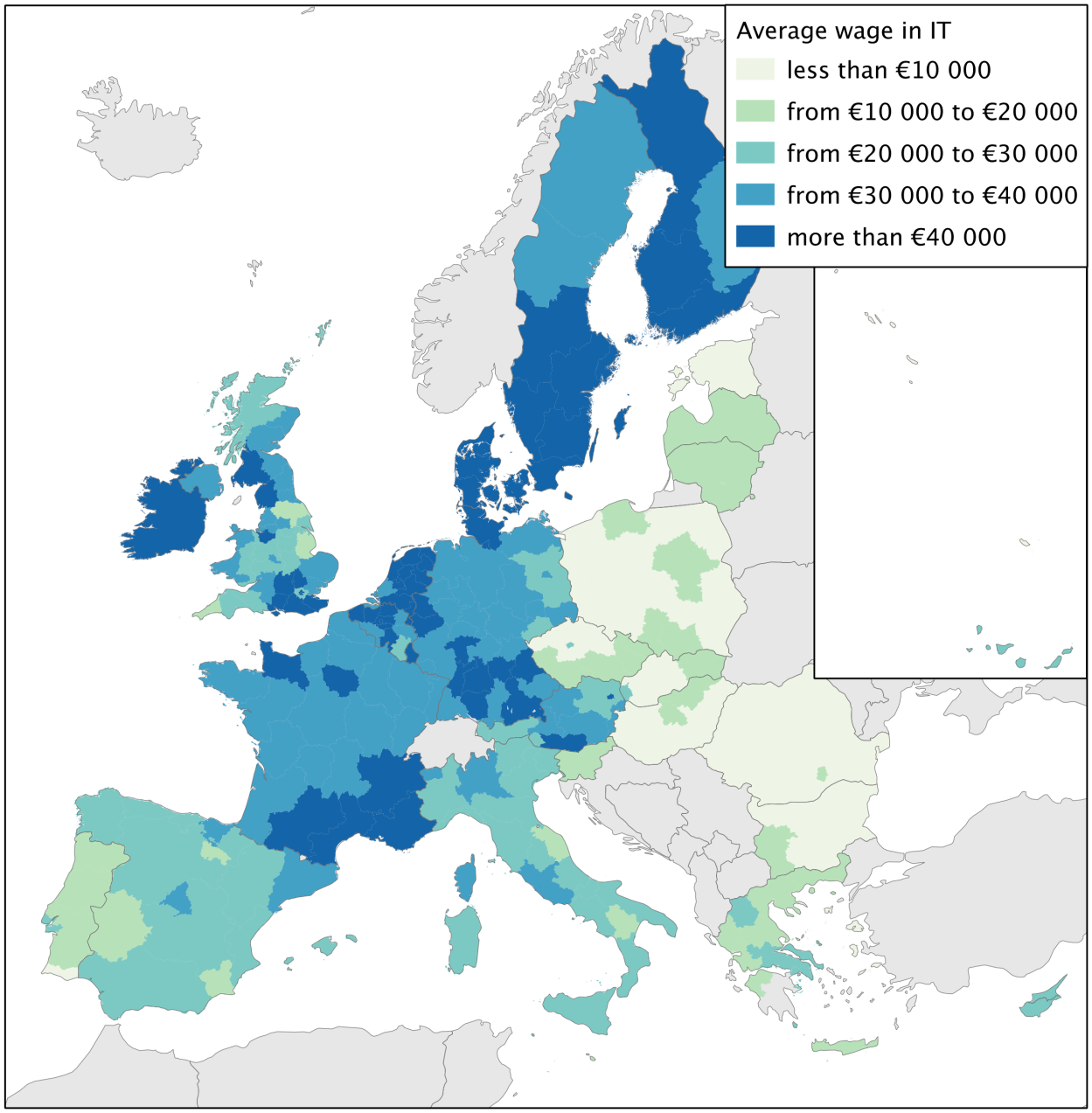
Table 1. Average wage per cluster category in Europe

Aerospace	44,718 €	Paper products	24,995 €
Financial services*	43,930 €	Sporting and children's goods	23,498 €
Biotech	42,384 €	Building fixtures	22,827 €
Pharmaceuticals	40,735 €	Stone quarries	21,183 €
Analytical instruments	39,519 €	Processed food	20,993 €
Chemical products	38,381 €	Construction	20,894 €
Information technology	37,360 €	Construction materials	20,063 €
Oil and gas	36,073 €	Textiles	17,902 €
Telecommunication equipment	35,960 €	Jewelry and precious metals	16,303 €
Production technology	32,371 €	Furniture	16,131 €
Automotive	29,399 €	Leather products	15,594 €
Plastics	29,066 €	Maritime	14,274 €
Medical devices	28,928 €	Tourism and hospitality	13,961 €
Power generation and transmission	28,927 €	Agricultural products	13,852 €
Lighting and electrical equipment	28,767 €	Tobacco	13,567 €
Transportation and logistics	27,462 €	Education and knowledge creation	13,132 €
Heavy Machinery	26,393 €	Apparel	11,885 €
Metal manufacturing	26,269 €	Footwear	11,238 €
Business services	25,964 €	Entertainment	11,034 €
Distribution	25,888 €	Farming and animal husbandry	3,859 €
Media and publishing	25,556 €		

** Financial services data only reflect 75 out of 255 regions that provided such information in Austria, Bulgaria, Finland, France, Hungary, Latvia and Slovenia.*

Figure 1 then shows how wages differ across regions within cluster categories, taking the Information Technology (IT) cluster category as an example. Even though there is a general trend of wages being higher in some countries than in others, there are also marked differences within some countries. In large countries like the United Kingdom and Germany but also smaller countries like Belgium average annual income within the IT cluster varies by more than 20 thousand Euros depending on the region.

Figure 1. Average wage in IT sector in Europe



Source: European Cluster Observatory

The simplest way to analyze the effects of regional specialization on average wages is to define a regression model using the (log of) average wage as the outcome variable and controlling for regional and sectoral fixed effects. The predictor variables can vary depending on the broadness of a sector they represent (a single industry or the whole cluster), and how they are defined (number of employees, share of regional employment, or location quotient). Fortunately, the second dimension is largely irrelevant as due to the log-based model specification, the terms related to a region or an industry as a

whole are captured by the fixed effects and thus we can concentrate on exploring the effects of the sectoral scope.

The results of the models are presented in Table 2 with the first one only including the fixed effects (the observations represent combinations of 4-digit industries and NUTS 2 regions). It is evident that region and industry properties are extremely important in explaining the difference in wages in Europe: combined they explain 85% of variation (with regions accounting for 68% and industries for 28% when used separately).

However, the focus of this study is to quantify the effects of specialization and we start by including a measure of employment in a given NACE 4-digit industry (Model 2). This does not dramatically change the explanatory power of the model, however the coefficient for employment is highly significant and suggests that the elasticity of wages with respect to employment localization in an industry is approximately 2.9% (we will discuss the interpretation of the magnitudes of coefficients in a latter section).

Table 2. The effects of localization on industry-level wages

	1	2	3	4	5
log(industry localization)		0.029[a]		0.007[a]	0.021[a]
		(0.001)		(0.002)	(0.002)
log(cluster localization)			0.055[a]	0.048[a]	
			(0.002)	(0.003)	
log(cluster localization outside industry)					0.027[a]
					(0.002)
R^2	0.854	0.855	0.856	0.856	0.855
Adjusted R^2	0.852	0.853	0.855	0.855	0.854

[a] significant at <0.01 level. All models include a constant as well as industry and region indicators. The number of observations is 59 067, which includes traded industries and region/industry combinations with at least 10 employees. The observations are weighted according to the number of employees in a region/industry combination.

Changing the model to instead include the effects of the employment in a cluster that contains a given industry (Model 3) gives striking results: the coefficient is considerably larger at 5.5% suggesting that being part of a strong cluster increases the wages in in an industry more than simply being part of a concentrated industry. This is consistent with cluster presence supporting 'high road' strategies

supporting higher productivity and wages, while industry specialization supports only economies of scale.

To compare the relative importance of these effects, we include both in the same model with two different specifications for cluster effects: one including all the industries in a cluster and one only including the industries in a cluster other than the industry of the observation (Models 4 and 5). The results suggest that both effects have approximately the same magnitude and whichever is larger depends on how cluster effects are specified.

These results indicate a clear relationship between wages (reflecting higher labor productivity) and the presence of strong local agglomerations in sets of related industries. They also show that cross-cluster locational factors play a significant role. The cluster theory does indicate the cluster-level performance depends both on underlying cluster-specific business environment conditions and on the strength of the cluster measured by agglomeration alone.

While we do not have an indicator of cluster-specific business environment conditions at the regional level, we can use an indicator of regional business environment quality. The high impact of the location dummy in the results above is consistent with the hypothesis that business environment quality differs more across locations than across clusters within a location. The indicator we use for regional business environment quality is drawn from the dataset of regional competitiveness drivers and outcomes prepared by Orkestra (Franco et al., 2011) and available at the Cluster Observatory website. It is a composite measure taken by averaging the normalized contributions of 12 variables covering the local business environment such as education, research, use of internet and social capital[vi].

Figure 2 plots the measures of regional business environment quality against an overall indicator of cluster presence, which we measure by the share of the regional wage bill generated in strong clusters (Chapter three discusses this indicator in more detail). The correlation between these two indicators is insignificant (and negative): Clusters exist at all levels of business environment quality and this economic development. Clusters are potentially an additional factor driving economic outcomes, not a purely endogenous mechanism. We then explore these effects by comparing the strength of cluster effects in regions with high versus low levels of business environment quality. We rank all regions by business environment quality, and then select the first and the fourth quartiles respectively to create subgroups of ‘low’ and ‘high’ quality business environments.

Figure 2. Business environment and cluster portfolio strength

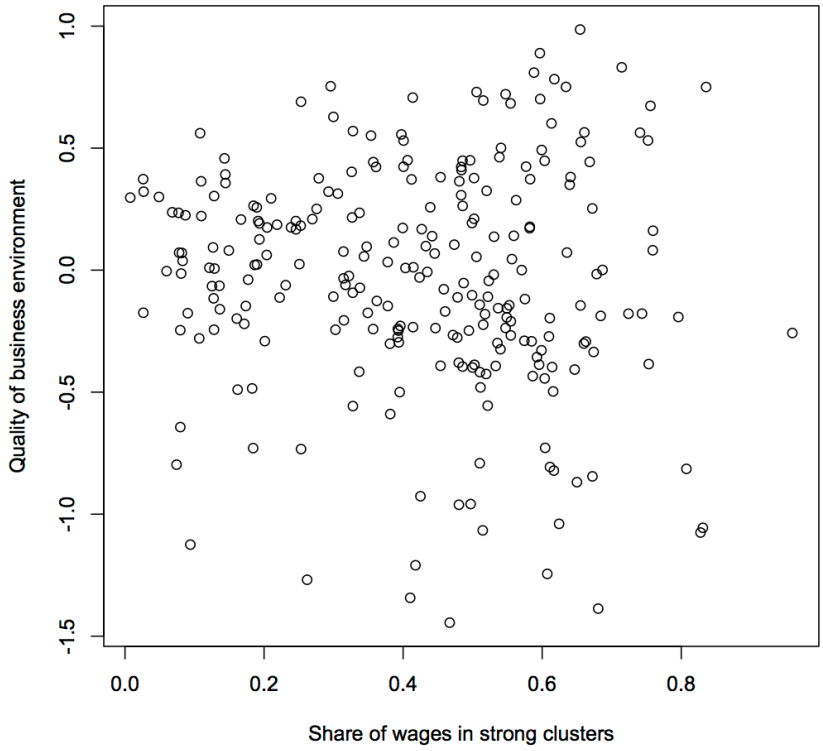


Table 3 shows that in all cases the cluster effects are considerably larger in the regions with top business environment, by about 50% compared to the general case. There is also a symmetric decline for the regions with poor business environment: the strength of the agglomeration effects is decreased by a third. This indicates that clusters enhance a region's ability to translate business environment qualities into economic performance.

Overall, these results indicate that cluster strength has an independent positive impact on wages. This impact is stronger for clusters than for narrow industry specialization alone. And it is increasing in the quality of the business environment. The results are consistent with specialization providing benefits, and with clusters supporting 'high road'-competition based on high productivity and high wages. The results also indicate that clusters are not endogenous to business environment quality, but also not a similarly independent driver of economic performance: they are best understood as a facilitator that leverages business environment quality into higher economic outcomes.

Table 3. The effects of localization on wages depending on business environment

	Top business environment			Bottom business environment		
	1	2	3	1	2	3
log(industry localization)	0.055[a]		0.043[a]	0.028[a]		0.020[a]
	(0.003)		(0.003)	(0.003)		(0.003)
log(cluster localization)		0.090[a]			0.055[a]	
		(0.004)			(0.005)	
log(cluster localization outside industry)			0.044[a]			0.026[a]
			(0.004)			(0.005)
R^2	0.734	0.736	0.736	0.859	0.860	0.860
Adjusted R^2	0.726	0.728	0.729	0.855	0.860	0.860

[a] significant at <0.01 level. All models include a constant as well as industry and region controls. Top and bottom business environment groups correspond to fourth and first quartiles respectively and contain 14 362 and 13 800 observations respectively. The observations are weighted according to the number of employees in a region/industry combination.

c. Interpreting the size of the cluster effect

Our results so far suggest that the effects of cluster presence are important in addition to the effects of agglomeration in individual industries, and that the elasticity of both of them relative to wages is on the order of several percent. This is in line with most recent studies that attempted to quantify the magnitude of the effect of density and localization (Table 4). While the first estimates put this effect at as much as 27% (Shefer, 1983), the current consensus is that these effects lie in the range of 1-5%. Recent studies using detailed microdata on plant or individual level are in line with this trend (Combes et al., 2010; Protsiv, 2012).

This effect might appear fairly small as it implies that doubling of specialization will result in an effect of a few percent on the wages. However, differences in specialization are indeed rather large across locations so that a doubling of specialization from one place to another is not unrealistic. For example, the most specialized cluster in Europe with at least 5 000 employees is Oil and Gas in Aberdeen, United Kingdom. The LQ of this cluster is 33.5, which could increase productivity by 94% compared to an average region if we take a conservative estimate of cluster effect at 2%, and by more than 500% if we assume the effect to be 5.5% as in our model in Table 1.

Table 4. Estimated effects of density on productivity

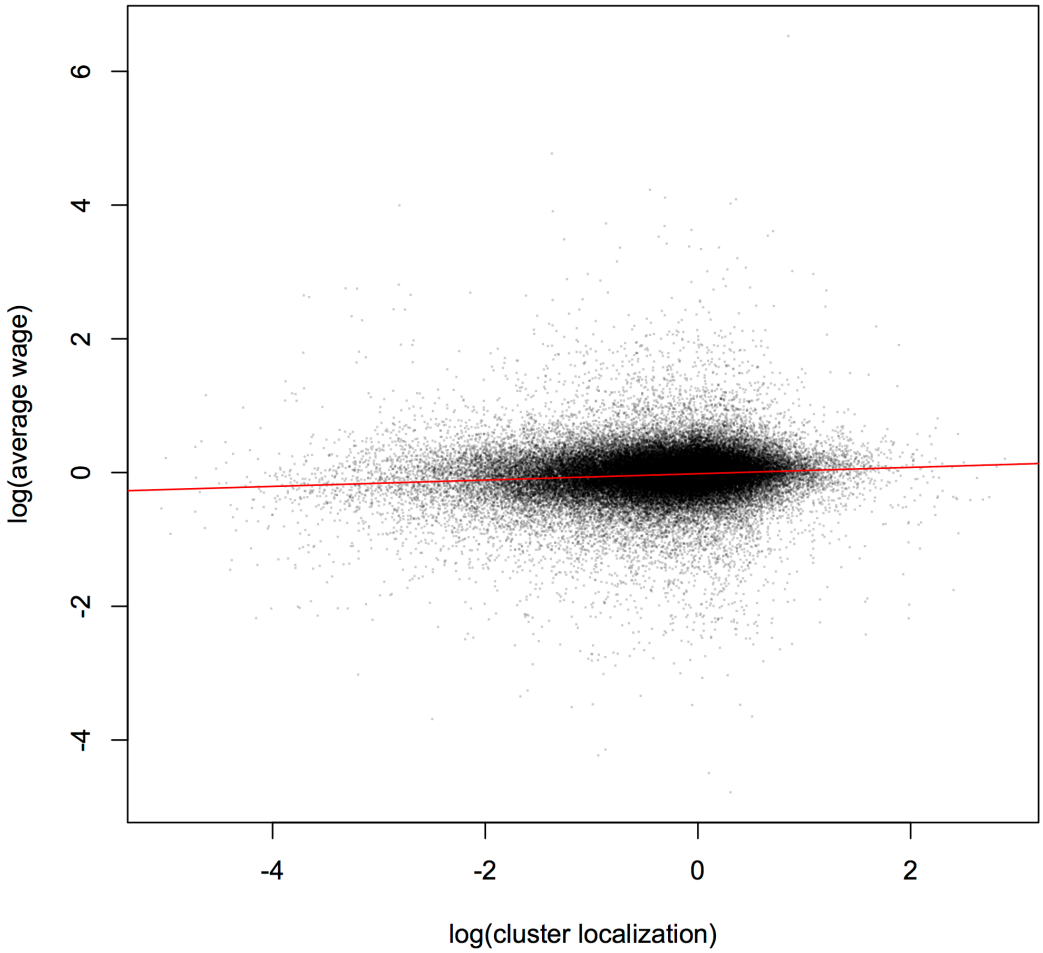
Study	Dependent variable	Explanatory variable	Level of analysis	Estimated elasticity
Shefer (1973)	Value Added	Population	SMSA[a] in US	14-27%
Sveikauskas (1975)	Value Added	Population	SMSA[a] in US	6%
Segal (1976)	Value Added	Population	SMSA[a] in US	8%
Moomaw (1981)	Value Added	Population	SMSA[a] in US	2.7%
Ciccone & Hall (1996)	Gross State Product	Density	Counties and states in US	6%
Combes et al. (2010)	Wages, TFP[b]	Density, Market Potential	Individuals aggr. to prov. in France	2-3.5%
Protsiv (2012)	Wages	Density/Population	Plants	1.5-3%

[a] Standard Metropolitan Statistical Area, [b] Total Factor Productivity

Table A1 in the appendix presents more details on the distribution of LQs in each of the cluster categories[vii] and highlights that in the majority of sectors top 25 regions (approximately top 10%) have location quotients above two suggesting that the effect of localization on wages could be substantial.

Thus, even seemingly small effects could become significant due to the extreme variation in specialization across space. The estimates we obtained in this study are strongly significant and the positive slope of the regression line in Figure 3 suggests a positive relationship between the strength of local clusters and average wages leading us to believe that clusters increase productivity and could support regions on a high-road path to competitiveness.

Figure 3. Average wage and cluster localization



Both measures were normalized by region and industry, i.e. they represent residuals of regressing the raw variable on these two sets of indicators. The slope of the line in the plot is 0.047 and is highly significant.

d. Key findings

In this first section, we have deployed a new dataset on European regions to establish that specialization is significantly correlated with wages. We show that both the agglomeration in narrow industries and the agglomeration in clusters of related industries matter. The prior is consistent with the presence of economies of scale, the latter of cluster dynamics. We also show that locational factors, in particular business environment quality, are important. The effect of cluster presence on wages is increasing in the quality of business environment conditions. And we show that the size of the cluster effect is meaningful given the significant differences in cluster-level density across locations.

For the New Growth Path analysis, these findings establish the importance of clusters for narrow economic performance. Our conceptual framework suggests that clusters make it more likely that a high road equilibrium emerges in which companies achieve higher productivity and pay higher wages. Clusters are shown here to be correlated with higher wages than specialization in narrow industries alone. This is consistent with clusters supporting a high path-equilibrium, but not conclusive: these results could also reflect standard cluster dynamics that occur in all scenarios. The next section tries to provide more clarity on this relationship, adopting a regional perspective.

3. Regions, New Growth Path Performance, and the role of clusters

The New Growth Path ultimately has to affect the reality of entire locations, not just of individual clusters. In this section, we thus take a locational perspective. We aim to classify subnational regions by their performance relative to the objectives outlined by the New Growth Path, and then look at the role that clusters play in relation to these different outcome patterns.

a. Existing literature and research approach

The literature on economic performance differences across locations has traditionally focused on nations as the unit of analysis (Porter, 1990; Hall and Jones, 1999). Nations are also relevant for the New Growth Path-related analysis: there are significant differences in New Growth Path-performance across nations, and national policy makers control many important tools that affect the adoption of practices in line with this approach. For our analysis, however, the level of subnational regions (which we call 'regional' in the remainder of this paper) is more relevant. The cluster-level dynamics that are at the focus of our work occur at the level of regions, not nations. Nations are more appropriate for studying the general contextual policies under the control of government, i.e. policies affecting the relative price of energy and population or rules and regulation affecting the functioning of labor markets. Regions are more relevant for the microeconomic factors that drive the systemic interaction among firms.

Economic performance as measured by traditional indicators like GDP per capita differs widely across regions. The recent literature on regions has focused on the interplay of factor inputs, in particular human capital, location in terms of neighbors, and different types of institutional qualities (social fabric, social capital, etc.) as drivers of these performance differences (e.g., Dettori et al., 2010; Rodríguez-Pose/Crescenzi, 2008). Institutional qualities of different kinds are found to be critical for a region to benefit from factor inputs and positive spillovers from adjacent regions (e.g., Rodríguez-Pose/Storper, 2006). These empirical studies are based on a number of conceptual approaches like regional innovation systems, learning regions, and the creative class (e.g., Cooke, 2001; Asheim/Gertler, 2004; Florida, 2002). The literature on cities and the new economic geography (Glaeser, 2011; Jacobs, 1961; Fujita et al;. 2001) adds an important perspective by studying the impact of agglomeration on these dynamics.

Particularly relevant for our work here are studies that focus on the role of clusters on regional economic performance (e.g., Porter, 2003; Delgado/Porter/Stern, 2012). As the literature on cities/new economic geography, these contributions look at the impact of local spill-overs and other linkages. But their hypothesis is that these linkages occur at the cluster level, i.e. between a set of related industries, not the entire regional economy. This focuses the interest on differences in composition across regions, not so much on differences in the density of economic performance.

A number of existing empirical studies look at all three dimensions, i.e. the quality of economic fundamentals including institutions, the degree of urbanization, and cluster strength (Lall/Mengistae,

2005; Carlino/Hunt, 2007; Brülhart/Mathys, 2008; DeGroot et al., 2008). There is no clear consensus across these studies but the overall evidence suggests that all three play an independent role.

Over the last few years, a new literature has emerged that documents broader measures of economic performance differences across locations, capturing more New Growth Path-related aspects (Porter et al., 2013; WEF, 2012; SolAbility, 2012; OECD, 2012; Yale, 2012). This work is almost exclusively focused on nations, not the least because of the significant challenges in data availability that exist. It also remains so far concentrated on measuring rather than explaining performance differences across regions.

Our ambition is to extend the existing work in a very specific way: We want to extend the analysis of New Growth Path-performance to regions, and learn about the possible role that cluster strength and the pattern of cluster portfolios have in this context.

At a first step, we develop indicators that capture New Growth Path-consistent performance at the regional level for the three pillars of economic prosperity, environmental sustainability, and social inclusion. This is a complex task given the existing data limitations, especially at the regional level. We then group regions by their level of performance across these three dimensions and create a composite indicator of New Growth Path-performance. Finally, we include indicators of cluster portfolio strength alongside other variables in an empirical model to explain the performance observed. We also document the types of cluster categories typically present in different groups of regions.

b. Regional New Growth Path performance

Assessing the New Growth Path performance of European regions requires quantification of each of the main pillars: economic prosperity, social inclusion and environmental sustainability. As there was no readily available regional indicator for these concepts, we have constructed our own definitions based loosely on the way Eurostat defines these dimensions as part of Sustainable Development Indicators.[viii]

Each of the indicators is a composite measure composed of four individual variables selected to capture the properties of the respective phenomenon from several sides. The main reason for choosing a composite indicator is that the three concepts are complex and multi-dimensional and are thus hardly possible to be captured by a single variable. In addition, having a single measure for each of the pillars greatly simplifies the interpretation of the results and makes subsequent analyses manageable.

The methodology for constructing the indicators was the same in all cases: we first explored a wider set of variables and chose the four final ones based on their coherence with the overall concept and at the same time not capturing the same thing. Data availability was also an issue, in particular in the case of sustainability indicators, and will be discussed further in the text.

Once the theoretically consistent set of variables was chosen, we proceeded with testing the quality of resulting indicators according to the recommendations of the OECD (2008). In particular, all measures

were well-correlated with their combination's first principal component and were all pointing in the same direction.

The variables were pre-processed by first log-transforming (to have less skewed distributions) and negating them if necessary (so that the high values of the variable always correspond to high values for the broader concept). We then standardized the variables by subtracting the mean and dividing by the standard deviation, so that the variables are directly comparable to each other. This method of normalization was chosen instead of, for example, putting the values in the 0 – 1 range based on minimum and maximum to reduce the influence of potential outliers and to have an intuitive interpretation that a region that is better than average has positive values and correspondingly for the negative ones.

Finally, the indicator was created by combining the regions' values in the four variables. Since there was no theoretical foundation to choose any specific weights for indicators and using data-based weights (such as contributions to the principal component) would result in weights changing as new data is added, we chose to use equal weights resulting in a simple arithmetic mean of the four indicators.

Economic Prosperity

One of the main indicators of social progress is economic prosperity. It has been traditionally measured with output-based indicators, such as GDP per capita, though recently this approach has been called into question (Stiglitz et al, 2009). For example, in countries where the income distribution is very skewed or a large share of profits gets repatriated by foreign firms, there might not be a visible increase in people's prosperity even as the GDP per capita increases if the results of this increase are largely appropriated by a few individuals or organizations.

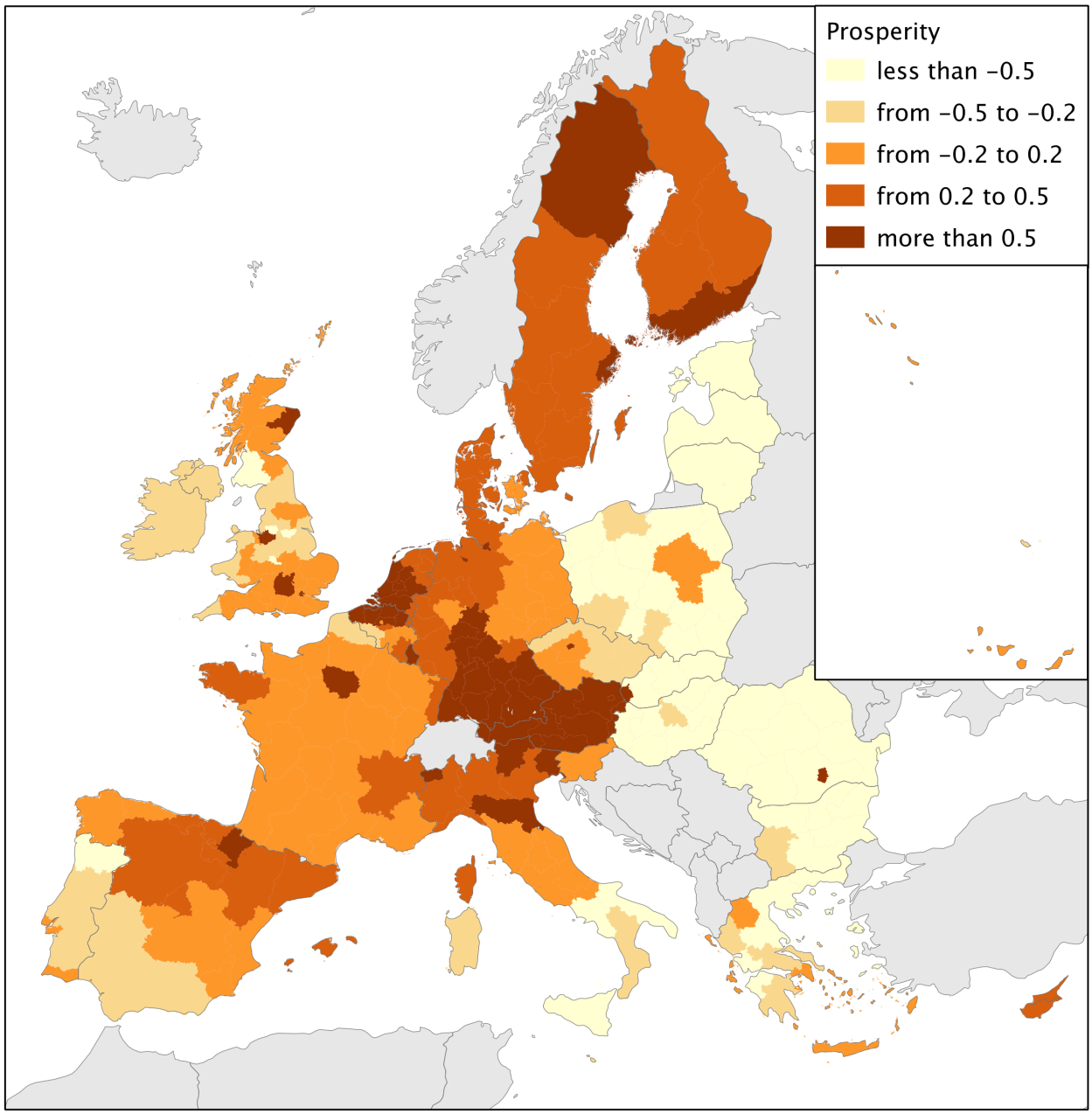
Nevertheless, *GDP per capita (PPP)* remains a key indicator of economic performance, as it is a measure of the total output of the economy the results of which are shared among all citizens. It is thus an integral part of economic prosperity and was incorporated as one of the variables.

A better measure of the well-being of people in a region should take into account the household perspective and focus more on income rather than production. In our framework this is captured by *Disposable Income per capita (PPP)*, which takes into account the incomes receivable and payable to the rest of the world.

Future growth of the region is conditioned on high productivity in the region. We measure this using *Gross Value Added per Hour Worked* to measure the productivity of labor and to take into account the actual number of hours worked as the typical length of a working week could vary a lot among regions.

Finally, economic prosperity depends on population's participation in labor force as unemployed citizens face lower quality of life and increase the burden on society. We capture the society's ability to involve all available labor resources by using the *Long-term Unemployment Rate* that covers individuals that have not been employed for the past 12 months.

Figure 4. Economic prosperity in EU-27



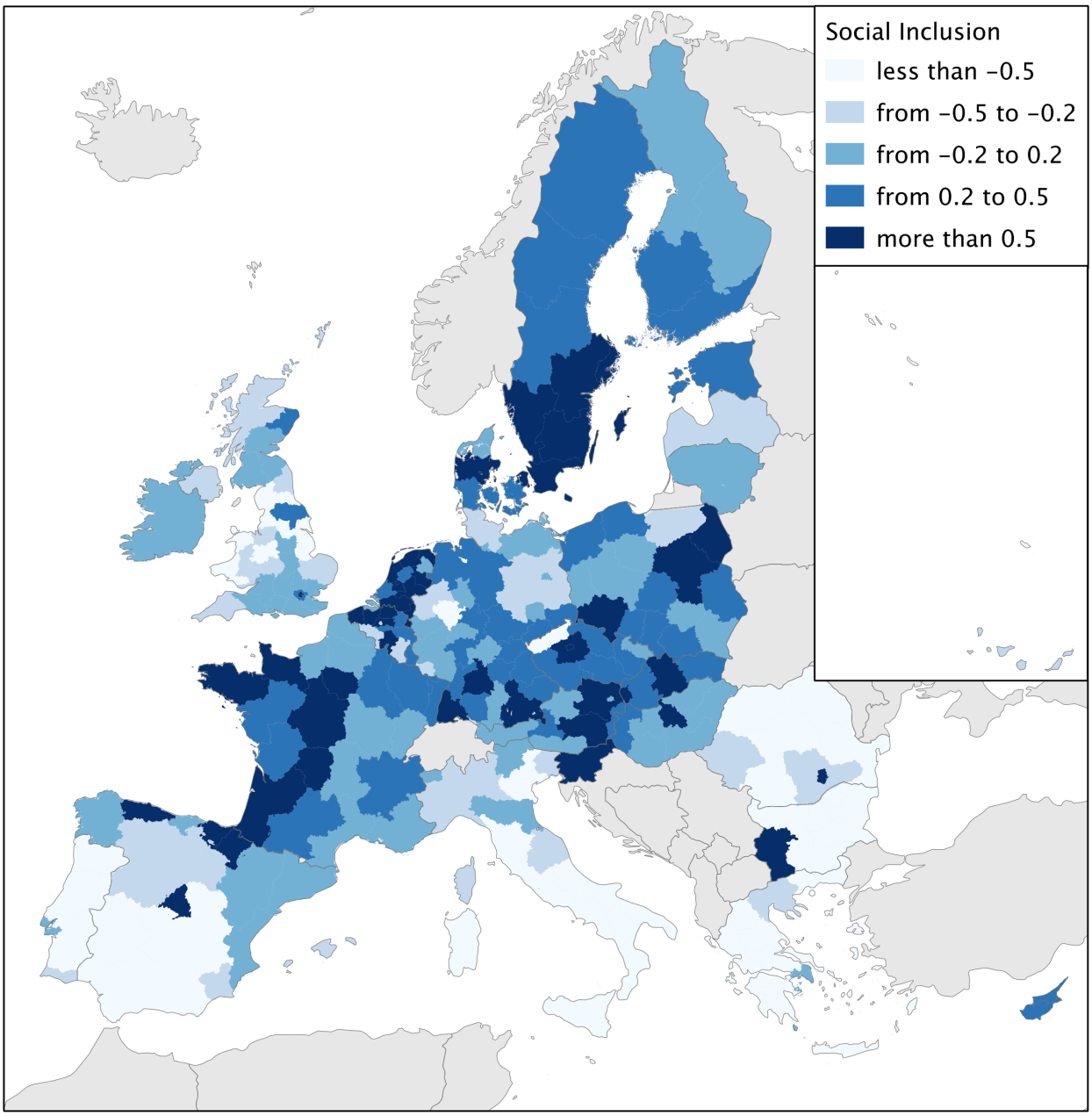
Original Data Source: Eurostat. The values represent the deviations from the mean and the cutoff points roughly correspond to the quintiles of the distribution.

Combining the variables as described before to form a single indicatorix reveals a largely expected pattern: the most prosperous regions are in the area stretching from Benelux to Northern Italy, as well as in Scandinavia and in almost all capital regions. On the other hand, most of Eastern and Southern Europe scores poorly on this indicator. Perhaps more surprisingly, many non-central regions of the UK also score rather poorly, mostly due to low scores on long-term unemployment.

Social Inclusion

The second set of indicators conceptualizes social inclusion in terms of avoiding discrimination based on gender, age, income and other factors. The well-being of the society is assumed to depend disproportionally on the well-being of its more vulnerable segments (Council of Europe, 2008).

Figure 5. Social inclusion in EU-27



Original Data Source: Eurostat. The values represent the deviations from the mean and the cutoff points roughly correspond to the quintiles of the distribution.

The primary measure of social inclusion is the *Share of People at Risk of Poverty* since it is harder for people living below the poverty threshold to be contributing members of the society. The threshold for this variable is at 60% of median disposable income.

Another key dimension of social discrimination is the difference between men and women along multiple measures. In this paper we are using the *Relative Difference in Employment between Men and Women* as the indicator of gender equality.

High workforce participation is critical for the sustainable development of a region and one of main ways to increase this measure is to involve the youth. Thus, we use the measure of *Youth Unemployment* as a gauge for the ability of society to involve all potential workers regardless of age and reduce the negative impacts of initial unemployment on the future prospects of individuals.

The last measure is concerned with education, critical to promote sustainable development. We use *Tertiary Educational Attainment among People Aged 30-34* that captures the potential of individuals to obtain a high-skilled job based on the knowledge and competencies obtained though tertiary education.

The composite measure[x] highlights a clear divide between the North and South of Europe as almost all regions in the Southern third (with exception of Madrid, Northern Spain, Sofia and Bucharest) scoring below average on social inclusion. This is mostly due to very poor performance in terms of gender equality and education attainment. Conversely, relatively poor performance in parts of the UK is mostly due to a large share of people living below the poverty line suggesting large income disparities.

Environmental Sustainability

The final set of indicators covers the environmental sustainability of production and consumption of the economy. Taking the carrying capacity of ecosystems into account and assessing the environmental impact of economic activity is crucial for the analysis of how balanced a region's development is.

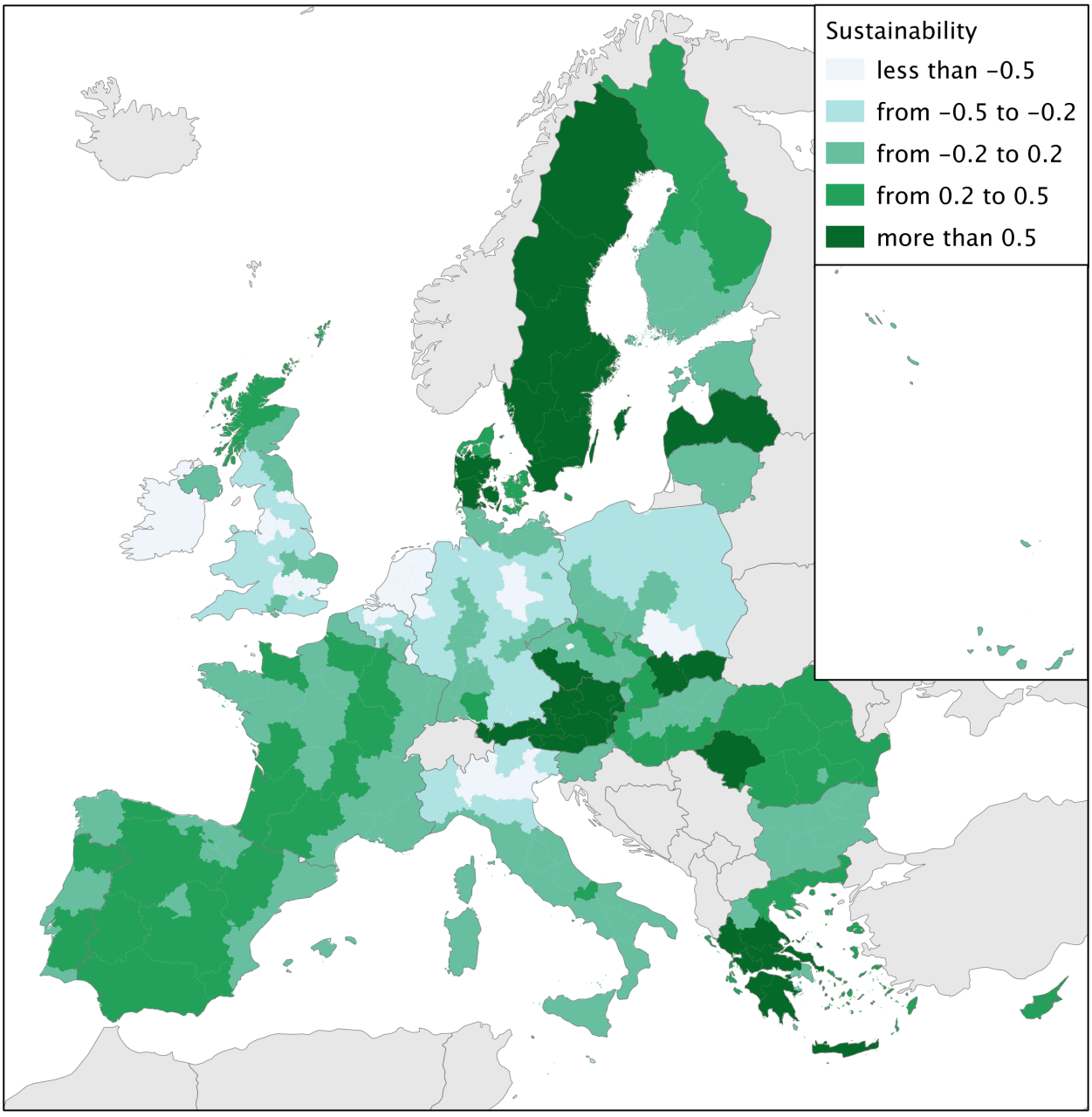
A key factor of sustainable development is energy use best represented by the *Share of Renewables in Gross Final Energy Consumption*. As most of the traditional fossil fuels are in limited supply, using renewable energy is paramount to ensuring the sustainable development of a region. The energy sources covered by this definition include hydro, geothermal, wind and solar power, biomass and the biodegradable fraction of waste.

In addition to sustainable use of energy, the way the land resources are used is of prime importance for sustainable development as overburdening the environment could have drastic consequences for the society. This is measured within our framework by the *Share of Land Use with Heavy Environmental Impact*, which includes land used for industry, mining and transport.

Sustainable development also requires less wasteful production processes and better recycling practices. We capture this by the *Non-mineral Waste Treatment per capita*, which excludes mineral wastes since they are heavily dependent on the industrial composition of the economy. Ideally, we

would like to have a measure of waste generation, not treatment, however that was not available on regional level and we opted to use a fairly well-correlated measure of treatment instead.

Figure 6. Environmental sustainability in EU-27



Original Data Source: Eurostat. The values represent the deviations from the mean and the cutoff points roughly correspond to the quintiles of the distribution.

The final indicator is the main variable used to measure the effect of the economy on climate: *Greenhouse Gas Emissions per GDP*. The effects of climate change on the economy and well-being of people could have drastic consequences at global level and reducing the emissions is one of the key goals of the sustainable development program.

Unfortunately, the availability of regional indicators was severely constrained for environmental sustainability variables and thus the only one measure available for NUTS 2 regions in land use. Waste treatment is defined on NUTS 1 level and recycling and greenhouse gas emissions are both only available on the national level.xi Due to these constraints, and the uncertainty in the quality of measuring the effects on environment in general, this measure is the weakest of the tree, but we believe it captures the overall level of environmental sustainability.

The patterns of environmental sustainability vary more coarsely than the other two indicators due to lower granularity of data. The most notable feature is very poor performance of the Benelux countries as they score far below average in all four constituent variables. Less drastic, but still poor, performance also appears in Germany (aided by above-average share of renewables) and UK (good land use). On the other hand, most Southern countries as well as Sweden, Austria, Latvia and Lithuania score very high on this indicator with Latvia being the strongest performer.

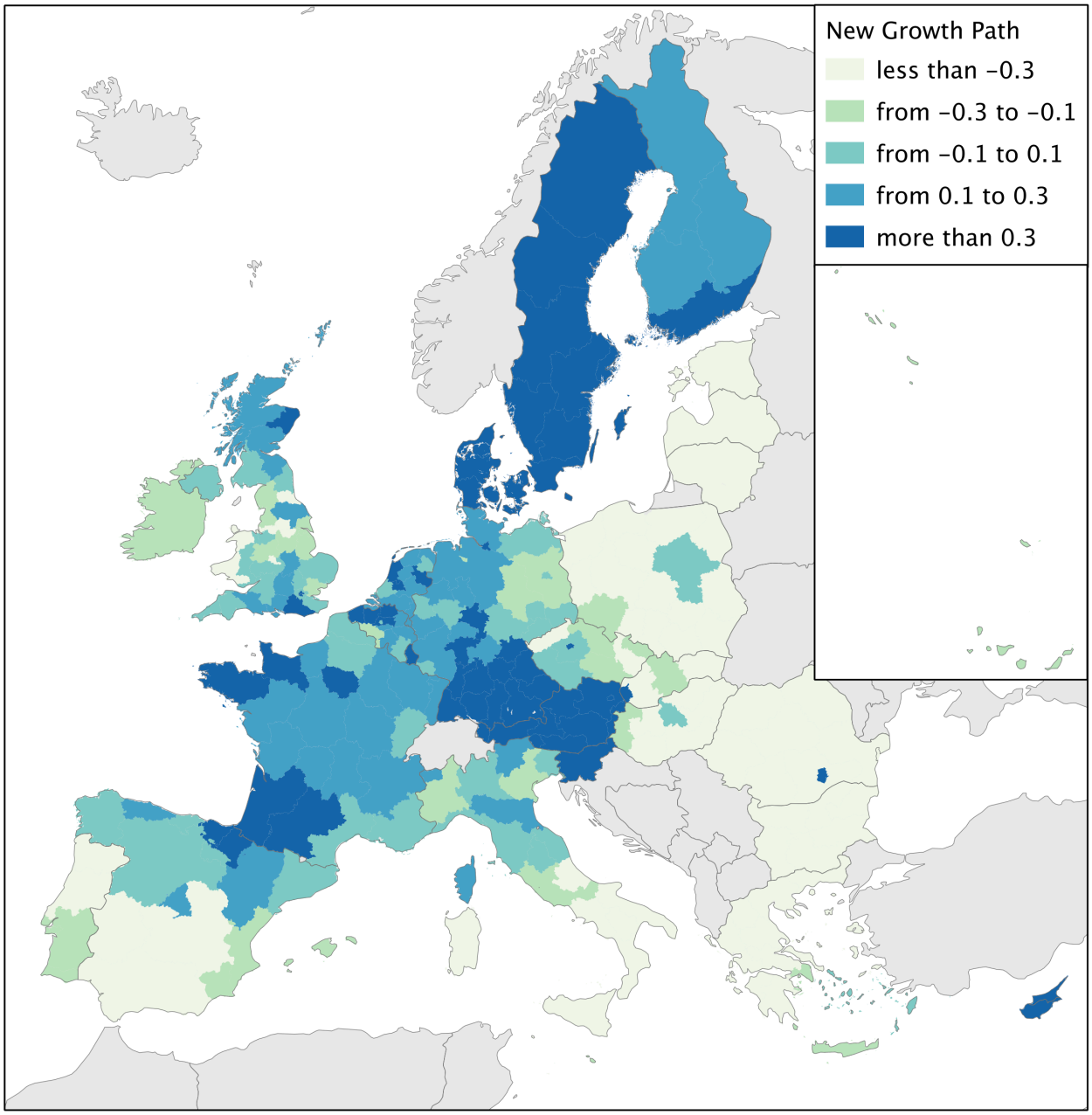
New Growth Path indicator

The next step is to combine the three pillars together to obtain the overall New Growth Path indicator. As the variables involved capture three different sides of regional development, we can construct a composite indicator in the same way as we did for individual pillars. To express the New Growth Path performance as a single number we simply average the three components. Since all the individual measures are already centered, the bias does not pose a problem. However despite them having slightly different variances we decided to not further renormalize the components to have equal contributions from each factor. Thus, in effect, the New Growth Path measure is an average of all twelve variables that constitute the individual pillars.

The resulting pattern highlights that the strongest performers are located in Scandinavia, Central Europe and the regions around the Bay of Biscay (see Appendix 2 for the full data summary). The three strongest countries by far are Sweden, Austria and Slovenia while Malta, Bulgaria and Greece are on the other side of the spectrum. Perhaps the most surprising feature is the relatively poor performance of the United Kingdom with only London, Brighton and Aberdeen in Europe's strongest quintile. Among the larger countries, only Sweden and Austria show consistently good performance (while Greece and Bulgaria are consistently poor). The most typical pattern is that the capital regions perform much better than the rest of the country (Romania, Slovakia, Poland, Czech Republic and Hungary). The exceptions to the rule are Germany, Italy and the Netherlands, which are all relatively decentralized countries with strong regions. Figure 7 graphs the distributions of NGP performance across regions. The patterns that emerge are remarkably similar to the patterns of competitiveness in the Regional Competitiveness Index (Dijkstra et al., 2011). Capital regions are also pronouncedly better performers and even the countries

where the best region is not a capital are similar in both indexes, though it is more common for the New Growth Path indicator. In addition to Germany, Italy and the Netherlands, top-performer is not a capital also in Austria, Belgium, Denmark, Greece and Spain, though in most countries the capital comes at the second or third place.

Figure 7. New Growth Path performance in EU-27



Original Data Source: Eurostat. The values represent the deviations from the mean and the cutoff points roughly correspond to the quintiles of the distribution.

Figure 8 plots the aggregate New Growth Path score per region against average GDP per Capita (PPP) per region. There is clearly meaningful correlation between the two concepts; not surprising given that GDP per capita (PPP) is one of the components of the New Growth Path composite. But there are also clear differences, especially for regions with higher levels of both GDP per capita and New Growth Path performance. This is consistent with a no road/low road/high road perspective: poor performance affects all dimensions of outcomes but good performance can be achieved through different paths that can be ranked from a New Growth Path perspective.

Figure 8. New Growth Path performance and GDP per capita

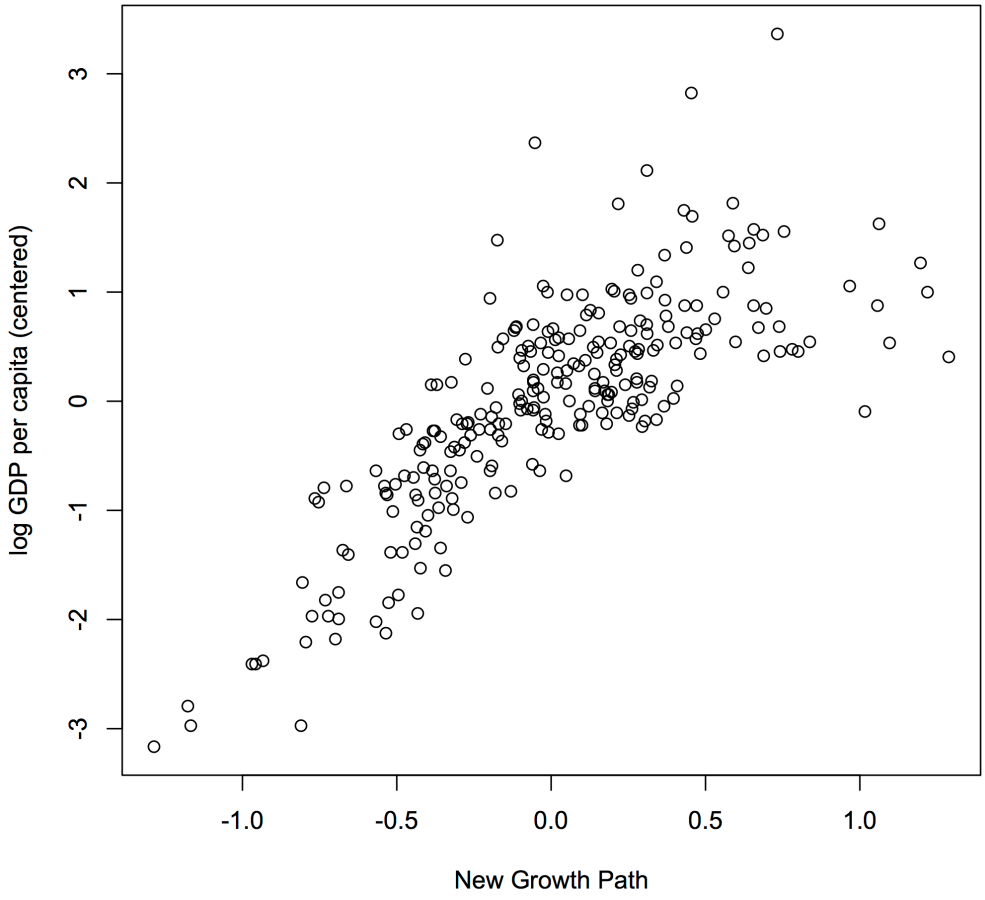


Table 5 provides descriptive statistics on the components of the New Growth Path indicators. The indicators available are also a reminder how challenging at is given the data available to appropriately track whether or not companies decide to compete on a high or low road-strategy. Company behavior is most likely to affect all of the prosperity indicators, with gross value added the most directly driven indicator. Company behavior may also affect gender differences in employment, youth unemployment, and greenhouse gas emissions. But other factors will drives these indicators at least as much. And the

additional indicators used are only tangentially driven by company decisions. The New Growth Path indicator is thus a relatively indirect way to track low or high road-strategies.

Table 5. Descriptive statistics on the components of the New Growth Path indicator

Indicator	Median	Mean	Std Dev
GDP per capita (PPP)	22800	23592	9075
Disposable Income per capita (PPP)	14820	14103	4119
Gross Value Added per Hour Worked	31.86	29.68	13.63
Long-term Unemployment Rate	3.19	3.93	2.70
Economic Prosperity	0.23	0.00	0.86
Share of People at Risk of Poverty	16.50	17.16	6.34
Relative Difference in Employment	3.47	5.34	5.93
Youth Unemployment	21.70	22.62	11.85
Tertiary Educational Attainment, 30-34	34.70	33.54	10.96
Social Inclusion	-0.01	0.00	0.61
Share of Renewables in Gross Final Energy Consumption	10.10	12.52	9.57
Share of Land Use with Heavy Environmental Impact	3.85	5.05	4.19
Non-mineral Waste Treatment per capita	1.04	1.23	0.79
Greenhouse Gas Emissions per GDP	0.81	0.82	0.39
Environmental Sustainability	-0.02	0.00	0.54
New Growth Path	-0.01	0.00	0.45

Source: Eurostat

Grouping regions by patterns of New Growth Path-performance

In the final step of the analysis, we explore whether there are any systematic groupings of regions based on their profile of New Growth Path-performance. We are interested to find out whether these groups then match the predictions of either the no, low, or high growth path scenarios.

Table 6 first shows the simple correlation patterns across all twelve individual indicators and the three composites for prosperity, social inclusion, and environmental sustainability that we create. While the indicators for prosperity and social inclusions point broadly in the same direction, the indicators for environmental sustainability often send the opposite signal. This is consistent with a trade-off between economic activity and environmental sustainability. There are also individual indicators, especially the gender gap in unemployment rates, that have generally weak correlation with other dimensions of New

Growth Path-performance. This suggests that the choices (by policy or by firms) that drive these outcomes are not systematically connected but can be made independently.

Table 6. Correlations among variables and indicators

	GDP per capita	Disposable Income	GVA per Hour	LT Unemployment	Prosperity	Poverty	Gender Equality	Youth Unempl.	Tertiary Education	Social Inclusion	Renewables	Heavy Land Use	Waste Treatment	Greenhouse Gas	Sustainability
GDP per capita	1	0.85	0.86	0.48	0.93	0.44	0.05	0.43	0.5	0.58	-0.11	-0.44	-0.18	0.38	-0.15
Disposable Income	0.85	1	0.91	0.36	0.91	0.27	0.01	0.36	0.41	0.43	-0.22	-0.29	-0.14	0.36	-0.13
GVA per Hour	0.86	0.91	1	0.38	0.92	0.24	0.06	0.38	0.45	0.47	-0.19	-0.33	-0.23	0.4	-0.16
LT Unemployment	0.48	0.36	0.38	1	0.65	0.57	0.03	0.75	0.22	0.64	-0.03	-0.21	0.02	0.28	0.03
Prosperity	0.93	0.91	0.92	0.65	1	0.44	0.04	0.56	0.46	0.62	-0.16	-0.37	-0.15	0.42	-0.12
Poverty	0.44	0.27	0.24	0.57	0.44	1	0.06	0.5	0.12	0.69	0.15	-0.22	0	0.07	0
Gender Equality	0.05	0.01	0.06	0.03	0.04	0.06	1	0.05	0.15	0.52	0.14	-0.02	0.05	0.04	0.09
Youth Unemploym.	0.43	0.36	0.38	0.75	0.56	0.5	0.05	1	0.08	0.67	-0.09	-0.34	0.02	0.1	-0.15
Tertiary Education	0.5	0.41	0.45	0.22	0.46	0.12	0.15	0.08	1	0.55	-0.22	-0.13	-0.36	0.1	-0.28
Social Inclusion	0.58	0.43	0.47	0.64	0.62	0.69	0.52	0.67	0.55	1	-0.01	-0.3	-0.12	0.13	-0.14
Renewables	-0.11	-0.22	-0.19	-0.03	-0.16	0.15	0.14	-0.09	-0.22	-0.01	1	0.23	0.33	-0.09	0.67
Heavy Land Use	-0.44	-0.29	-0.33	-0.21	-0.37	-0.22	-0.02	-0.34	-0.13	-0.3	0.23	1	0.05	-0.13	0.53
Waste Treatment	-0.18	-0.14	-0.23	0.02	-0.15	0	0.05	0.02	-0.36	-0.12	0.33	0.05	1	-0.01	0.63
Greenhouse Gas	0.38	0.36	0.4	0.28	0.42	0.07	0.04	0.1	0.1	0.13	-0.09	-0.13	-0.01	1	0.35
Sustainability	-0.15	-0.13	-0.16	0.03	-0.12	0	0.09	-0.15	-0.28	-0.14	0.67	0.53	0.63	0.35	1

Given the difference in outcomes across these three groups of indicators, we can create groups of regions that have broadly similar patterns of performance across the dimensions of the New Growth Path. We conducted a simple k-means cluster analysis of the regions according to their performance on the three dimensions[xii]. The optimal number of clusters to both highlight the different strategies regions chose and keep the interpretation simple was six.

Figure 9 plots these six groups of regions three times two symmetric matrices that each shows a pair of performance indicators for each region. Table 7 shows descriptive statistics about the regions included in each grouping. Figure 10 finally provides a European map highlighting regions by their respective grouping.

Figure 9. New Growth Path performance groups

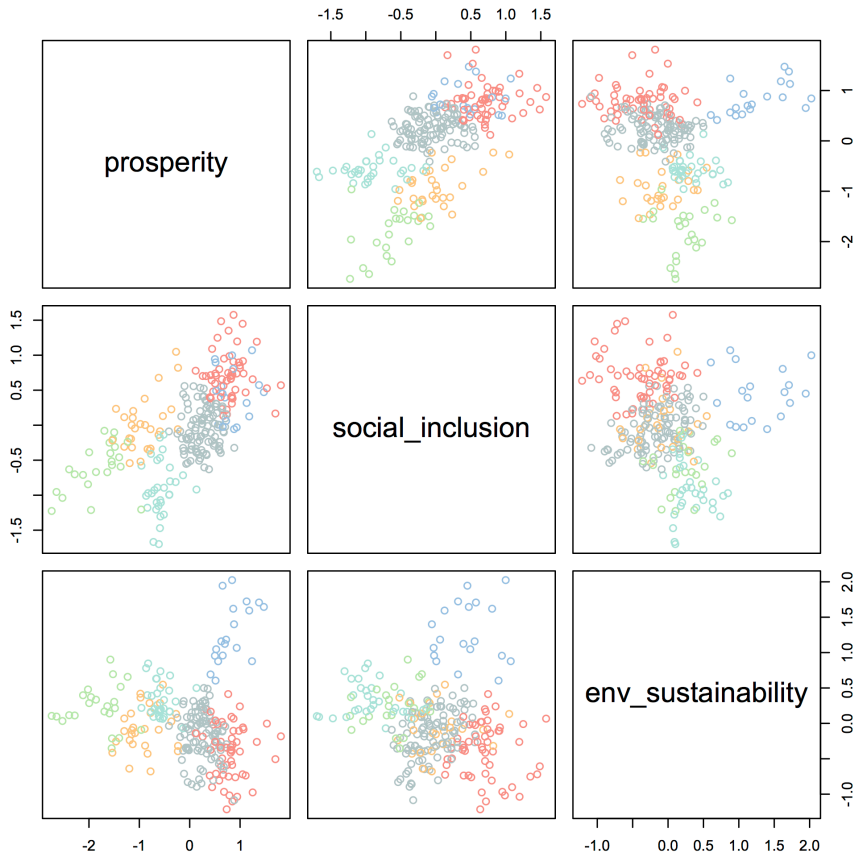


Table 7. New Growth Path group descriptive statistics

Group	Number of regions	Prosperity	Inclusion	Sustainability	Example regions
Group 1	19	0.83	0.44	1.27	Lower Austria, Stockholm, Midtjylland
Group 2	55	0.79	0.71	-0.38	London, Freiburg, Bucharest
Group 3	99	0.26	-0.05	-0.17	Basse-Normandie, Zealand, Cyprus
Group 4	31	-0.57	-0.91	0.33	Murcia, Crete, Alentejo
Group 5	28	-0.90	0.01	-0.07	Warsaw, Slovenia, Budapest
Group 6	23	-1.81	-0.61	0.23	Latvia, Zilina, Timișoara

Group 1 (blue) regions score high on all indicators. This is a relatively small group of advanced regions in Austria, Denmark and Sweden that have both reached a high level of economic performance and show New Growth path performance consistent with a 'high road' strategy.

Group 2 (red) includes a somewhat larger group of regions from the Netherlands, Belgium, Western Germany, Southern Finland, selected parts of the UK and France, and a small number of regions in Italy and Spain as well as the Bucharest region in Romania. They all also achieve high economic performance and register strong social inclusion, but fall behind on the environmental indicators. This is more consistent with a 'low road' strategy, despite the high levels of economic performance.

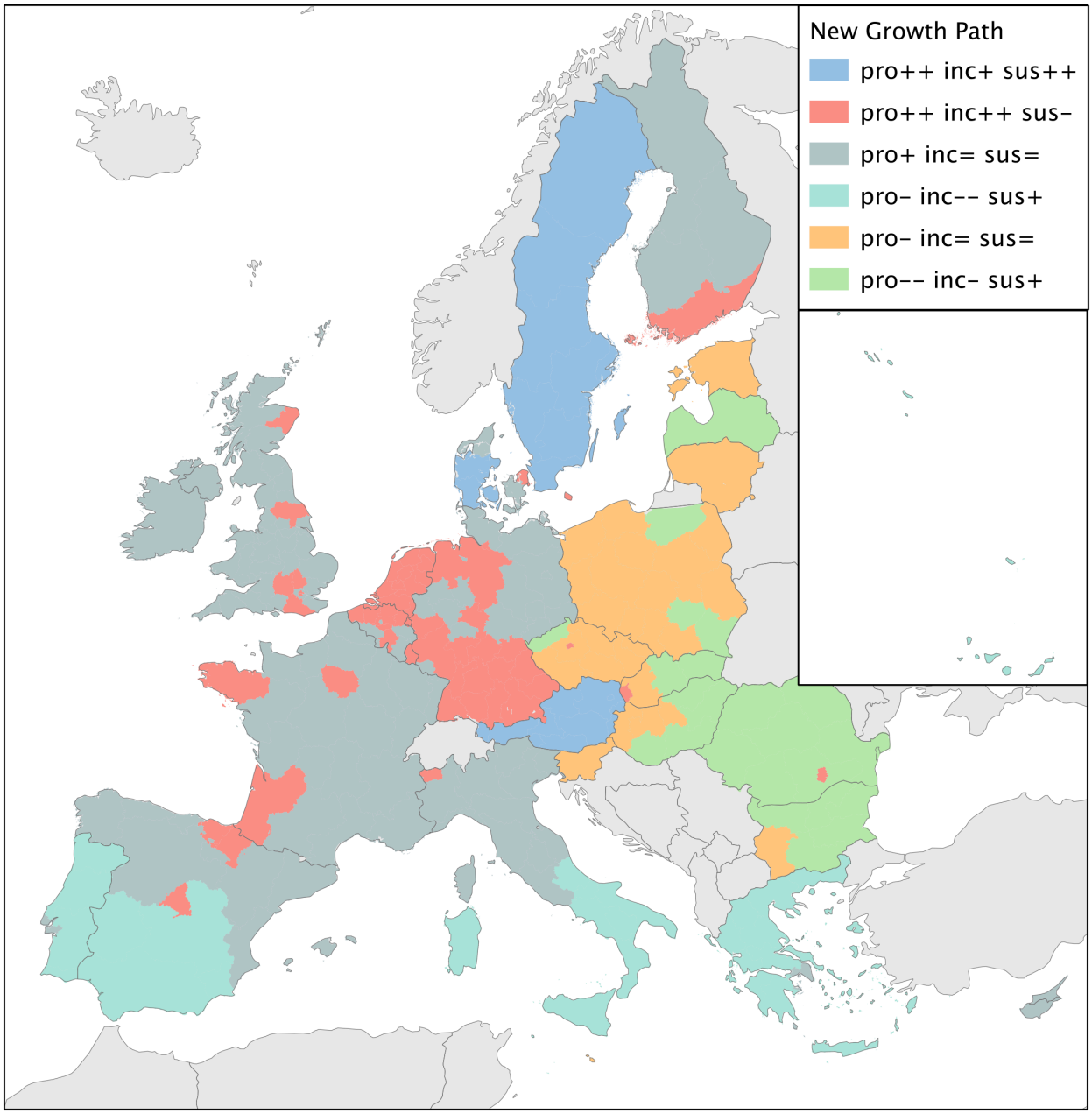
Group 3 (dark blue) includes 40% of all European regions, covering most of the remaining parts of Western Europe. They perform solid and balanced across all dimensions, but seem to be more 'stuck in the middle' without clear patterns of differentiation.

Group 4 (turquois) regions are those in Southern Europe hit hardest by the economic crisis. They rank high on environmental sustainability but worst of all groups on social inclusion.

Group 5 (orange) includes regions in Eastern Europe most clearly on a healthy catch-up path. Their economic performance is still relatively low, but social inclusion better than in groups 3 and 4, suggesting that growth is reaching most parts of society. Economic sustainability is higher than in groups 2 and 3, most likely because of the still lower level of economic activity.

Group 6 (green) includes those regions in Eastern Europe were the catch-up dynamics have not developed in the same way. Economic performance is lower than in all other groups and social inclusion even worse. Environmental sustainability is more positive, but also just a reflection of low economic activity.

Figure 10. New Growth Path regional patterns



The legend describes the average performance of region in each class on the three New Growth Path objectives.

c. Regional New Growth Path performance and clusters

Cluster portfolios in high- and low-performing regions

The presence of strong clusters can be connected to good performance on the New Growth Path measures. We start this investigation by looking at the cluster portfolios of regions that score high and low on NGP measures.

Table 8 compares the strongest clusters among best and worst regions based on their NGP performance. The exact measures used are the leading cluster categories by average log location quotient for the regions belonging to fourth and first quartiles on overall NGP performance.

Table 8. Cluster portfolios depending on NGP performance

Strong clusters in best NGP regions	Strong clusters in worst NGP regions
Biotechnology	Tobacco
Analytical Instruments	Apparel
Finance	Footwear
Sporting Goods	Leather Products
Medical Devices	Farming and Animal Husbandry

According to this measure, high-performing regions (in the NGP sense) tend to have strong clusters in Biotechnology, Analytical Instruments, and Finance. On the other hand, Tobacco, Apparel and Footwear are mostly prevalent in regions that score very low on New Growth Path objectives.

Of course these numbers are purely descriptive and can to a large degree reflect the industrial composition of nations such as Sweden and Austria that are top performers in NGP. Nevertheless, the fact that high-performers support IT and Instruments clusters that are on average 7-8 times more specialized, while only half as specialized in Apparel and Tobacco, suggest that there could be substantial differences among the effects of individual cluster categories on the New Growth Path performance.

Cluster strength and New Growth Path performance

With regions profiled by their New Growth Path-performance, we are now in a position to analyze whether cluster strength is systematically related to these outcomes.

While our previous analysis was focused on individual clusters, we now move to an indicator of cluster strength at the regional level. We first identify clusters that meet predefined cut-off criteria of strength, and then calculate an overall indicator of the strength of the regional cluster portfolio.

The process of identifying strong clusters is based on a methodology used in the latest research on clusters (Delgado et al., 2012). Within each cluster category we assign the "strong" status to the top 20% of clusters arranged according to their LQ. Thus, given the 253 regions included in our analysis, at most 50 clusters within each category will be deemed strong. This quantile-based cutoff is preferable to a fixed LQ threshold such as 1.5 or 2 because it takes into account that some industries tend to concentrate more than others simply due to their overall size (it is considerably easier to be specialized in a small sector, such as aerospace, than in a large one, such as business services). Furthermore, we add another filter that a strong cluster must be within the top 80% of all clusters in a category ranked by employment to remove very small spurious clusters.

We explored three different types of cluster portfolio measures based on this definition of strong clusters: First, we count the number of strong clusters per region. This is straightforward, but treats clusters with very different overall size equally. Second, we calculate the share of regional traded employment in strong clusters. This does take account of size differences across clusters, but weights labor-intensive cluster categories more strongly than others. Third, we calculate the share of regional payroll earned in strong clusters. This is driven by both employment and wages, and is thus most directly linked to value creation by strong clusters in the region. These three indicators are strongly related and in fact performed rather similarly in our analysis, hence we only report the results obtained with the most conceptually convincing one: *share of payroll in strong clusters in overall regional payroll in traded industries.*

An additional aspect that needs discussion before we present the results of our analysis is the selection of controls. Since the analysis in this chapter is on the level of regions, we cannot include regional fixed effects and ought to incorporate the covariates that could explain regional performance in the model explicitly. To capture the key effects that differentiate the regions and at the same time keep the model parsimonious, we included three control variables:

- *Business environment,* as described previously, is a measure of the overall regional conditions for doing business
- *Urbanization,* measured simply as population density, is a measure of the economies emanating from the sheer density of economic activity regardless of sectoral components
- *EU-12 indicator* to differentiate between the 12 latest countries to join the EU in 2005-2007 and the incumbent members. This is a proxy for the overall level of institutional and economic development that countries have reached.[xiii]

Table 9 reports a range of models to explain dimensions of New Growth Path performance using the drivers just discussed. The measure of cluster portfolio strength is in all specifications of the models significantly related to the NGP indicators, with the exception of social inclusion. The effect is predictably strongest for GDP where doubling cluster portfolio strength is associated with a 21%

increase in GDP per capita. Nevertheless, this strong effect persists when we take other prosperity measures into account, suggesting that cluster performance and economic prosperity are related.

This is not the case for social inclusion, even though social inclusion is rather strongly related to the prosperity indicator. This suggests that the variation in social inclusion is mostly explained by other factors rather than cluster portfolio strength. A more careful examination reveals that indeed social inclusion is very strongly positively related to business environment quality and to being part of the EU-12. Interestingly, the situation is reverse with the sustainability indicator: cluster portfolio strength is very strongly related to sustainability (positively) as is urbanization (negatively), while business environment has no role.

Table 9. Effects of cluster portfolio strength on the New Growth Path and its components

	GDP per capita	*Economic Prosperity*	*Social Inclusion*	*Environmental Sustainability*	*New Growth Path*
Log share of wages in strong clusters	0.211[a]	0.069[a]	-0.006	0.081[b]	0.048[b]
	(0.047)	(0.034)	(0.038)	(0.041)	(0.026)
Log population density	0.123[a]	0.037[b]	-0.012	-0.253[a]	-0.076 [a]
	(0.030)	(0.021)	(0.024)	(0.026)	(0.016)
Business environment	1.147[a]	1.080[a]	1.096[a]	0.060	0.706[a]
	(0.088)	(0.063)	(0.070)	(0.077)	(0.048)
R^2	0.731	0.815	0.536	0.310	0.614
Adjusted R^2	0.727	0.812	0.529	0.299	0.608

[a] significant at <0.01 level, [b] significant at <0.05 level. All models include a constant term and an indicator for being part of EU-12. The number of observations is 253.

Finally, the relationship between the strength of the cluster portfolio and the overall New Growth Path composite is positive and significant suggesting that regions with strong clusters tend to follow a more balanced development path. Further exploring this model reveals that the effect is in fact strongest once the control variable are accounted for and removal of any of them results in more blurred estimates for the rest. This suggests that failing to incorporate these controls results in a strong omitted variable bias and that the cluster portfolio measure alone is far from sufficient to explain NGP performance.

We also tested whether the effects of cluster portfolio stronger in regions with better business environments. As in chapter 2 we included the interactions between cluster strength and business environment measures. The results (not reported here) show that in all cases where there was an effect of cluster portfolio strength (i.e. all models except social inclusion), there is a strong and significant additional positive effect of good business environment. Here, as well, cluster strength leverages underlying business environment quality.

d. Key findings

In this section, we have created new indicators of regional performance on the New Growth path and its key components. Using these indicators, we show large performance variations across European regions. Even among the more prosperous regions of Western Europe there are clear differences in New Growth Path-performance. One group of regions performs high on all dimensions of the New Growth Path, while another group of regions suffers from low social inclusion and/or weak environmental sustainability. In the catch-up regions of Eastern Europe, one group of regions combines growth with solid social inclusion but often lower environmental performance. The other group of regions shows the opposite pattern. We then analyze the role of business environment conditions and cluster presence as possible drivers of New Growth Path performance. We find that both have an impact on New Growth Path performance, with the strongest direct link to the narrow economic performance indicators.

For the New Growth Path analysis, these findings are at the regional level consistent with the notion of multiple equilibria as the High Road/Low Road-framework proposes: For the same level of economic performance, regions register different levels of broader New Growth Path outcomes. These findings also suggest that cluster presence, as well as business environment quality, is positively associated with higher economic performance and stronger New Growth Path performance. The effect is largely driven by the impact on economic performance, not on environmental sustainability or social inclusion. Given the measures available, this is not entirely surprising: they are likely to be driven much more by a combination of policy choices, inherited endowment effects, overall levels of economic performance. The economic performance analysis suggests that clusters might indeed enhance the likelihood of high road equilibria to emerge. But the broader New Growth Path data is not sufficient to test whether a high road equilibrium is also reflected by higher environmental sustainability and more social inclusion.

4. Cluster Initiatives and New Growth Path-related activities

Cluster initiatives are a platform for the type of collective action within clusters that our framework suggests might support the emergence of high road equilibria. In this section, we analyze a European dataset of cluster initiatives to map in which regions and what type of cluster categories such initiatives are most prevalent. We then further classify whether these cluster initiatives have a focus on New Growth Path-related objectives, beyond enhancing the competitiveness of their cluster. Finally, we test whether the presence of cluster initiatives is significantly correlated with New Growth Path-related outcomes at the regional level.

a. Existing literature and research approach

Cluster initiatives have become a new focus of especially the policy-oriented cluster literature over the last decade (Solvell et al, 2003; Mueller et al., 2012; ECEI, 2012). Much of this literature has been focused on what such initiatives do, how they are organized, and what impact they might have on cluster performance. The performance analysis in particular has focused on individual cluster efforts, or groups of cluster efforts in one region or organized under one policy program.

Our ambition is to extend the existing research in a number of ways. First, we provide descriptive statistics on where cluster initiatives are most prevalent, both in terms of location and cluster categories, and explore potential reasons. We then produce descriptive statistics on how many of these cluster initiatives are engaged in activities that are related to New Growth Path-related objectives. Third, we extend our previous analysis on the relation between clusters and New Growth Path-performance by also including an indicator of regional cluster initiative intensity.

b. The presence of cluster initiatives

The key source of cluster initiative data we use is the European Cluster Observatory. It covers more than 2000 organizations overall, with the vast majority of them within Europe. The database was originally constructed via several rounds of directed search for cluster initiatives and is being continuously updated via self-registration on the website and other ad-hoc additions. The data might thus be biased towards specific regions or sets of cluster initiatives that have been more actively in contact with the Observatory.

The database is, despite its weaknesses, a significant resource that has not been systematically analyzed before. First, we systematically went through every listed organization's website to check if it is still functional and is involved in the same activities as it was when it was originally added. After limiting our database to EU-27 countries and removing the initiatives with non-functioning websites, the final count

of organizations is 1085. The regions of Rhône-Alpes (France), Västsverige (Sweden) and Catalonia (Spain) had the largest counts of organizations at 32, 26 and 25 respectively, while 56 regions had none. All high-performing regions are large in both population and area.

Table 10 ranks regions by the number of organizations per million inhabitants. Norra Mellansverige (Sweden), Namur (Belgium) and Luxembourg are the top performers with approximately 21, 15 and 14 initiatives per million inhabitants respectively. This measure is still not ideal as it is based on a particular database and does not take the size of an initiative into account, but this is the most comprehensive metric that is feasible to obtain. Table 11 reports cluster organizations by cluster category, both overall and normalized by the number of employees per cluster category.

Table 10. Top Regions by Cluster Effort

NUTS	Region Name	CI count	CI per million people
SE31	Norra Mellansverige, Sweden	17	20.6
BE35	Namur, Belgium	7	14.9
LU00	Luxembourg	7	14.1
HU22	Nyugat-Dunantul, Hungary	14	14.0
SE23	Västsverige, Sweden	26	14.0
DK05	Nordjylland, Denmark	8	13.8
SE32	Mellersta Norrland, Sweden	5	13.5
DK03	Syddanmark, Denmark	16	13.3
SE22	Sydsverige, Sweden	18	13.1
HU33	Del-Alfold, Hungary	15	11.3

Source: European Cluster Observatory, Eurostat

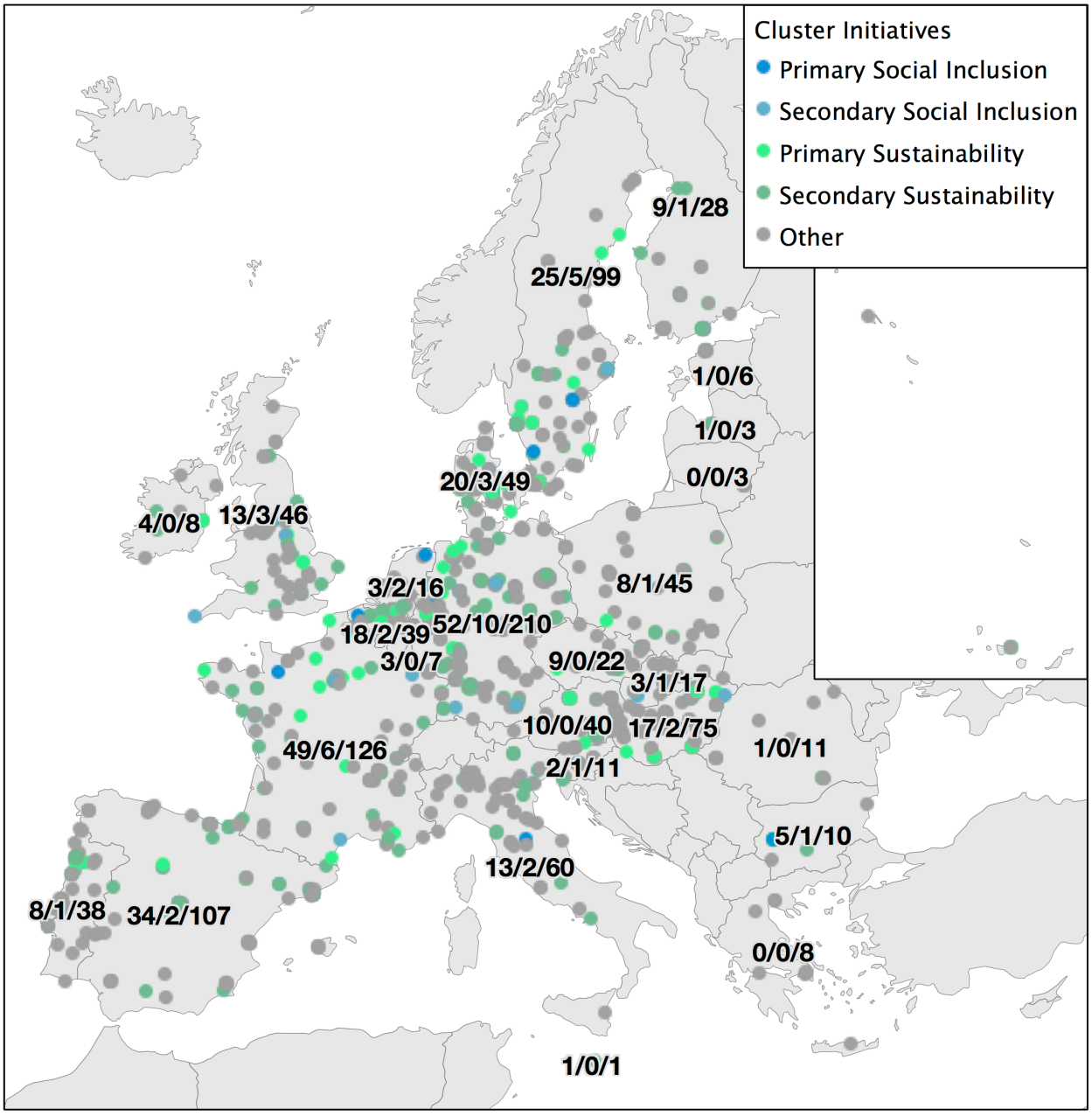
Table 11. Top Sectors by Cluster Effort

Cluster Category	CI count	Cluster Category	CI per million employees
IT	111	Biotechnology	718
Biotechnology	54	Aerospace	99
Automotive	50	Energy	83
Transportation and Logistics	38	IT	70
Processed Food	37	Maritime	67
Aerospace	35	Medical Devices	48
Maritime	29	Materials	32
Tourism	25	Jewelry	23
Medical Devices	23	Textile	23
Construction	22	Automotive	22

Source: European Cluster Observatory, Eurostat

Figure 11 shows the distribution of cluster efforts across European regions. Most of the cluster efforts are concentrated in Germany, France and Scandinavia. This pattern is broadly similar to the many previous maps we saw in previous chapters and could be related to the strength of cluster measures, regional business environment and the New Growth Path performance. Hungary seems to be a special case, likely to be driven by the inclusion of all Hungarian cluster efforts in the dataset.

Figure 11. Cluster initiatives in Europe



Source: Cluster Observatory, 2013. The numbers denote the number of organizations involved in sustainability/inclusion/total respectively.

Cluster efforts are most common in Information Technology[xiv], followed by biotechnology and automotive (Table 9). Cluster categories with the most cluster effort include a number of relatively small sectors, such as biotechnology, aerospace and medical devices. Normalizing the number of cluster initiatives by the number of employees in Europe in a sector, we have a staggering number of 718 initiatives per million employees in biotechnology (or one initiative per 1400 employees), and this number is likely biased downward as the database of initiatives we used is incomplete. Other top sectors include aerospace, energy and IT, where there is approximately one organization per 10 thousand employees.

Finally, when it comes to the intersection of regional and sectoral dimensions, the data is of course rather sparse as we have approximately 1 000 organizations and 10 000 possible intersections of region and sector. Nevertheless, having several organizations in the same region was relatively common with, for example, IT in Stuttgart and Helsinki, as well as Tourism in Žilina having four initiatives each. There are seven other combinations, also mostly in IT, with three initiatives in the same region (Table 12).

Table 12. Region/sector combinations with at least three cluster organizations

DE11	Stuttgart, Germany	IT	4
FI18/FI20	Etelä-Suomi/Åland, Finland	IT	4
SK03	Stredne Slovensko, Slovakia	Tourism	4
FR71	Rhône-Alpes, France	IT	3
DE71	Darmstadt, Germany	IT	3
DK01	Hovedstaden, Denmark	Maritime	3
DK05	Nordjylland, Denmark	IT	3
HU22	Nyugat-Dunantul, Hungary	Energy	3
IE00	Ireland	IT	3
ITC4	Lombardia, Italy	Textile	3
SE23	Västsverige, Sweden	Automotive	3

Having profiled the presence of cluster initiatives, we now move to analyzing the reasons for this effort to be present. The possible explanations for this could involve a strong business environment and strong local cluster portfolio (we operate on a regional level here, so the effect of the cluster portfolio is not tied to individual sectors).

We use the same measure of business environment as in the previous chapters and the share of wages in strong clusters as the indicator of cluster portfolio strength. Both variables are strongly positively related to the presence of cluster efforts confirming the intuition that cluster initiatives appear in regions with suitable overall business conditions and where the specialization of the economy is large. Nevertheless, we cannot claim any causality here and especially the relationship between cluster portfolio strength and cluster effort presence could reinforce each other. In addition, these measures only explain 18% of variation in the presence of cluster efforts suggesting that there are other variables

missing from the model. The strongest candidate is the extent to which government is focusing on cluster development in a particular region.

Table 13. The Drivers of Cluster Effort Presence

	1	*2*
Business environment	2.604[a]	
	(0.455)	
Social capital		0.513[a]
		(0.114)
Urbanization	-0.989[a]	-0.685[a]
	(0.175)	(0.166)
Cluster portfolio strength	0.509[b]	0.578[b]
	(0.254)	(0.264)
R^2	0.176	0.134
Adjusted R^2	0.165	0.123

[a] significant at <0.01 level, [b] significant at <0.05 level. All models include a constant term. The number of observations is 230 as 23 regions (mostly in Italy) lacked a measure of social capital.

One option would be to disentangle the measure of business environment and in particular to separate the measure of 'social capital', a factor that the regional science literature has increasingly highlighted as a major driver of performance differences across locations (Rodríguez-Pose/Crescenzi, 2008). As cluster organizations are a platform for joint action, their formation depends on the level of trust in the society both towards potential partners and towards the government.

We measure social capital by separating the trust indicators from the other indicators of local business environment. The results are expectedly positive (Model 2 in Table 13) and including social capital as the only business environment related predictor in the model reinforces the idea that it is a significant predictor of the presence of cluster efforts and the share of variance explained by the model drops only slightly. Including both social capital and business environment less social capital in the same models provided poor results due to high correlation between the two variables (0.79) and the model not being able to differentiate between the two influences.

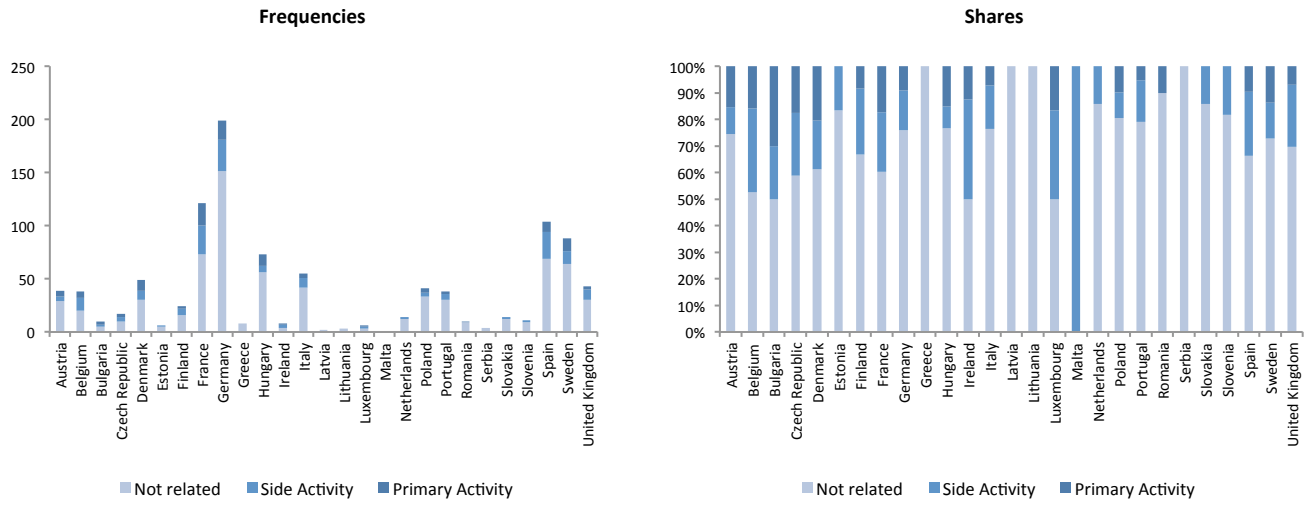
c. Cluster effort and the New Growth Path Objectives

As part of the systematic review of cluster organization websites, we analyzed the information they report about their activities and classified them with respect to their relatedness to environmental sustainability and social inclusion, namely having each as (i) their primary activity, (ii) side activity or having a related project participation and (iii) not related to environmental sustainability and social inclusion at all.

Clusters and Environmental Sustainability

Based on the Cluster Observatory database, we have identified a total of 309 cluster organizations in 24 EU Member states that indicate environmental sustainability as their primary or secondary priority. Figure 12 below provides frequencies and shares of these clusters in total count of cluster organizations for each country.

Figure 12. Clusters and Environmental Sustainability



Notably, across all Member states, about 40% of all cluster initiatives have environmental sustainability as their primary or side activity. Only in Cyprus, Greece and Lithuania there were no organizations operating in environmental sustainability in our database. This brings the average per country ratio to 30%, and, excluding Malta's only cluster, to about 25%. On the opposite side of the spectrum, top performers with both the average amount of clusters concerned with environmental sustainability and the average share of those clusters above the mean, are Denmark, France, Germany, Spain and Sweden.

Emergence (or lack of) of cluster organizations in sustainable environment area could in part be explained by the amount of policy measures at a country level that are devoted to supporting relevant sectors. In fact, Latvia and Lithuania consistently lack coordinated policy support, while clusters in Denmark, Germany and Sweden operate within elaborated structure of government measures targeted at development of sustainable environment (Eco-Innovation Observatory, 2011).

Industries that these clusters operate in are also rather predictable. Clusters that have environmental sustainability as their main activity tend to operate in Energy Technology, Environmental Technology, as well as Green, Renewable and Bioenergy sectors. These clusters are typically concerned with R&D and production of renewable energy solutions.

Perhaps, less obvious are industries in which clusters have environmental sustainability as their side activity. These are Automotive, Maritime, Construction, Agricultural and IT sectors, and clusters typically work in reduction and higher efficiency of energy use, and (for the IT sector) development of smart grids systems.

Generally, such clusters work in improved energy use, waste management and technologies that reduce environmental impact from conventional activities. To name a few, 'Svenskt Aluminium', a Swedish aluminum industry cluster, devotes a significant effort to promotion of recycling of aluminum waste and packaging material, since recycling allows saving about 95% of energy needed to produce aluminum from raw materials.

The construction industry is another example: Austrian cluster 'Ecoplus' works in refurbishment of old houses to low-energy standards and develops technologies for construction of new multi-story buildings to passive house standards, thus lowering demand for excessive energy consumption and reducing emissions. Similarly, German cluster 'CFK Valley Stade Recycling' facilitates fiber recycling plants and offers technology solutions for automobile construction that require new ways of sustainable recovery of carbon fiber contained production remainders and end-of-life components.

Clusters and Social Inclusion

As for the clusters working in the area of social inclusion, this is predictably an area with much less activity than environmental issues. The issues related to social inclusion could be viewed as more related to value chain activities or as a prerogative of the government, not an area that directly affects products or services provide by companies. Nevertheless, we found 9 cluster organizations stating social inclusion as their primary activity and a further 34 participating in related side activities.

We can broadly classify the social inclusion initiatives in the following broad categories: (i) facilitation of inclusion in the labor market or return to employment for the disadvantaged (elderly, disabled, women, students with no work experience), (ii) provision of rehabilitation for disabled persons after serious injuries, (iii) application of ICT for the benefit of the disadvantaged groups and (iv) R&D in prosthetics for the disabled.

A good example of clusters claiming social inclusion as their main priority is a German rehabilitation cluster 'Teltra' that provides computer-assisted rehabilitation in neurological disorders by means of software solutions targeted to people with cortical visual impairments arising from strokes, brain injury or brain tumor, and by providing education in wheelchair use for people with movement impairment.

As for social inclusion as the side activity, a UK-based cluster 'Learning Light' that specializes in e-learning systems offers a special program for the elderly that is targeted at increasing computer literacy and acquisition of ICT-related skills necessary in modern labor market.

d. Cluster Initiatives and regional performance

To assess the importance of cluster initiatives for the performance of the region as a whole we look at the relationship between the measures of business environment, cluster portfolio strength and cluster effort with regional outcomes. We use three measures of outcomes: the traditional GDP per capita, the economic prosperity indicator, and the composite New Growth Path performance measure that we created. The measure of the presence of cluster effort is the number of cluster initiatives per million inhabitants, while the measure for cluster portfolio strength is the (log of) share of wages in strong clusters.

Table 14. Cluster Effort Presence and Regional Outcomes

	GDP per capita	*Prosperity*	*New Growth Path*
Cluster effort	0.014	-0.005	0.018[a]
	(0.011)	(0.008)	(0.006)
Cluster portfolio strength	0.206[a]	0.071[b]	0.041
	(0.048)	(0.034)	(0.025)
Urbanization	0.136[a]	0.032	-0.060[a]
	(0.032)	(0.023)	(0.017)
Business environment	1.106[a]	1.095[a]	0.654[a]
	(0.094)	(0.067)	(0.050)
R^2	0.733	0.815	0.628
Adjusted R^2	0.728	0.811	0.620

[a] significant at <0.01 level, [b] significant at <0.05 level. All models include a constant term and an indicator for EU-12. The number of observations is 253.

As we move from the narrow, more traditional indicators of regional performance (GDP per capita) to the broader ones that encompass other measures of sustainable development, the pattern is clear: business environment quality becomes less important as a driver, while the presence of cluster efforts becomes relatively more meaningful. Of course, given this data we cannot claim anything about the causality of the relationship, but the overall trend is that there are more cluster initiatives in regions that score high on the New Growth Path indicator.

Further analysis looks at the intersection of regions and industries as in Chapter 2. Here we measure the cluster effort not only per region, but also per cluster category. Naturally, this results in most of the values of this indicator being zero as discussed in the beginning of the chapter. Nevertheless, once the strength of cluster effort is included in the model together with cluster specialization, it appears to have a weak negative influence, while its interaction with specialization has a strong positive impact. These results suggest that the presence of cluster initiatives only has positive impact on wages when the

underlying agglomeration is strong. In weak clusters, cluster efforts are more a sign of government action, and this the data suggests is biased towards regions where wages are systematically lower.

Table 15. The effects of localization and cluster effort on wages

	1	2	3
Cluster specialisation	0.055[a]	0.054[a]	0.052[a]
	(0.002)	(0.002)	(0.002)
Cluster effort		-0.007[b]	-0.014[a]
		(0.003)	(0.004)
Cluster specialisation * Cluster effort			0.015[a]
			(0.005)
R^2	0.856	0.862	0.862
Adjusted R^2	0.855	0.860	0.860

[a] significant at <0.01 level, [b] significant at <0.05 level. All models include a constant as well as industry and region indicators. The number of observations is 57 628, which includes traded industries and region/industry combinations with at least 10 employees. The observations are weighted according to the number of employees in a region/industry combination.

Naturally, the results in this chapter are sensitive to the quality of the underlying data. The analysis on the cluster level in particular is somewhat problematic given that the vast majority of clusters do not have any initiative present. Additionally, the effect of cluster organizations, while significant statistically, is nearly negligible compared to the effects of the broader regional and sectoral factors. Still, there appears to be a significant relationship between the presence of clusters and worker wages, and this relationship is moderated by the presence of cluster organizations.

e. Key findings

In this third section, we have exploited the European Clusters Observatory (ECO) data set of cluster initiatives to create new indicators for the presence of cluster initiatives across regions and cluster categories. We have also classified all cluster initiatives in the data set by their orientation towards New Growth Path-objectives.

We find clear differences in cluster initiative intensity across regions and cluster categories). At the regional level, differences in social capital but also cluster portfolio strength have an impact on the likelihood to find cluster initiatives. However, other factors – presumably often related to government policy- explain a much larger share of cross-regional variation in cluster initiative presence. We also find that about 40% of all cluster initiatives report significant activities related to New Growth Path-objectives, in particular environmental sustainability. Finally, when including cluster initiative presence in our empirical framework for explaining New Growth Path-performance at the regional level, we find a

significant correlation for the broader New Growth Path measure but not for narrow economic performance.

For the New Growth Path analysis, these findings have two core implications. First, cluster initiatives are a platform for collective action that is widely used to pursue goals in line with the New Growth Path, in particular environmental sustainability. This suggests that as a policy tool at least cluster initiatives have potential. It is also consistent with our conceptual framework in this chapter that suggests clusters to provide an environment where the collective action needed to purse High Road strategies is more likely to emerge. Second, cluster initiatives are across all regions not significantly correlated with prosperity but with the other aspects of the New Growth Path. There are two possible explanations: Either cluster initiatives do indeed lead to collective action that enhances environmental sustainability and social inclusion. Or cluster initiatives are more likely to be initiated in regions that also more aggressively push for these New Growth Path objectives through other means.

5. Conclusions

This paper explores the relationship between the presence of clusters and cluster initiatives and the different dimensions of economic, environmental, and social outcomes that underpin the New Growth Path. It describes key elements of a conceptual framework where the systemic interaction between companies can lead to different types of behavior, even when the overall policy context and the individual motivations of companies are similar. One of these scenarios sees companies taking the 'high road,' competing on value, supported by investment in skills and machinery. In this scenario New Growth Path – consistent behavior, especially a focus on environmental sustainability, is often either a side benefit of overall high productivity or even an element of the value position. The other scenario sees companies taking the 'low road,' competing on cost based on the most intense use of the existing labor force and capital stock. In this scenario, New Growth Path-consistent behavior is likely to fall of short term cost minimization.

The main part of the paper is focused on exploring new data sets that can shed an initial perspective on the empirical relevance of this conceptual framework. We exploit the European Cluster Observatory data set to conduct new analysis on the impact of cluster presence on wages across European regions. We combine different regional data sets from the European Cluster Observatory and the European Regional Competitiveness Index to design a new index of New Growth Path performance across European regions, study the patterns of performance at the regional level on different dimensions of this Index, and related New Growth Path performance to cluster presence. Finally, we calculate indictors of regional and cluster category-specific cluster initiative intensity, and create a new data set that indicates whether cluster initiatives engage in New Growth Path related activities.

The paper is organized around three key research questions:

1. *Do clusters contribute to higher productivity and wages?*

   We find that average wages are positively and statistically significantly affected by the presence of clusters. This suggests that specialization does indeed play a role in driving economic performance. We also find that the three other factors, i.e. industry concentration, location-specific fixed effects, and industry-specific fixed effects have an impact as well. Industry fixed effects are a reflection of differences in industry features like capital- and knowledge intensity. Location-specific effects point towards the importance of business environment conditions that vary more by the overall stage of development of the location than the specific cluster or industry within the location. Industry concentration effects can be a reflection of the narrow economies-of-scale specialization that the hypothesis suggests is more likely to drive low path-behavior. The fact that wages benefit from industry-level specialization but benefit even more if that specialization happens within a context of a strong cluster is consistent with this view.

2. What role do clusters play in regions with stronger New Growth Path performance?

We find that there are significant differences in New Growth Path performance across European regions. More specifically for regions of comparable levels of prosperity we find significant variations in both social inclusion and environmental sustainability. This suggests that there are indeed different paths of competing, and that these paths are relevant at different levels of economic development.

For prosperous regions, there are three subgroups: High performance on all categories; high performance with the exception of environmental sustainability, and overall weaker performance on all indicators. This is consistent with a High Road strategy in the first group, a Low Road strategy in the second group, and weaker performance in the third. For less developed regions, the key differentiator is social inclusion. Regions on a robust catch-up path generate opportunities to ensure social inclusion but often at a cost to environmental sustainability. Regions struggling to catch-up also suffer from social challenges; their better environmental performance seems due to a lack of economic activity. While the gap between high and low prosperity largely separates western and eastern Europe, the gap between high and low path strategies largely separates northern and southern Europe. Within large countries, there are significant differences that do not follow these broad geographical trends.

We then find that economic performance is driven by both business environment quality and the strength of the regional cluster portfolio. The impact on other aspects of New Growth Path performance is visible, even if it is less pronounced. This could as well be an artifact of the limited data available than of a genuinely lower impact of cluster presence on these performance dimensions.

3. Do cluster initiatives contribute to New Growth Path performance?

We find significant differences in cluster initiative presence across regions and cluster categories. We also find a remarkably high share of cluster initiatives to be engaged with New Growth Path-consistent activities, in particular environmental sustainability. Cluster initiative presence is more likely for higher levels of regional social capital and cluster portfolio strength; other factors, in particular policy choices, are relevant as well.

The presence of cluster initiatives is positively correlated to better New Growth Performance-performance at the regional level. It is, however, not significantly correlated to prosperity differences which are driven by business environment quality and cluster portfolio strength. This could indicate that cluster initiatives are a tool to extend performance into non-prosperity related fields. Alternatively, it could also indicate that regions that politically support many cluster initiatives also push harder to achieve New Growth Path-goals.

Overall, the data and analysis in this report is broadly consistent with the conceptual framework sketched out at the outset. We do find different New Growth Path performance profiles at the regional level, even for regions with broadly similar economic performance. This is consistent with a view that High Road strategies generate somewhat more prosperity, but also higher social inclusion and environmental sustainability.

And we find cluster presence to be positively correlated to wage levels, and cluster portfolio strengths to regional performance, prosperity but also the broader measures of performance implied by the New Growth Path. This is consistent with a view that clusters increase the likelihood of High Road strategies. That these effects occur at least partially as a multiplier on the benefits derived from strong business environments is consistent with both prior research and the framework developed here.

And we finally find many cluster initiatives to be engaged in New Growth Path related-activities, and the presence of such initiatives to be correlated with strong New Growth Path performance. This is consistent with such initiatives being a possible platform for New Growth Path-related policies. That these effects materialize when clusters are present and have a strong leverage effect when business environments are strong is again consistent with both prior research and the framework developed here.

The next level of analysis will require a further step change in the availability of data. While the coverage of cluster data has become much better in recent years, it still has weaknesses, particularly in relation to regional average wages in narrow industries for large European countries. Also problematic is the lack of good regional data on New Growth Path-related outcomes. What is measured at the moment is largely driven by policy choices or external regional factors; it is not a good reflection of High Road-strategies chosen by companies.

Appendix

A1. Distribution of location quotients per cluster category

Cluster category	LQ of a region at rank:			
	50th	25th	10th	1st
Aerospace	1.03	2.00	5.53	14.24
Agricultural products	1.62	2.29	4.12	8.97
Analytical instruments	1.52	2.13	3.01	8.99
Apparel	1.59	3.00	7.40	13.12
Automotive	1.68	2.96	3.85	6.06
Biotech	1.37	2.02	3.53	5.88
Building fixtures, equipment and services	1.70	2.23	2.63	3.09
Business services	1.26	1.48	1.77	2.52
Chemical products	1.42	2.13	2.61	5.55
Construction	1.47	1.90	2.27	2.87
Construction materials	1.40	2.09	2.69	7.81
Distribution	1.22	1.47	1.81	3.09
Education and knowledge creation	1.54	1.85	2.15	2.99
Entertainment	1.27	1.59	1.90	2.32
Farming and animal husbandry	2.14	5.01	7.79	14.38
Financial services	1.12	1.34	1.75	4.14
Footwear	1.15	2.44	6.06	31.34
Furniture	1.96	3.28	4.66	11.05
Heavy Machinery	1.68	2.77	3.97	14.69
Information Technology	1.43	1.79	2.36	6.02
Jewelry and precious metals	1.26	1.98	3.53	17.72
Leather products	1.58	2.70	6.10	61.31
Lighting and electrical equipment	1.51	2.37	3.40	8.21
Maritime	1.78	2.77	6.39	13.35
Media and publishing	1.19	1.40	1.65	2.85
Medical devices	1.41	2.01	2.99	9.71
Metal manufacturing	1.63	2.24	3.05	5.02
Oil and gas	1.74	2.98	4.91	33.45
Paper products	1.68	2.16	3.00	7.15
Pharmaceuticals	1.28	1.88	2.83	20.76
Plastics	1.47	2.08	2.59	5.76
Power generation and transmission	1.73	2.66	3.78	8.34
Processed food	1.56	1.95	2.46	3.50
Production technology	1.50	2.15	3.65	7.40
Sporting, recreational and children's goods	1.22	3.07	4.98	14.50
Stone quarries	2.10	3.57	6.05	15.00
Telecommunications	1.28	1.80	2.51	5.01
Textiles	1.61	3.02	4.21	8.78
Tobacco	1.48	3.11	9.23	25.97
Tourism and hospitality	1.28	1.99	4.81	7.97
Transportation and logistics	1.21	1.57	2.04	4.19

A2. Data sources for raw data used by the Cluster Observatory

Country	Year	Source
Austria	2010	Statistics Austria
Belgium	2008	National Office of Social Security, Belgium
Bulgaria	2010	National Statistical Institute, Bulgaria
Cyprus	2010	Eurostat, Luxembourg
Czech Republic	2005	Eurostat, Luxembourg
Denmark	2009	Statistics Denmark
Estonia	2010	Statistical Office of Estonia
Finland	2010	Statistics Finland, Business statistics
France	2010	INSEE, France
Germany	2011	Statistik der Bundesagentur fur Arbeit, Germany
Greece	2006	National Statistical Service of Greece
Hungary	2011	Hungarian Central Statistical Office
Ireland	2010	Eurostat, Luxembourg
Italy	2009	Istituto Nazionale di Statistica, Italia
Latvia	2010	Central Statistical Bureau of Latvia
Lithuania	2010	Statistics Lithuania
Luxembourg	2010	Eurostat, Luxembourg
Malta	2002	Eurostat, Luxembourg
Netherlands	2005	Eurostat, Luxembourg
Poland	2010	Central Statistical Office of Poland
Portugal	2009	Instituto Nacional de Estatistica, Portugal
Romania	2010	National Institute of Statistics of Romania
Slovakia	2010	Statistical Office of the Slovak Republic
Slovenia	2011	Statistical Office of Slovenia
Spain	2008	Instituto Nacional de Estadistica
Sweden	2010	Statistiska Centralbyran, Sweden
United Kingdom	2007	Office for National Statistics of United Kingdom; DETI, Northern Ireland

A3. Share of clusters by category relative to EU average wage in each category

Cluster	< 0.7x	0.7 – 0.9x	0.9 – 1.1x	1.1 – 1.3x	> 1.3x
Aerospace	43.3%	24.5%	17.2%	6.9%	8.2%
Financial services*	34.0%	22.0%	38.0%	4.0%	2.0%
Biotechnology	42.9%	16.7%	17.6%	9.0%	13.7%
Pharmaceuticals	37.6%	21.2%	22.0%	13.1%	6.1%
Analytical instruments	39.4%	19.5%	22.4%	11.2%	7.5%
Chemical products	34.9%	15.1%	21.8%	14.7%	13.5%
Information Technology	42.5%	13.9%	21.8%	11.1%	10.7%
Oil and gas	34.7%	8.9%	12.4%	20.3%	23.8%
Telecommmunications	26.0%	15.0%	26.8%	15.4%	16.9%
Production technology	33.1%	16.9%	15.4%	23.2%	11.4%
Automotive	34.9%	14.1%	13.3%	23.1%	14.5%
Plastics	28.3%	13.5%	17.9%	19.9%	20.3%
Medical devices	42.5%	11.1%	21.0%	13.9%	11.5%
Power generation and transmission	28.9%	12.0%	18.5%	19.7%	20.9%
Lighting and electrical equipment	31.0%	13.7%	10.1%	21.4%	23.8%
Transportation and logistics	32.2%	14.9%	22.4%	16.9%	13.7%
Heavy Machinery	27.5%	9.0%	12.9%	12.5%	38.0%
Metal manufacturing	32.5%	9.4%	14.5%	15.7%	27.8%
Business services	46.5%	16.9%	18.1%	8.7%	9.8%
Distribution	36.1%	12.0%	13.7%	21.2%	17.0%
Media and publishing	39.6%	13.7%	13.3%	17.3%	16.1%
Paper products	34.9%	9.0%	9.4%	14.1%	32.5%
Sporting and children's goods	30.0%	8.8%	18.3%	15.8%	27.1%
Building fixtures	31.8%	7.1%	9.4%	12.9%	38.8%
Stone quarries	28.0%	6.5%	11.7%	10.3%	43.5%
Processed food	30.6%	10.6%	10.2%	18.4%	30.2%
Construction	31.0%	5.1%	11.8%	7.8%	44.3%
Construction materials	29.8%	12.2%	14.9%	16.1%	27.1%
Textiles	32.3%	6.7%	12.2%	7.9%	40.9%
Jewelry and precious metals	37.5%	8.3%	11.9%	9.1%	33.2%
Furniture	31.0%	6.7%	8.2%	7.5%	46.7%
Leather products	34.8%	6.2%	11.9%	9.0%	38.1%
Maritime	35.8%	7.1%	3.9%	8.3%	44.9%
Tourism and hospitality	43.3%	18.5%	9.8%	8.7%	19.7%
Agricultural products	36.6%	13.0%	14.2%	9.8%	26.4%
Tobacco	31.7%	9.0%	2.1%	4.8%	52.4%
Education and knowledge creation	53.9%	11.0%	6.3%	5.5%	23.2%
Apparel	25.6%	7.1%	7.1%	8.3%	52.0%
Footwear	28.4%	2.1%	6.7%	5.7%	57.2%
Entertainment	72.0%	2.8%	0.8%	3.9%	20.5%
Farming and animal husbandry	63.7%	3.5%	1.5%	2.0%	29.4%

** Financial services data only reflect 75 out of 255 regions that provided such information in Austria, Bulgaria, Finland, France, Hungary, Latvia and Slovenia.*

6. References

Acemoglu, Daron, James A. Robinson, Thierry Verdier (2012), Can't we all be more like Scandinavians? Asymmetric growth and institutions in an interdependent world, NBER Working Paper No. 18441, Boston

Aharonson, Barak, Joel Baum, Maryann Feldman, Desperately Seeking Spillovers? Increasing returns, industrial organization and the location of new entrants in geographic and technological space, *Industrial and Corporate Change*, Vol. 16 (2007), No. 1, 89 – 130

Amiti, Mary, Lisa Cameron, Economic Geography and Wages, *Review of Economics and Statistics*, Vol. 89 (2007), 15 – 29.

Asheim, Bjorn and Mark Gertler (2004), Understanding regional innovation systems, in: Jan Fagerberg, David Mowery and Richard Nelson (eds.), Handbook of Innovation, Oxford: Oxford University Press

Audretsch, David, Maryann Feldmann, Knowledge Spillovers and the Geography of Innovation, *Handbook of Urban and Regional Economics*, 2003.

Becattini, Giacomo, The Marshallian district as a socio-economic notion, in: F. Pyke, G. Becattini, W. Sengenberger (eds.), *Industrial districts and intra-firm collaboration in Italy,* International Institute for Labor Studies, Geneva: 1990.

Boasson, Vigdis, Alan MacPherson, The role of geographic location in the financial and innovation performance of publicly traded pharmaceutical companies: empirical evidence from the United States, *Environment and Planning A*, Vol. 33 (2001), 1431 -1444.

Boschma, Ron, Asier Minondo, and Mikel Navarro (2013), The emergence of new industries at the regional level in Spain: A proximity approach based on product-relatedness, Economic Geography, Vol. 89, pp. 29–51.

Brülhart, M., & Mathys, N. A. (2007). *Sectoral Agglomeration Economies in a Panel of European Regions*. Regional Science and Urban Economics.

Carlino, G. A., Chatterjee, S., & Hunt, R. M. (2007). *Urban density and the rate of invention*. Journal of Urban Economics.

Chatterji, Aaron, Edward L. Glaeser, and William R. Kerr (2013), Clusters of Entrepreneurship and Innovation, *NBER Working Pape*r, No. 19013. National Bureau of Economic Research, 2013.

Combes, P., Duranton, G., & Gobillon, L. (2010). Estimating Agglomeration Economies with History, Geology, and Worker Effects. *Agglomeration Economics,* 15-66

Cooke, Philip (2001), Regional innovation systems, clusters, and the knowledge economy, Industrial and Corporate Change, Vol. 10, pp. 945-974.

Council of Europe (2008) Report of high-level task force on social cohesion: Towards an active, fair and socially cohesive Europe. *Council of Europe, Strasbourg.*

Dauth, W. (2010). *The mysteries of the trade: Employment effects of urban interindustry spillovers*. IAB discussion *paper, No. 15/2010.*

Delgado, Mercedes, Michael Porter, and Scott Stern*, Clusters and Entrepreneurship*, Journal of Economic Geography, Vol. 10 (2010a), No. 6, pp. 1 - 24.

Delgado, Mercedes, Michael Porter, and Scott Stern, *Clusters, Convergence, and Economic Performance*, HBS Working Paper, Boston: October 2010b.

De Groot, Henri, Jacques Poot, Martijn Smit, *Agglomeration Externalities, Innovation and Regional Growth: Theoretical Aspects and a Meta-Analysis*, University of Waikato, Working Papers in Economics 01/08, Hamilton: February 2008.

Dettori B., Marrocu E., and Paci R. (2012), Total factor productivity, intangible assets and spatial dependence in the European Regions, Regional Studies, Vol. 46, No. 10, pp. 1401 - 1416.

Dijkstra, Lewis, Paola Annoni, Kornelia Kozovska (2011), A New Regional Competitiveness Index: Theory, Methods and Findings, Working Paper 2/2011, Brussels: European Commission

ECEI European Cluster Excellence Initiative (2012), The quality label for cluster organisations - criteria, processes, framework of implementation, Document dated 22 May 2012, accessed at http://www.cluster-excellence.eu/fileadmin/_cluster-excellence/downloads/GOLD-Assessment.pdf

Eco-Innovation Observatory (2012) The Eco-Innovation Gap: An Economic Opportunity for Business. *Eco-Innovation Observatory. Funded by the European Commission, DG Environment, Brussels.*

Ellison, Glenn, Edward Glaeser, William Kerr, What Causes industry Agglomeration?*, American Economic Review*, Vol. 100 (2010), pp. 1195 – 1213.

Eriksson, R., & Lindgren, U. (2008*). Localized mobility clusters: impacts of labour market externalities on firm performance*. Journal of Economic Geography, *9*(1), 33–53. doi:10.1093/jeg/lbn025

European Commission, *Innovation Clusters in Europe: A Statistical Analysis and Overview of Current Policy Support*, PRO INNO Europe Paper No. 5, Brussels: December 2007.

Florida, Richard (2002). The rise of the creative class: And how it's transforming work, leisure, community and everyday life. New York: Basic Books.

Franco, S., Murciego, A., Wilson, J.R. (2011). Business Environment Secondary Data Report. *European Cluster Observatory - Phase II, deliverable D13.*

Freser, Edward, Henry Renski, Harvey Goldstein, Clusters and Economic Development Outcomes, *Economic Development Quarterly*, Vol. 22 (2008), No. 4, 324 – 344.

Fujita, Masahisa, Paul Krugman, and Anthony J. Venables (2001), The Spatial Economy, MIT Press: Cambridge, MA.

Furman, Jeffrey L., Michael E. Porter, and Scott Stern, The determinants of national innovative capacity, *Research policy,* Vol. 31 No. 6, 899-933.

Gertler, Meric S., Bjørn T. Asheim, T*he Geography of Innovation: Regional Innovation Systems*, in: Jan Fagerberg, David Mowery, Richard Nelson (eds.), The Oxford Handbook of Innovation, Oxford University Press, Oxford: 2006.

Glaeser, Edward L. (2011), The Triumph of the City, Penguin Press: New York, NY

Glaeser, Edward, Wiliam Kerr, Local Industrial Conditions and Entrepreneurship: How much of the Spatial Distribution can we explain?, *Journal of Economics & Management Strategy*, Vol. 18 (2009), No. 3, pp. 623 - 663.

Greenstone, M., Hornbeck, R., & Enrico Moretti, E. (2010), Identifying agglomeration spillovers: Evidence from million dollar plants (MIT Department of Economics Working Paper No. 07-31). Cambridge, MA: Massachusetts Institute of Technology.

Hall, R. E. and C. I. Jones, Why Do Some Countries Produce So Much More Output per Worker than Others?, *Quarterly Journal of Economics*, Vol. 114, No. 1 (1999): 83–116.

Hall, Peter, David Soskice (2001), Varieties of capitalism: The institutional foundations of comparative advantage, Wiley.

Hausmann, Ricardo, Bailey Klinger, *The Structure of the Product Space and the Evolution of Comparative Advantage,* CID Working Paper No. 146, Kennedy School of Government, Cambridge: April 2007.

Henderson, J. (2003). *Marshall's scale economies*. Journal of Urban Economics, 53(1), 1-28.

Huber, F. (2011). *Do clusters really matter for innovation practices in Information Technology? Questioning the significance of technological knowledge spillovers.* Journal of Economic Geography.

Jacobs, Jane, *The Death and Life of Great American Cities*, Vintage Books, New York: 1992 (original 1961).

Ketels, Christian, *Clusters and Competitiveness: Porter's contribution*", in: R. Huggins, H. Izushi (eds.), Competition and Competitive Advantage: The Ideas of Michael Porter, Oxford University Press, forthcoming.

Lall, S. V., & Mengistae, T. (2005). *The Impact of Business Environment and Economic Geography on Plant-level Productivity*. World Bank Publications.

Lin, Justin Y., Celestin Monga, *Growth Identification and Facilitation: The Role of the State in the Dynamics of Structural Change*, World Bank Policy Research Working Paper 5313, Washington, D.C.: May 2010.

Lindqvist, G., Ketels, C. and Sölvell, Ö., *The Cluster Initiative Greenbook*, TCI & Ivory Tower, Stockholm: 2003.

Marshall, Alfred, *Principles of Economics*, Macmillan, London: 1890.

Martin, Philippe, Thierry Mayer, Florian Mayneris, *Spatial concentration and firm-level productivity in France*, CEPR Discussion Paper 6858, London: 2008.

Mion, G., & Naticchioni, P. (2009). *The spatial sorting and matching of skills and firms*. Canadian Journal of Economics/Revue canadienne d'économique, 42(1), 28–55.Moomaw, R. L. (1981). Productivity and City Size: A Critique of the Evidence. *The Quarterly Journal of Economics*, *96*(4), 675–688.

Moreno, Rosina, R. Paci, S. Usai, *Geographical and Sectoral Clusters of Innovation in Europe*, CRENOS, Working Paper, 2004/15.

Muller, Lysann, Thomas lamer-Gamp, Gerd Meier zu Kocker, Thomas Alslev Christensen (2012), Clusters are Individuals, Danish Ministry of Science/VDI/VDE, Copenhagen/Berlin.

Neffke, Frank, Martin Henning, and Ron Boschma (2011), How do regions diversify over time? Industry relatedness and the development of new growth paths in regions, Economic Geography, Vol. 87 (3), pp. 237-265.

OECD (2012), OECD Better Life Index, Paris.

OECD (2008). Handbook on Constructing Composite Indicators: Methodology and User Guide.

Piore, M, C. Sabel (1984), The Second Industrial Divide, Basic Books: New York.

Porter, Michael E., *The Competitive Advantage of Nations, The* Free Press, New York: 1990.

Porter, Michael E., The Economic Performance of Regions, *Regional Studies*, Vol. 37 (2003), No. 6/7.

Porter, Michael E., Marc Kremer (2006), Strategy and Society, *Harvard Business Review,* Dec 2006, 78-92.

Porter, Michael E., Scott Stern, Roberto Artavia Lorea (2013), *The Social Progress Index*, Social Progress Imperative, Washington, DC.

Prahalad, CK (2006), The Fortune at the Bottom of the Pyramid, Pearson Education.

Protsiv, Sergiy (2012). Attraction and Repulsion: Modelling interfirm interaction in geographical space. *Stockholm School of Economics, Stockholm.*

Rodríguez-Pose Andres, Riccardo Crescenzi (2008), R&D, spillovers, innovation systems and the genesis of regional growth in Europe, Regional Studies, Vol. 42(1), pp. 51-67

Rodríguez-Pose, Andres, Michael Storper (2006), Better rules or stronger communities? On the social foundations of institutional change and its economic effects, Economic Geography, Vol. 82(1), pp. 1–25.

Rodríguez-Pose, Andres (1998) Social conditions and economic performance: The bond between social structure and regional growth in Western Europe, International Journal of Urban and Regional Research, Vol. 22, pp. 443–459.

Scott, AJ, and M. Storper (2003), Regions, globalization, development, *Regional Studies*, Vol. 37, 579-593.

Segal, D. (1976). Are There Returns to Scale in City Size? *The Review of Economics and Statistics*, 58(3), 339–350.

Shefer, D. (1973). Localization Economies In SMSA's: A Production Function Analysis. *Journal of Regional Science*, *13*(1), 55–64.

SolAbility (2012), The Global Sustainable Competitiveness Index 2012, Seoul.

Spence, Michael, Patricia Clarke Annez, Robert Buckley (eds.), *Urbanization and Growth*, Commission on Growth and Development, Washington: 2009.

Stiglitz, J.E., A. Sen, J.-P. Fitoussi (2009). Report by the Commission on the Measurement of Economic Performance and Social Progress. *www.stiglitz-sen-fitoussi.fr*

Sveikauskas, L. (1975). The Productivity of Cities. *The Quarterly Journal of Economics*, *89*(3), 393–413.

Thompson, Peter, Patent Citations and the Geography of Knowledge Spill-Overs: Evidence from Inventor- and Examiner-Added Citations, *Review of Economic and Statistics*, Vol. 88 (2006), 383 – 388.

Wennberg, Karl, Göran Lindqvist, The effect of clusters on the survival and performance of new firms, *Small Business Economics*, June 2008.

World Economic Forum (2012), *Global Competitiveness Report 2012*, WEF, Geneva.

Yale (2012), *Environmental Performance Index 2012*, New Haven, CT.

ENDNOTES

[i] www.clusterobservatory.eu

[ii] The overseas territories were omitted and some regions merged to NUTS 1 due to data availability. These include: Ireland, Slovenia, and the German lands of Brandenburg, Niedersachsen and Rheinland-Pfalz each represented as a single region. Also, South Tyrol was merged with Trento in Italy and Åland with South Finland.

[iii] Data in Czech Republic, Greece and the Netherlands is only available on 3-digit level, while data in United Kingdom only available using NACE revision 1.1. For all these countries the data is also relatively old and comes from 2005-2006. For the rest of the countries the data typically covers 2010 or 2011.

[iv] Using the same technique for the countries where the data was actually available on regional 4-digit level, we checked that the correlation between the estimated data and the actual one is 0.83.

[v] The effect of the individual industry was somewhat more pronounced than in the full sample, however it is hard to judge whether this is due to the discrepancies introduced when estimating average wages, or due to the systematic differences between the large countries that were excluded from the sample and the remaining ones.

[vi] The full list of variables is: Total R&D expenditure (GERD) over GDP, Human resources in science and technology – Core, as a percentage of total population, Percentage of households with broadband access, Percentage of individuals who ordered goods or services over the internet for private use, Number of students in tertiary programmes with academic orientation (ISCED5a) over population aged 20 to 24, Number of students in pre-vocational (ISCED3VPV) and vocational (ISCED4VPV) programmes over population aged 15 to 24, Percentage of adults aged 25-64 participating in education and training, Percentage of the active population aged 25 and over who have attained at least upper secondary education (ISCED3), Foreign nationals in skilled occupations (ISCO1, ISCO2 and ISCO3) as a percentage of total employment (all the variables listed so far were sourced from Eurostat), Regional multimodal potential accessibility (based on ESPON data), Percentage of people who says that most people can be trusted, Percentage of people who says that they have trust in the legal system (Calculated from the European Social Survey).

[vii] Among the clusters that fall in top 80% by employment within their respective sector. This filtering is done to remove the very small clusters that achieve spuriously high LQs.

[viii] http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators

[ix] Most data points for the economic prosperity indicator were available, though income for Malta had to be estimated and institutional investment was only available on national level for Bulgaria.

[x] Data for social inclusion was mostly available, though with some issues: poverty data is rather poor in UK and Portugal and refers to 2009 and 2005 respectively. Elsewhere, data had to be estimated from a larger region for DED1 and DED3 for unemployment, FR83, ITC2, PT20 for tertiary education, and AT11, AT21, AT32, FR63, FR83, UKM5 and SK01 for early leavers from education datasets. Also, due to the single decimal digit precision of the employment indicators, sometimes the difference between sexes was 0, which is problematic for taking logs and was replaced with values 0.05 that is less than the precision of the reported values.

[xi] Environmental sustainability indicators defined on national level were available for all countries, waste treatment was also present for all regions but for the Portuguese islands PT20 and PT30, which were assigned the levels of mainland Portugal. The land use indicator, on the other hand, was missing for Bulgaria, Malta and Romania, as well as some island regions: ES53, ES70, GR22, GR41, GR42, PT20 and PT30. Since the land use patterns in these regions are far from similar and to avoid assigning completely arbitrary numbers, we chose to impute the missing values based on another, less precise Corine land use dataset, which covers most of the missing regions. Islands in Greece and Portugal were also missing from Corine and were assigned the overall mean of the dataset.

[xii] We also included an indicator of belonging to EU12 to more clearly separate the two large groups of regions as they have rather different medium-term history.

[xiii] We also experimented with a full spatial model where the performance in a region depends on the values of performance and predictors in the neighboring regions and achieved similar, even more pronounced results. But to keep the modeling simple we simply include the EU-12 dummy as it captures the most imporatant spatial distinction among regions in Europe.

[xiv] When an organization was involved in several sectors, it was split equally among them. Some sectors, such as Nanotechnology, cannot be matched to NACE codes and thus were skipped. Thus, after also discounting organizations that had no sectoral information available, there were 692 organizations linked to sectors.

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Project Information

Welfare, Wealth and Work for Europe

A European research consortium is working on the analytical foundations for a socio-ecological transition

Abstract

Europe needs a change: The financial crisis has exposed long neglected deficiencies in the present growth path, most visibly in unemployment and public debt. At the same time Europe has to cope with new challenges ranging from globalisation and demographic shifts to new technologies and ecological challenges. Under the title of Welfare, Wealth and Work for Europe – WWWforEurope – a European research consortium is laying the analytical foundations for a new development strategy that enables a socio-ecological transition to high levels of employment, social inclusion, gender equity and environmental sustainability. The four year research project within the 7th Framework Programme funded by the European Commission started in April 2012. The consortium brings together researchers from 33 scientific institutions in 12 European countries and is coordinated by the Austrian Institute of Economic Research (WIFO). Project coordinator is Karl Aiginger, director of WIFO.

For details on WWWforEurope see: www.foreurope.eu

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