
# Theoretical and policy aspects of competitiveness at different aggregation levels

By
Lionel Fontagné and Gianluca Santoni

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# Mapcompete is a project designed to provide an assessment of data opportunities and requirements for the comparative analysis of competitiveness in European countries

The project leader is László Halpern for CERS-HAS. The leaders of the six teams are: Carlo Altomonte (Bocconi University) for Bruegel; Giorgio Barba Navaretti (University of Milan) for Ld'A; Gábor Békés for CERS-HAS; Katja Neugebauer for IAW; Lionel Fontagné for Paris School of Economics and Philippe Martin for Science Po.

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Paris School of Economics[1]

## 1. Introduction and theoretical framework

Enhancing competitiveness is a popular target in economic policy making. This target is legitimate if competitiveness is defined in terms of capacity to enhance living standards and achieving full employment and sustainable growth. According to the European Commission “An economy is competitive if its population can enjoy high and rising standards of living and high employment on a sustainable basis”.[2] While a huge amount of development funds are allocated to serve this purpose, the concept of competitiveness is still a frequently debated issue (see Krugman (1994) and the subsequent debate) for economists who generally prefer the better established notion of productivity.[3] As a consequence, a large pool of theoretical and empirical literature aims to summarize the findings of existing works in terms of definitions, theories and measurement.[4]

Simply translate a rather well-established micro-economic concept to a macroeconomic one is not straightforward: firms are heterogeneous, compete against each other: hence productivity is heterogeneous among the grains that constitute the overall economic reality, and the size of the grains is subject to permanent changes due to selection effects and redistribution of market shares. The purpose of this paper is to survey the related literature and tentatively clarify the concepts, with a policy perspective.

1 Lionel Fontagné and Gianluca Santoni. Section 3 is written by Gábor Békés.
2 European Competitveness report, 2000, p.23
3 “(…) all are free, if they wish, to use the term "competitiveness" as a poetic way of saying productivity” Krugman, 1994.
4 Measurement issue using trade data are addressed in Cheptea et al. (2014).

Several concepts of competitiveness have been proposed in economic literature. For Micro-economics, competitiveness usually relates to firm productivity; as well-established concept it is relatively easy to quantify empirically, both at the firm and sectoral level. On the other hand, Macro-economic definitions are generally less well-established and more controversial.

Recent literature on firm heterogeneity, Melitz and Ottaviano (2008) and Ottaviano et al. (2009), Corcos et al. (2012), helps to underline and show empirically how aggregate performance relates to firm-level factors (organization, technological capacity and the environment in which firms operate).

In particular, in the cited models, firm heterogeneity can be interpreted as the result of uncertain R&D investment; firms need to pay a fixed cost in order to "invent" their own variety. After, the sunk cost is paid; the producer will gain positive profits (and stay in the market) only if his efficiency level reaches a "performance" cut-off. The cut-off value represents the minimum level of productivity that a firm needs to reach in order to compete successfully (sectoral and market specific). Ottaviano et al. (2009) and Corcos et al. (2012) show that the "cut-off" depends on the size of demand and the remoteness of the market, but also on a specific term which identifies the determinants of a country's ability to generate low-cost (high productive) firms. This term is meant to capture various exogenous determinants of a country's ability to generate low-cost firms. According to the model, the key determinants of supply-side performance are:

***Fixed costs***: likely to be determined by sector and country factors, including trade policy and regulation, access to inputs, exporter-specific trade costs.

***Inputs costs***: unit costs of capital and labour; availability of skilled human capital and intermediates; as well as macroeconomic factors which (directly or indirectly) alter input

prices, such as: the level and volatility of the exchange rate, macroeconomic uncertainty, public debt and current account exposures, tax burden.

***Technology***: encompassing a full set of structural determinants, such as sector and country specific infrastructures, and other macroeconomic determinants, including the level of a country's inflation, and other public policies that may impair the efficient allocation of factors of production.

It clearly results from this framework that country competitiveness should be assessed through the aggregation of firm level information, as pointed out by Altomonte et al.. (2011). However, one should consider not only average performance but also other elements of distribution, especially for policy purposes. This is even truer when a time span is considered: external shocks are impacting the distribution of firms (e.g. a negative demand shock might well hit more severely less productive firms), firms will exhibit different individual productivity performance, pricing behaviour and pass through might well differ across firms facing different demand elasticity due to their different size.

In recent years public debate on competitiveness has tended to focus mostly on macro-economic determinants of competitiveness. Although such (macro) indicators are less grounded in economic theory than micro indicators, their success stems from the fact that they are usually easier to communicate and, more importantly, they are strongly connected with macro imbalances[5].

From a Macro perspective, assessment of country competitiveness is usually based on relative prices, or current accounts. The underlying idea is that in equilibrium factor

5 As noted by Altomonte et al. *(*2011), design competitiveness policies relying only on macro stability may neglect sustainable growth targets or even contradict them.

prices are lower in competitive economies, regardless of the source of such an advantage (input abundance, technology, economies of scale).

Real and real effective exchange rates are common measurements of competitiveness based on relative prices. These indicators have been used extensively in the literature, as far back as Lipshitz and Mc Donald (1991) and Durand and Giorno (1987), in order to perform cross-country comparison. The performance of such indicators is indeed very much related to the underlying deflators used: Consuemr Price Indices (CPI), export prices or unit labour costs will give different information. Unit labour costs, can be preferred for international comparison for countries using similar technologies, as unit labour costs are a function of wage rates, labour productivity and exchange rates (see Hickman 1992). However, what perimeter to use is subject to caution: unit labour cost in manufacturing are not necessarily a good indicator of the competitiveness of the industry due to 1) intermediate use of serves and 2) the presence of global value chains and the increasing importance of imported intermediate consumption. Using labour cost computed for the economy as a whole is not the solution as not all services are tradable, even indirectly through their intermediate use in the industry.

The bottom line of this debate is certainly stressed that macro and micro economic determinants of competitiveness should not be separated Sala-i-Martin and Artadi (2004). [6] The ability of firms to compete successfully depends, among other things, on public institutions, the educational system, and the macroeconomic stability of the country. However, the macro environment alone does not guarantee a high country

6 Sala-i-Martin and Artadi (2004) developed the World Economic Forum's "Global Competitiveness Index" (GCI) framework. Other, previous, multi-dimensional approaches to competitiveness are those by Porter (1990) and Buckley, Cass and Prescott (1992) which also stressed the dynamic nature of competitiveness.

performance if firms are not productive at the micro-level, in other words if firms do not produce valuable goods or do not employ inputs efficiently.

As highlighted by the firm heterogeneity literature cited above, the microeconomic foundation of productivity involves the overall efficiency of production processes as well as the business environment. From a macro perspective then, country productivity is a function of underlying firm-level productivity, both in terms of the prices they can charge for their products and the efficiency of production. Moreover, high productive firms can offer higher wages and higher returns on investments, thus affecting both the income level and the growth potential of the overall economy.

The evidence that firms drive overall competiti veness has led to European policies such as the Competitveness and Innovation Framework Programme (CIP), with small and medium-sized enterprises (SMEs) as a main target. This Programme supports innovation, and aims at providing better access to finance in European regions. This programme has been run from 2007 to 2013 with a budget of 3.6 billion.[7]

## 2. Macroeconomic Perspective

### *2.1 Innovation and Economic Growth*

Overall macroeconomic stability is one of the key determinants of competitiveness, both at country and at firm level. In shaping the economic environment, the role of public and private institutions is crucial, but with a different focus according to the development stage (following Sala-i-Martin and Artadi 2004). Functional social and legal institutions, for example, are crucial factors for economic growth, especially in the early stages of

[7] The programme was relying on several financing schemes in order to facilitate access to loans and equity finance for SMEs where market failures had been identified.

development, reducing the risk-aversion of investors and consequently sustaining productivity increase through investment[8]. Although improving infrastructures, market regulations and resource-efficiency do have a positive impact on growth[9], innovation seems to be the key factor in improving the competitiveness of more advanced economies.

Actual innovations, in terms of new products or production techniques, may be due to a learning-by-doing effect, reached through human capital accumulation or, more frequently, the output of investment in R&D activities. If innovation is characterized by the inclusion of a new good in the selling portfolio of a firm or a more efficient production process (in both cases resulting in an increase in profits), the arrival rate of innovations will be an increasing function of R&D investment (Klette and Kortum, 2004). When the innovation concerns a currently produced good, the incumbent firm loses it from its selling portfolio (*creative destruction*). At the aggregate level, the intensity of creative destruction and by that the growth rate of the economy, depends on innovations by incumbents as well as by entrants. As a consequence, if no firm enters the market (no innovative start-up) the mass of firms declines and surviving firms become increasingly larger.

From a firm-level perspective, allocating labour and capital to research projects is indeed costly. During economic crises, firms tend to cut their investment on R&D: basically because during economic crisis, firms face tougher competition and need to cut costs. Providing that returns from R&D expenditure are uncertain and usually do not materialize in the short-run, they are likely to be among the first expenses to be

8 See, for example, Rodrik (2003) and Acemoglu and Johnson (2005).
9 For example, from the knowledge and technological spillovers generated by Foreign Direct Investments. We will review the effect on productivity of factors related to economic environment in Section 4.1.

scrutinized[10]. On the one hand, from an individual firm perspective reducing research expenses during economic downturns may even, in some circumstances, represent the optimal choice. In the absence of credit constraint the share of R&D investment has been proved countercyclical in the French case, with results magnified for sectors that depend more upon external finance (Aghion et al., 2012).

On the other hand, at country level, the effect of the pro-cyclicality of private R&D expenditures may lead to slow recovery, therefore calling for counter-cyclical public support to R&D. In general, investment in R&D results not only in private gain but also generates significant spillovers (see, for example, Mc Morrow and Werner, 2009), emphasising the need for public intervention to compensate for the excess volatility of private R&D.

There are several possible interventions aimed at boosting innovation support: R&D support policies (tax credits or cash refunds), innovation-oriented public procurement and capital market interventions. Tax incentives tend to benefit incumbent firms more than entrant firms, while for young firms a wage refund for R&D personnel seems to be more effective. In the case of public procurement, one of the key targets for policymakers is to ensure competition, as well as to manage possible technological or market-related risks (see OECD, 2014). As far as support for risk capital is concerned, it appears to be a successful way to support young innovative companies. Generally, along with support for R&D, for incumbent firms an effective innovation policy should also include support for young innovators and start-ups that bring new ideas and products to the market, by designing instruments to ease the creation of innovative firms (new establishment or university and corporate spin-offs). There is also clear evidence

10 See, for example, European Competitiveness Report 2009.

that public support is more efficient for smaller firms that are more likely to face financial constraints (Bronzini and Lachini, 2011).

The role of young leading innovators in shaping the EU-US gap in R&D intensity is decisive. Almost one third of the R&D difference between the EU and the US is related to the fact that the EU has fewer young firms among its leading innovators (Cincera and Veugelers, 2013). [11]. Young innovators tend to show a higher R&D intensity than older firms, along with higher growth rates in R&D, sales and employment. More than half of the R&D deficit is due to the lower R&D intensity among young EU innovators compared to their US counterparts, evidence almost completely driven by sectoral composition. EU innovators are specialized in sectors which are relatively less R&D intense with respect to US innovators, suggesting that in order to close the differentials more structural interventions are needed.

The aggregate effect of R&D subsidies come from the reallocation of R&D inputs towards high productive firms, or high productive production lines, (Acemoglu et al. , 2013). Along with reallocation, selection is another channel of positive aggregate growth, with new innovative firms entering the market and less productive ones exiting. A simple subsidy scheme may shield less productive incumbent firms, while at the same time preventing innovative new firms from entering the market, thus reducing overall growth. In order to foster aggregate growth, the model suggests that public policies should “strongly leverage the selection effect”, easing market entry and exit and freeing resources from low productive incumbents. Along with the evidence that “focusing on

11 The main data source used in the analysis is the EU industrial R&D investment scoreboards (different editions 2004–2008) conducted by the JRC-IPTS of the European Commission, covering the largest R&D investing firms in the world in manufacturing and services (1000 largest Europe, 1000 largest non-Europe). Scoreboard data can be found at: http://iri.jrc.ec.europa.eu/scoreboard.html

young innovative firms may prove to be a more effective way of fostering innovation", the European Competitiveness Report (2011) suggests that effective policies aiming to foster innovation and productivity growth should also consider the aggregate effect of both reallocation and selection forces.

Regarding competitiveness, previous literature show how economic cycles, as well as market imperfections such as credit constraint negatively affect individual incentive to invest in research. From a social welfare point of view the optimal firm strategy – cutting R&D costs in downturns – may not be the most efficient equilibrium, making the case for a public support to research activities. However, the effectiveness of such policies is deeply related to the adopted scheme along with the characteristics of most innovative firms.

### *2.2 Cost competitiveness: Exchange Rates and Unit Labour Costs*

A popular interpretation of country competitiveness is based on relative prices. The main rationale behind this interpretation is that in competitive economies factor prices in equilibrium will be lower than those of competitors, due to several possible factors: input availability, level of technology, production scale (or a combination these).

A widely used measure of price competitiveness – see, for example, Lipschitz and Mc Donald (1991) – is the real effective exchange rate (REER). The REER is built as a weighted average of exchange rates, usually applying trade shares as weights, and is expressed in real terms using a similar weighted average of foreign versus domestic

costs (among the most commonly used deflators are: the consumer price index, producer price, GDP deflators or unit labour costs[12]).

At least three main issues arise when computing REERs: the choice of currencies included in the computation, the choice of price (cost) measure, and the base period considered (Turner and Van‘t Dack, 1993). CPI, in fact, are only a weak proxy for tradable goods, while producer price indices, since they are based on gross values, do not capture the effect of imported inputs in determining final costs. Moreover, the costs of inputs and services may differ substantially across countries due to differences in taxation, market specific regulations or the distribution of firms; smaller enterprises, for example, are less likely to access international capital markets, as they face a different cost for capital with respect to bigger firms.

Another approach to cross-country competitiveness comparison is the unit labour costs (ULC) criterion. The ULC approach relies on the idea that this indicator is indicative for international comparison of countries with comparable technologies. ULC (expressed in common currency) is a function of important determinants of competitiveness: wage rates, exchange rates and labour productivity (Hickman 1992). Looking more closely at productivity dynamics, for example, reveals that - since productivity is generally pro-cyclical - comparing ULC across countries with different economic cycles may be misleading. Moreover, labour cost indicators tend to abstract from the cost function. Lower labour costs may, in fact, not signal higher competitiveness, but rather be the result of differences in capital or intermediate input intensity.

In assessing competitiveness relative price or costs position can be interpreted as both a cause and a consequence of aggregate performance (Turner and Van‘t Dack 1993). If

12 See Chinn (2006) for an overview of the theoretical frameworks of different REER measurements.

it is true that higher prices, or higher costs, may result in the weakened capacity of a country to compete internationally, it is also true that higher economic performance may lead to higher relative prices (for example through exchange rate appreciation). Moreover, if a country is performing well in non-price factors – for example producing high-quality goods[13] – its prices and labour costs may apparently be worse. But, as Turner and Van't Dack (1993) pointed out this would be a "symptom of success not of failure".

Finally, as referred to above, the economy is increasingly characterised by the fractioning of value chains and the externalisation of activities by firms (Johnson and Noguera, 2012, Stehrer, 2012). Accordingly, what is the perimeter of activities to be considered in terms of unit labour cost is subject to questioning: to some extent, services have to be in, but not necessarily all services. This is a domain where computing competitiveness at the firm level before aggregating might be superior to a macroeconomic approach.

### *2.3 External Competitiveness*

***Constant Market Share Analysis.*** One way to look at country international competitiveness is through the levels of trade performance. In the past two decades most of the OECD countries have experienced a market share loss in international markets, while Emerging countries have strengthened their relative position. Knowing how a country performs relative to its competitors, as well as over time, is crucial in order to strengthen its supply-side capacity and improve competitiveness[14].

13 See Deliverable 5.2 for an analysis of non-price factors for competitiveness.

14 Export performance is a good proxy for country aggregate competitiveness mainly because trade data is very detailed and internationally comparable, which is crucial to assessing countries' relative

Looking just at country market shares may be misleading. A country may maintain the same market share for each product and each destination, but still lose aggregate shares in world trade simply because it is specialized in products and destination markets that grow more slowly than the world average.

In order to decompose export growth and separate the contribution from "pull" factors (product and market specialization) and from "push" factors (country competitiveness), Gaulier et al. (2013) propose an econometric approach to Constant Market Share Analysis based on a weighted OLS regression. The econometric market shares decomposition overcomes the main drawbacks of the traditional algebraic approach[15] and allows the identification of the contribution to overall country change in export market shares due to product and market specialization compared to that due to exporter-specific factors (country competitiveness).

The resulting Export Performance Database (EPD) means it is possible to distinguish between "pull" and "push" factors in export market shares growth. In this framework, country A is more competitive than country B if its exports and market shares increase over and above those of countries having a similar composition of exports – in terms of product exported and market served. The view of the "push" factors as a proxy for relative competitiveness relies on a consolidated strand in trade literature, see, for example, Magee (1968) and Milana (1988). Providing the market share decomposition

competitiveness. Moreover, if a country is competitive in its exports, it will presumably be competitive on the domestic market as well.

15 Econometric shift share analysis overcomes the main drawbacks of traditional (algebraic) decomposition as it ensures that the export growth component is fully orthogonal, bringing much more robust results. This approach was first proposed by Cheptea et al. (2005) and further refined by Cheptea et al. (2014) and Bricogne et al. (2012).

at quarterly frequency the EPD makes it possible to keep track of structural as well as short term changes in countries' export performance[16].

The EPD database, along with other indices of price and cost[17] competitiveness, is based on widely available data (bilateral trade at the product level) and offers a good coverage in time, but also permits computations at higher frequencies.

Moreover, it avoids some drawbacks of other common measures of price and cost competitiveness such as the failure to account for market and product composition differences across countries; and supports the view of competitiveness as a zero-sum game, where the improvement of a country is seen as corresponding to an equivalent loss by other countries.

***Global Value Chains.*** International fragmentation of production[18], although not a recent phenomenon[19], has become increasingly relevant: from 1990 to 2010 the import content of exports rose from 20 to 40%, with an expected further increase to 60% by 2030 (Lamy 2013). At country level, this implies that a large percentage of gross exports are based on imported intermediates, with significant heterogeneity across countries and

16 The full database covers 228 countries from 2005 Q1, it is updated twice a year. Full dataset will be available from the World Bank as well as Banque de France websites.

17 See Appendix I for a detailed list of available indicators and databases on competitiveness.

18 The OECD_WTO database on trade in value added is a comprehensive dataset on the incidence on international fragmentation of production, containing 39 indicators on global production networks and supply chains, based on national Input-Output tables, covering 34 OECD plus 24 non-member countries. The database is publicly available at: www.oecd.org/trade/valueadded.

The World Input-Output Database (WIOD) is another public database on international fragmentation of production. It provides time-series of world input-output tables for forty countries worldwide and a model for the rest-of-the-world, covering the period from 1995 to 2011. These tables have been constructed on the basis of officially published input-output tables in conjunction with national accounts and international trade statistics. In addition, the WIOD provides data on labour and capital inputs and pollution indicators at the industry level. Website: http://www.wiod.org.

19 According to Baldwin (2006, 2012), the first "unbundling" occurs from 1850-1914 and from the 1960s onwards, with the separation between production and consumption. The second "unbundling" started in the mid-1980s, when the production process itself was divided across countries (off-shoring) and production phases (out-sourcing).

sectors[20]. We already mentioned that such imbrication was leading to difficult issues regarding assessment of relevant unit labour costs. The measurement of market share is indeed also affected by the difference between gross and value added trade.

Country involvement in complex international production networks implies relevant opportunities as well as risks (Cattaneo et al. 2013). On the one hand, it may allow countries to overcome their traditional comparative advantage, moving to higher value added activities and benefiting from knowledge spillovers, improving overall country competitiveness. On the other hand, participation in Global Value Chains may also expose countries to some risks, notably those related to imported crisis through trade (Escaith, Lindinberg and Miroudot, 2010) or the transmission of shocks - as for the earthquake that hit Japan in 2011 and whose effect spread over other Asian countries (Fujita 2013).

Given the increased interconnectedness of the countries involved, the emergence of GVC calls for a revision of public policies for competitiveness (Cattaneo and Miroudot, , 2013) andfour main paradigm changes:

- Strategic framework: from country to firm-relevant intervention. Imports are interpreted as a means for firms to access efficient inputs. The need to look at both inward and outward flows (either for trade or FDIs) in an integrated framework.
- Economic framework: identify country most competitive supply of tasks; recognise the role of services (financial, R&D, logistics) to product high value added manufactures.

20 For smaller economies the ratio is significantly higher: for example, figures for Hungary record over 60% of intermediate imports in exported goods. Regarding sectors, the foreign content of exported electronic goods in Mexico is around 60%.

- Relevant Economic assets: from stock to flows; firms are both competitors and sources of inputs for each other and GVC may act as a valuable channel of transmission for knowledge, capital and services.
- Relevant Barriers: requires international cooperation and public-private discussion in order to identify winners and losers from trade policy and behind-the-border measures.

The changes in international trade relations induced by the increasing international fragmentation of production also imply the need for a revision of specific barriers and for an ad hoc framework in designing public policies for competitiveness.

### *Box 1 – Macroeconomic Perspective: Relevant Indicators and data needs*

***Multi-Dymensional Competitiveness Indices.*** World Economic Forum's "Global Competitiveness Index" (GCI - http://www.weforum.org/issues/global-competitiveness) and the World Bank's "Doing Business" report are two examples of multidimensional competitiveness indices. The GCI provides country rankings based on a weighted average of different components, grouped into three pillars of competitiveness: "basic requirements" (institutions, infrastructure, macroeconomic conditions, health and education), "efficiency enhancers" (market efficiency, labour market efficiency, financial market efficiency, advanced human capital, technological readiness, and openness/market size) and "innovation and sophistication factors" (business sophistication, innovation).

The "Doing Business" report (http://www.doingbusiness.org/reports/) on the other hand focuses on business regulation environments, based on surveys on the ease of doing business in each country.

***Innovation.*** The EU Industrial R&D Investment Scoreboard provides economic and financial data and analysis of the top (1000) corporate R&D investors from the EU and from abroad. The data correspond to companies' latest published accounts, intended to be their 2012 fiscal year accounts[21].

R&D investment is the cash investment which is funded by the companies themselves (excluding R&D undertaken under contract for customers such as governments or other companies). It also excludes the companies' share of any associated company or joint

[21] Data are collected from companies' annual reports and accounts by Bureau van Dijk Electronic Publishing GmbH (BvD).

venture R&D investment when disclosed. Companies are allocated to the country of their registered office (it may be different from the operational headquarters). The results are independent of the actual location of the R&D activity. Sectors are classified according to the NACE Rev. 2. Scoreboard data are published annually since 2004. http://iri.jrc.ec.europa.eu/scoreboard.html

***Price and Cost Competitiveness.*** Publicly available Data on REER is provided by many international organizations: BIS, Eurostat, European Central Bank, OECD, IMF (not publicly available) World Bank. The Bruegel think tank also provides a public database on CPI-based REER for 178 countries (plus the euro area) for annual frequency and for 153 countries (plus the euro area) for monthly frequency.

***Export Competitiveness Database.*** The ECD containing the econometric market share decomposition from Gaulier et al. (2013) is available for around 218 countries at quarterly frequency – starting from 2005 Q2 – from the World Bank and Banque de France websites. The ECD methodology allows for the decomposition of market shares growth rate into three main contribution: sectoral composition, geographic specialization and an exporter specific component (exporter performance), the latter captures the country market share growth rate net of sectoral and geographical components.

***Global Value Chains.*** The OECD_WTO database on trade in value added is a comprehensive dataset on the incidence on international fragmentation of production, containing 39 indicators on global production networks and supply chains, based on national Input-Output tables, covering 34 OECD plus 24 non-member countries. The database is publicly available at: www.oecd.org/trade/valueadded

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# 3. Regional Competitiveness

## *3.1 What is regional competitiveness?*

The concept of regional competitiveness is elusive and a subject for debate between economists. As a consequence, a large pool of theoretical and empirical literature aims to summarize the findings of existing works in terms of definitions, theories and measurement (see e.g. Ecorys, 2003).

First of all, regional competitiveness lacks even a clear definition. A variety of descriptions abound from a rather diverse set of academics and institutions. However, these multiple definitions may be classified into two main groups: one group of the proposed definitions discusses regional competitiveness as an aggregate of firm-level competitiveness, while the other group derives regional competitiveness from the macro level.

The characteristics of a competitive region are less debated by the literature than the concept itself. For instance, Martin (2005) collates some key issues about regional competitiveness. He argues that no single economic theory (such as export-base theories, endogenous growth theory, cluster theories, evolutionary theory) is able to provide a generally acceptable definition of regional competitiveness. However, he offers some unquestionably key determinants of regional competitiveness, such as productive capital, human capital, infrastructure, the competitiveness and adaptive capability of firms (for example, innovation) and the interaction of all these factors. As a best measure of regional competitiveness, he proposes a measure of sustainable long-term economic growth, compared to other regions.

One of the most problematic issues of regional competitiveness is that it aims to transfer a concept of competitiveness which was originally defined for national levels (itself a concept subject to much debate) without rethinking the essential modifications necessary to use the same notion at a sub-national scale (Kitson et al. 2004). To solve this problem Kitson et al. (2004), propose a concept of regional competitiveness that identifies six crucial components: productive capital, human capital, social-institutional capital, cultural capital, infrastructural capital and knowledge/creative capital.

The path dependence of regional competitiveness is also an important issue to be considered for responsible policy making. In an evolutionary economics, perspective, regions can be interpreted as dynamic entities that show characteristics such as irreversibility or lock-in effects (Boschma, 2004)? These characteristics have important implications about regional competitiveness as a target of development subsidies.

Despite these attempts, a consensus among economists on the concept of regional competitiveness is yet to be achieved. Due to the large amount of money spent on subsidies in this area, achieving a consensus is essential. Without the development of a solid framework, policies lack coherent conceptual and evidential foundations, and therefore policy outcomes may prove variable and ineffective. This current work aims to contribute to the literature of regional competitiveness by focusing on the proper measurement of growth prospects, rather than providing a new definition or developing a theoretical framework.

### *3.2 Growth and competitiveness at regional level – why different from countries?*

As argued above, regional competitiveness is often a derivation of macroeconomic competitiveness, defined at national level, using nationally aggregated statistics.

Notwithstanding intrinsic difficulties, EU regional competitveness indices are published (JRC, 2013). Competitiveness is then defined at the level of agglomerations: the most competitive regions in Europe in 2013 were accordingly: Utrecht, London area (Inner London, Outer London, Bedfordshire, Hertfordshire and Essex), Berkshire, Buckinghamshire and Oxfordshire, Region of Stockholm, Surrey, East and West Sussex, Region of Amsterdam (Flevoland and
Noord-Holland), Frankfurt (Darmstadt), Île de France, Copenhagen (Hovedstaden) and Zuid-Holland. The index is based on pillars describing "inputs and outputs of territorial competitiveness". Basic, factors of competitiveness. refer to "Quality of Institutions", "Macro-economic Stability", "Infrastructure", "Health" and the "Quality of Primary and Secondary Education". Efficiency factors refer to "Higher Education and Lifelong Learning", "Labour Market Efficiency" and "Market Size". Finally, innovative factors refer to "Technological Readiness," "Business Sophistication" and "Innovation". This is accordingly a large set of different dimensions of competitiveness to be aggregated in a one-dimensional index, with all concerns related to composite indicators.

Thus, it is certainly cautious to ask what is special about the regional aspect of development and why should we discuss this topic separately to national competitiveness, before comuting composite indicators. There are two answers to this question. First, regional disparities matter at national policy level in a context where differences in GDP per capita across regions within one EU country may be on a par with differences between the least and the most developed countries in the EU. For instance, Romania has a per capita (at PPP) GDP of 32% of Germany, but the poorest Romanian region (North-East) has a per capita GDP of just 26% of the richest one (Bucharest). As a result of regional disparities, people living in depressed regions may

enjoy much fewer opportunities, along with less access to education and healthcare, especially when services are financed by local and regional governments.

Secondly, understanding regional growth has a special dimension – a greater dynamics of factor movement. While the assumption of fixed capital, labour and human capital is fairly acceptable at a national level, migration and the free flow of capital across regions is certainly a key feature of European countries. This leads to the "hard problem" of regional economics (Krugman 1995, Breinlich et al. 2013, Desmet and Rossi-Hansberg 2012): one has to deal with the distribution of economic activity over time and space in the presence of price equalization determined by trade and mobility. As Krugman has argued, the growth process at regional level is closely related to various patterns of agglomeration and dispersion. Growth will both react to and affect skill composition, industrial structure and productivity of firms and people. In addition, several localized pecuniary externalities will complicate this dynamic process, making endogenous growth regressions inadequate to access growth potential.

Finally, location of regions is even more heterogeneous than that of countries, with the role of first geography characteristics being rather significant. Mountainous regions may make up a small fraction of a country, but can profoundly affect economic structure and even values of some regions located solely at high altitude. Also, given their smaller size and, therefore, smaller internal markets, regions are much more interdependent than countries are. This implies that the conditions of neighboring entities matter more for regions than for countries. A prosperous region (within the country or in a neighboring country of the EU) will offer a market for goods produced locally as well as allowing ideas to spread, thus helping the development of innovative methods. At the same time,

it may also attract the best students and professionals, thus draining the region's human capital base.

As a result, spatial dynamics, growth and competitiveness are rather hard to model – a difficult problem indeed. Therefore, analysis of regional growth and competitiveness requires a rather eclectic approach - considering several strands of the literature such as modified growth models, new economic geography, location and transport networks or agglomeration externalities and clusters. Issues related to level and change of population, income, local prices (such as rents) should be considered as one (Glaeser and Gottlieb 2009).

At the national level, competitiveness and long-run growth potential are often both discussed within the framework of human capital extended Solow models as well as with reference to endogenous growth theories. Factors of production as well as technological progress determine the growth path. Both frameworks can also be extended to the regional level with some modifications. Barro and Xala-i-Martin (1992) report the results of Solow growth regressions, showing evidence of slow convergence in European regions. The exercise has been frequently repeated and similar results were found (Boldrin and Canova (2001), Martin (2004)).

### *3.3 Agglomeration, performance and growth*

Firms agglomerate to benefit from Marshallian externalities, which may be enjoyed in proximity to each other, and also to save on transaction costs when working together in a supply chain or network of knowledge and innovation. This proposition was suggested by New Economic Geography models as well as theories on regional growth with knowledge externalities (Ciccone and Hall 2006). These theories suggest that positive

externalities will arise from several channels, such as the sharing of indivisible goods, savings on matching costs of workers and firms and learning (Duranton and Puga 2004). At the same time, however, competition of co-localized firms will yield centrifugal forces, reducing the effect of agglomeration benefits. In models of new economic geography, proximity will have several major implications. First, when firms co-locate, they will offer a high number of job opportunities and hence attract people as well. This will increase the size of the internal market and reduce average transport of the consumption bundle of people living in the region. A second channel is represented by the savings caused by cheaper transport between firms, as producers of intermediate goods will be located closer to the users of these goods. Finally, total factor productivity of firms may also increase because of knowledge spillovers from other producers. Furthermore, given productivity benefits, the impact on income will be more than proportional to the number of firms.

One additional channel is related to labour productivity in larger and more densely populated regions, in particular in cities (Puga 2010). This greater efficiency of labour may be partially explained by productivity benefits at the firm level which are translated into gains of marginal productivity labour. However, in addition to this more competitive regions will also attract talented people and therefore spatial sorting will lead to wider differences across regions. Indeed, several estimates find that about half of the earning surplus achieved in agglomerated areas comes from sorting. Finally, there are certain aspects of large urban areas that are more constructive to learning and personal improvement fostered by peer pressure as well as easier access to a variety of educational services.

Proximity to other firms often leads to improved performance of firms located in more agglomerated areas. While forces of positive agglomeration benefits and costs of competition may not be measured individually, their combined effect can be estimated. Evidence of such agglomeration economies is provided by an average elasticity of labour productivity to density of 6% and 5% in the US and EU respectively (Ciccone and Hall, 1996 and Ciccone, 2002),. In the past decade, similar exercises have showed that agglomeration effects in European countries will typically range between 3-8% even once selection and first geography effects are accounted for (Duranton et al. 2012).

Another approach mixing the aforementioned models of endogenous growth spurred by technological progress, regional spillovers and agglomeration externalities may be more interesting for purposes of policy. In this setup, innovation is key, as development of additional varieties will generate growth. Importantly, regional growth models also build on the notion that transaction costs and frictions of spreading ideas will offer benefits to co-location in a given region. Importantly, several channels are strongly interrelated, and an important feature of NEG models is cumulative causation *à la* Myrdal, where localization enhances the agglomeration of innovation and manufacturing and agglomeration and growth can reinforce each other.

The dynamics of regional growth is complex when geography matters. Transactions across regions are affected by the transport costs of exchanging goods as well as the communication costs of exchanging knowledge (Minerva and Ottaviano, 2009). Innovation takes place in one region first, generating additional growth and income. This increases expenditure in that region, thereby creating even more jobs in manufacturing. In this model, agglomeration and growth are jointly determined: forces that promote

more innovation and growth will also generate higher agglomeration and agglomeration will yield more new products and therefore faster growth.

### *3.4 Local Institutions*

The branch of institutional theories represents another common viewpoint from which to explain the divergence in income levels across countries (Acemoglu and Robinson 2012). These theories provide an original and particularly powerful tool to explain the path dependence of growth trajectories and thus the long-term origins of national underdevelopment. Therefore, a natural consequence of such empirical power at the national level is an attempt also to apply the institutional view of economic development to explain economic development at the regional level. This is not an easy task. While we know that local institutional variations have substantial long-term consequences for the economies of developing countries, the underlying reasons and mechanisms are still not entirely clear (Dell, 2010). Institutional views of the origins of poverty have different empirical implications at regional level.

First, the same institutional factors that work at national level also have an important role in the economic performance of regions, particularly where long-term effects are concerned. This approach considers regions as a micro-level building-block of the entire country. Therefore, the determinants of the institutional environment, such as political institutions, crime and social norms also play a significant role in the regional levels of economic development.

Secondly, and most importantly, variations across the level of development of the institutional framework within the same country can explain income disparities at the sub-national level. For instance, the historically large divisions between Northern and

Southern Italy might also be explained by the different development path of institutional environments. Furthermore, the case of declining cities and regions, such as Detroit in the US or the Italian region of Sicily, shows that changes in institutional factors, such as social norms and crime, are important elements to consider as amplifier factors of economic changes of different roots.

The Dutch region of Randstad, where EU regional development funds have proved inefficient due to the lack of effective governance, is a good example (Lambregts et al., 2008). The factors and their origins that hinder the efficient usage of EU regional funds were inter-governmental competition, ambiguous loyalties, unconvincing reasoning and a lack of leadership that results in ineffective governance are the key causes. Of course these arguments can be extended to most Eastern European regions as well.

Applying the complex institutional theories of economic development at the regional level is a question that is currently particularly interesting for growth and development economists, resulting in a new strand of empirical literature that uses sub-national data to analyze the effects of institutional variations (e.g. Holmes (1998) or Tabellini (2010). Using data from European regions, shows that cultural and institutional variations have a causal effect on economic development (Tabellini, 2010).

### *3.5 Regional Policy, Infrastructure and Public Investment*

Public investment, particularly infrastructural development, will likely affect regional competitiveness. However, mostly due to the non-transparent operation of institutional distribution networks and widespread corruption issues, the effectiveness of the allocation of regional subsidies is often a subject of intense policy debate. As a result, a large pool of empirical literature aims to investigate the role of regional subsidies and

public investment in economic growth and development across regions. Given European political aspirations of territorial cohesion and available policies, several studies have used EU regional grants and projects financed by these grants to study the effectiveness of infrastructure investment.

Some public projects, such as building transport infrastructure linking various regions, can increase or decrease regional development depending on the evolution of agglomeration forces (Ottaviano and Thisse 2004). In some cases a new motorway will simply allow people from poorer regions to commute to jobs in richer regions, thus enforcing competitiveness of the richer rather than the poorer region.

Typically, national governments believe that local public investment will have an unquestionably positive impact on growth. The impact of transport infrastructure spending (as part of the EU's cohesion strategies) on regional growth is not always ascertained. ontrolling for other factors which may condition economic growth, such as innovation, migration and local socioeconomic conditions, infrastructural investment has a relatively insignificant role in regional economic growth (Crescenzi and Rodrígues-Pose, 2012). Growth is spurred by a combination of other determinants they had controlled for. They argue that most likely the potential benefits of transport infrastructure investment are jeopardized by purely political considerations that largely influence the selection of development projects, as well as their spatial allocation.

The effect of public investment on regional economic growth and convergence in Greece has however been proved to be effective. A positive long-run impact of public investment on regional economic growth with substantial spillover effects between regions has been reported (Psycharis et al., 2012)However, there is no evidence for

convergence andthe growth effects of public investment vary between different types of investment, with the highest impact for education and infrastructural spillovers.

An alternative view is that subsidies and public works may have a positive effect, but that the level of subsidies should not be too high, and in any case will only prove effective in selected areas (O. Becker et al. 2010). In this spirit of heterogeneous effects, Hospers (2006) examines what kind of regional policies are the most efficient, investigating if best practices in regional policy are actually useful for regional development. He argues that the most successful regional development strategies should always enhance region-specific advantages - as many regional development success stories in Europe show (such as the Ruhr Area, Manchester, or the Swedish region of Landskrona).

## 4. Microeconomic Perspective

From a firm-level point of view, as showed in Section 1, competitiveness measures are motivated by solid foundations from economic theory as soon as we depart from the usual perspective of competition for market shares among firms. Firm-level competitiveness is not the ability of gain market shares over competitors, though market shares, size and growth ultimately reflect competiveness. In a nutshell, outcomes and determinants have to be distinguished Altomonte et al. (2011) define micro-level competitiveness as “the ability of firms in a given country to mobilise and efficiently employ the productive resources required to offer goods and services”.

At the firm level, a common metric for efficiency in production is given by productivity, that expresses the ability of a firm to transform inputs to outputs: very basically, this is a ratio of outputs over inputs. We immediately identify two issues: a firm will generally

have one more than output (e.g. multiproduct firms) that will have to be aggregated using prices. Hence the sensitivity of the measure to price-related issues. Second, a firm is always using several inputs. You may increase the apparent productivity of one input by increasing the use of another input: increasing the capital/labour ratio will increase the apparent productivity of labour but not the overall efficiency of the firm if one goes beyond the relative marginal productivity of the two factors.

Single factor productivity – usually labour – is the simplest measure, will accordingly be inflated by the relative intensity in production of other inputs. Consider two firms using the same technology; they can have different levels of labour productivity simply because one is using capital more intensively. Multifactor productivity or Total Factor Productivity (TFP) consider both labour and capital as invariable to factor intensity. Besides the different methods of measuring or estimating TFP, there are relevant constant features in firm productivity evaluation across countries and sectors[22]. First of all there is considerable and persistent heterogeneity in firm productivity, even within highly disaggregated or homogeneous goods industries (Bartelsman and Dhrymes 1998; Syverson 2004a, 2005b; Foster, Haltiwanger and Syverson 2008; Hsieh and Klenow 2009); a second factor is that more highly productive firms have increased probability of survival in markets (Syverson 2011). To get an idea of the relevance of the phenomenon, Syverson (2004b) reports a TFP ratio of 1.92 among firms at 90 percentile and 10 percentile of the distribution, computed at 4 digit industry level. This figure

22 TFP, in fact, may be measured by using an Index Number approach – which in general is more flexible in defining firm technology but is also sensitive to measurement errors – or estimated using parametric or semi-parametric methods – which in turn assume a homogenous technology within sectors but allow control for unobserved productivity shocks that can lead to simultaneity bias. Generally, different methods are based on different assumptions; see Van Biesebroeck (2008) for an evaluation of the robustness of different methods. In what follows we use the terms measure and estimate interchangeably. The basic evidence of high productivity dispersion within industries is invariant with respect to the way productivity is measured or estimated.

implies simply that most productive firms are able to produce almost twice the output of less productive ones, with the same amount of inputs[23]. One relevant corollary to the observed differences in the estimated productivity at firm level is that there is room for public intervention, through regulation and targeted policies, to improve the reallocation of inputs towards more efficient users (Bartelsman et al.. 2009).

### *4.1 Drivers of firm productivity: Internal and External factors*

A common starting point for the evaluation of TFP is to define a firm production function, typically a Cobb-Douglas, where the amount of output (revenues of physical quantity) is a function of labour, capital and intermediates inputs, plus a Hicks-neutral productivity term.

Empirically, this formulation implies that TFP is estimated as a residual, interpreted as the variation in output unexplained by the implied inputs[24]. Syverson (2011) provides a clear taxonomy of two different "drivers" for productivity at firm level that may also shape the aggregate dispersion of values within industries.

The first set of determinants is represented by the "internal factors", namely those "levers" that entrepreneurs are usually able to directly operate in order to affect productivity. Among these internal drivers, managerial practices are among the most scrutinized determinants of firm performance. Since the pioneering work on the subject by Bloom and Van Reenen (2007) the effect of management on levels of firm

23 The reported ratio is an average across industries for several sectors. In fact the dispersion is significantly higher: taking into consideration standard deviation, the ratio at the industry level ranges from 1.61 to 2.27.

24 Since productivity is essentially a relative notion, TFP usually refers to firm performance with respect to the sector average; in the case of Index Number measures this implies its expression as actual deviation from the industry mean, while in the case of a regression approach this implies using industry fixed effects, or sector specific regressions.

performance has been the subject of several empirical studies aiming to shed light on the productivity differential due to management quality, usually captured by a "fixed effect" in panel data frameworks[25]. Bloom and Van Reenen provide a score for managerial practices based on a "double blind"[26] survey of 732 enterprises in four countries: the United States, the United Kingdom, France and Germany. The final firm level managerial score is built on 18 key practices, grouped in four main areas: operations, monitoring, targets and incentives. Their results show that higher managerial quality is significantly correlated with several dimensions of firm performance: TFP and labour productivity, sales growth, return on capital and the probability of survival. Moreover, their findings show that on the one hand managerial quality is positively correlated with the degree of competition faced by the firm, while on the other hand managerial scores are lower when management control is handed down by primogeniture. Market competition and family-owned firms accounts for around 50% of the management gap between French and US firms, and around 30% of UK firms' gap[27].

Further research in this field corroborates and extends previous findings (Bloom and Van Reenen 2010, Bloom et al. 2012, and Bloom et al. 2013)[28]. Imperfectly competitive markets, family ownership, restrictive regulations and informational barriers are generally associated with worst management at firm level. Moreover, management practices vary significantly both within and between countries. A large part of the

25 See Mundlak (1961).

26 The "double blind" approach implies that interviewed managers do not know they are being scored and interviewers do not know the performance of the firm. The scoring grid was originally developed by McKinsey.

27 Note that US firms are those with higher scores in management quality; German firms are not statistically different in terms of management scores with respect to US enterprises.

28 The cited papers use progressively larger versions of the first survey. The different waves of the survey are available online at www.worldmanagementsurvey.org.

difference in countries' management quality results from a "long tail" of very badly managed firms. Interestingly, exporters are on average better-managed than non-exporters[29]. Finally, family-owned enterprises nominating a family member as chief executive show poorer management scores, while government-owned firms perform even worse (see Bloom and Van Reenen, 2010).

From a policy viewpoint, management practices are influenced by different factors, with by far the most relevant being the degree of market competition; a tougher competitive environment tends to push badly managed firms out of the market and at the same time to motivate survivors to adopt best practices. Furthermore, taxes or incentives schemes that sustain family firms seem to hamper the adoption of best practices, while investment in education and the number of multinationals seem to positively affect the spread of high-quality managerial practices (see Bloom et al. 2012).

Finally, there is that the ability of management quality is explaining country differences in TFP., One standard deviation in management quality may cause a 10% increase in TFP (Bloom et al., 2013). To make a concrete example, if Greece were to improve its management score up to the US level, this would lead to a 16% increase in TFP.

To return to the issue of productivity dispersion, even when management quality is taken into account the interquartile range remains relatively high. Syverson (2011), for example, notes that in the Bloom and Van Reenen sample management ability accounts for no more than 23 % of the overall TFP interquartile range, suggesting that there are other economic forces besides management shaping TFP dispersion.

Labour and capital quality, R&D investment and product innovation, learning-by-doing and firm decision-making structures are the other internal levers of productivity listed by

29 It is also interesting to note that exporters are on average worse-managed than multinational firms.

Syverson. Regarding the quality dimension of labour as a factor of production, empirical research based on the effect of human capital on productivity is relatively modest compared to that focusing on wages. Danish matched employer-employee data provides additional evidence but show that labour characteristics but explain only a small percentage of TFP dispersion within industries (Fox and Smeets, 2011) [30].

As far as innovation is concerned[31], find the increasing TFP dispersion in UK firms over the period 1984-2000, and a corresponding growth of wage inequality in the same period has been observed (Faggio et al., 2010). Rise in productivity dispersion was more rapid for those industries with a higher growth of Information Technology (IT) intensity. The latter finding seems consistent with the findings that adoption of IT results in an increase in the variance of firm productivity and profits (Bartelsman et al., 2011). At the aggregate level, providing that poor innovation output is associated with market exit, increasing variance should be reflected in higher average productivity: in the mid-1990s, when IT started to became readily available, countries with low employment protection legislation benefited more from the adoption of IT, while in countries with tougher employment regulations, high-risk and more innovative sectors tended to be smaller (Bartelsman et al. , 2011).

Along with the internal factors described above, productivity dynamics may also be affected by the productive environment: agglomeration spillovers, degree of competition and market regulation, labour and capital rigidities[32].

30 Once workforce characteristics are included in TFP estimations, the 90th to 10th percentile range only marginally decreases, by about 10%, Syverson (2011).

31 We consider a broad definition of innovation here that collates R&D, product innovation and learning-by-doing categories. See Section 2.1 for a more detailed discussion on the effect of innovation on aggregate as well as firm productivity.

32 The classification is from Syverson (2011).

Such drivers are “external” to the firm production process, they are not “levers” that entrepreneurs may operate to influence firm productivity and yet they may still influence firms’ incentives to investment. Poor institutional quality or market regulation may lower expected return on investment by raising costs or increasing uncertainty of returns, resulting in impact on both the ability of individual firms to improve their performance as well as the probability that innovative entrants supplant less productive incumbents (*resource reallocation*).

To return to the theoretical framework outlined in Section 1, external drivers are likely to shape the productivity cut-off point, influencing the minimum level of efficiency needed to stay in the market and consequently the average level of productivity and the consequent degree of dispersion. From this viewpoint, the economic environment defines the strength of Darwinian selection in the markets through the performance threshold that firms need to reach to successfully compete in domestic and international markets[33].

Market competition as a driver for productivity has already been discussed when looking at the impact of managerial ability; a broader picture of the relation of completion to productivity is given in Syverson (2004b). For a homogenous and relatively non-tradable manufacturing product such as concrete, the density of local product markets positively affects competitiveness. The denser the local market the more difficult it is for less productive (high cost) producers to survive, as industry productivity distribution then appears to be truncated. Moreover, higher levels of competition in the construction

33 See Corcos et al. (2012).

sector[34] affect aggregate competitiveness, determining higher efficiency cut-off for concrete producers to stay in the market, higher aggregate (average) productivity levels as well as less dispersion (more efficient allocation of inputs)[35].

Rigidity in Inputs markets reduces producers' flexibility to react to demand shocks by adjusting optimal production size. For example, friction in the labour market may hamper the reallocation of workers towards more efficient firms and consequently slow growth of high productive firms. A good example is provided by the efficiency of input allocation across Chilean firms consecutive to two subsequent increases in firing costs (Petrin and Sivadasan, 2013). . The wedge between the marginal product of an input and its cost is the "gap" to be measured at firm level. It is a measure of inefficiency in input allocation. Such gaps can be used to measure the change in production if one unit of input is reallocated across firms, but also to evaluate the effect of a policy change on a particular input market.

In the case of the Chilean manufacturing study, the tougher labour market regulation introduced in 1984 and 1990, saw a sudden increase in the average firm gap between the marginal product of labour and wages. As a consequence of the increased adjustment costs in the labour market, the overall allocative efficiency of manufacturing firms decreased.

Significantly, the effects of the highlighted channels are not independent of each other, on the contrary, most of them interact and generate feedback effects; policy aiming to

34 Note that the construction sector here is used as an exogenous measure of market density, since concrete production goes almost completely to the construction sector, while concrete is a relatively small fraction of the construction industry's overall costs.

35 Bloom et al. (2011) analyse the effect of trade competition, after China's entry to the WTO, on innovation (patenting, IT, R&D) and TFP of a large panel of European firms). Their results show that increasing Chinese import competition positively contributed to aggregate productivity, stimulating innovation within firms, and forcing reallocation of labour towards more innovative firms (inducing less efficient firms to exit the market especially in low-tech sectors).

strengthen countries supply-side capacity and improve competitiveness should account for such interdependence.

### *4.2 Firm Productivity and Input (mis)allocation*

The analysis of input allocation has been the subject of several research projects: awareness of the constraints preventing more efficient re-allocation of inputs is relevant not just for competitiveness but also for a country's overall economic performance. Actually, income differences across countries are mostly due to TFP differentials (from 50% to 70%) and to a lesser extent to levels of human and physical capital (Hsien and Klenow, 2010). Along with its direct effect, TFP also positively influences income indirectly through human and physical capital accumulation[36]. Moreover, most of the observed differences in productivity across countries seem to be imputable to input misallocation. Even when other drivers of productivity are considered, TFP distribution still shows significant heterogeneity, reflecting in large part the inefficient allocation of inputs across firms and industries.

The aggregate implication of inefficient inputs allocation in China and India manufacturing sectors, compared to US allocation is also a good example to look at (Hsien and Klenow, 2009) [37]. Allocative inefficiency is signalled by the dispersion of revenue-based productivity[38]. Productivity dispersion in this approach signals that low (high) performance firms are smaller (larger) with respect to the efficient allocation case.

36 The effect of productivity on physical and human capital accumulation is induced by changes (decreases) in their relative price.
37 US productivity naturally displays gaps and a degree of misallocation, the distribution is used just as a control group.
38 Without distortions revenue-based productivity should be equal for all firms in the same sector. In other words, the marginal revenue products of labour and capital should equate across firms. The higher is the dispersion of productivity (marginal products) the higher is the degree of distortions faced by firms.

The degree of misallocation is higher in China and India than in the US. More interestingly, the gain in TFP by achieving the same allocative efficiency as the US would be between 30-50% for China, and as much as 40-60% for India, while the increase in output would be almost two times higher.

A slightly different approach to measuring the degree of allocative efficiency across different countries is worth considering (Bartelsman et al., 2009).[39] The underlying idea is that if resources were allocated randomly the covariance would be zero; a positive covariance among firms' market share and productivity indicates a relatively more efficient allocation[40]. In other words, market rigidity and distorted regulations may affect firm entry and exit processes, weakening the correlation with market fundamentals. In the case where the process is completely random, no difference is expected between entering, exiting and incumbent producers. The framework providing a theoretical model where heterogeneous firms are confronted with adjustment friction and distortions can be further extended (Bartelsman et al., 2013); aggregate outcome[41] is then influenced by selection and allocative efficiency. Their main findings, which are robust across both studies, are that during the 1990s, the US demonstrates high levels of allocative efficiency: observed labour productivity in manufacturing is 50% higher than it would be

39 The procedure, following Olley and Pakey (1996), uses the covariance between firm size and productivity within sectors to assess the efficiency of input allocation.

40 Note that this is the static version of allocative efficiency, on a cross-section framework; see Haltiwanger, (2011) for a discussion on static and dynamic allocative measures.

41 According to the model, an increase in the dispersion of distortions decreases aggregate consumption. Given the extremely high correlation between consumption and output, it is likely that the same negative shock in distortions should imply a decrease in output per capita, see Bartelsman et al. (2013) online appendix.

if employment were allocated randomly. Among European countries, allocation efficiency is relatively lower, ranging from 15-38 %[42].

Recently the Competitiveness Research Network[43], presented a new sectoral database on comparable productivity indicators for 11 European countries over the period 1995-2011; for a detailed description see CompNet (2014)[44].

In line with previous research, particular attention has been devoted to the evaluation of countries' allocative efficiency. The evidence reported in CompNet (2014) shows that (static) allocative efficiency in Europe, over the period 2003-2007, is relatively low, but consistent in terms of country rankings with previous findings (Bartelsman et al. 2009). The covariance between labour productivity and firm size reaches 0.2 for Hungary and Spain, meaning that in those countries labour allocation is about 20% more efficient than the random allocation benchmark. Moreover, labour allocation appears to be 3 times higher in manufacturing than in services[45], although cross-country heterogeneity is significantly high.

The relevance of allocative efficiency in shaping country performance is confirmed by the estimated elasticity of productivity growth to the covariance term: results from CompNet (2014) show that a 1% increase in allocative efficiency could result in a 0.7% increase in sectoral productivity.

42 The data used in the cross-country comparisons was produced from a series of projects funded by the OECD, the World Bank and Eurostat. See Appendix I for a detailed description.

43 The Competitiveness Research Network (CompNet) is composed of economists from the 28 national central banks of the European Union (EU) and the European Central Bank; international organisations (World Bank, OECD, EU Commission), universities and think-tanks, as well as non-European Central Banks (Argentina and Peru) and organisations (US International Trade Commission). The objective of CompNet is to develop a more consistent analytical framework for assessing competitiveness, allowing for a better correspondence between determinants and outcomes.

44 Along with aggregate information from Eurostat industry statistics, the database contains information on the distribution of firms across competitiveness-related dimensions: such as productivity and size. Countries covered: Belgium, Czech Republic, Germany, Estonia, France, Hungary, Italy, Poland, Spain, Slovakia and Slovenia

45 Manufactures and services are proxy using tradable versus non-tradable sectors

From a policy perspective, previous findings offer significant implications. Product market competition, labour and capital rigidity, as well as other friction and adjustment costs, all seem to hamper reallocation of resources from less to more efficient firms, preventing the entry of new efficient producers. Importantly, such distortions affect negative aggregate productivity. Given the high degree of heterogeneity in cases of allocative inefficiency, both between and within countries, and the possible feedback between different drivers of productivity, evaluation of alternative interventions should be tailored to country and market-specific distortions.

In a growth model with heterogeneous firms, Restuccia and Rogerson (2008) show how policy-induced distortions, by introducing differences in relative prices (either for output or production factors) faced by individual firms, may negatively influence the reallocation process and harm output and productivity.

Changes to costs and the profit structure of individual firms brought about by taxation and subsidies[46] may have sizeable negative impact on aggregate outcomes[47]. If those interventions are negatively correlated with firms' productivity, for example, they may lower the efficiency cut-off needed to enter the market, or allow less productive firms to stay in the market.

46 But also an inefficient banking sector offering selected interest rates.

47 In the Restuccia and Rogerson set-up the drop in output and productivity due to the introduction of policy distortion may reach 30%.

### *Box 2 – Microeconomic Perspective: Relevant Indicators and data needs*

***Managerial Practices.*** The different waves of the managerial quality survey (Bloom et al. 2012) are available at www.worldmanagementsurvey.org last available data covers 10000 organizations across 20 countries for the period 2004-2010. Data has been anonymized due to confidentiality issues. Those who have access to a U.S. Census Research Data Center can apply to us to gain access to the full dataset, since data within the RDCs is protected by U.S. federal law. The survey is conducted with a double blind approach, where the interviewed managers do not know they are being scored and interviewers do not know the performance of the firm. The survey evaluate and score management practices codifying them from 1 (worst practice) to 5 (best practice) across key management practices used by organizations across different sectors. These practices are grouped into five areas: 1) Operations Management, 2) Performance Monitoring, 3) Target Setting, 4) Leadership Management and 5) Talent Management.

***Firm Level productivity.*** For a comprehensive description of the firm level data from European National Statistical Institutes, their availability and the degree of computability of bottom-up productivity indicators see Deliverables 2.1, 2.2.

*Bartelsman et al. (2013):* the database was produced from a series of projects funded by the OECD, the World Bank and Eurostat; it covers 24 countries, a downloadable version can be found at http://econweb.umd.edu/~haltiwan/BHS_jobflows_productivity/

The indicators used in the paper were computed using a Distributed Micro-data approach.

*CompNet (2014):* the database uses the same approach as Bartelsman et al., starting from firm-level data to generate customized indicators of firm dynamics at industry level (distributed micro-data analysis). The database covers 11 EU countries which together represent about two-thirds of the European Union's GDP: Belgium, Czech Republic, Germany, Estonia, France, Hungary, Italy, Poland, Spain, Slovakia and Slovenia; 58 NACE Rev.2 industries over the period 1995-2011 with comparable information on productivity performance and dynamics of underlying heterogeneous firms. Data access is currently restricted.

### *4.3 Micro / Macro interactions and aggregate outcome*

Besides dispersion, other characteristics of micro productivity distribution are linked to macroeconomic performance. The "granular" hypothesis shows how idiosyncratic shocks to large firms affect aggregate fluctuations and, through general equilibrium channels, all other firms as well (Gabaix, 2011).

Starting from the evidence that the distribution of firms tends to be highly skewed, sales of the top 100 firms in the United States, for example, are equal to almost 30% of country GDP[48], Gabaix demonstrates that the effect of firm-level shocks does not cancel out as the number of firms increases[49]. For the US economy, shocks occurring to the top 100 firms are responsible for one-third of the country's GDP fluctuation.

A significant consequence of the micro and micro interdependence is that productivity shocks (R&D, investment behaviour, management changes, etc…) affecting large firms have a non-negligible impact on the state of the economy.

48 The proportion is remarkably stable over a period spanning 1975 to 2010.
49 The law of large numbers no longer applies if the distribution of firms sales departs from normality and displays "fat-tail".

The effect of firms' "granularity" on export growth rates volatility is visible in the data (di Giovanni et al., 2013). Up to half of aggregate volatilityis due to demand shocks. Moreover, the magnitude of the firm level contribution is equal to the sum of sectoral and macroeconomics (common to all firms). Finally, CompNet (2014) relates countries trade performance to various elements of productivity distributions, such as dispersion and skewness. Results confirm that export performance is positively correlated with average productivity, as well as with productivity dispersion, skewness and interquartile range. As skewness captures the incidence of the upper tail of distribution, ComNet results also confirm that countries' external competitiveness is positively influenced by the most productive firms.

Sectoral linkages may act as another channel through which microeconomic shocks may affect to the macroeconomic outcomes and generates a "cascade effect" (Acemouglu at al., 2012). Localized sectoral shock may propagate to the whole economy through intermediate supplies linkages. The main idea is that where production structure shows inter-sectoral dependence (via Input-Output mechanism) the microeconomic shocks does not average out at the aggregate level. On the contrary, firms and sectoral interconnections may be a vehicle propagating the fluctuations to the whole economy.

At a regional point of view the same channels may play even a more relevant role. For instance, Detroit economic prosperity was strongly connected to those of few sectors and mainly to those of three firms -- Chrysler, Ford and General Motors (Glaeser, 2011). Given the highlighted channels and the low industrial diversification any idiosyncratic shock affecting those firms or their main suppliers has a relevant influence for the welfare of the area. The previous evidence confirms that microeconomic characteristics

at firm, sectoral and regional level, sensibly affect macroeconomic outcomes both in terms of output and economic performance, suggesting that micro macro linkages play a crucial role in shaping aggregate competitiveness.

## 5. Conclusions

At its core, competitiveness is a multi-dimensional concept. Besides the metrics used to measure it, aggregate country performance is the result of the interaction of several interdependent forces where individual firms are crucial players.

Although these forces are primarily driven by levers under the direct control of single producers, the effect of the external economic environment on firm performance is far from negligible. In this respect, public intervention is essential to shape the economic milieu, but policies aiming to improve supply-side capacity and competitiveness should account for interdependence.

Product market competition as well as capital and labour market flexibility are crucial ingredients to easing the flow of resources from less efficient businesses to more productive enterprises and reducing the entry barriers faced by new innovative firms.

Given the high degree of heterogeneity within and between countries, similar policy intervention might spur different outcomes on aggregate performance across countries or industries. Alternative interventions, therefore, need to be tailored to country and market-specific distortions and to take into account more informative phases of firms' performance distribution than those of the "average" producer.

## 6. References


Acemoglu D, U Akcigit, N Bloom and WR Kerr (2013), "Innovation, Reallocation and Growth," NBER Working Papers 18993, National Bureau of Economic Research, Inc.

Acemoglu D and J Robinson (2012), “Why Nations Fail: The Origins of Power, Prosperity, and Poverty”, Crown Business; 1 edition March 20, 2012

Acemoglu D, VM Carvalho, A Ozdaglar and Alireza Tahbaz-Salehi, 2012. "The Network Origins of Aggregate Fluctuations," Econometrica, Econometric Society, vol. 80(5), pages 1977-2016, 09.

Acemoglu D and S Johnson (2005), “Unbundling institutions”, Journal of Political Economy 113(5): 949–995.

Aghion P, P Askenazy, N Berman, G Cette and L Eymard (2012), "Credit Constraints And The Cyclicality Of R&D Investment: Evidence From France", Journal of the European Economic Association, European Economic Association, vol. 10(5), pages 1001-1024, October.

Altomonte C, G Barba Navaretti, F Di Mauro and GIP Ottaviano (2011), “Assessing competitiveness: how firm-level data can help,” Policy Contributions 643, Bruegel.

Barro RJ and X Sala-i-Martin (1992), "Convergence," Journal of Political Economy, University of Chicago Press, vol. 100(2), pages 223-51, April.

Bartelsman EJ and PJ Dhrymes (1998), "Productivity Dynamics: U.S. Manufacturing Plants 1972-1986," Journal of Productivity Analysis, 9:1 pp. 5-34.

Bartelsman EJ, J Haltiwanger, and S Scarpetta (2009), “Cross-Country Differences in Productivity: The Role of Allocation and Selection”, National Bureau of Economic Research Working Paper 15490.

Bartelsman EJ, PA Gautier and J de Wind (2011), "Employment Protection, Technology Choice, and Worker Allocation," DNB Working Papers 295, Netherlands Central Bank, Research Department.

Becker SO, PH Egger and M von Ehrlich (2012), "Too much of a good thing? On the growth effects of the EU's regional policy", European Economic Review, Elsevier, vol. 56(4), pages 648-668.

Bloom N and J Van Reenen (2007), “Measuring and Explaining Management Practices across Firms and Countries.” Quarterly Journal of Economics, 122(4): 1351–1408.

Bloom N and J Van Reenen (2010), “Why Do Management Practices Differ across Firms and Countries?” Journal of Economic Perspectives, 24(1): 203–24.

Bloom N, M Draca, and J Van Reenen. (2011), “Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity.” National Bureau of Economic Research Working Paper 16717.

Bloom N, R Sadun and J Van Reenen (2012) "Americans Do IT Better: US Multinationals and the Productivity Miracle," American Economic Review, American Economic Association, vol. 102(1), pages 167-201, February.

Bloom N, R Sadun and J Van Reenen (2013) "Management as technology”, mimeo.

Boldrin M and F Canova. (2001), “Inequality and Convergence: Reconsidering European Regional Policies”, Economic Policy, 16, pp. 207-53.

Boschma R (2004), "Competitiveness of Regions from an Evolutionary Perspective," Regional Studies, Taylor & Francis Journals, vol. 38(9), pages 1001-1014.

Breinlich H, GIP Ottaviano and JRW Temple (2013) "Regional Growth and Regional Decline," CEP Discussion Papers dp1232, Centre for Economic Performance, LSE.

Bricongne JC, L Fontagne, G Gaulier, D Taglioni and V Vicard (2012), “Firms and the Global Crisis: French exports in the turmoil”, *Journal of International Economics* 87, 1 134-146.

Bronzini R. and E Iachini (2011), “Are incentives for R&D effective? Evidence from a regression discontinuity approach”, Banca d’Italia, Working Paper 791, February 2011.

Buckley PJ, CL Pass and K Prescott (1988), “Measures of International Competitiveness: A Critical Survey”, Journal of Marketing Management 4 (2), 175-200.

Cattaneo O, and S Miroudot (2013), “From Global Value Chains to Global Development Chains: An Analysis of Recent Changes in Trade Patterns and Development Paradigms”, in Zedillo E and B Hoekman (eds.), 21st Century Trade Policy: Back to the Past?, volume in Honor of Professor Patrick Messerlin, New Haven, CT: Yale University Press.

Cattaneo O, Gereffi G, Miroudot S and Taglioni D (2013), "Joining, upgrading and being competitive in global value chains : a strategic framework," Policy Research Working Paper Series 6406, The World Bank.

Cheptea A., Fontagné L., Zignago S. (2014), European Export Performance, Review of World Economics, 150(1): 25-58.

Cheptea A, G Gaulier and S Zignago (2005), “World Trade Competitiveness: a Disaggregated View by Shift-Share Analysis,” *CEPII Working Paper* 23.

Chinn M D (2006), “A Primer on Real Effective Exchange Rates: Determinants, Overvaluation, Trade Flows and Competitive Devaluation”, Open Economies Review 17, 115–143

Chinn MD (2006), “A Primer on Real Effective Exchange Rates: Determinants, Overvaluation, Trade Flows and Competitive Devaluation”, Open Economies Review 17, 115–143

Ciccone A (2002), "Agglomeration effects in Europe", European Economic Review, Elsevier, vol. 46(2), pages 213-227, February.

Ciccone A and RE Hall (1996), "Productivity and the Density of Economic Activity", American Economic Review, American Economic Association, vol. 86(1), pages 54-70, March.

Cincera M and R Veugelers (2013), "Young leading innovators and the EU's R&D intensity gap," Economics of Innovation and New Technology, Taylor & Francis Journals, vol. 22(2), pages 177-198.

Combes P-P, G Duranton, L Gobillon, D Puga and S Roux (2012), “The productivity advantages of large cities: Distinguishing agglomeration from firm selection”, Econometrica 80(6), 2543-2594.

CompNet (2014), “Micro-based evidence of EU competitiveness The CompNet database”, Working Paper Series, European Central Bank.

Corcos G, M Del Gatto, G Mion and GIP Ottaviano (2012), "Productivity and Firm Selection: Quantifying the ‘New’ Gains from Trade," Economic Journal, Royal Economic Society, vol. 122(561), pages 754-798, 06.

Crescenzi R and A Rodríguez-Pose (2012), "Infrastructure and regional growth in the European Union," Papers in Regional Science, Wiley Blackwell, vol. 91(3), pages 487-513, 08.

Dell M (2010), “The Persistent Effects of Peru’s Mining Mita”, Econometrica,78(6), 1863-1903.

Desmet K and E Rossi-Hansberg (2012), "On the Spatial Economic Impact of Global Warming," NBER Working Papers 18546.

Di Giovanni J, AA Levchenko and I Méjean (2013), "Firms, destinations, and aggregate fluctuations," Economics Working Papers 1387, Department of Economics and Business, Universitat Pompeu Fabra.

Durand M and C Giorno (1987), “Indicators of International Competitiveness: Conceptual Aspects and Evaluation”, OECD Economic Studies No. 9, 147-182.

Duranton G and P Diego (2004), "Micro-foundations of urban agglomeration economies," Handbook of Regional and Urban Economics, in: JV Henderson and JF Thisse (ed.), Handbook of Regional and Urban Economics, edition 1, volume 4, chapter 48, pages 2063-2117 Elsevier.

Ecorys (2003), A Study on the Factors of Regional Competitiveness, report for DR Regio, European Commission.

Eric Bartelsman & John Haltiwanger & Stefano Scarpetta, 2013. "Cross-Country Differences in Productivity: The Role of Allocation and Selection," American Economic Review, American Economic Association, vol. 103(1), pages 305-34, February.

Escaith H, N Lindinberg and S Miroudot (2010), “Global Value Chains and the Crisi: Reshaping Trade Elasticity?”, in Cattaneo O, G Gereffi and C Staritz (eds) (2010), Global Value Chains in a Postcrisis World. A Development Perspective. Washington, D.C.: The World Bank, 73-124.

Faggio G, Kjell GS and J Van Reenen (2010), “The Evolution of Inequality in Productivity and Wages: Panel Data Evidence.” Industrial and Corporate Change, 19(6): 1919–51.

Fernandes A M, Paunov C (2012), “Foreign Direct Investment in services and manufacturing productivity growth: evidence for Chile”. Journal of Development Economics 97, 305-321.

Foster L, J Haltiwanger and C Syverson (2008), “Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?” American Economic Review, 98(1): 394–425.

Fox JT and V Smeets (2011), “Does Input Quality Drive Measured Differences in Firm Productivity?” National Bureau of Economic Research Working Paper 16853.

Fujita M (2013), “The lessons from the Great East Japan Earthquake and the Great Floods in Thailand”, Vox EU, 18 November.

Fujita M, P Krugman and AJ Venables (1999), ”The Spatial Economy: Cities, Regions, and International Trade”, The MIT Press

Gabaix X (2011), "The Granular Origins of Aggregate Fluctuations," Econometrica, Econometric Society, vol. 79(3), pages 733-772, 05.

Gaulier G, G Santoni, D Taglioni and S Zignago (2013), "In the wake of the global crisis : evidence from a new quarterly database of export competitiveness," Policy Research Working Paper Series 6733, The World Bank.

Glaeser EL (2011), "Triumph of the city", Macmillan, London.

Glaeser EL and JD Gottlieb (2009), "The Wealth of Cities: Agglomeration Economies and Spatial Equilibrium in the United States", Journal of Economic Literature, American Economic Association, vol. 47(4), pages 983-1028, December.

Haltiwanger J (2011), "Firm dynamics and productivity growth," EIB Papers 5/2011, European Investment Bank, Economics Department.

Hickman NG (1992), "International Productivity and Competitiveness: An Overview" in Hickman eds International Productivity and Competitiveness, Oxford University Press.

Holmes TJ (1998), "The effect of state policies on the location of manufacturing: evidence from state borders", Journal of Political Economy, 106(4), 667-705.

Hospers GJ (2006), "Silicon somewhere? Assessing the usefulness of best practices in regional policy", Policy Studies, 27: 1–15.

Hsieh CT and PJ Klenow (2010), "Development Accounting," American Economic Journal: Macroeconomics, American Economic Association, vol. 2(1), pages 207-23, January.

Hsieh CT and PJ Klenow. (2009) "Misallocation and Manufacturing TFP in China and India." Quarterly Journal of Economics, 124(4): 1403–48.

Johnson, R. C., & Noguera, G. (2012). Accounting for intermediates: Production sharing and trade in value added. Journal of International Economics, 86(2), 224-236.

JRC (2013), EU Regional Competitiveness Index, RCI 2013, European Commission, Joint Research Centre, Institute for Security and Protection of the Citizens

Kitson M, R Martin and P Tyler, (2004), "Regional Competitiveness: An Elusive yet Key Concept?", Regional Studies, Vol. 38.9, pp. 991–999.

Klette TJ and S Kortum (2004), "Innovating Firms and Aggregate Innovation," Journal of Political Economy, University of Chicago Press, vol. 112(5), pages 986-1018, October.

Krugman P (1994),"Competitiveness: A Dangerous Obsession", *Foreign Affairs*, 73, 2,pp. 28-44.

Lambregts, Janssen-Jansen, Haran (2008), "Effective governance for competitive regions in Europe: the difficult case of the Randstad", GeoJournal, Vol. 72, No. 1/2, Geographies of Governance in the European Union.

Lamy P (2013), "Global value chains, interdependence, and the future of trade", Vox EU, 18 December.

Lipschitz L and D McDonald (1991), "Real Exchange Rates and Competitiveness: A Clarification of Concepts and Some Measurement for Europe" IMF Working Papers.

Magee (1968), "Theoretical and Empirical Studies of Competition in International Trade: a Review" US Council of economic advisors.

Martin R (2005), "Thinking about regional competitiveness: Critical issues", Cambridge: East Midlands Development Agency.

Mc Morrow K and R Werner (2009), "R&D capital and economic growth: The empirical evidence", EIB papers, European Investment Bank.

Melitz MJ and GIP Ottaviano (2008), "Market Size, Trade, and Productivity", Review of Economic Studies 75(1), 295-316.

Melitz, M. and GIP Ottaviano (2008), "Market size, trade and productivity", Review of Economic Studies, 75, 295–316.

Milana C (1988), "Constant Market Shares Analysis and Index Number Theory" European Journal of Political Economy, Vol. 4, No. 4, pp. 453-478.

Minerva GA, GIP Ottaviano (2009), "Endogenous Growth Theories: Agglomeration Benefits and Transportation Costs", in R Capello and P Nijkamp, eds., Handbook of Regional Growth and Development Theories. Cheltenham: Edward Elgar.

Mundlak Y (1961), “Empirical Production Function Free of Management Bias”, Journal of Farm Economics 43(1): 44-56

Olley S and A Pakes (1996), “The dynamics of productivity in the telecommunications equipment industry”, Econometrica, 64, 1263–97.

Organisation for Economic Co-operation and Development and World Trade Organization (2013a), “OECD-WTO Database on Trade in Value-Added First Estimates: 16 January 2013”, Paris: OECD

Ottaviano G, D Taglioni and F Di Mauro (2009), “The Euro and the Competitiveness of European Firms”, Economic Policy.

Petrin A and J Sivadasan (2013), "Estimating Lost Output from Allocative Inefficiency, with an Application to Chile and Firing Costs," The Review of Economics and Statistics, MIT Press, vol. 95(1), pages 286-301, March.

Porter ME (1990), “The Competitive Advantage of Nations”, The Free Press: New York.

Psycharis Y, A Rodríguez-Pose, V Tselios (2012), “Public investment and regional growth and convergence: Evidence from Greece”, Papers in Regional Science, Wiley Blackwell, vol. 91(3), pages 543-568, 08.

Puga D (2010), "The Magnitude And Causes Of Agglomeration Economies," Journal of Regional Science, Wiley Blackwell, vol. 50(1), pages 203-219.

Restuccia, D. and R. Rogerson (2008): “Policy distortions and aggregate productivity with heterogeneous establishments,” Review of Economic Dynamics 11: 707-720.

Rodriguez-Clare A (1996) “Multinationals, linkages, and economic development”, American Economic Review 86 (4), 852-873.

Rodrik D (2003),”Institutions, Integration and Geography: In Search of the Deep Determinants of Economic Growth”, in D Rodrik (ed.) In Search of Prosperity: Analytic Narratives on Economic Growth, Princeton University Press: Princeton, pp: 1–19.

Sala-i-Martin X and EV Artadi (2004), “The Global Competitiveness Index’, in M.E. Porter, K Schwab, X Sala-i-Martin and A Lopez-Claros (eds.) The Global Competitiveness Report 2004–05, Palgrave Macmillan, World Economic Forum: New York, pp: 51–80.

Stehrer, R. (2012). Trade in value added and the value added in trade. WIOD WPN, 8.

Syverson C (2004b), “Product Substitutability and Productivity Dispersion,” Review of Economics and Statistics, 86(2): 534–50.

Syverson C (2011), "What Determines Productivity?," Journal of Economic Literature, American Economic Association, vol. 49(2), pages 326-65, June.

Syverson, C (2004a), “Market Structure and Productivity: A Concrete Example,” Journal of Political Economy, 112(6): 1181–1222.

Tabellini G. (2010), “Culture and Institutions: Economic Development in the Regions of Europe”, Journal of the European Economic Association, Volume 8, Issue 4, pages 677–716.

Turner P and J Van ‘t Dack (1993),”Measuring International Price and Cost Competitiveness”, BIS Economic Papers No. 39, Bank for International Settlements,

United Nations Conference on Trade and Development (2013), “Global Value Chains and Development: Investment and Value Added Trade in the Global Economy”. UNCTAD.

Van Biesebroeck J (2008), “The Sensitivity of Productivity Estimates: Revisiting Three Important Productivity Debates.” Journal of Business and Economic Statistics, 26(3): 321-38.

Van Biesebroeck J (2008), “The Sensitivity of Productivity Estimates: Revisiting Three Important Debates.” Journal of Business and Economic Statistics, 26(3): 311–28.