



DELIVERABLE 1.1

ISSUES OF COMPETITIVENESS AND REGIONAL GROWTH IN RELATION TO TRANSPORT INFRASTRUCTURE INVESTMENT: A LITERATURE REVIEW ON ASSESSMENT METHODOLOGY

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1. Summary

Competitiveness can be defined in a narrow sense, as we will do, as

Competitiveness is the extent to which firms in a particular region can compete with those elsewhere. Critical factors for competitiveness are those that determine the level of productivity in a region in relation to other regions.

However, especially in the language of policy, ‘broad’ definitions abound, where the competitiveness of regions equates the success of regions, however defined, without theory or empirics. This document surveys part of the definitions current in the literature, as well as some of the analyses of factors underlying (influencing) competitiveness. Transport infrastructure

Finally, this document gives a brief overview of two appropriate economic models for regional growth, as well as some recent empirical work on competitiveness.

2. Introduction

This document is the first deliverable of the first work package of the I-C-EU project on the Impact of Transport Infrastructure on International Competitiveness of Europe. The project seeks to relate the concept of competitiveness to that of transport infrastructure development. Explaining this relationship will be made possible by state-of-the-art assessment tools, an analysis of the current situation of European economic and competitiveness, and an overview of the current European strategy to improve economic performance and competitiveness. Based on this, I-C-EU will provide recommendations to the European Commission on political interventions to enhance the competitiveness of Europe both externally, i.e. in relation to the rest of the world, and internally, i.e. between its countries and regions.

Transport plays a vital role in the different stages of world economic development, including the current phase of globalisation. In particular, as Baldwin (2006) summarizes, the invention of the railways made the spatial separation of production and consumption possible, so that cities could start to produce goods for other cities, and their food could come from further away. Before the nineteenth century, such regional specialization had been lucrative only for very special commodities, such as pepper from the East Indies; but from that moment onwards, whole nations could specialise according to their competitive advantage. More recently, the digital revolution made it possible to separate not only production and consumption, but even the separate stages of production – the so-called “second unbundling”. Such unbundling involves even more transport of intermediate goods, even if only between adjoining factories as in the case Dell computers (Friedman 2005). Regions without appropriate transport infrastructure risk being left out of the global chains of production. Hence the prime importance of transport infrastructure for growth and competitiveness.

As a first step, this document contains a brief survey of the issue of competitiveness, focusing on two questions: how is it generally and can it be best defined (sections 3 and 4), and what determines the competitiveness of a region (section 5)? We also give a brief overview of related theoretical (section 6) and empirical work (section 7), to show how the concept is operationalized in models and estimations. Section 8 concludes.

Some closely related future deliverables within the project are:

- D1.3, an overview of indicators of competitiveness and regional growth in relation to transport infrastructure investment, expected mid-2013;
- D2.2, a review of infrastructure project assessment practice in Europe regarding impacts on competitiveness and growth, expected in late 2013; and
- D4.1, a review of European policy approaches to foster competitiveness; also expected in late 2013.

3. Overview of definitions

3.1 Competitiveness of a firm

The concept of competition of course has its origin at the firm level. Basic definitions of firm competitiveness abound; it will suffice to quote just two. In a preparatory study for the Fifth Cohesion Report (Cambridge Econometrics et al. 2004), competitiveness is defined as

[being] based on the capacity of firms to compete, to grow, and to be profitable. At this level, competitiveness resides in the ability of firms to consistently and profitably produce products that meet the requirements of an open market in terms of price, quality (p. 2-1)

and likewise in the UK:

the ability to produce the right goods and services of the right quality, at the right price, at the right time. It means meeting customer needs more efficiently and effectively than other firms. (Department of Trade and Industry 1998, cited in Budd & Hirmis 2004)

These are straightforward elaborations of the concept of competition on price and quality. The “Porter diamond” (Porter (ed.) 2009) is likewise based on notions of competing firms.

However, when applied to countries or regions, all of these definitions are vulnerable to what is called Krugman’s Coca Cola-critique: countries can grow (enjoy increasing standards of living) also when they are not themselves “profitable” (have a positive trade balance, in Krugman’s view), because they enjoy positive feedback from the growth of other countries (Krugman 1994). We therefore feel these definitions, and similar definitions at the firm level, do not have much to say for the country or regional level.

3.2 Issues with competitiveness

The “competitiveness” of countries and regions is a fashionable concept, underlined and enhanced by its position at the core of the Lisbon Strategy (2006).¹ The wide body of extant literature has not reached a common definition, and in fact, a sizeable number of papers is devoted to struggle against common misconceptions. To quote Budd & Hirmis 2004,

“there is a danger that competitiveness at a territorial level becomes a conceptual chimera. The essential problem is that territorially based actors and agencies seek to position and maintain the utility of their regions and subregions by reference to a set of measures and indicators that are conceptually suspect and often empirically weak.”

Similar criticism was voiced by Bristow (2005), who called the discourse on regional competitiveness “chaotic and ill-defined”. She even goes so far as to suggest that solving this problem comes from “within the policy process and the imperative of legitimating certain courses of policy action.” We, however, will argue there is a sensible, scientifically useful side to the concept of competitiveness.

In the literature on competitiveness, much effort is devoted time and again to formulating a proper definition. Since the concept is not in wide use among economists, but popular among policy makers

¹ It has, however, disappeared from the new Europe 2020 strategy (European Commission & European Com 2010).

(Budd & Hirmis 2004), definitions are varied and possibly geared towards political debate rather than scientific analysis; “policy has raced ahead of conceptual understanding and empirical analysis” (Kitson et al. 2004).

One major flaw in the application of competition to countries, as Krugman (1994) points out, is that countries are not independent from each other. He contrasts this with competition between firms: Coca Cola does not sell much of its coke to Pepsi employees, and thus will not suffer from a demise of Pepsi (Krugman 1994). The fate of countries is much closer intertwined; the current crisis shows that countries indeed do not easily go bankrupt (Wyplosz 2010).

We will now briefly discuss, in chronological order, a number of definitions of competitiveness at the country or regional level, noting the purpose for which they were written, and their deficiencies. For comparison, a second section gives some definitions of firm competitiveness.

We start with five definitions that share some characteristics. An old US definition, prepared under the Reagan administration but apparently used until much later, reads

"A nation's competitiveness is the degree to which it can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously expanding the real incomes of its citizens. Competitiveness at the national level is based on superior productivity performance and the economy's ability to shift output to high productivity activities which in turn can generate high levels of real wages. Competitiveness is associated with rising living standards, expanding employment opportunities, and the ability of a nation to maintain its international obligations. It is not just a measure of the nation's ability to sell abroad, and to maintain a trade equilibrium."
[The Report of the President's Commission on Competitiveness (1984)]

It is this definition that Krugman discusses, together with a similar, shorter one, in Krugman 1994:

[the] ability to produce goods and services that meet the test of international competition, while [...] citizens enjoy a standard of living that is both rising and sustainable [attributed to Laura D'Andrea Tyson, Council of Economic Advisors (of the USA)]

And in one of the European Competitiveness reports we similarly find

"An economy is competitive if its population can enjoy high and rising standards of living and high employment on a sustainable basis. More precisely, the level of economic activity should not cause an unsustainable external balance of the economy nor should it compromise the welfare of future generations." (European Communities 2000)

The OECD uses varying definitions, among which we find the following:

"[Competitiveness] may be defined as the degree to which, under open market conditions, a country can produce goods and services that meet the test of foreign competition while simultaneously maintaining and expanding domestic real income" (OECD Programme on technology and the Economy 1992)

Finally, an influential definition comes from the scientific literature:

We can define (systemic) competitiveness of a territory as the ability of a locality or region to generate high and rising incomes and improve livelihoods of the people living there."
(Meyer-Stamer 2008, p. 7)

What these five definitions have in common, is that they focus on welfare. In our view, outcomes should not be part of the issue itself. In fact, the EC definition only gives two outcomes, and then proceeds to give further instructions that seem to apply more to sustainability than to competitiveness. Against this type of definition, Krugman (1994) protests that the standard of living is influenced by many other factors than a trade balance, and all the more so for countries or regions where there is little outside trade – such as the US in the 1950s. In those cases, competitiveness would more or less equal productivity. Therefore, rising standards of living may well be the ultimate goal of policy, but they should not be included in the definition. It is useful, however, to note that where at the firm level being competitive leads to survival, at the country level an equivalent is sought to indicate a country thrives. Other definitions which choose to measure an outcome focus on the attraction of R&D, FDI or, in the case of Huovari et al. 2001, attracting production factors such as capital and labour:

Regional competitiveness is defined as an ability of regions to perpetuate and attract mobile production factors.

This is a completely different perception of competitiveness: it boils down to providing the right locational factors for people (jobs, housing, amenities, etc.) and firms (accessibility, agglomerational advantages, institutional quality, etc.). We call this a broad definition of the concept. A strict, though vague, definition is found in Kitson et al. 2004:

[R]egional (and urban) competitiveness might be defined as the success with which regions of production and cities compete with one another in some way.

The OECD, in a report on the *Impact of Transport Infrastructure Investment on Regional Development* (2002), follows a similar distinction; they distinguish different ‘goals of government’, stating that

[t]here is an abundance of literature on the productivity of infrastructure investment. The general conclusion reached is that public capital has an impact on private capital, on labour productivity and hence on economic growth

but that a “broader view of economic development” can also be taken, “linked to the concept of sustainable growth” – i.e., not to competitiveness, but a broad and often vague concept nonetheless (Daly 1993).

Finally, the World Economic Forum has been using the same definition for many years in its yearly reports on competitiveness at the country level:

[the] set of institutions, policies and factors that determine the level of productivity of a country (Porter et al. 2007)

We define competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country (Schwab & Sala-i-Martin 2012, p. 4)

This definition is more brief than those above, leaving out consequences of being competitive, and staying close to an economists’ interpretation: in competition, productivity is what decides who will gain the upper hand. Therefore, this is the definition upon which we will base our own, with one modification: this definition seems to give an exhaustive, threefold list of determinants, but in fact the third determinant is a hold-all category of “factors”. In our definition, institutions and policy are also subsumed into that category, and section 5 will discuss which factors we deem important.

4. Definition

We have now outlined these common pitfalls of defining “competitiveness” in section 3 above. Our basic working definition, that we will use within the I-C-EU project as a whole will be:

Competitiveness is the extent to which firms in a particular region can compete with those elsewhere. Critical factors for competitiveness are those that determine the level of productivity in a region in relation to other regions.

In this definition, we understand ‘compete with firms elsewhere’ to mean that they “produce goods and services that meet the test of international markets”. Other key elements of the definition are ‘firms’, ‘region’, and ‘productivity’; we will discuss these three below. Finally, the definition refers to ‘critical factors’. Literature has not decided which factors these may be, and we discuss some attempts in section 5 below, with a focus on empirical work in section 7.

4.1 Firms

The key actors in competitiveness, as in innovation and economic growth, are individual units – firms, entrepreneurs, employees – and not sectors or regions. This contributes to the problems of “regional competitiveness” discussed above (§3), but the relevance of the region vis-à-vis individual actors is a recurring issue in the literature (Lagendijk 2001), where ‘reification’ of regions – treating abstract objects as if they were concrete – can be dangerous; it can lead us to believe the region itself makes decisions (rather than its institutions) or has knowledge (rather than its inhabitants). Regions are only a construct, and our definition therefore explicitly reads “firms in a region”.

4.2 Region

Competitiveness can be considered at any regional scale – nations, supranational bodies (such as the EU), and at any subnational level. Since institutions are generally assumed to play a role in regional competitiveness (Rodrik et al. 2004), a regional level without governmental institutions (e.g., the NUTS3 level in some European countries) may be less appropriate. However, any spatial grouping of firms can be analysed. Within the I-C-EU project, we will particularly look at the subnational level, since this is where infrastructural investments take place. At the European scale, several large investments cover multiple (NUTS1 or NUTS2) regions; we are thinking especially of the TEN corridors. Yet in the end, these also amount to a string of regions that are connected, and within a country or a group of countries, the positive effects of these investments are invariably found in some places and not in others.² Of course, these local effects can easily be added up to calculate a national or European effect; in fact, large-scale infrastructure investments in Europe’s regions are mostly intended to benefit the Union or even the continent as a whole. This is why we can speak of an international competitiveness of Europe, as in the title of the I-C-EU project.

4.3 Productivity

The core concept in competition is a productivity difference. Michael Porter discusses the many concepts of competitiveness in *On Competition* (09), in a text box titled ‘What is National Competitiveness?’:

² Due to waterbed effects, regions further away from the investment can easily experience negative effects.

“some see national competitiveness as a macroeconomic phenomenon, driven by variables such as exchange rates, interest rates, and government deficits. [...] Others argue that competitiveness is a function of cheap and abundant labor. [...] Another view connects competitiveness with bountiful natural resources. [...] government policy [...] differences in management practices [...] Clearly, none of these explanations is fully satisfactory; none is sufficient by itself to rationalize the competitive position of industries within a national border. [...] The only meaningful concept of competitiveness at the national level is productivity.” (pp. 174-176)

Classical economic models assume that such differences across regions do not exist; it was with the introduction of so-called endogenous growth models that structural differences in productivity were acknowledged (see 6.1 below). Technically, in these models regions (most often countries) evolve over time towards an estimated steady-state, which is predicted from region-specific factors (the “A” component in such models).

5. Factors

At the regional level, there are many prerequisites for competitiveness and growth. Of course this starts with primary geography, those aspects of the physical world that man has not shaped himself; Hungary is land-locked, most of Norway is mountainous, Italy has a mediterranean climate. In the literature, we therefore see that surveys of enabling factors for competitiveness and growth focus on the built environment (infrastructure), on societal characteristics, and on economic aspects.

5.1 Previous overviews

Among the factors influencing competitiveness, Schwab & Sala-i-Martin (2012) as well as previous World Economic Forum publications mention the following twelve ‘pillars’, which together constitute their Global Competitiveness Index (GCI); the list is amended by the Joint Research Centre of the European Commission (Annoni & Kozovska 2010, pp. 4-7), who propose some minor changes when setting up their Regional Competitiveness Index (RCI). Mainly, they leave out the goods and financial markets, as these are rather homogeneous within the EU; they also split pillar 4. That leads to the following comparison:

World Economic Forum list	JRC list
1. institutions	institutions
2. infrastructure	infrastructure
3. macroeconomic environment	macroeconomic stability
4. health and primary education	health
	primary and secondary education
5. higher education and training	higher education and training
6. goods market efficiency	
7. labour market efficiency	labour market efficiency
8. financial market development	
9. technological readiness	technological readiness
10. market size	market size
11. business sophistication	business sophistication
12. innovation	innovation

JRC then proceeds to mark the last four items on their list as “output” variables, which are outcomes rather than driving forces of competitiveness. This implies these variables can be used to measure a region’s competitiveness, but not to influence it. They *reveal* competitiveness, just as the location choice of firms or investments (e.g., foreign direct investment) does. A clear division of indicators between outputs on the one hand and outcomes on the other is very important; the current debate on the Common Monitoring and Evaluation Framework of the EU also stresses that outcome targets should be explicitly linked to the policies and projects in question (Barca & McCann 2011). Therefore, factors that are only vaguely associated with a concept but are not an underlying cause should, if possible, not be taken into account.

The OECD in 2001 published a study “The New Economy: Beyond the Hype”, discussed by Cambridge Econometrics et al. 2004 (p. 2-22). The OECD, heavily influenced by the economic vicissitudes of the 1990s, identified:



1. ICT
2. innovation and technology diffusion
3. human capital (including all types of education as well as child care)
4. entrepreneurship
5. macroeconomic factors: stability, competition, financial systems

In a similar attempt, the Cambridge Econometrics study we mentioned above provides a review of empirical studies on competitiveness, and reaches the following threefold overview of regional factors of competitiveness (p. 2-32), where the third class is in fact a hold-all of different factors:

1. infrastructure & accessibility
physical, technological, knowledge (i.e., education), “quality of place”
2. human resources
migration of skilled workers, diversity, knowledge-intensive skills
3. productive environment
entrepreneurial culture, agglomeration, exports, investments, innovation, institutions, capital

The question is now, whether these are factors that stand side-by-side, or whether we can present them in a more structural way. Influential work at both firm and country level has been done by Michael Porter, who created a four-category framework, the so-called “Porter Diamond” (Porter 1990, cited in Budd & Hirmis 2004). Its four edges signify:

- factor conditions
- demand conditions
- related and supporting industries
- firm strategy, structure and rivalry.

However, it is plain to see that Porter’s analysis at the country level is rooted deeply in his work as a strategist with mercantilist tendencies (Krugman 1996); in his work, competition, competitiveness and comparative advantage often conflate (Davies & Ellis 2000).

Another early attempt to classify the factors underlying the competitiveness of regions (or cities, in this case) is Kresl 1995 (discussed in Budd & Hirmis 2004). He sees six factors, grouped into two categories: quantitative on the one hand, qualitative (‘strategic’) on the other. In general, his perspective is that of the local government looking for policies to implement, not that of the economist analysing the relative performance of cities. This makes his classification difficult to use in an analytical context:

- high-skill, high-income jobs
- environmentally orientated goods and service production
- production of goods and services with high-income elasticity of demand
- rate of economic growth geared to full employment without overheating markets
- specialization of activities based on future potential
- move up the urban hierarchy (cf. Christaller 1933).

Another attempt to clarify the relative position of factors is presented by Gardiner et al. 2004. They organize competitiveness in a triangle (partly based on Lengyel 2004), which we reproduce in Figure 5.1 below. Gardiner et al. acknowledge the position of living standards and quality of life as a “target outcome” – hence, not part of competitiveness per se. Competitiveness is *revealed* in labour productivity, lack of unemployment and a high regional GDP (“Gross Regional Product” or GRP), and



these also are not the knobs that policy can turn. The factors that actually constitute competitiveness, and we could call these the “critical” factors, are found at the bottom of their pyramid: these are culture, human capital (“skills”), accessibility, and some others. Thus, this pyramid gives a three-way categorisation of factors, which we will expand upon below.³

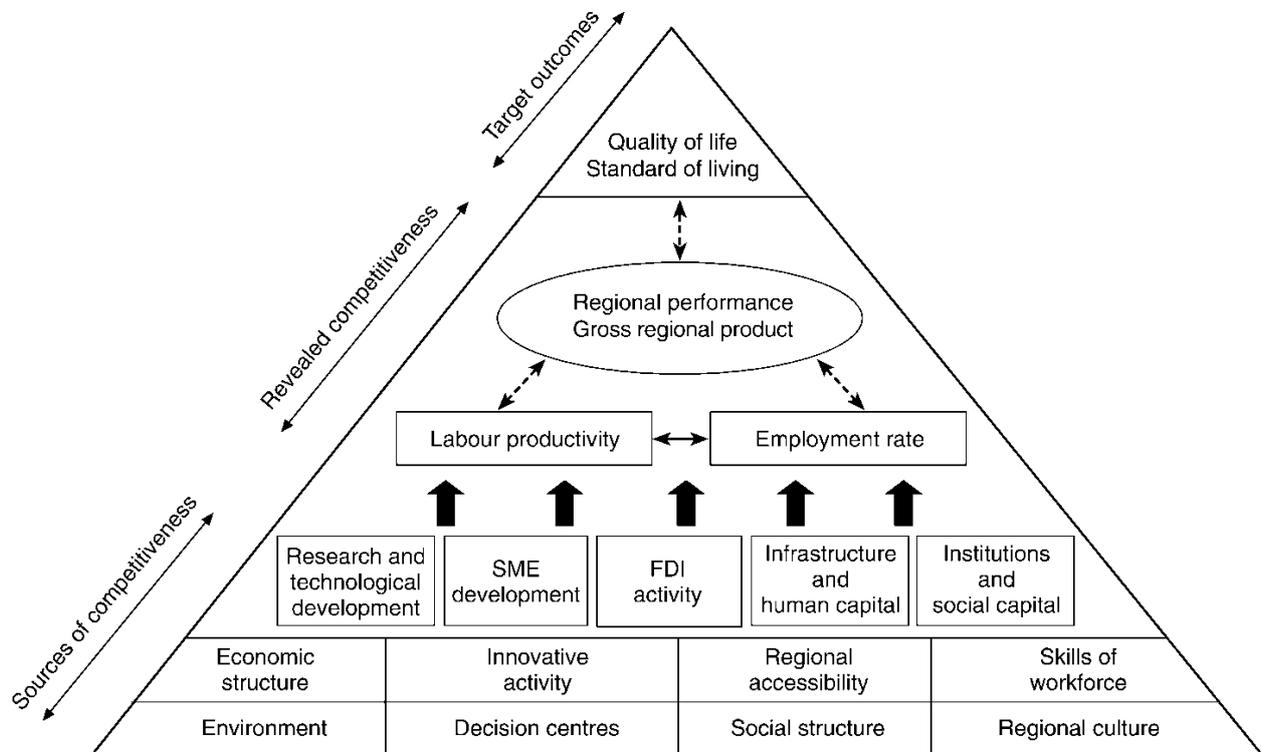


Figure 5.1 Competitiveness triangle of Gardiner et al. (2004).

5.2 The role of infrastructure

Infrastructure is a key factor in all the models discussed above. Indeed, infrastructure is a key instrument for local and national governments to influence the spatial configuration of activities as well as the competitiveness of regions, however we define competitiveness. Looking at infrastructure, we mainly think of physical infrastructure for transporting goods or persons; but in fact, some studies follow a pure definition that is much broader, and see as infrastructure (Martin & Rogers 1995)

any facility, good, or institution provided by the state which facilitates the juncture between production and consumption. Under this interpretation, not only transport and telecommunications but also such things as law and order qualify as public infrastructure.

In such a wide definition, all public investments qualify as infrastructure. There has been a long strand of economic research into the benefits of public investment, starting from Aschauer 1989. An overview of the empirical literature was undertaken by Bom & Ligthart 2011, who not only managed to explain most of the variation in the literature by looking at characteristics in the extant analyses, but also provide us

³ Note that in our opinion, the choice by Gardiner et al. to position innovative activity at the bottom can be questioned, as this could also be an outcome at the middle level. However, it makes some sense that there is at least one knowledge-related variable at the bottom of the triangle.

with a balanced average elasticity of such investments; they pin this output elasticity at 0.051, which is rather small, but it is higher for investments at the regional level and in the longer run.

We will stick, however, to just transport infrastructure. Although the studies mentioned above provide excellent overviews of the factors influencing competitiveness, their interpretation of the position of infrastructure and transport as a separate factor alongside the others is debatable. This is valid even in the pyramid of Gardiner et al. 2004. We therefore propose to categorise the factors constituting competitiveness in yet another way, with specific regard to infrastructure.

We choose not to see infrastructure as a separate factor, since we feel this cannot be its true significance, however useful it may be in empirical studies to treat it as one of the factors.⁴ The bare ability to drive over a motorway doesn't make a contribution to (the possibilities of) economic growth without somewhere to go – be it to meet people, to fetch spare parts, or to go to the theatre. Instead, the prime function of infrastructure is that it defines the spatial scope of activities, which is often measured in minutes rather than kilometres. The Chunnel brought Paris and London closer (Vickerman 1994); high-speed trains in effect made France, Japan and Spain smaller countries, although their effect is thought to be mixed (Givoni 2006); the NEAT project is thought to radically adjust the human geography of Switzerland (cf. Spiekermann & Wegener 1994). By bringing new areas into the biosphere of a (city) region, certain aspects of that region become stronger, and some of these drive competitiveness.

We will give three simple examples of how infrastructure investments influenced other factors: the A24 in Italy, the HSL Zuid in the Netherlands, and the Rotterdam harbour.

- Rome is a city of many amenities – ancient and baroque heritage, a lively cultural scene, acceptable housing (Pacione 1998). However, the opening of the Gran Sasso motorway in 1970 (Rome-Torano, A24) added a new aspect to this, with mountain recreation now at an easy drive from the city. Such amenities contribute to the attractiveness of the city, and thus to the quality of the labour force.
- In the Netherlands, the mean commuting time is commonly estimated to be one hour (Schwanen et al. 2004). Thus, Amsterdam and Rotterdam used to be outside each other's labour markets, although their markets overlap (including the cities of The Hague, Gouda and possibly Leiden). With the construction of the new high-speed line between those two cities, which opened in 2009, travel time from Rotterdam Centraal to the business developments at the Amsterdam South Axis is now 42 minutes; this means that those living not too far from Rotterdam Centraal can now reasonably work at one of the financial companies in Amsterdam. Hence, those companies enjoy a denser labour market, with all of its Marshallian advantages.
- Again in the Netherlands, the harbour of Rotterdam has benefited or is thought to benefit in the future from two large investments over the past decade: a second Maasvlakte, built out into the sea, which allows for even larger vessels to be (off)loaded; and a dedicated railway into the German hinterland, the Betuweroute. The first keeps Rotterdam in the world market, where ship

⁴ Note that this compares to cost-benefit analysis, where one can either analyse the total gains in travel time, or the economic benefits in lower transport costs: but in the end, both amount to the same figure. (

sizes are ever increasing; the second keeps Rotterdam an attractive choice also for the Ruhrgebiet and beyond to use as a transfer point for imports and exports.

We therefore propose to regroup the common set of factors that together influence competitiveness, differentiating by those that are mediated by infrastructure, and those that are not. We do not cover ‘output indicators’ such as innovation; those are mainly useful for *measuring* competitiveness.

5.2.1 Factors for which spatial scope is flexible

There are six factors in the general lists that are highly influenced by their spatial scope, and where this spatial scope can be changed. Increasing the spatial outreach of the entities involved (hospitals, universities, firms) brings more individuals within their reach, and thus these individuals can become healthier and more educated; firms can simply sell their products to more consumers or other firms, including better matching of intermediate products. Agglomeration benefits also occur here, especially on the job market, where better matching can be provided, but also in more extensive knowledge spillovers between firms.

1. health (but not primary education)
2. higher education and training (both through accessibility of locations providing these; in the case of higher education also through wider commuting)
3. goods market efficiency
4. labour market efficiency
5. market size
6. technological readiness (= absorptive capacity)

The last four items of this list are in line with the table Elhorst et al. 2004 give of additional welfare effects (Table 3.1, p. 32, translated in the Appendix).

5.2.2 Factors with less flexible spatial scope

For some of the commonly mentioned factors, changes in the spatial scope are difficult and/or rare. Institutions normally operate within administrative boundaries that are largely set in stone; they only rarely change due to infrastructural developments. These borders are also very influential for the macroeconomic environment and financial markets, both of which develop mainly at the national level. In general, factors such as the public sector, finance and barriers to foreign trade should not be considered when looking at regional competitiveness (Huovari et al. 2001). The scope of primary education, finally, we find at the opposite end: it is so local that an increase in infrastructure can only enhance its range in areas of very low density.

1. institutions
2. macroeconomic environment
3. primary education
4. financial market development

5.2.3 Infrastructure for prestige

A final role for infrastructure, which falls outside the above categories, is that of being a location factor for firms that want to be seen – being located next to a motorway is as much a question of quick access for customers as it is a way to gain free publicity. In turn, this leads to a higher status of firms located



very close to infrastructure, as well as an expanded role for “accessibility” in the perception of entrepreneurs – which is among the top factors influencing location choice, both in the Netherlands (Meester & Pellenbarg 2006) and abroad (Kawamura 2004). Even if no one is actually driving on the motorway, it can be a matter of perceived prestige to be located on it. Moreover, perceived accessibility is also of importance for residential location choice (Zondag & Pieters 2005).

6. Modelling

Analysing regional success (whether we focus on growth, productivity or productivity) inevitably leads to one of the models that economists have developed in the past decades. Besides the traditional neoclassical paradigm, two strands stand out in particular: the Endogenous Growth literature, and the New Economic Geography.⁵ For a broader discussion of all three paradigms, see Kitson et al. 2004.

6.1 Endogenous Growth

Until the 1990s, a large part of the models of regional economics followed the neoclassical road indicated by Solow (1956) and Swan (1956). In these models, labour and capital were the only two production factors. The growth rate of total production is exogenous; although it supposedly captures technological factors, it is in fact no more than a ‘measure of our ignorance’ (Abramovitz 1956). Kenneth Arrow (1962) and Eytan Sheshinski (1967) instead strove to develop a model of economic growth that placed the amount of available knowledge at the core of production, on a par with labour and capital inputs. It is their work that was later developed by Paul Romer into his endogenous growth models (1990).

In Arrow’s 1962 paper on learning by doing, he strives to develop “an endogenous theory of the changes in knowledge” (p. 155). To that end, he uses the stock of capital goods as a proxy for experience, which functions as a determinant of productivity. Van de Klundert & Smulders (1992) give a good overview of the theory of Arrow and Sheshinski in a framework closely related to that of neoclassical economics. They write

$$y_i = Ak_i^\alpha l_i^{1-\alpha} \quad (1)$$

at the firm level (i), with A as a technological modifier. A can then be written as the sum of all capital stocks, with an extra multiplier γ (van de Klundert & Smulders 1992, footnote 3):

$$A = \left(\sum_{i \in I} k_i \right)^\gamma = K^\gamma \quad (2)$$

where K is the sums of all k ’s. The most interesting feature of this specification is the summation over all firms i out of a population I , and the main question is how to demarcate this population. (This topic we will cover in the next section.) Substituting (2) into (1) and rewriting (1) for the whole economy Y instead of for individual firms then renders

$$Y = AK^\alpha L^{1-\alpha} = K^{\alpha+\gamma} L^{1-\alpha} \quad (3)$$

Hence, individual firms benefit from a given technology parameter A ; but the economy as a whole benefits from the accumulated technology, embedded in capital. In other words, there are increasing returns to scale at the macro level.

There are many ways in which we can interpret these stocks of accumulated technology. Romer himself wrote of technological change that he interpreted it as ‘improvement in the instructions for mixing together raw materials’ (Romer 1990, p. S72, but cf. also Romer 1998). Yet that definition is derived from the model itself, which otherwise contains the raw inputs of capital and labour, and a human capital

⁵ The brief summary of endogenous growth theory is taken from Smit & de Groot f.c..

variable, which Solow and Swan also used. Human capital in these models is considered an embodied factor, that cannot accumulate indefinitely. Productivity then partly depends on tacit knowledge embedded in these individuals; their quality has an important influence on the results of mixing capital and labour.

There are, however, other ways to interpret the knowledge component. It might be embedded in capital goods, for example, which are far less localized than individuals. Yet for capital goods, an important part is played by knowledge about the existence of these goods, and the ability to operate, repair and improve them. In contrast to the private character of capital goods, the new factor Romer added (in Romer 1990, but cf. again Romer 1998) was meant as a nonrival technological component; knowledge that can be simultaneously used by an unlimited number of producers. In many cases empirical work has taken this to mean a stock of R&D or accumulated patents; we see this for in the literature surveyed by Wieser 2005. However, the technology component is not restricted to knowledge; we can also see it as any measure that gives the local productivity an extra edge – i.e., a measure close akin to competitiveness.

Empirical applications of endogenous growth modelling in regional analysis are fewer than those at the country level; an overview is given in Izushi 2008. However, at the country level much work has been done to connect theory and empirics. Since endogenous growth models predict economic growth at country level, and actual growth rates do not match with predicted growth, some factors must be missing. Barro (1990) extended endogenous growth models with a government sector, that uses taxes to fund public services. Barro explicitly refers to infrastructure in this respect, following Aschauer 1989, but does not expand upon the effects of infrastructure investment. Note, however, that Sala-i-Martin 1997 compared the effect of dozens of variables on economic growth at the country level, and came to the rather disturbing conclusion that

no measure of government spending (including investment) appears to affect growth in a significant way.

6.2 New Economic Geography

Paul Krugman's famous conversion⁶ to regional economics, which led to him winning the Nobel Prize in 2008, set off with his publication of Krugman 1991a. Coming from a background in trade, Krugman there gave an explicit regional dimension to trade and agglomeration. His basic model, lucidly discussed in Brakman et al. 2001, mixes the following ingredients:

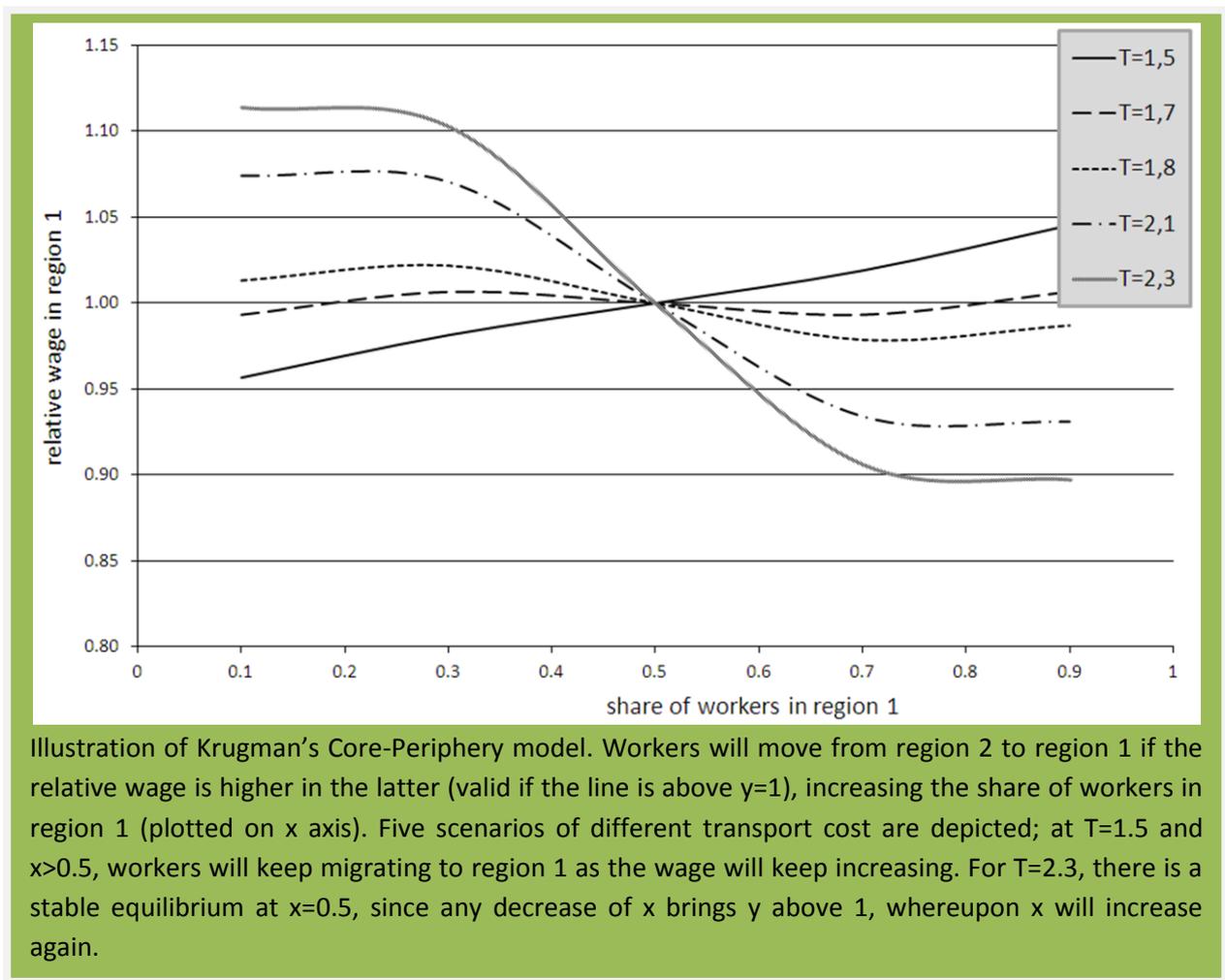
- two identical regions; distance plays no role (often referred to as 'north' and 'south')
- two sectors, of which one is mobile between the regions ('industry', with the immobile sector referred to as 'agriculture')
- iceberg transport cost (i.e., you produce a percentage more than you deliver to your buyer)
- firms consist of one labour unit ('worker') and no capital
- each firm produces one type of product (monopolistic competition; see Brakman & Heijdra 2004; Dixit & Stiglitz 1977), and consumers have a 'love of variety', i.e. they derive welfare from consuming different types of products

⁶ Actually, Krugman writes "I have spent my whole professional life as an international economist thinking and writing about economic geography, without being aware of it" (Krugman 1991b).

In this simple model, dynamics (in wages and in location decisions) result in a steady state, which can be calculated based on the parameters chosen. In such a steady state, push factors offset pull factors. One characteristic of the Krugman model is that it can predict not only stable equilibria (where the equilibrium is restored when a small change occurs – a new coal mine opening on one region, a butterfly flapping its wings), but also unstable equilibria.

Many aspects of the real world are highly stylized in the NEG model. For example, it does not include intermediate goods, continuous space, capital, or flexible prices for agricultural products. Subsequent work has picked up some of these aspects, leading to Krugman & Venables 1995, Krugman 1993, Baldwin & Martin 2004 and Puga 1999; an overview of adjustments to the model is presented in Ottaviano & Puga 1998.

Although its applicability to empirical research has been doubted (David 1999), and empirical applications initially were limited (Neary 2001), some studies have managed to successfully integrate parts of Krugman's model into empirical research, be it predictions or effects – e.g., Davis & Weinstein 1996; Kim 1995.



The specifics of investments in infrastructure are taken up in the context of New Economic Geography modelling by Baldwin et al. 2011. They show in their Chapter 17 how infrastructural improvements impact an NEG model with knowledge spillovers as well as congestion. Regional policy can choose to reduce transport cost within or between regions (viz., by adding infrastructure), but there are important tradeoffs between spatial efficiency and spatial equity, often with multiple possible outcomes ('equilibria') in the same model: high growth and low spatial concentration (an excellent result!), or low growth and high spatial concentration.

In our opinion, four aspects of the New Economic Geography have proven to be vital injections to the literature:

- the importance of space in modelling economic growth. Even in models based upon Dixit & Stiglitz, the location of firms matters for welfare, and so does the relative location of regions.
- the importance of transport. Infrastructure tended not to be present in spatial models, but Krugman's iceberg trick shows how transport cost can be included in a simple but compelling way, and Baldwin et al. 2011 manage to differentiate between intra- and interregional transportation.
- the importance of the migration of individual workers and firms. The macro and the micro level interact, and one decision to migrate can offset a chain reaction.
- the possibility of complete agglomeration in one region, with the other region (almost) empty. This happens at low transport cost, and is a risk of improving infrastructure.

Space, transport, migration and the risk of 'waterbed' effects will be issues studied within the I-C-EU project.

7. Empirics

Empirical work on competitiveness can be roughly divided into three classes. First of all, there is a large literature on its underlying factors, measuring their effect on growth, productivity, trade, migration etc., but not necessarily mentioning ‘competitiveness’. Secondly, there is a body of literature in which competitiveness is defined and/or described, but no analysis of (causal) relationships is undertaken. Such analyses then characterize the third group of studies, which will be the focus of this section. Cambridge Econometrics et al. 2004 (§2.3) provides a brief overview of these, which we have used as a basic stepping stone.

The empirical literature on competitiveness can also be described by another threefold division, and we will follow this for the rest of this section: by scale. The origins of competitiveness being at the firm level, there are many studies in that field. Historically, the next step was to look at the competitiveness of nations (Porter 1990). The final and for us most significant step is then to study the competitiveness of regions. For practical reasons, we will then look at studies that focus on Europe, and studies that look at the rest of the world.

As for the position of infrastructure in this literature, there is a large discrepancy between cost-benefit analysis and analyses of productivity and economic growth – where would also place analyses of competitiveness. Piet Rietveld wrote the following comparison, which unfortunately still holds true today (Rietveld 1995, our emphasis):

There is a remarkable gap between the recent studies on the contribution of infrastructure to productivity and economic growth, and the standard social cost benefit analysis of infrastructure projects as they are carried out in most countries (cf. Gramlich 1994 for a recent discussion). It is important to emphasize that the standard social cost benefit approach – although it undoubtedly has a number of shortcomings – contains a number of elements that are unfortunately overlooked in these productivity types of studies. This holds true for example for the negative externalities in infrastructure that are explicitly accounted for in social cost-benefit analysis, but that are ignored in productivity studies. Another major difference is that productivity studies completely ignore the benefits for consumers. Because of their polyvalence, most infrastructure types generate benefits for both firms and consumers. The benefits for consumers are often larger than for firms. For example, investments in the road network to overcome congestion problems often lead to travel time gains that - when evaluated in monetary terms – mainly accrue to consumers. Productivity studies focus on the benefits of infrastructure for the business sector. These studies often try to capture the indirect and long-term effects of infrastructure that are usually ignored in social cost benefit analysis. Another difference between the two approaches is that cost benefit studies are usually carried out at the project level, whereas productivity studies have a much more aggregate orientation. It is clear that the productivity-related studies are currently addressing very challenging research themes. Therefore, it can be accepted that these studies use a rather limited scope according to the standard social cost benefit approach. However, a closer link between the two types of approaches would be most welcome.

7.1 Firm-level competitiveness

Competitiveness is a clear-cut concept at the firm level: competitive firms are those that survive and possibly grow, non-competitive firms are bound to disappear. However, what actually underlies this Darwinian process is a jungle of factors. We name a few studies to show the wide range of factors taken into account at this level.

Networks have gained the interest of regional economists over the past decade. Both strong ties and weak ties have been found to be important for the spread of knowledge and the capacity of firms to innovate. Lechner & Dowling (2003) show with case studies how firms choose a different relational mix at different stages of their development in order to compete successfully.

Another popular topic is the impact of (cultural) diversity of the workforce. As a somewhat older example of this research at the firm level, Cox & Blake (1991) show how the competitive position of a firm can improve in six different ways: cost, resource acquisition, marketing, creativity, problem-solving, and organizational flexibility; and they relate these six areas to diversity.

7.2 National and regional competitiveness

At the regional level, the first step is to define indices to measure competitiveness. Within the I-C-EU project, we call these indices ‘indicators’, and will further elaborate on this topic in future deliverables. We will briefly summarize some previous attempts here.

Huovari et al. (2001) use a broad definition of competitiveness, looking at the general attractiveness of a region, which greatly expands the number of indicators they can use; they call this an “overall and coherent general index” as opposed to the “restricted number of aspects” that other studies cover. In fact, they look at a range of indicators at the labour market level (p. 7):

- | | |
|-----------------------------------|---|
| 1. Working-age population (15-64) | 9. High-tech sectors, share of value-added |
| 2. Participation rate | 10. Population |
| 3. Students | 11. Agglomerative sectors |
| 4. Technical students | 12. Supporting sectors |
| 5. Highly educated | 13. Specialisation |
| 6. R&D expenditures | 14. Road accessibility of markets |
| 7. Patents | 15. Air accessibility |
| 8. Innovative establishments | 16. Establishments engaged in foreign trade |

which they use to build a custom indicator of competitiveness. They find that some of these indicators (‘subindices’) are highly correlated: human capital, innovation, agglomeration and accessibility. As the next step, they perform an empirical analysis, matching their competitiveness indicator to short-term economic growth, measured in increases in GDP, income, employment or migration. Correlations with the short-term increase in GDP are especially low.

Norton (1992) looks at the relationship between national (US) and regional (New York, Route 128) competitiveness, arguing that urban agglomerations should be the main focus in the competitiveness debate. However, he does not offer a definition, and his empirics stem from sectoral analyses rather than regionally aggregated data.



Finally, Camagni argues strongly that the mechanisms presumed to underlie national competitiveness do not apply at the regional level, and that therefore much of Krugman’s critique is not valid at that level. He focuses on measuring competitiveness as “the attractiveness of local products by taking action on innovation”, what he calls “non-price competitiveness”. He lists five “sources of territorial competitiveness”:

1. Exports (in the short term) and supply side factors in general (in the long term)
2. Specific local resources
3. Local interaction networks, as in an innovative *milieu*
4. Regional interaction
5. Community strengths in attracting firms.

Unfortunately, no empirical work has ensued from this analysis.

8. Conclusion

Competitiveness is a concept with pitfalls and possibilities. Both in science and in policy it is often used without a proper definition. In preparing for a further analysis of competitiveness in the context of transport infrastructure in Europe, this document has provided a survey of definitions that are in fact used. Broad definitions, where the competitiveness of a country or region is almost synonymous with general ‘success’, abound, but are rarely conceptually embedded or empirically supported. Therefore, we have chosen to focus on a strict definition of competitiveness.

We have also briefly surveyed the factors underlying regional competitiveness. Some of these factors are strictly local, some strictly national; for most, however, infrastructure determines the relevant spatial range. This is the case, for example, in the exchange of goods, services and ideas. Transport infrastructure thus plays a key role in promoting the competitiveness of regions.

Appendix

This table is a translated extract of Table 3.1 in Elhorst et al. 2004. It reproduces the first seven rows (out of ten) and columns 3-11 out of twelve. The table contains, in the rows, types of infrastructure combined with types of labour markets; in the columns, we find different aspects of the regional economy. The cells show how under different labour markets, different types of new infrastructure are expected to have certain influences on the regional economy, both positive and negative. In some cases, the direction of effect is unknown, but in most, there is a tendency towards a positive or a negative effect, though of unknown size.

infra / labour market	product markets			labour markets			knowledge spillovers	international	
	price ≠ m.c.	scale advantages	product differentiation	geographic scope: quality	geographic scope: quantity	frictions		direct relocation	macroeconomic rebound
point / thin	-/+	+	0/+	0/+	0	-	0/+	+	-/0
point / thick	-/+	0/+	0/+	0	0/+	+	0/+	++	0
line / thin	-/+	0/+	0/+	+	0	-	0/+	-/+++	--
line / thin+thick	-/+	0/+	0/+	0/+	0/+	+	0/+	-/++	-
line / thick	-/+	0/+	0/+	0	0	0	0/+	-/+	0
goods	-/+	+	0/+	0	0	-/+	0	+	-/0
persons, services	--/++	0/+	0/+	0/+	0/+	-/+	+	+	-/0

abbreviations:

m.c. marginal cost



References

- Abramovitz, M. (1956), "Resource and Output Trends in the United States since 1870", *American Economic Review*, vol. 46, no. 2, pp. 5-23
- Aiginger, K. (2006), "Revisiting an Evasive Concept: Introduction to the Special Issue on Competitiveness", *Journal of Industry, Competition and Trade*, vol. 6, no. 2, pp. 63-66
- Annoni, P. & K. Kozovska (2010), *EU Regional Competitiveness Index* no. EUR 24346 EN
- Arrow, K.J. (1962), "The Economic Implications of Learning by Doing", *Review of Economic Studies*, vol. 29, no. 3, pp. 155-173
- Aschauer, D.A. (1989), "Is Public Expenditure Productive?", *Journal of Monetary Economics*, vol. 23, no. 2, pp. 177-200
- Baldwin, R. (2006), *Globalisation: the Great Unbundling(s)*, Economic Council of Finland, Helsinki
- Baldwin, R., R. Forslid, P. Martin, G. Ottaviano, & F. Robert-Nicoud (2011), *Economic Geography and Public Policy*: Princeton University Press
- Baldwin, R.E. & P. Martin (2004), "Agglomeration and Regional Growth", in J.V. Henderson & J.-F. Thisse (edd.), *Handbook of Regional and Urban Economics*, vol. 4, Amsterdam: Elsevier, pp. 2671-2711
- Barca, F. & P. McCann (2011), *Outcome Indicators and Targets: Towards a New System of Monitoring and Evaluation in EU Cohesion Policy*
- Barro, R.J. (1990), "Government Spending in a Simple Model of Endogenous Growth", *Journal of Political Economy*, vol. 98, no. 5, p. S103-S125
- Bom, P.R.D. & J.E. Ligthart (2011), *What Have We Learned From Three Decades of Research on the Productivity of Public Capital?* (working paper)
- Brakman, S., H. Garretsen, & C. van Marrewijk (2001), *An Introduction to Geographical Economics*, Cambridge: Cambridge University Press
- Brakman, S. & B.J. Heijdra (2004), *The Monopolistic Competition Revolution in Retrospect*, Cambridge: Cambridge University Press
- Bristow, G. (2005), "Everyone's a 'Winner': Problematising the Discourse of Regional Competitiveness", *Journal of Economic Geography*, vol. 5, no. 3, pp. 285-304
- Budd, L. & A. Hirmis (2004), "Conceptual Framework for Regional Competitiveness", *Regional Studies*, vol. 38, no. 9, pp. 1015-1028
- Cambridge Econometrics, Ecorys-NEI, & R.L. Martin (2004), *A Study on the Factors of Regional Competitiveness*
- Christaller, W. (1933), *Die zentralen Orte in Süddeutschland: eine ökonomisch-geographische Untersuchung über die Gesetzmässigkeit der Verbreitung und Entwicklung der Siedlungen mit städtischen Funktionen*, Jena: Fischer
- Cox, T.H. & S. Blake (1991), "Managing Cultural Diversity: Implications for Organizational Competitiveness", *The Executive*, pp. 45-56



- Daly, H.E. (1993), "Sustainable Growth: An Impossibility Theorem", in H.E. Daly & K.N. Townsend (edd.), *Valuing the Earth: Economics, Ecology, Ethics*, Cambridge (MA): MIT Press, p. 267
- David, P.A. (1999), "Krugman's Economic Geography of Development: Negs, Pogs, and Naked Models in Space", *International Regional Science Review*, vol. 22, no. 2, pp. 162-172
- Davies, H. & P. Ellis (2000), "Porter's Competitive Advantage of Nations: Time for the Final Judgement?", *Journal of management studies*, vol. 37, no. 8, pp. 1189-1214
- Davis, D.R. & D.E. Weinstein (1996), *Does Economic Geography Matter for International Specialization?* (working paper: NBER #5706)
- Department of Trade and Industry (1998), *Regional Competitiveness Indicators*, HMSO, London
- Dixit, A.K. & J.E. Stiglitz (1977), "Monopolistic Competition and Optimum Product Diversity", *American Economic Review*, vol. 67, no. 3, pp. 297-308
- Elhorst, J.P., A. Heyma, C.C. Koopmans, & J. Oosterhaven (2004), *Indirecte Effecten Infrastructuurprojecten*, Rijksuniversiteit Groningen/SEO, Groningen/Amsterdam
- European Commission & European Com (2010), *Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth*, European Commission, Brussels
- European Communities (2000), *European Competitiveness Report*, Luxembourg
- Friedman, T.L. (2005), *The World is Flat: A Brief History of the Globalized World in the Twenty-first Century*, London: Lane
- Gardiner, B., R. Martin, & P. Tyler (2004), "Competitiveness, Productivity and Economic Growth across the European Regions", *Regional Studies*, vol. 38, no. 9, pp. 1045-1067
- Givoni, M. (2006), "Development and Impact of the Modern High-Speed Train: A Review", *Transport reviews*, vol. 26, no. 5, pp. 593-611
- Gramlich, E.M. (1994), "Infrastructure Investment: A Review Essay", *Journal of Economic Literature*, vol. 32, no. 3, pp. 1176-1196
- Huovari, J., A. Kangasharju, & A. Alanen (2001), *Constructing an Index for Regional Competitiveness* (working paper: Pellervo Economic Research Institute #44)
- Izushi, H. (2008), "What Does Endogenous Growth Theory Tell About Regional Economies? Empirics of R&D Worker-Based Productivity Growth", *Regional Studies*, vol. 42, no. 7, pp. 947-960
- Kawamura, K. (2004), "Transportation needs, location choice, and perceived accessibility for businesses", *Transportation Research Record*, vol. 1898, pp. 202-210
- Kim, S. (1995), "Expansion of markets and the geographic distribution of economic activities: the trends in US regional manufacturing structure, 1860–1987", *Quarterly Journal of Economics*, vol. 110, no. 4, pp. 881-908
- Kitson, M., R. Martin, & P. Tyler (2004), "Regional Competitiveness: An Elusive yet Key Concept?", *Regional Studies*, vol. 38, no. 9, pp. 991-999



- Kresl, P.K. (1995), "The Determinants of Urban Competitiveness: a Survey", in P.K. Kresl & G. Gappert (edd.), *North American Cities and the Global Economy*, Thousand Oaks: Sage, pp. 45-68
- Krugman, P. (1991a), "Increasing Returns and Economic Geography", *Journal of Political Economy*, vol. 99, no. 3, pp. 483-499
- Krugman, P. (1993), "First Nature, Second Nature, and Metropolitan Location", *Journal of Regional Science*, vol. 33, no. 2, pp. 129-144
- Krugman, P. (1994), "Competitiveness: a Dangerous Obsession", *Foreign affairs*, pp. 28-44
- Krugman, P. & A.J. Venables (1995), "Globalization and the Inequality of Nations", *Quarterly Journal of Economics*, vol. 110, no. 4, pp. 857-880
- Krugman, P.R. (1996), "Making Sense of the Competitiveness Debate", *Oxford review of economic policy*, vol. 12, no. 3, pp. 17-25
- Krugman, P. (1991b), *Geography and Trade*, Leuven: Leuven University Press
- Legendijk, A. (2001), "Scaling Knowledge Production: How Significant is the Region?", in M.M. Fischer & J. Fröhlich (edd.), *Knowledge, Complexity and Innovation Systems*, Berlin: Springer, pp. 79-100
- Lechner, C. & M. Dowling (2003), "Firm Networks: External Relationships as Sources for the Growth and Competitiveness of Entrepreneurial Firms", *Entrepreneurship & Regional Development*, vol. 15, no. 1, pp. 1-26
- Lengyel, I. (2004), "The Pyramid Model: Enhancing Regional Competitiveness in Hungary", *Acta Oeconomica*, vol. 54, no. 3, pp. 323-342
- Martin, P. & C.A. Rogers (1995), "Industrial Location and Public Infrastructure", *Journal of International Economics*, vol. 39, no. 1, pp. 335-351
- Meester, W.J. & P.H. Pellenbarg (2006), "The Spatial Preference Map of Dutch Entrepreneurs: Subjective Rating of Locations, 1983, 1993 and 2003", *Tijdschrift voor Economische en Sociale Geografie*, vol. 97, no. 4, pp. 364-376
- Meyer-Stamer, J. (2008), *Systemic Competitiveness and Local Economic Development* (working paper: http://www.meyer-stamer.de/2008/Systemic+LED_SouthAfrica.pdf)
- Neary, J.P. (2001), "Of Hype and Hyperbolas: Introducing the New Economic Geography", *Journal of Economic Literature*, vol. 39, no. 2, pp. 536-561
- Norton, R.D. (1992), "Agglomeration and Competitiveness: From Marshall to Chinitz", *Urban Studies*, vol. 29, no. 2, pp. 155-170
- OECD (2001), *The New Economy: Beyond the Hype*, OECD, Paris
- OECD (2002), *Impact of Transport Infrastructure Investment on Regional Development* no. E112022, OECD, Paris
- Ottaviano, G.I.P. & D. Puga (1998), "Agglomeration in the Global Economy: A Survey of the 'New Economic Geography'", *The World Economy*, vol. 21, no. 6, pp. 707-731



- Pacione, M. (1998), "The Social Geography of Rome", *Tijdschrift voor Economische en Sociale Geografie*, vol. 89, no. 4, pp. 359-370
- Porter, M.E. (1990), *The Competitive Advantage of Nations*, Houndmills: Macmillan
- Porter, M.E. (ed.) (2009), *On Competition*, Boston: Harvard Business School Publishing Corporation
- Porter, M.E., K. Schwab, & X. Sala-i-Martin (2007), *The Global Competitiveness Report 2007-2008*, World Economic Forum
- Puga, D. (1999), "The Rise and Fall of Regional Inequalities", *European Economic Review*, vol. 43, no. 2, pp. 303-334
- Rietveld, P. (1995), "Infrastructure and Spatial Economic Development", *Annals of Regional Science*, vol. 29, no. 2, pp. 117-119
- Rodrik, D., A. Subramanian, & F. Trebbi (2004), "Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development", *Journal of Economic Growth*, vol. 9, no. 2, pp. 131-165
- Romer, P.M. (1990), "Endogenous Technological Change", *Journal of Political Economy*, vol. 98, no. 5, pp. 71-102
- Romer, P.M. (1998), "Two Strategies for Economic Development: Using Ideas and Producing Ideas", in D.A. Klein (ed.), *The Strategic Management of Intellectual Capital*, New York: Butterworth-Heinemann, pp. 211-238
- Sala-i-Martin, X. (1997), "I Just Ran Two Million Regressions", *American Economic Review*, vol. 87, no. 2, pp. 178-183
- Schwab, K. & X. Sala-i-Martin (2012), *The Global Competitiveness Report 2012-2013*, World Economic Forum
- Schwanen, T., M. Dijst, & F.M. Dieleman (2004), "Policies for Urban Form and their Impact on Travel: The Netherlands Experience", *Urban Studies*, vol. 41, no. 3, pp. 579-603
- Sheshinski, E. (1967), "Optimal Accumulation with Learning by Doing", in K. Shell (ed.), *Essays on the Theory of Optimal Economic Growth*, Cambridge (MA): MIT Press, pp. 31-52
- Smit, M.J. & H.L.F. de Groot (f.c.), "Stocking Up: The Influence of Past Innovativity in a Region", *European Planning Studies*
- Solow, R.M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, vol. 70, no. 1, pp. 65-94
- Spiekermann, K. & M. Wegener (1994), "The Shrinking Continent: New Time-Space Maps of Europe", *Environment and Planning B: Planning and Design*, vol. 21, no. 6, pp. 653-673
- Swan, T.W. (1956), "Economic Growth and Capital Accumulation", *Economic Record*, vol. 32, no. 2, pp. 334-361
- van de Klundert, T. & S. Smulders (1992), "Reconstructing Growth Theory: A Survey", *De Economist*, vol. 140, no. 2, pp. 177-203

Vickerman, R.W. (1994), "The Channel Tunnel and Regional Development in Europe: an Overview", *Applied Geography*, vol. 14, no. 1, pp. 9-25

Wieser, R. (2005), "Research and Development Productivity and Spillovers: Empirical Evidence at the Firm Level", *Journal of Economic Surveys*, vol. 19, no. 4, pp. 587-621

Wyplosz, C. (2010), "The Eurozone Debt Crisis: Facts and Myths", *VoxEU.org*

Zondag, B. & M. Pieters (2005), "Influence of accessibility on residential location choice", *Transportation Research Record*, vol. 1902, pp. 63-70