European Cities seeking for Economic Supremacy

A Data Envelopment Analysis

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European Cities seeking for Economic Supremacy
A Data Envelopment Analysis

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Vorwort

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Stefan Sommeregger 31.März 2011

Abstract

This paper explores the possible application of the Data Envelopment Analysis on city benchmarks. For this purpose the 3T model (Talent, Technology, and Tolerance) from the paper "Europe in the Creativity Age" by Richard Florida and Irene Tinagli has served as starting point. It has been slightly modified and adapted for city comparison.

After collecting data on the 14 European cities Amsterdam, Athens, Copenhagen, Barcelona, Brussels, Helsinki, Lisbon, London, Madrid, Munich, Paris, Rome, Stockholm and Vienna the DEA was applied to produce three benchmarks.

The first benchmark, named "**are best**", is an in depth analysis of the cities' strengths and weaknesses. The analysis shows that nearly all European cities are efficient, meaning that they score best regarding their individual preferences. Two sets of groups have been established:

Ignoring variable returns to scale

Group Euro dominant: Stockholm, Copenhagen, Paris
Group Euro efficient: Brussels, Munich, Amsterdam, London
Group Euro catch-ups: Vienna, Helsinki
Group Southern catch-ups: Rome, Madrid, Barcelona, Athens, Lisbon

Considering variable returns to scale

Group Euro VRS efficient: Amsterdam, Munich, Copenhagen, Stockholm, Brussels, Vienna
Group Euro VRS catch-ups: Rome, Barcelona, Lisbon, Athens

London, Paris and Helsinki are not part of those results due to methodological reasons.
A further analysis into the individual strengths shows that Munich scores best, followed by Paris and Copenhagen, meaning that they are ahead of the other cities. The southern European cities are at the bottom of the ranking.

The second analysis, "**capitalise best**", investigates which cities can transform their individual assets best into monetary value.

And the third analysis, "**invest best**", looks at how efficiently cities invest their money into certain economic factors.

This paper shows that the Data envelopment analysis is an adequate tool for city benchmarking. The "3 Benchmark" analysis goes beyond simply producing a ranking and respects diversity and individual preferences and is rich in information. Furthermore in this paper the various possibilities of DEA in city benchmarking are portrayed.

Zusammenfassung

Diese Arbeit untersucht die mögliche Anwendung der „Data Envelopment Analysis“ auf Städtevergleiche. Ausgehend vom Modell „3T“ (Talent, Technology, Tolerance) aus der Arbeit „Europe in the creativity age“ von Richard Florida und Irene Tinagli wurde ein Modell erstellt, das leicht abgeändert und für Städte angepasst wurde.

In weiterer Folge wurden die Daten für die 14 Städte Amsterdam, Athen, Barcelona, Brüssel, Helsinki, Kopenhagen, Lissabon, London, Madrid, München, Paris, Rom, Stockholm und Wien gesammelt und anhand des oben genannten Modells mittles Data Envelopment Analyse in 3 Schritten verglichen.

Zuerst wurde der Vergleich „**are best**“ angestellt. Dieser gibt detailliert Auskunft über die Stärken und Schwächen einer Stadt. Hier zeigt diese Arbeit, dass fast alle Europäischen Städte effizient sind, das heißt nach ihren individuellen Gesichtspunkten das beste Ergebnis erzielen. Es ergaben sich 2 Gruppeneinteilungen:

ohne Berücksichtigung der Stadtgröße

Gruppe Euro-dominant: Stockholm, Kopenhagen, Paris
Gruppe Euro-effizient: Brüssel, München, Amsterdam, London
Gruppe Euro-Nachzügler: Wien, Helsinki
Gruppe Südeuropa-Nachzügler: Rom, Madrid, Barcelona, Athen, Lissabon

mit Berücksichtigung der Stadtgröße

Gruppe Euro VRS effizient: Amsterdam, München, Kopenhagen, Stockholm, Brüssel, Wien
Gruppe Euro VRS Nachzügler: Rom, Barcelona, Lissabon, Athen

London, Paris und Helsinki fallen bei dieser Untersuchung aus methodologischen Gründen heraus.
Eine weitere Untersuchung der individuellen Stärke der Städte zeigt, dass sich München vor Paris und Kopenhagen am meisten von den anderen Städten abhebt. Am Ende der Reihung befinden sich die südeuropäischen Städte.

Die zweite Untersuchung, „**capitalise best**“ geht der Frage nach, wie effizient die Städte ihre Stärken in Wohlstand umwandeln.

Und der dritte Vergleich, „**invest best“** zeigt, wie effizient Städte in treibende Wirtschaftsfaktoren investieren.

Diese Arbeit zeigt, dass die DEA für einen Städtevergleich eine passende Methode darstellt und viele Anwendungsmöglichkeiten bietet. Mit ihrer Hilfe können Untersuchungen angestellt werden, die weiter gehen als nur eine Rangliste zu erstellen und die auf individuelle Städteausrichtungen und individuelle Präferenzen eingehen.

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1. Introduction

Through international competition and global benchmarking, quantifications of performances play a central role in economy. There is an urge of performance measurement and city performance doesn't fall short as the following quotation of the OECD executive report "State of European Cities" shows: "Cities are the indisputable engines of economic growth across Europe. In virtually all European countries, urban areas are the foremost producers of knowledge and innovation – the hubs of a globalising world economy."

Nowadays papers are full of city rankings of all kinds. You'll find rankings, where it is best to live, rankings where to make your holidays, rankings which are the global cities etc. The quantification of qualitative measures is a very difficult task and often controversial and misleading, because the methodology is hardly ever transparent.

Cities compete on an international level for image, living standards and economic capacity. But they do this not only to satisfy the local population, but to attract businesses and talented people.

On the OECD homepage there is a quote that stresses the importance of a city to be successful: "*Successful cities attract talented young highly-skilled workers, are centres of innovation and entrepreneurship and are competitive locations for global and regional headquarters.* " [1]

And the trend of growing importance of cities is not going to end, but further increasing. In the future more and more people will live in cities contributing to the city's economy. In the UN report "States of the World's Cities 2010/2011" it is stated that the world's urban population now exceeds the world's rural population[2]. And the tendency continues as the following diagram shows.

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[1] OECD (2006), OECD Territorial Reviews: Competitive Cities in the Global Economy, OECD publications, Paris

[2] UN Habitat (2010), State of the World's Cities 2010/2011 - Cities for All: Bridging the Urban Divide, http://www.unhabitat.org/content.asp?cid=8051&catid=7&typeid=46&subMenuId=0, (23rd of March 2011)

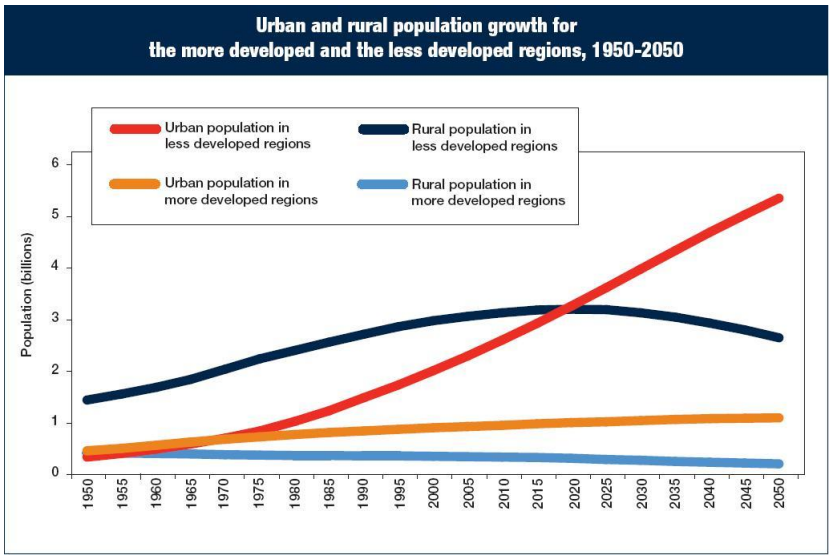

Table 1.a) Source UN[3]

Cities need to find a sustainable strategy to create a productive environment and manage the human capital as well as possible. City leaders feel the rising importance of urban areas and therefore get under more and more pressure in terms of their city performing well. Every country, area and city focuses on different criteria they want the city to excel in; because of their diversity comparison is difficult, this is why the existing rankings with their fixed priorities may not be suitable.

DEA therefore seems to be very fitting. A "Data Envelopment Analysis" shows dominant or better performing cities for each measurement. For a city that needs or wants to improve in specific areas, this paper provides a benchmark for individual purposes.

The goal of this paper is to establish a model describing the main factors for the GDP and the GDP growth of a city and analysing the strengths and weaknesses of several cities through a Data Envelopment Analysis. As data availability is still not completely satisfactory the results need to be considered with caution.

[3] United Nations (2008), World Urbanization Prospects: The 2007 Revision, Department of Economic and Social Affairs - Population Division, New York, chart available at http://www.un.org/esa/population/publications/wup2007/2007_urban_rural_chart.pdf (23rd of March 2011)

1.1. City indexes

Investors, companies and people seek to compare cities for different reasons. They look for a location to do business or search for a city to live. For any interest whatsoever, there seems to be an appropriate city ranking. In this paragraph there are listed some of the existing and most known city rankings and the measurements they are based on. All of them are based on surveys.

1.1.1. Mercer's Quality of living Index

Mercer is an international human resources consulting company and is an affiliated company of Marsh & McLennan Companies and so a sibling company of Marsh, Guy Carpenter and Oliver Wyman.

Mercer defines themselves as follows:
Mercer is the global leader for trusted HR and related financial advice, products and services. In our work with clients, we make a positive impact on the world every day. We do this by enhancing the financial and retirement security, health, productivity and employment relationships of the global workforce. [4]

Mercer releases a "Quality of living" report on a yearly basis. The intention of this report is to evaluate the living conditions for expatriates and to give guidelines how to compensate them, as they state on their homepage: "*Mercer conducts the ranking to help governments and multi-national companies compensate employees fairly when placing them on international assignments. The rankings are based on a point-scoring index, which sees Vienna score 108.6 and Baghdad 14.7. Cities are ranked against New York as the base city, with an index score of 100"* [5]

The Report consists of 39 factors in 10 dimensions:

"1. Political and social environment (political stability, crime, law enforcement, etc)
2. Economic environment (currency exchange regulations, banking services, etc)
3. Socio-cultural environment (censorship, limitations on personal freedom, etc)
4. Health and sanitation (medical supplies and services, infectious diseases, sewage, waste disposal, air pollution, etc)
5. Schools and education (standard and availability of international schools, etc)

……

[4] Mercer, www.mercer.com/about-mercer (23rd of March 2011)

[5] Mercer, Quality of Living worldwide city rankings 2010 – Mercer survey, http://www.mercer.com/press-releases/quality-of-living-report-2010#City_Ranking_Tables (23rd of March 2011)

6. Public services and transportation (electricity, water, public transport, traffic congestion, etc)
7. Recreation (restaurants, theatres, cinemas, sports and leisure, etc)
8. Consumer goods (availability of food/daily consumption items, cars, etc)
9. Housing (housing, household appliances, furniture, maintenance services, etc)
10. Natural environment (climate, record of natural disasters)"[6]

A complete list of the 39 factors and the ranking can be found in the annexe.

1.1.2. Global City Index

This Index is developed by the magazine Foreign Policy (FP) together with AT Kearney and the Chicago Council on Global Affairs. It ranks the most global world's cities examining the following five factors: Business activity, Human Capital, Information exchange, cultural experience and political engagement. A full list of all the sub factors and the ranking can be found in the Annexe.

1.1.3. Anholt-GFK Roper city Index

The GfK Group is an international market research company. Together with Simon Anholt, an independent advisor, they developed a City Brands index that evaluates Cities' images. They build their model upon the following six factors Presence, Place, Pre-requisites, People, Pulse and Potential.

Table 1.1.3.a) [7]

……

[6] Mercer, Quality of Living worldwide city rankings 2010 – Mercer survey, http://www.mercer.com/press-releases/quality-of-living-report-2010#City_Ranking_Tables (23rd of March 2011)

[7] Simon Anholt, GfK Roper Public Affairs & Corporate, The Anholt-GfK Roper City Brands Index, http://www.gfkamerica.com/practice_areas/roper_pam/placebranding/cbi/index.en.html (23rd of March 2011)

1.2. Creative Industries

In recent years, the idea of creative professions positively influencing the economy has attracted more and more interest. Not only contribute those professions to the economy by creating additional value, they, according to related research, also create a fertile ground for innovation. Michael Rushton in his paper "The Creative Class and Economic Growth in Atlanta" describes this theory as follows:

"Amongst urban planners, the first decade of the twenty-first century will be remembered as the time when all attention was directed toward the "creative class", those young, educated, and mobile individuals who work in occupations involving some degree of creativity and judgment, and who are seen as the most important source of growth in contemporary urban economies. The creative class naturally includes artists, but also involves architects, software engineers and industrial designers, among others. But artists are seen by some as particularly important as an anchor for the other parts of the creative class, in terms of providing innovation in ideas ("knowledge spillovers", to use the term from the literature on economic growth), and also as providing an urban environment with the cultural amenities favored by young and mobile knowledge workers. [8]

Researchers tend to use different definitions in their work: The need for a common mapping of creative industries was undeniable. The Department of Culture, Media and Sport in the UK (DCMS) first released a mapping of creative industries in 1998. They now define the creative industries comprehending 13 fields: Advertising, Architecture, Art & Antiques Market, Crafts, Design, Designer Fashion, Film & Video, Interactive Leisure Software, Music, Performing Arts, Software & Computer Services and Television & Radio.[9]

1.2.1. Europe in the Creativity age by Florida/Tinagli

Dr Richard Florida is an American Professor who has revived the discussion with his work in the field of creative industries with the publications "The Rise of the Creative Class" and "Europe in the Creativity age". His controversial ideas have been rejected on the one side, but have been realised in several city projects on the other.

In his work together with Irene Tinagli, "Europe in the Creativity age", he extends the definition of the Creative Industries. It says on page 11: *"Today, from between 25 to more*

……

[8] Rushton, Michael: The Creative Class and Economic Growth in Atlanta, Nonprofit Studies Program, Working Paper 07-02, February 2007, Georgia State University – Andrew Young School of Policy Studies, p.3 available at http://aysps.gsu.edu/nonprofit/working/NSPwp0702.pdf (23rd of March 2011)

[9] Department for culture, media and sport (UK) 2001, Creative Industries Mapping Document 2001, DCMS

than 30 percent of workers in the advanced industrial nations work in the creative sector of the economy, engaged in science and engineering, research and development, technology-based industries, in the arts, music, culture, aesthetic and design industries, or in the knowledge-based professions of health care, finance and law."[10] So he adds to the above mentioned fields science and engineering and all high tech industries.

The main statement in his work is that the Creative Industries influence economic growth in several ways as the following diagram shows.

Figure 1: Tolerance, Creativity & Economic Growth

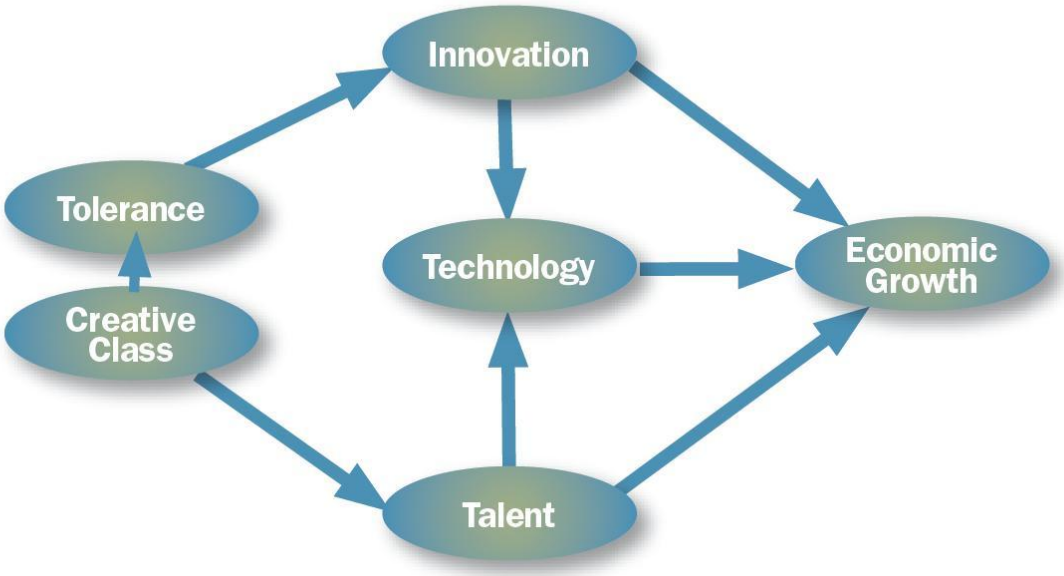

Table 1.2.1.1.a) Richard Florida – Europe in the Creativity Age p.11[11]

The Creative Class- i.e. people working in the Creative Industries- contribute to the talent pool on the one side. They belong to the skilled part of the population and create value. On the other hand they positively influence their environment by knowledge spillovers. People working in other fields may get inspired by consuming goods from the Creative Industries, which can enhance innovation. They also create a vivid and tolerant environment, which is a fertile ground for new ideas and attract highly skilled people from all over the globe as it says on page 11: "*Clearly, the more tolerant or open a nation or region is, the more talent it is able to mobilize and attract."*[12]

Florida claims that the above mentioned "Tolerance" and "Talent", both influenced by the Creative Class, together with "Technology" are the key factors for economic growth.

In his work he ranks, respectively to those factors, 14 European countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. He also compares those countries to the United States.

[10,11,12] Florida/ Tinagli, Europe in the Creativity Age, DEMOS 2004

Florida therefore establishes the Model "the 3 T's". It consists of three Indexes, the "Talent" Index, the "Technology" Index and the "Tolerance" Index, all three being composed by three sub factors. The following chart gives an overview of all factors and of all data used.

Index	Sub-Indexes	Description	Source
Talent	Creative Class	Employed in creative occupations as percentage of total employment	ILO (2002) [http://laborsta.ilo.org, data extracted on October 2002]
	Human Capital	Percentage of population 25-64 with a bachelor degree or above	OECD (2001)
	Scientific Talent	Number of researchers in scientific disciplines per thousand workforce	European Commission-Eurostat (2001)
Technology	Innovation Index	Patents applications to the US Patent Office per million population	USPTO as reported by the European Commission, DG Research, in:"Towards a European Research Area. Key Figures 2001".
	Technology Innovation Index	High-Tech Patents per million population (US Patent Office)	USPTO as reported by the European Commission, DG Research, in:"Towards a European Research Area. Key Figures 2001".
	R&D Index	R&D expenditure as percentage of GDP	European Commission-Eurostat (2001)
Tolerance	Attitudes Index	Percentage of population that express tolerant attitudes toward minorities	European Monitoring Centre on Racism and Xenophobia, EUMC and SORA Institute for Social Research Analysis (2001)
	Values Index	Degree to which a country is based on traditional values versus more rational/secular values	World Values Survey, University of Michigan [http://wvs.isr.umich.edu]
	Self Expression Index	Degree to which a country recognizes and accepts self expression values.	World Values Survey, University of Michigan [http://wvs.isr.umich.edu]

Table 1.2.1.1.b) Richard Florida/ Irene Tinagli – Europe in the Creativity Age p.44 [13]

The score of every Sub-Index is scaled, the highest score corresponds to 15 points, and all other countries get points according to their score. For the overall ranking every Index is given a weight of a third and every Sub-Index a weight of a ninth to determine the overall score.

Only Sweden scored better than the United States, followed by Finland and the Netherlands. Germany was ranked sixth and Austria 10th. On the bottom of the list are Italy, Greece and Portugal.

[13] Florida/ Tinagli, Europe in the Creativity Age, DEMOS 2004

1.2.1.1. Criticism

Richard Florida has earned a lot of acknowledgements for his ideas and has definitely touched a nerve, but the paper "Europe in the creativity age" has a few weaknesses.

- First, in the beginning of this chapter it has been shown that cities play the dominant role in economic performance and rural and urban areas can hardly be compared. By evaluating the countries' performances the results can only be seen as an approximation for the cities' performances, the hot spot for innovation and creative industries. In the "State of European Cities Executive Report" by the European Commission from May 2007 it says "*Cities are the indisputable engines of economic growth across Europe. In virtually all European countries, urban areas are the foremost producers of knowledge and innovation – the hubs of a globalising world economy.*"[14]
- Second, in that paper all factors are given the same weight. Some factors might have different importance for the economy and especially for the countries' individual needs. There is no evidence that every of the nine factors used in this paper contribute exactly a ninth to economic success.
- Third, the point "Tolerance" is not yet fully elaborated, as it is also admitted in the paper.
- And fourth, Creative Industries per se do not contribute much to economic success. Referring to data by Eurostat, the percentage of people working in Creative Industries is even negatively correlated to the GDP. It therefore stands to reason that not the number of people working in CI is important, but the quality and how immaterial creative wealth is transferred to the population and to other, more profitable segments.

[14] European Comission (2007), State of European Cities Executive Report May 2007

2. Model

The goal of this paper is to evaluate the performance of a city from an economic point of view. The GDP of a city is the value to maximise and therefore cities need to attract and develop businesses. There are many suitable indicators to evaluate a city's' performance, but the accessibility of homogeneous data for different regions with different policies is a very difficult task. The OECD and Eurostat provide an exhaustive dataset for the Cities' GDP and indicators.

The following framework is based on the model of Richard Florida and Irene Tinagli's „Creative Industries", adapting the point „Tolerance", that has been criticised before.

In a first step Florida/Tinagli's idea is retraced by a simple model with the attempt to consider all the key factors. To create a model fully incorporating complexity of the matter and number of factors, a demand to be mutually exclusive and collectively exhaustive (MECE) is an aspiration that unfortunately cannot be entirely satisfied.

2.1. Talent, Technology, Attraction and Cultural Participation (TTA)

This model focuses on the needs of businesses.

Businesses sell products and are keen on maximising the revenue and reducing the costs. For industrial economies the focus is on additional value that creates revenue in order to be profitable, the costs are second. Therefore the factors determining a promising cost structure are neglected.

The main factor to develop a product that differs from the rest is human resources. On the one hand you need people with talent, who come up with new ideas and implement them, but on the other hand you also need a prosperous environment allowing and encouraging creativity.

Such an environment can be created by cooperation with universities, research institutions and other sophisticated businesses. These factors can be seen as the factor „**Technology**" in the work of Florida/Tinagli.
Culture also influences a creative environment by inspiring people. Cultural Participation is another factor going with Florida/Tinagli's idea, in that it enhances economy. By being open-minded, inspiration for the actual job might come through spillovers. Participating in a creative environment might lead to inventive ideas.

But after all, the key factor for industrialised economies is people's intellectual ability. Florida and Tinagli state in their paper "Europe in the Creativity age" on page 5: *The ability to compete and prosper in the global economy goes beyond trade in goods and services and flows of capital and investment. Instead, it increasingly turns on the ability of nations to attract, retain and develop creative people."*[15] The creative and intellectual potential of employees determines the innovative potential of a company. The goal therefore is to hire and attract the brightest brains from a nowadays global pool of people.

On the one hand companies' talent pool strongly depends on the people in situ. Florida and Tinagli take this key factor into consideration and named it „**Talent**".

Another source for talent is the global labour market. Nowadays, especially in developed countries, people move for good jobs. Besides a financial incentive provided by the salary offer, people want to move to a liveable and attractive city. There, the image of a city becomes key. An open minded society and „**Tolerance**" also is important, since foreign talents should be integrated and participate, and not move away after a short period of time. But tolerance is, in my point of view, only a part of the factor that describes the attraction of a city. I therefore want to adapt Florida/Tinagli's model by putting together the image of a city, Tolerance and the above mentioned Cultural Participation.

Another key factor is sustainability. Where is the city going? Does it have long term strategies? Does it responsibly manage its capital? Is it worth moving to this city or investing in it?

The following diagram shows a simple model describing the key factors, or the so called indicators, of Creative industries and the changes made to Florida/Tinagli's paper.

Change in Florida/Tinagli's model

Florida/Tinagli's creativity Index		TTA	
Talent	Creative Class	Talent	Creative Class
	Human Capital		Human Capital
	Scientific Talent		Scientific Talent
Technology	Innovation Index	Technology	Innovation Index
	Technology Innovation Index		Technology Innovation Index
	R&D Index		R&D Index
Tolerance	Attitudes Index	Attraction	Attitudes Index
	Values Index		Cultural Part. Index
	Self expression Index		Image Index

Table 2.1.a)

[15] Florida/ Tinagli, Europe in the Creativity Age, DEMOS 2004

The following chart summarizes the important factors to business needs. It shows a logical decomposition explaining the TTA model break down.

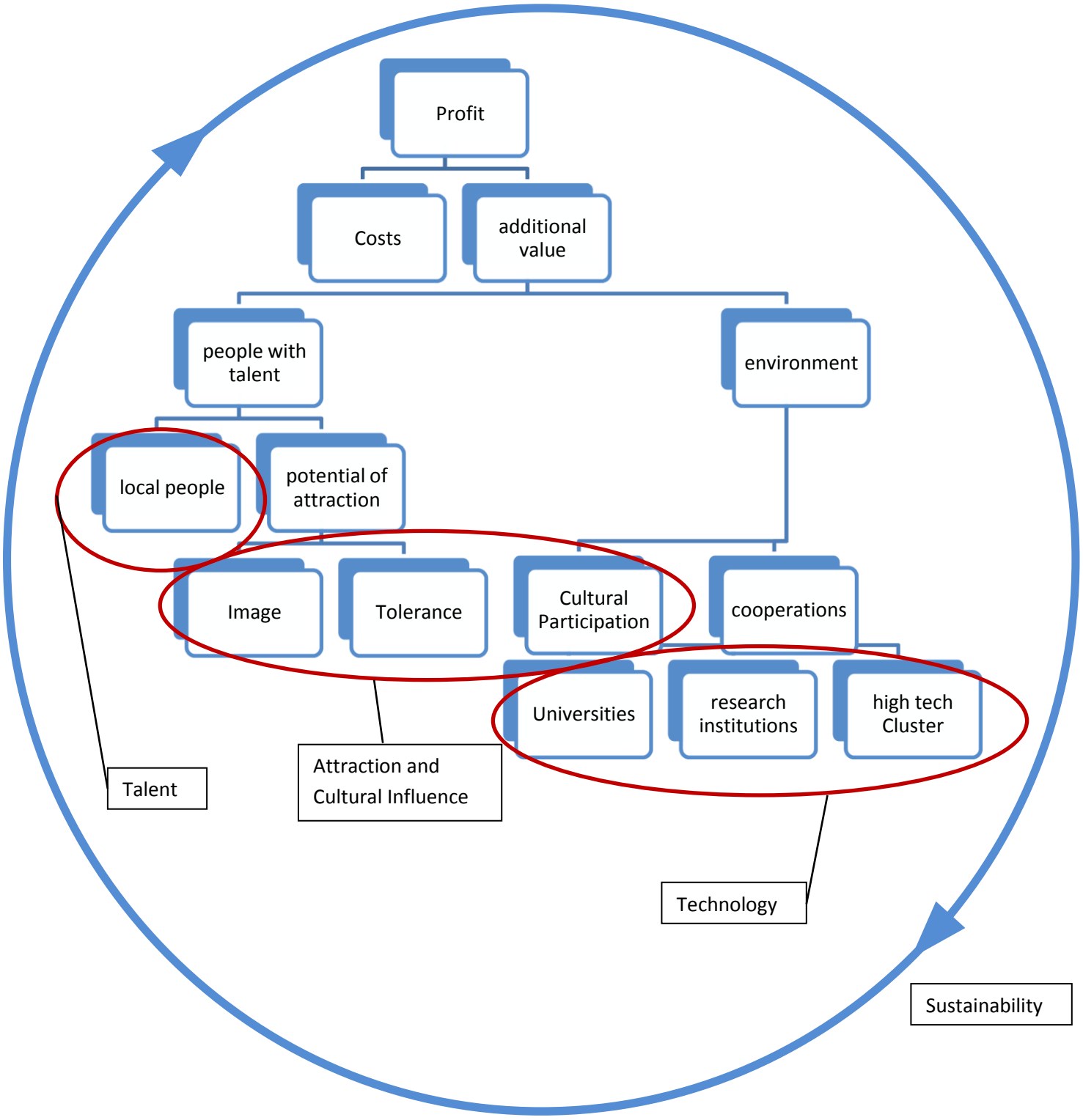

Table 2.1.b)

2.2. Data Methodology

In paragraph 2.1, the connection between the models and the GDP has been established and the desired indicators have been described. All data used for this model has been retrieved from either the OECD or the Eurostat statistical database guaranteeing comparable datasets. Data corresponds to either the OECD'S metro area, to the Eurostat's Urban Audit statistics, to country regions or NUTS 2 areas presented in this chapter.

Even though every indicator's source is the same for every city, there is unfortunately inhomogeneous information. Many indicators are drawn from the NUTS 2 regions providing information for this territorial unit. Unfortunately some cities are a NUTS 2 region, some are not. For example Vienna's NUTS 2 region is the administrative unit of Vienna. The respective NUTS 2 region for Munich is Bavaria. This fact needs to be borne in mind and the results need to be treated with caution.

2.2.1. Organisation for Economic Co-operation and Development (OECD)

It is crucial to define a methodology when comparing data from different cities in different countries. Policies are different, definitions of city areas may differ, some currencies differ, and some cities are more expensive than others. The OECD collects and evaluates data also from the 13 countries treated in this paper and has established guidelines of how to compare data from different OECD member states.

2.2.1.1. Metro area

Another important question is how to define a city border. Do the suburbs and the commuter belt belong to the city or not? Every country and every city has a different definition of that and the OECD has developed a well suited and comprehensive method in order to have the same standards for every city:

"*Commonly the definition of metropolitan areas in use in different countries consists of a core area with significant concentration of employment or population and a surrounding area densely populated and closely tied with the core. Most of the definitions employ one or more of the 3 following criteria:*

Size: large size of a metropolitan region in terms of employment or population.

Density: the metropolitan region area is densely populated or densely built-up;

Commuting: the commuting within the metro region – from the periphery to the core area – has to be higher than commuting between the metro region and the other surrounding regions. [16]

The OECD defines that a suburb or commuter belt belongs to a city when population density is high enough and sufficient commuting takes place.

2.2.2. Eurostat

Eurostat also has a dataset on cities and collects information for the European Union. On the homepage it can be read:

"Eurostat's mission is to provide the European Union with a high-quality statistical information service.
Eurostat is the statistical office of the European Union situated in Luxembourg. Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions."[17]

2.2.2.1. "Urban Audit"

Here data on "core cities" is used collecting data from the administrative unit of a city. The purpose of this dataset is to provide "*information and comparable measurements on the different aspects of the quality of urban life in European cities***."**[18]

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[16] OECD, METROPOLITAN DATABASE, OECD METHODOLOGY FOR THE DEFINITION OF METROPOLITAN REGIONS, www.**oecd**.org/data**oecd**/41/37/45511614.pdf (23rd of March 2011), p.1

[17] Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/about_eurostat/corporate/introduction (23rd of March 2011)

[18] Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/city_urban (23rd of March 2011)

2.2.2.2. Nomenclature des unités territoriales statistiques (NUTS)

The datasets on regions are divided into three territorial units. "*The "Nomenclature of Statistical Territorial Units" (NUTS) is a hierarchical system for dividing up the economic territory of the EU"*

- *NUTS 1: major socio-economic regions*
- *NUTS 2: basic regions for the application of regional policies*
- *NUTS 3: small regions for specific diagnoses* [19]

2.2.2.3. Purchasing Power Parities (Ppp)

Purchasing Power Parities take into account that some products may be more expensive in some countries than in others. A similar indicator is the "Big Mac"-Index, that compares the prices of the known Burger from the fast food chain McDonalds in order to compare those differences. The OECD has developed a methodology similar to the "Big Mac" -Index, but they base their evaluation on several different products

"*Purchasing Power Parities (PPPs) are currency conversion rates that both convert to a common currency and equalise the purchasing power of different currencies. In other words, they eliminate the differences in price levels between countries in the process of conversion*."[20]

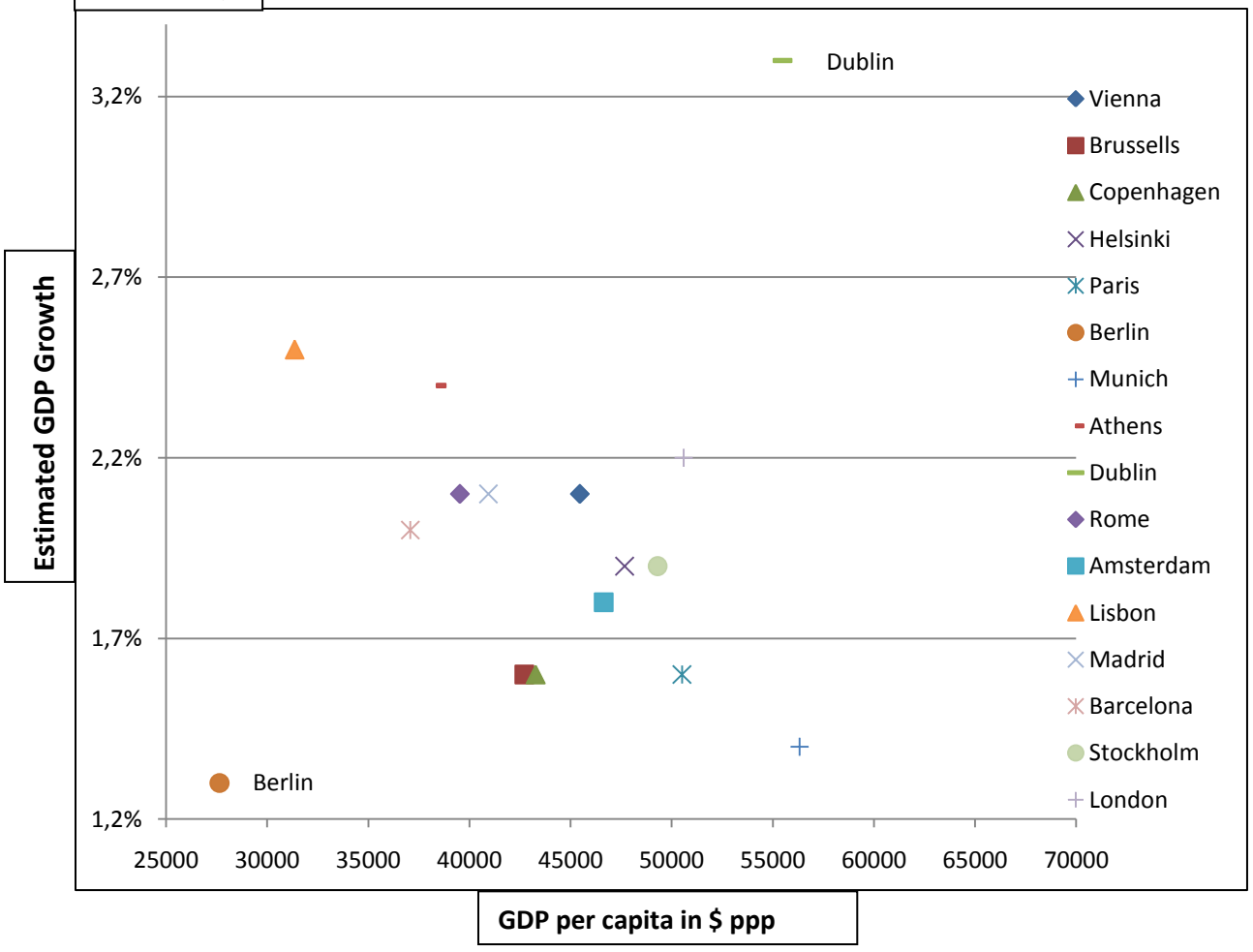
[19] Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction (23rd of March 2011)

[20] OECD, www.oecd.org/std/ppp (23rd of March 2011)

2.3. Choice of cities

Within the borders of a country there are very heterogeneous economic regions and rural areas can hardly be compared to urban areas. Furthermore Cities are the heart of innovative thinking and gain extra importance as more and more people move into cities.
In order to cluster the cities studied in this paper, the following diagram shows a graph with the GDP and the GDP growth rate of the economically most important cities of the following European cities: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
The data of the GDP is retrieved from the OECD homepage, and the data for the growth rate is taken from a publication by PricewaterhouseCoopers.[21]

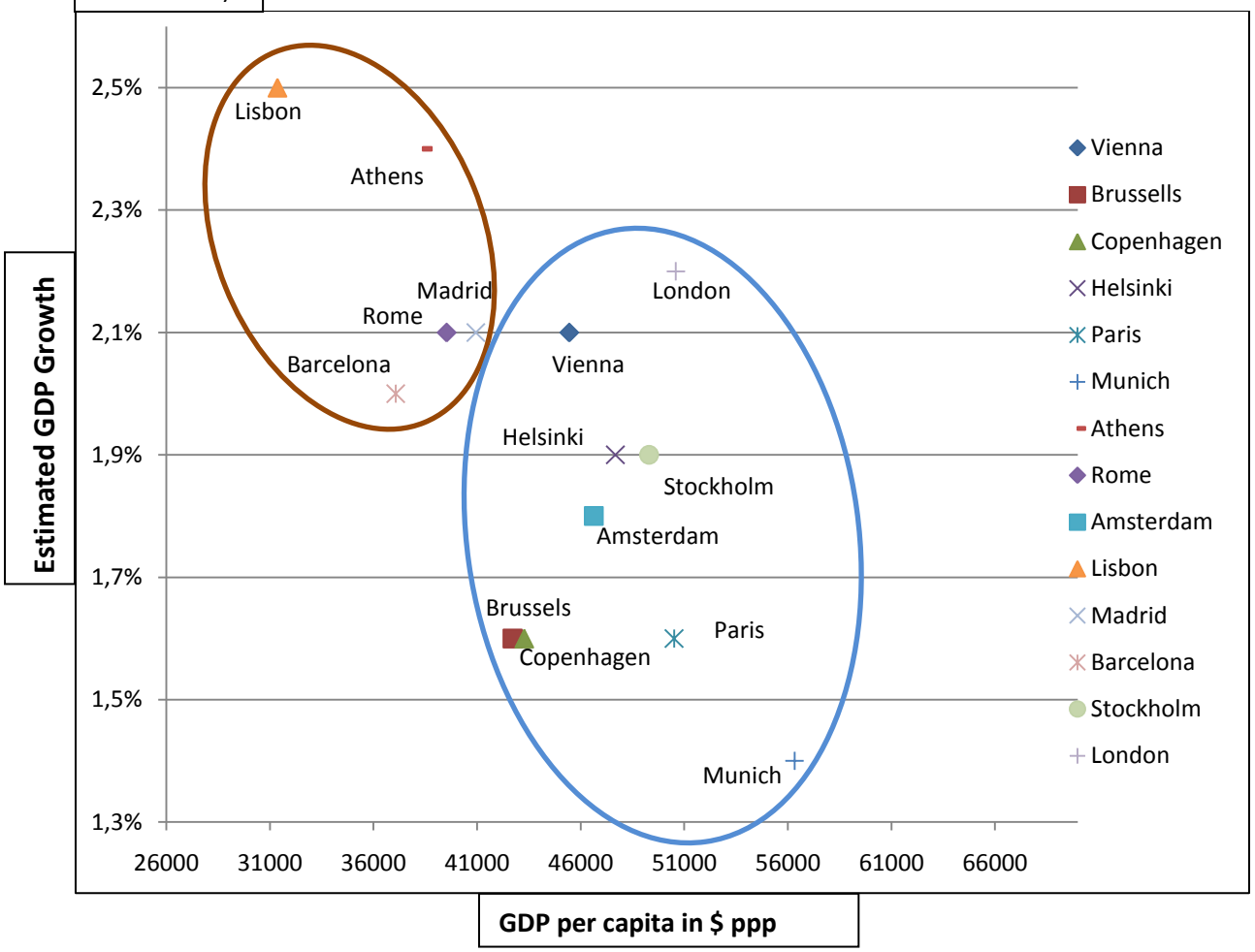
Table 2.2.a)



[21] PricewaterhouseCoopers (2009), UK Economic Outlook November 2009, p 31-34 extract "Global city GDP rankings 2008-2025" available at https://www.ukmediacentre.pwc.com/Media-Library/Global-city-GDP-rankings-2008-2025-61a.aspx (23rd of March 2011)

hand we see Berlin having a very weak growth rate and a very low GDP per capita.
As the differences of those cities might be too big for the benchmark, the research concentrates on the above European cities; Berlin and Dublin are taken out from. Neglecting those two cities the following diagram results:

Table 2.2.b)



This diagram renders visible that the southern European cities Barcelona, Rome, Madrid, Athens and Lisbon are at a different stage of economic development showing a higher growth rate and a lower GDP on average than the central and western European cities. Results of the benchmark need to be interpreted with this fact in mind.

2.4. Data Envelopment Analysis (DEA)

A main criticism on Tinagli/Florida's paper was the weight attribution. Given the fact that cities are diverse and put the economic emphasis on different indicators the DEA method is very suitable. It permits to create results that respect individually different weightings. Using DEA for city benchmarks has already been used in the paper "Modelling urban quality of life with data envelopment analysis methods" by Ho Chon Siong and Muhammad Zaly Shah Bin Muhd Hussein producing suitable results.

The following paragraph gives a short introduction in DEA in order to understand the method used. The work of Emmanuel Thanassoulis "Introduction to the Theory and Applications of Data Envelopment Analysis" or the work of Cooper, Seiford and Tone "Data Envelopment Analysis" for example allows for a profound insight into the matter.

DEA, the Data Envelopment Analysis, is a widely used efficiency measure method that was originally applied in production theory with the goal to identify the most efficient good's producer. It evaluates the production function looking at the input and the correspondent output, even with the exact process unknown or too complicated to analyse analytically. DEA is based on the efficiency measure "output per input", but extends the measure using multiple outputs and inputs.

2.4.1. Output-oriented radial model

The following problem drawn from the book "Betriebswirtschaftliche Optimierung" by Stepan/Fischer 2009[22] offers a concise introduction to DEA. Given are eight firms producing two goods using one input. The firms, called decision making units (DMU), use a certain amount of inputs x to produce the goods y1 and y2. The following chart summarizes the problem showing how many goods can be produced with the amount of one input.

DMU	A	B	C	D	E	F	G	H
X	1	1	1	1	1	1	1	1
Y1	1	2	3	4	5	6	7	8
Y2	5	4	4	6	2	3	3	1

Since the revenue of the outputs is unknown or may differ, many DMUs might be efficient. Assuming that all combinations are possible, there is always an efficient process. These efficient production possibilities are the efficient border defined by the efficient DMUs.

[22] Stepan/Fischer, Betriebswirtschaftliche Optimierung, 8. Auflage, Oldenburg, München 2009

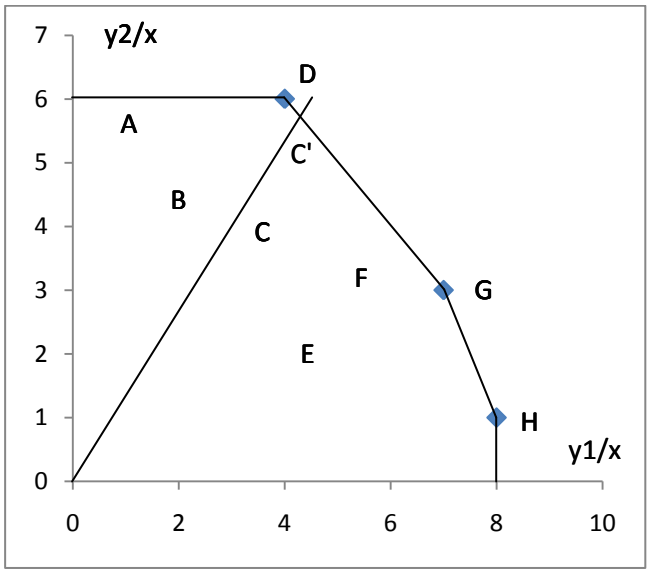


Figure 2.4.1 a),
„Betriebswirtschaftliche Optimierung“ p. 195 [23]

The x-axis in figure 2.4.1a) shows the amount of output 1 produced per input x and the y-axis the amount of output 2. The DMUs D, G and H define the efficient border producing the most output and therefore produce efficiently. The vectors connecting D, G and H build the smallest envelope comprehending all DMUs defining the efficient border. D, G and H are 100% efficient. To measure the efficiencies, or inefficiencies, of the other DMUs, the radial model suggests to draw a line connecting the origin with the DMU. The point where the prolongation of that line crosses the envelope, C’, marks the efficient process for the output mix of DMU C. C’ is then 100% efficient. The efficiency of DMU C is defined by the ratio 0C/0C’ and is 70%.

The DEA-Efficiencies for all DMUs are as follows:

DMU	A	B	C	D	E	F	G	H
Eff. (%)	83,3	66,7	70	100	70,6	90	100	100

This problem can be seen as 2-dimensional with 2 outputs and one input. Of course this model can be used for unlimited DMUs, inputs and outputs.

2.4.2.Super-efficiency

For a cities’ benchmark, ranking is necessary and therefore super-efficiency is used in this paper.

[23] Stepan/Fischer, Betriebswirtschaftliche Optimierung, 8. Auflage, Oldenburg, München 2009

"DEA super-efficiency models were introduced originally with the objective of providing a tie-breaking procedure for ranking units rated as efficient in conventional DEA models."
("Equivalent standard DEA models to provide super-efficiency scores" by CAK Lovell and APB Rouse)[24]

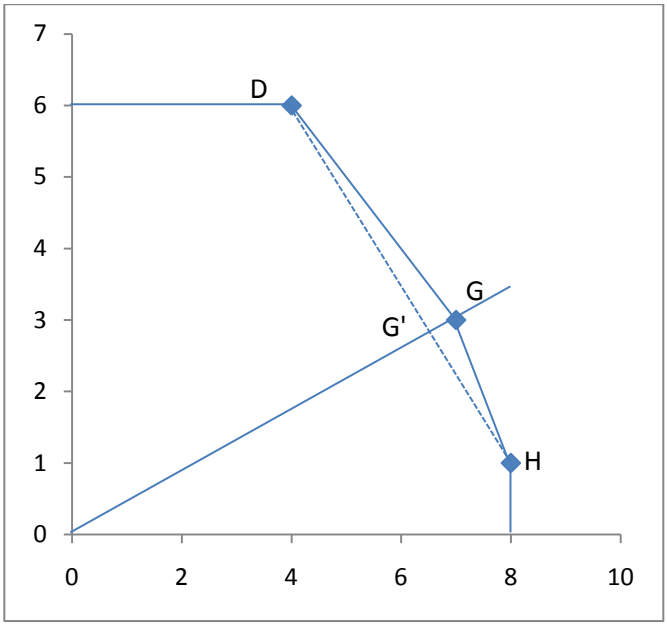


Figure 2.4.2 a)

Super-efficiency is a measure defining the DMU's distance to the efficient border if it wasn't part of the set of DMUs. It gives an idea of how the efficient border looks and gives a score for evenly weighted outputs in the case of the output-oriented radial model.

It also shows how much the output can be reduced to still be efficient. Referring again to the problem above focusing on the efficient DMUs, DMU G for example could reduce its output and still be efficient. Since G' would also be efficient, super-efficiency is defined as the ratio 0G/0G'. Applying super-efficiency to the problem above we get the following results.

DMU	A	B	C	D	E	F	G	H
Super-Eff.	83,3	66,7	70	137,5	70,6	90	106,8	114,3

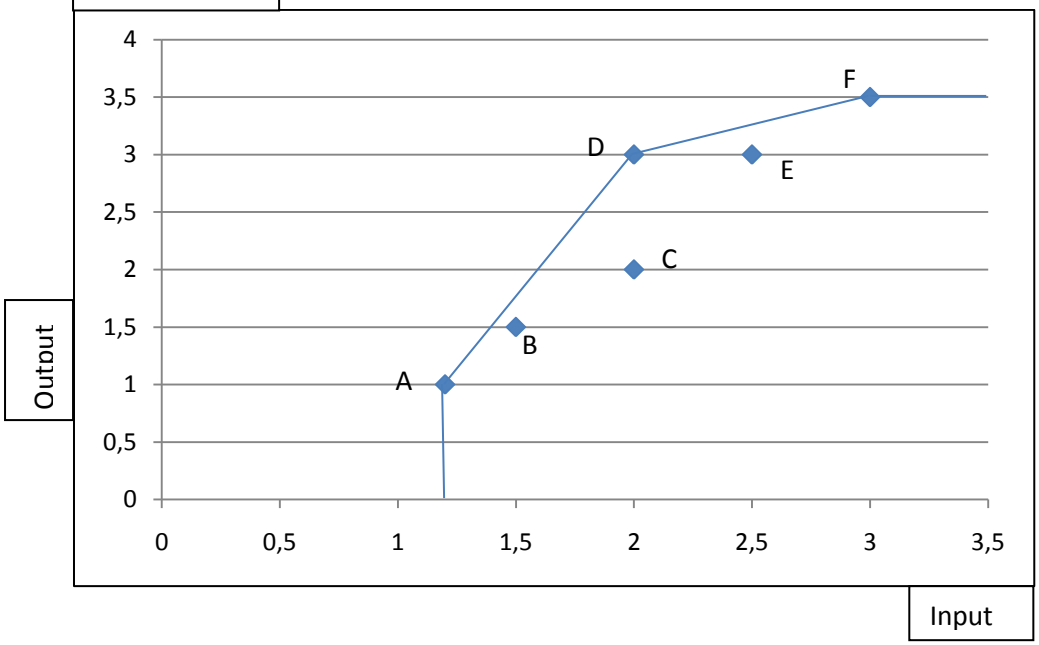
DMU D has the highest super-efficiency score and can reduce its outputs considerably and still be efficient. This high score is also an indication of DMU D's strong dominance. DMUs with a similar output mix need to make a bigger effort to be efficient. At problems with higher dimensions, where a geometric illustration is impossible, the super-efficiency score also gives an idea of the efficient border's structure.
For further models and information please refer to the article "Equivalent standard DEA models to provide super-efficiency Scores" published in the "Journal of the Operational Research Society (2003) 54, 101–108" by by CAK Lovell and APB Rouse.

[24] Lovell/Rouse, Equivalent standard DEA models to provide super-efficiency scores, Journal of the Operational Research Society (2003) 54, 101–108

2.4.3. Variable returns to scale

DEA also allows the possibility to consider variable returns to scale. Due to their small size some DMUs are not capable to produce as efficient as bigger DMUs. On the other hand there might be DMUs that already exceeded the optimal size not being able anymore to produce as efficient either. In Table 2.4.3a) DMUs A, D and F define the efficient border, while DMU A is in the region of increasing returns to scale and F in the region of decreasing returns to scale.

Table 2.4.3.a)



If variable returns wouldn't be considered in this example, only point D would be efficient. In the VRS model, the CRS efficient point D marks the change of region of increasing and decreasing returns to scale and represents the optimal size.

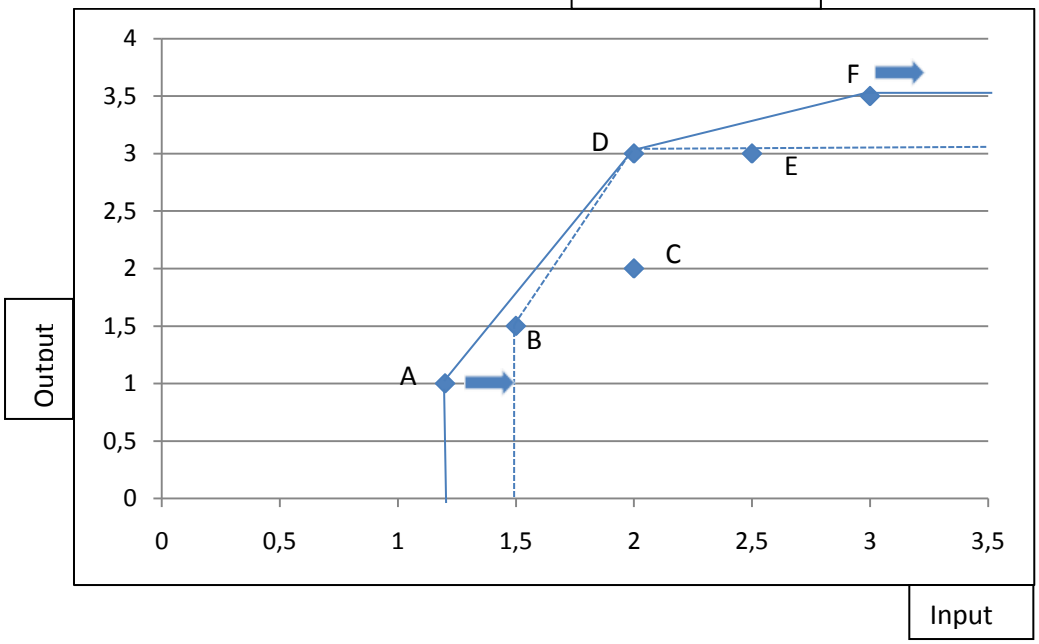
2.4.3.1. Super-efficiency in VRS models

The result shows by how many percent the input has to be reduced in order to be efficient. DMU B in table 2.4.3a) would have to reduce its input to move to the efficient border. In the table this would mean a horizontal shift to the left.

Super-efficiency results for efficient DMUs indicate that they can increase their input, with the output fixed. In the table this would mean a shift to the right to the efficient border.

In VRS models the DMUs with the biggest output and the smallest input are always efficient and a super-efficiency score cannot be evaluated or is not significant. The pointed line in Table 2.4.3.1a) shows the efficient border if DMU F and DMU A were excluded from the dataset. Increasing its input, DMU F can never cross the efficient border; therefore a super-efficiency result cannot be evaluated. DMU A can increase its input to cross the efficient border, but would only be weakly efficient, meaning that a marginal change in the output wouldn't affect the efficiency. Hence the super-efficiency results of the DMU with the smallest input and the biggest output are neglected.

Table 2.4.3.1.a)



2.4.4. Mathematical formulation of the DEA models used

For the calculation the "Efficiency Measurement System" by Holger Scheel has been used.[25] The radial output-oriented model from chapter 2.4.1 has been used for the benchmark regarding constant returns to scale (CRS). This model is called CCR model and is named after Banker, Charnes and Cooper, who first published this approach.

Considering variable returns to scale (VRS) the radial input-oriented model from chapter 2.4.3 has been used in order to obtain a score, where 0% is the minimal score and 100% is the score of an efficient DMU. Considering only constant returns to scale, the results of radial output and radial input-oriented models can be exchanged by inversing the results, which is not the case with VRS. Even though it is illogical to reduce the input (here the population), the scores are as applicable as if the model was output-oriented. This VRS model is called BCC model after Banker, Charnes and Cooper.

The mathematical formulations of the models are:

"*T denotes the technology and* (X^k, Y^k) *denotes the input output data of the DMU under evaluation."*[26]

"Radial: This measure (a.k.a. Debreu-Farrell-measure, or "radial part" of the CCR/BCC measure) indicates the necessary improvements when all relevant factors are improved by the same factor equiproportionally. Its oriented versions have nice price interpretations (cost reduction/revenue increase), but it doesn't indicate Koopmans efficiency.

non -oriented: $\max\{\theta \mid ((1-\theta)X_k, (1+\theta)Y_k) \in T\}$

input: $\min\{\theta \mid (\theta X_k, Y_k) \in T\}$

output: $\max\{\varphi \mid (X_k, \varphi Y_k) \in T\}$ "[26]

Further in this paper, the CRS radial output-oriented model is called "output CCR", and the VRS radial input-oriented model is called "input BCC". The results of the "output CCR" model have then been inverted to obtain a score where 0% is the minimum and 100% is the efficient score.

[25] Scheel, Holger, http://www.holger-scheel.de/ems/ (23rd of March 2011)

[26] Scheel, Holger, EMS: Efficiency Measurement System - User's Manual, Version 1.3 2000-08-15 p.8

3. Benchmarking: Talent, Technology, Attraction (TTA)

The indicators mentioned in chapter 2 have been slightly modified due to data availability and comparability. All data has been collected from the same source for each indicator to assure the benchmark results. The TTA model can be seen in figure 3.a)

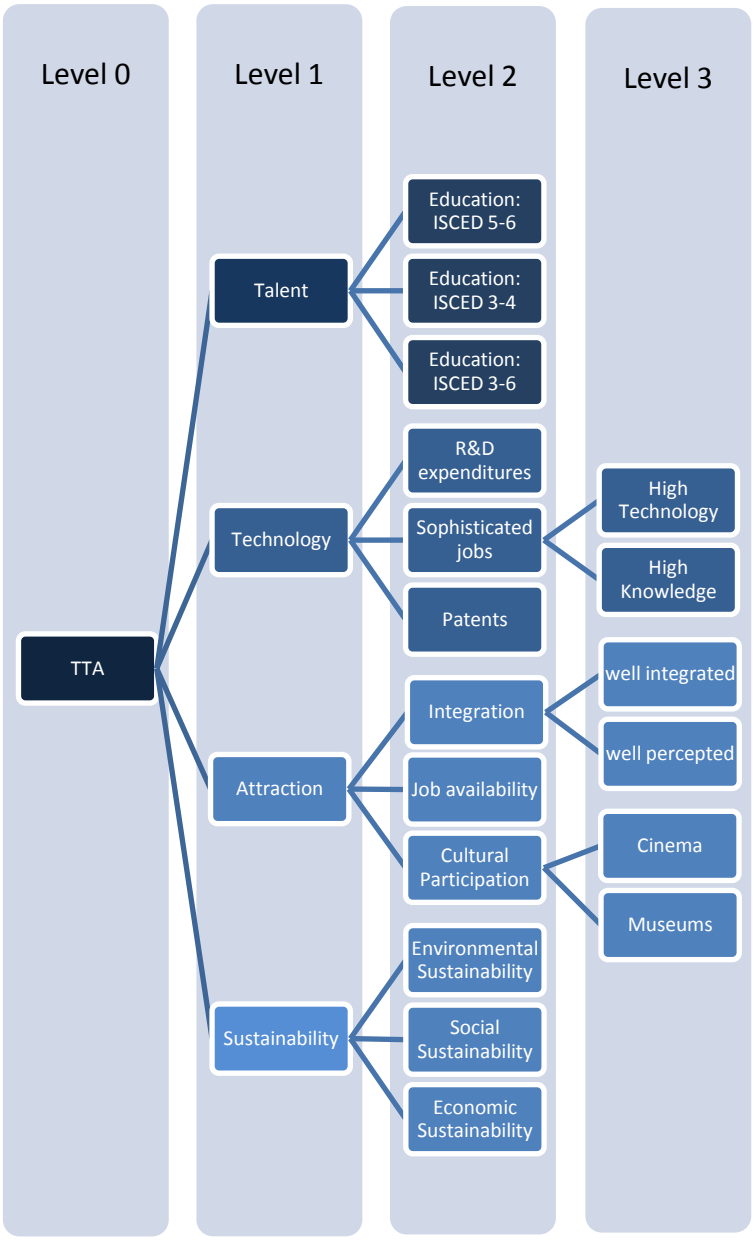


Figure 3.a)

3.1. Benchmarking procedure

3.1.1. Collecting the data

For the desired indicators the raw data has been collected from the OECD's and Eurostat's statistical databases. The indicators have been transformed to the ratio "indicator per capita" if necessary.
In a second step each indicator's maximum has been scaled to 1 individually by dividing the entire indicator's raw data by the respective maximum. This has the advantage of

- Comparability of the different indicators
- Visualisation of the Cities' strengths and weaknesses
- The value of the indicators can also be seen as a percentage, where the best performing city stands for 100 percent. This makes it possible to mix DEA scores and indicators in the model's methodology.

3.1.2. Applying DEA

The model has been established by the method "Top-Down". TTA on Level 0 represents the overall score being relied to the GDP. Indicators underneath are the sub-factors determining the GDP and are logically decomposed into different levels in order to assure the model's accuracy.

For the main analysis every Level DEA scores were computed. The score was then used for the next level analysis. The scores of level 3 are level 2 factors; the scores of level 2 factors are level 1 factors and so on. For example the factor "sophisticated jobs" consists of the DEA score of the two level 3 indicators "High Technology" and "High Knowledge", level 1 score "Talent" consists of the DEA score of all sub-factors and the final result, the level 0 score "TTA", of all the first Level scores "Talent", "Technology", "Attraction" and "Sustainability". As all indicators' denominator is "capita", the score can also be seen as output per capita, which makes a comparison of indicators and scores possible.

For every level the super-efficiency score has been computed but is only used for comparison. The data used in the following DEA level analysis doesn't comprehend super-efficiencies, so that the maximum is still 100% and can easily be compared to the initial indicators that are scaled to one. This also guarantees that individual preferences of cities are respected.

3.2. 3 Benchmarks

In the first and main analysis input data is the population. The outputs are the indicators. And as the indicators are already in the form “output per capita” in percent, the input value of every city is “1”. This first step shows how well a city manages its population creating the desired output, the indicators. It has been shown before that the indicators are strongly connected to the GDP. Compared to the original use of DEA this would be an analysis of the production function for developing economic wealth. The production function differs greatly among different cities. In the field of education different restrictions, financial policies and individual management influence the desired output of well educated people. By using the DEA, a benchmark can be developed easily. This analysis is also conducted on a level basis described before. This gives information on every city’s individual strengths and weaknesses. It gives Cities the possibility to see where they stand on each subject matter, where they need to improve and which city can be a benchmark. People seeking for a new city to work and live as well as businesses can examine the thematic results choosing a city regarding their individual preferences. The analysis is called “are best” in this paper.
To study the influence of a city’s size, an analysis considering variable returns to scale (VRS) has also been conducted. It shows the most efficient city size and evaluates every city’s performance regarding its population. Therefore the input data is the city’s population and the output is the absolute number of the indicator (for example number of researchers). To get suitable data, the indicators in the form output per capita have been multiplied with the city’s population. Unfortunately the sources for the indicators and the population differ, but for this analysis it can be assumed that the indicators, which present a percentage, can be adopted for the entire region the population data is drawn from. The same software has been used for the calculation. The radial input-oriented radial model from chapter 2.4.3 has been used.

In a second analysis the Indicators are the Input and GDP the Output. This shows how efficient cities transform their assets into monetary value. Therefore this analysis is called “capitalise best”. A VRS analysis is also conducted.

In a third analysis the GDP is the input and the indicators are the output. Again it is scaled to one because of the above mentioned reasons. This analysis shows how efficient a city invests its financial resources getting the desired indicators. The analysis is called “Invest best”. A VRS analysis is also conducted.

Those three analyses are combined in the figure 3.2.a)

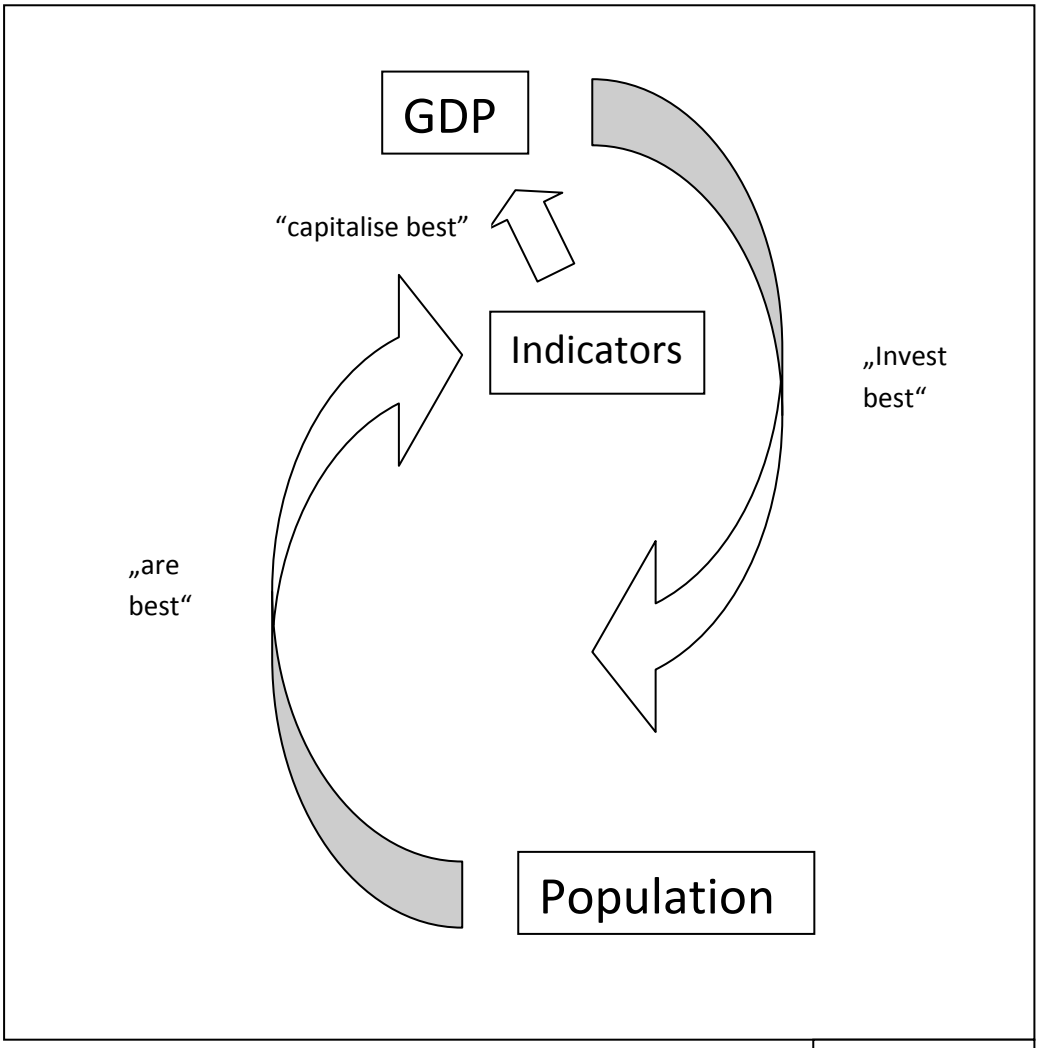


Table 3.2.a)

3.2.1. “are best”

3.2.1.1. Indicators, scores and results

The chart 3.2.1.1.a) gives an overview of all data used and its sources

Region	Metropolitan	Metropolitan	NUTS 2	NUTS 2	NUTS 2	NUTS 2	NUTS 2	NUTS 2	Metropolitan
Orginisation	OECD	OECD	OECD	OECD	OECD	OECD	OECD	OECD	OECD
Year	2007	2007	2007	2007	2007	2007	2007	2007	2007
Indicator	population	per capita GDP in US Dollars PPP (source OECD 2007)	EDU_LF_ISCED_34_PERC: Secondary education (as % of labour force)	EDU_LF_ISCED_56_PERC: Tertiary education (as % of labour force)	secondary and tertiary education (as % of labour force)	HTM_PERC_EMP: High and medium high-technology manufacturing (as % of total employment)	KIS_PERC_EMP: Knowledge intensive services (as % of total employment)	RD_PER_TOT_PERC: R&D personnel total (as % of employment)	PCT patent applications per million population
Vienna	2265524,00	45453,01	55,70	23,85	79,56	5,18	41,71	4,580725743	184,48
Brussells	3407432,00	42713,32	28,07	45,35	73,42	2,27	47,21	3,627888232	141,72
Copenhagen	1825814,00	43273,90	38,31	38,35	76,66	5,13	51,71	4,948932752	392,34
Helsinki	1467453,00	47672,06	43,49	38,37	81,86	6,68	42,92	3,518219904	498,59
Paris	11598866,00	50507,86	34,99	40,96	75,95	6,08	45,36	3,392770376	198,80
Munich	2714015,00	56321,53	59,03	24,37	83,40	12,97	33,09	2,16	611,92
Athens	4032456,00	38376,33	45,06	30,80	75,86	3,94	31,99	1,86	17,52
Rome	4013057,00	39528,50	49,35	20,99	70,35	4,38	37,87	2,15	51,08
Amsterdam	3583930,00	46637,07	46,49	26,56	73,05	2,96	42,85	0,79	147,76
Lisbon	2794226,00	31360,02	20,87	22,02	42,89	4,37	34,69	1,61	14,57
Madrid	6052583,00	40937,53	28,00	40,51	68,51	4,09	38,95	2,46	55,13
Barcelona	5257062,00	37070,66	25,72	31,25	56,96	7,46	28,72	1,66	73,87
Stockholm	1918104,00	49300,93	48,43	37,27	85,70	3,53	55,76	3,85	557,83
London	13156242,00	50594,71	38,34	43,33	81,67	2,31	52,30	1,88	118,12
								OECD 2001	
data deviation								OECD 2006	
								OECD 2007	

Region	Urban Audit	Urban Audit	City borders	Urban Audit	Urban Audit	Urban Audit	Country	Metropolitan	Country
Orginisation	Eurostat	Eurostat	Eurostat	Eurostat	Eurostat	Eurostat	Eurostat	OECD	Eurostat
Year	2003-2007	2003-2007	2003-2007	2009	2009	2009	2008	2007	2009
Indicator	cinema visits per year and capita	museum visits per year and capita	percentage of foreigners	Presence of foreigners good for the city (synthetic index 0-100)	Foreigner here are well integrated (synthetic index 0-100)	It is easy to find a good job here (synthetic index 0-100)	Energyefficiency (Energy consumption per GDP) (equivalent of oil in kg/1000€	employment rate	gini coefficient
Vienna	3,30	5,40	0,17	62,20	28,30	49,10	138,06	68,98	25,70
Brussells	4,60	2,00	0,26	59,60	42,70	31,70	199,82	62,3	26,40
Copenhagen	7,80	4,70	0,11	86,60	52,40	67,90	103,13	79,38	27,00
Helsinki	4,40	2,70	0,054682894	73,10	37,90	53,00	217,79	72,02	25,90
Paris	13,80	7,90	0,15	86,60	55,90	44,30	166,74	65,57	29,80
Munich	4,40	3,80	0,24	74,20	58,00	62,90	151,12	75,87	29,10
Athens	3,10	1,20	0,26	41,60	20,30	27,30	169,95	59,98	33,10
Rome	4,6	0,3	0,05	63,40	51,70	13,70	142,59	62,71	31,50
Amsterdam	4,20	10,20	0,12	83,90	55,50	64,80	171,58	77,70	27,20
Lisbon	8,90	6,50	0,034169416	79,70	65,20	15,80	181,53	69,09	35,40
Madrid	4,20	2,40	0,13	55,50	39,50	21,80	176,44	71,83	32,30
Barcelona	7,10	5,10	0,12	58,90	38,50	17,40	176,44	71,75	32,30
Stockholm	5,20	6,70	0,09	92,90	42,90	73,90	152,08	77,86	24,80
London	:	3,70	0,267671438	79,30	62,40	47,60	113,66	69,06	32,40
data deviation	1999_2002	1999_2002	1999-2001					2006	
			Census 2001						

Some indicators are in the form “output per labour force”, assuming that this ratio can be extended to the total population, bearing in mind that with this approach the participation rate and the constitution of the unemployed labour force are being neglected. A separate analysis shows that considering the participation rate, the results of Vienna, Brussels, Rome and Athens drop significantly due to their weak participation rate and the importance of the factors with the denominator “labour force”. Brussels even becomes inefficient. See appendix 5.3. But this fact is ignored in the results of this paper.

3.2.1.2. Talent

Education is without any doubt key to economic success. Some cities might put the emphasis on university graduates; others try to foster a broad workforce of fairly educated people, and all cities want to minimise uneducated workers.

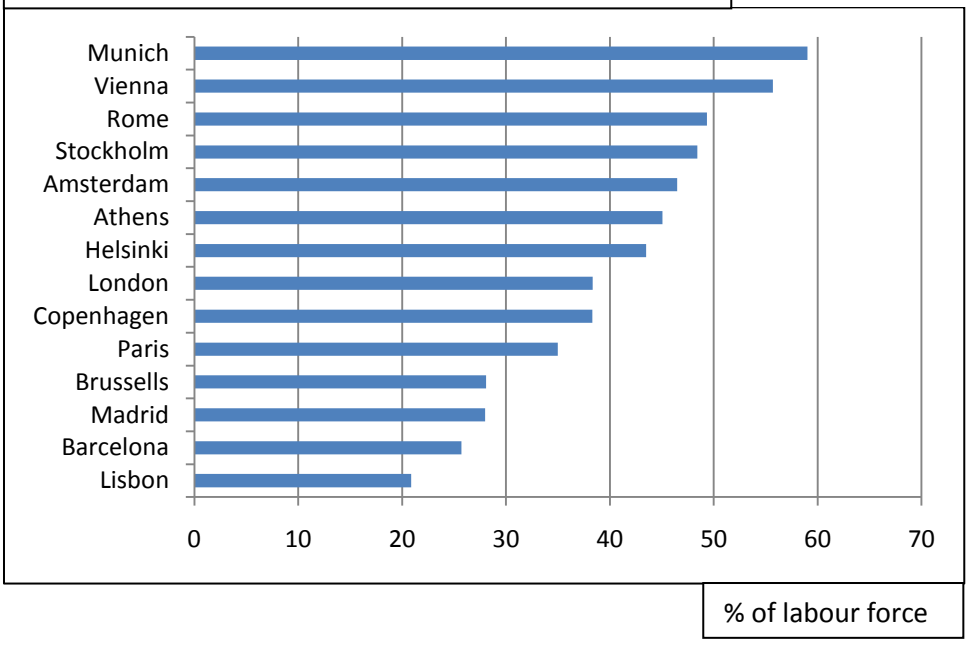
Therefore this models considers all possible education tactics evenly by evaluating every city´s performance in the points

- **Secondary education**
- **Tertiary education**
- **Secondary and Tertiary education**

All points correspond to the so called ISCED (International Standard Classification of Education)[27] determination by the UNESCO.

The point "Secondary education" shows the percentage of the labour force having attained a "(Upper) secondary education" or a "Post-secondary non-tertiary education" corresponding to the ISCED levels 3 and 4.
"Tertiary education" returns the percentage of the labour force having attained a "First stage of tertiary education" or a "Second stage of tertiary education" corresponding to the ISCED levels 5 and 6.
The point "Second and Tertiary education" states the summed up percentage of ISCED levels 3 to 6, reflecting the tactic to minimise the low educated workforce.

Table 3.2.1.2.a) Secondary Education (ISCED 3-4)



[27] UNESCO (1997), International Standard Classification of Education – ISCED 1997 available at http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm (23rd of March 2011)

Table 3.2.1.2.b) Tertiary Education (ISCED 5-6)

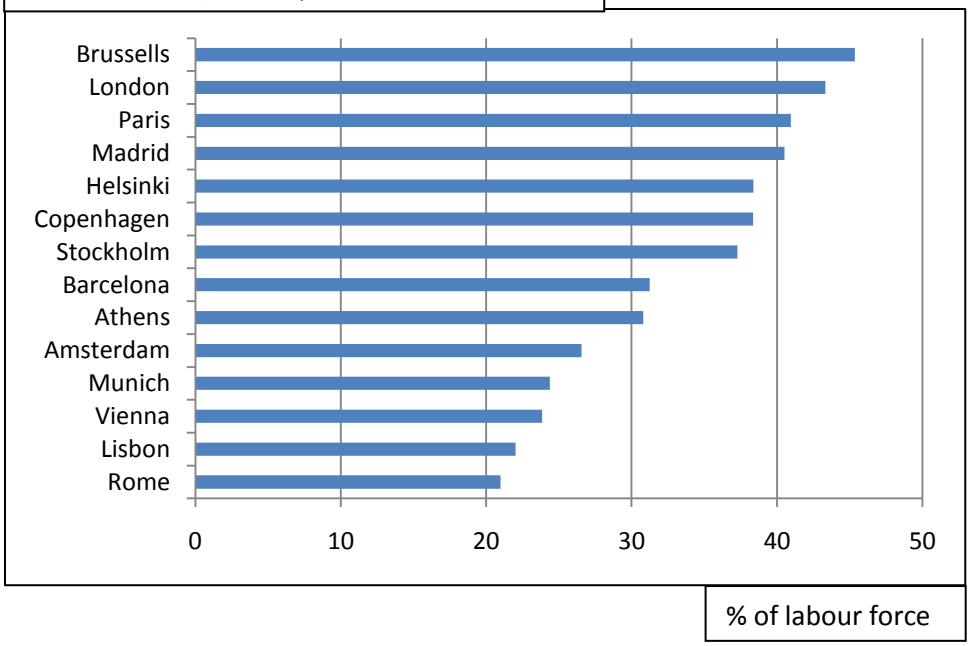
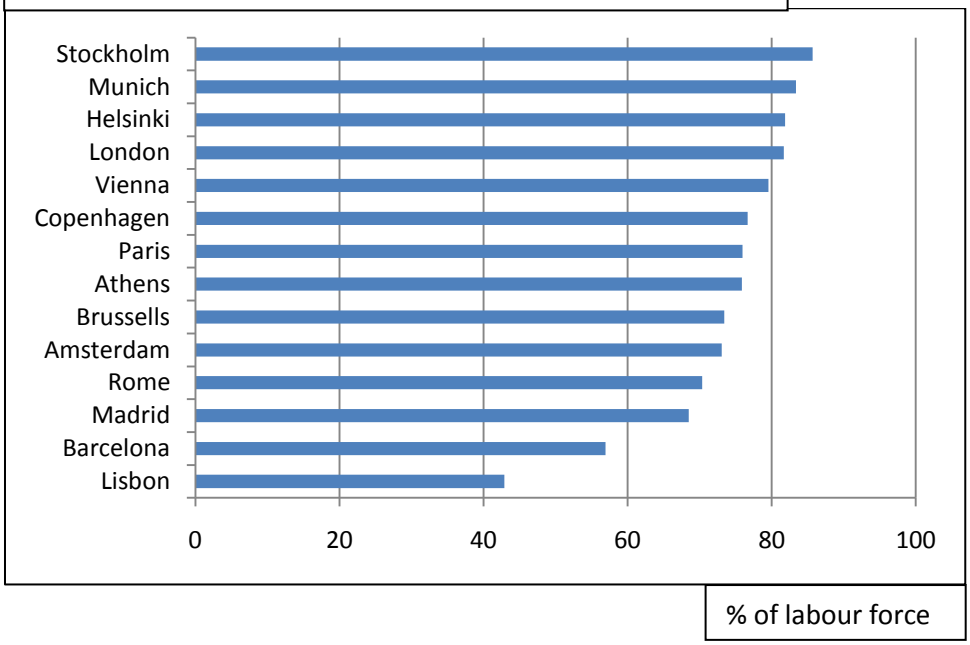


Table 3.2.1.2.c) Secondary and Tertiary Education (ISCED 5-6)



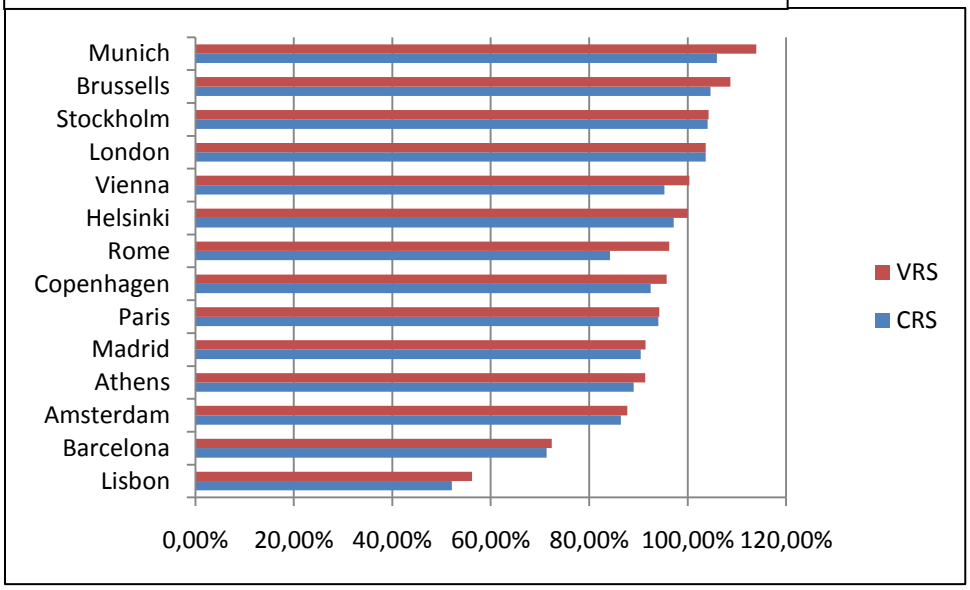
Talent Score

Table 3.2.1.2.d) represents the cities' population on the left side, the indicators determining the Talent score in the middle and the CRS and VRS DEA scores on the right side. For the CRS scores the "output CCR" model has been used for the calculation; for the VRS scores the "input BBC" model.

City	Population	ISCED 3-4	ISCED 5-6	ISCED 3-6	Talent (CRS)	Talent (VRS)
Vienna	2265524	0,94	0,53	0,93	95,26%	100,38%
Brussells	3407432	0,48	1,00	0,86	104,66%	108,65%
Copenhagen	1825814	0,65	0,85	0,89	92,47%	95,73%
Helsinki	1467453	0,74	0,85	0,96	97,18%	124,42%
Paris	11598866	0,59	0,90	0,89	94,04%	94,21%
Munich	2714015	1,00	0,54	0,97	105,97%	113,95%
Athens	4032456	0,76	0,68	0,89	89,02%	91,39%
Rome	4013057	0,84	0,46	0,82	84,25%	96,24%
Amsterdam	3583930	0,79	0,59	0,85	86,42%	87,74%
Lisbon	2794226	0,35	0,49	0,50	52,08%	56,22%
Madrid	6052583	0,47	0,89	0,80	90,46%	91,45%
Barcelona	5257062	0,44	0,69	0,66	71,36%	72,37%
Stockholm	1918104	0,82	0,82	1,00	104,06%	104,25%
London	13156242	0,65	0,96	0,95	103,64%	big *

*As discussed before, London's super-efficiency score cannot be computed

Table 3.2.1.2.e) CRS and VRS ranking



Munich, Brussels, Stockholm and London are efficient in the CRS analysis. Looking at the super-efficiency scores Munich has a slight edge over the other three cities. Munich scores high mainly because of the high percentage in secondary education. London and Brussels score high in tertiary education and Stockholm has a widely educated workforce, scoring well on all three indicators.

Considering variable returns to scale, also Vienna and Helsinki are efficient. Since Helsinki has the least population and therefore the smallest input value, the super-efficient score of Helsinki is not significant as discussed in chapter 2.4.3.1. Nevertheless Helsinki is efficient considering the size influence, as it is Vienna. Vienna is not efficient in CRS because it is dominated by Munich as Munich scores better on every indicator. Considering variable returns to scale Vienna is efficient as Munich happens to have the optimal size for education.

3.2.1.3. Technology

The category "Technology" investigates cities' industry. Do businesses operate on a sophisticated level? How innovative are they? How much is invested in research?

- **"Sophisticated Jobs"**
  This level 2 factor is the DEA score of the two level 3 indicators

  - **High and medium high technology manufacturing (as % of total employment)**
  - **Knowledge-intensive services (as % of total employment)**

  A detailed listing of the sectors comprehended in those two indicators can be found in the annexe 5.4.
  Those two indicators reflect the concentration of sophisticated industry, which perform at the top scientific level guaranteeing higher value added and promising economic perspectives.

Table 3.2.1.3.a) High and medium high technology

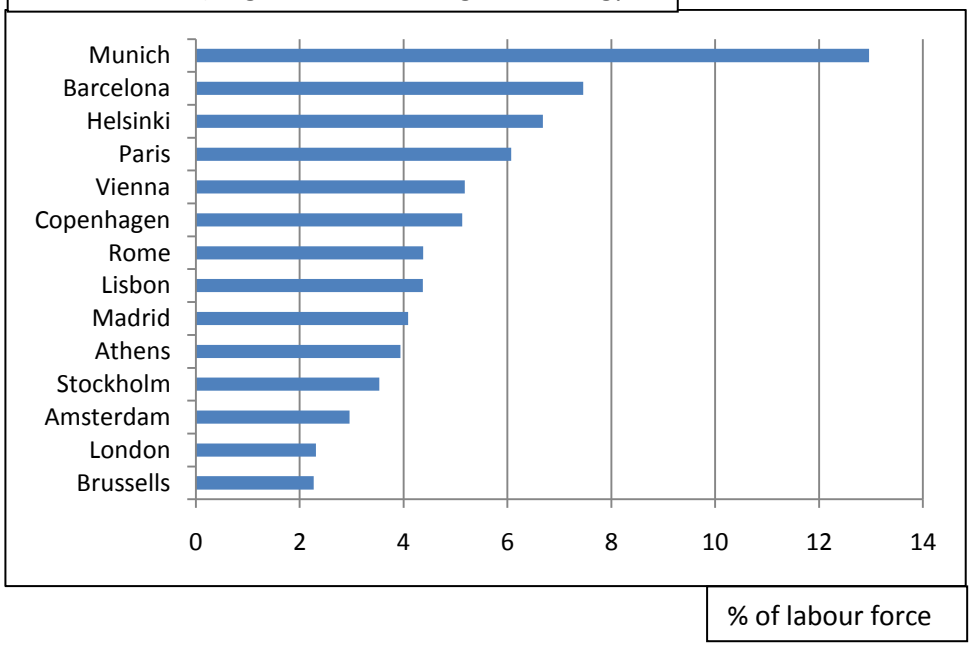


Table 3.2.1.3.b) Knowledge-intensive services

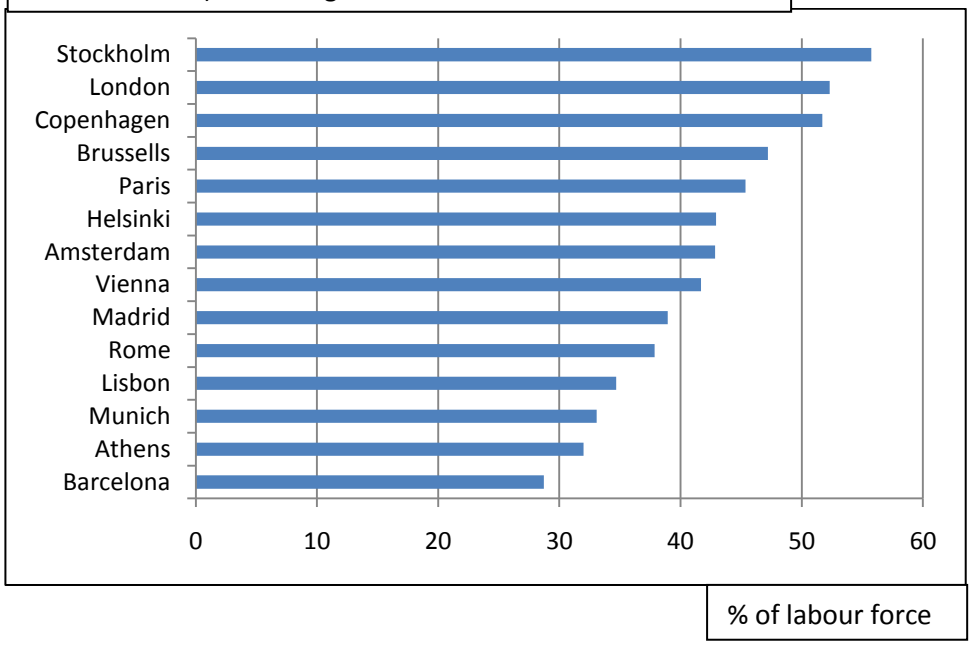
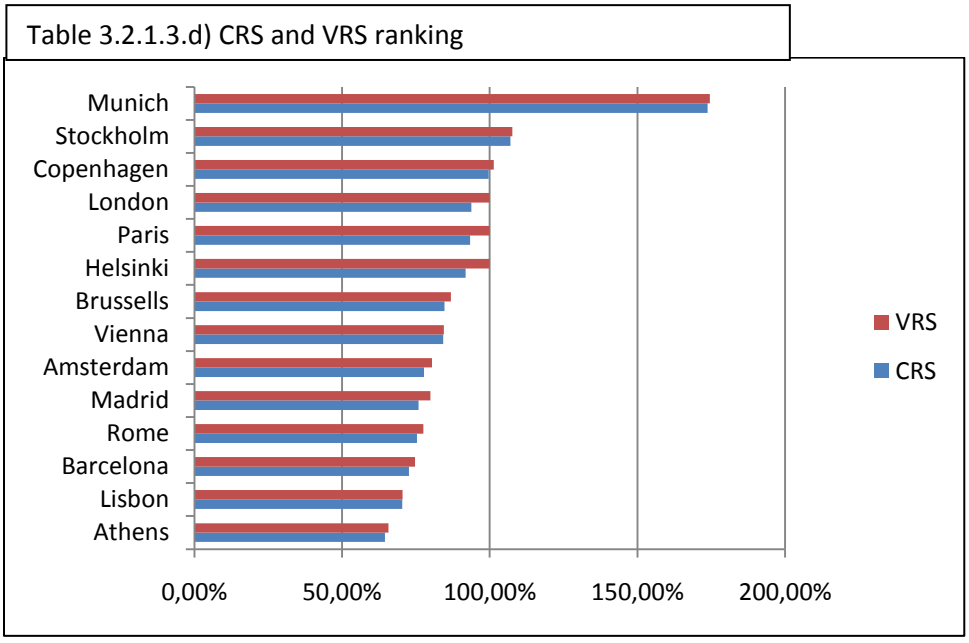


Table 3.2.1.3.c] All indicators scaled to 1 and the respective level2 scores “Sophisticated jobs”. For the CRS scores the “output CCR” model has been used for the calculation; for the VRS scores the “input BBC” model.

City	Population	Labourforce in HighTech	Labourforce in HighKnow	Sophisticated Jobs (CRS)	Sophisticated Jobs (VRS)
Vienna	2265524	0,40	0,75	84,29%	84,51%
Brussells	3407432	0,17	0,85	84,67%	86,89%
Copenhagen	1825814	0,40	0,93	99,68%	101,40%
Helsinki	1467453	0,52	0,77	91,81%	125,45%
Paris	11598866	0,47	0,81	93,33%	big
Munich	2714015	1,00	0,59	173,75%	174,53%
Athens	4032456	0,30	0,57	64,53%	65,68%
Rome	4013057	0,34	0,68	75,32%	77,49%
Amsterdam	3583930	0,23	0,77	77,77%	80,50%
Lisbon	2794226	0,34	0,62	70,35%	70,48%
Madrid	6052583	0,32	0,70	75,94%	79,96%
Barcelona	5257062	0,58	0,52	72,62%	74,66%
Stockholm	1918104	0,27	1,00	107,03%	107,66%
London	13156242	0,18	0,94	93,81%	big

Table 3.2.1.3.d) CRS and VRS ranking



Munich has a strong dominance in high technology manufacturing resulting in a high DEA score on sophisticated jobs. As Bavaria is a centre for industry this result is not surprising. The percentage of employment in industry is comparable to other cities with a strong industry like Milan for example. Stockholm and Copenhagen are also CRS efficient scoring well in Knowledge-intensive services. London, Paris and Helsinki are VRS efficient but the super-efficiency score is neglected as London and Paris have the biggest output and Helsinki the smallest input. At the bottom are the southern European cities Madrid, Rome, Barcelona, Lisbon and Athens.

- **R&D personnel (as % of total employment)**

  This indicator shows how much effort is put into research. Cities scoring well want to assure a sustainable innovative capacity.

- **Patents (applications per population)**

  Patent applications reflect the innovative results of cities. Cities scoring well have state-of-the-art industries and are an international centre of excellence in their fields of competence.

Table 3.2.1.3.e) R&D personnel as percentage of total labour force

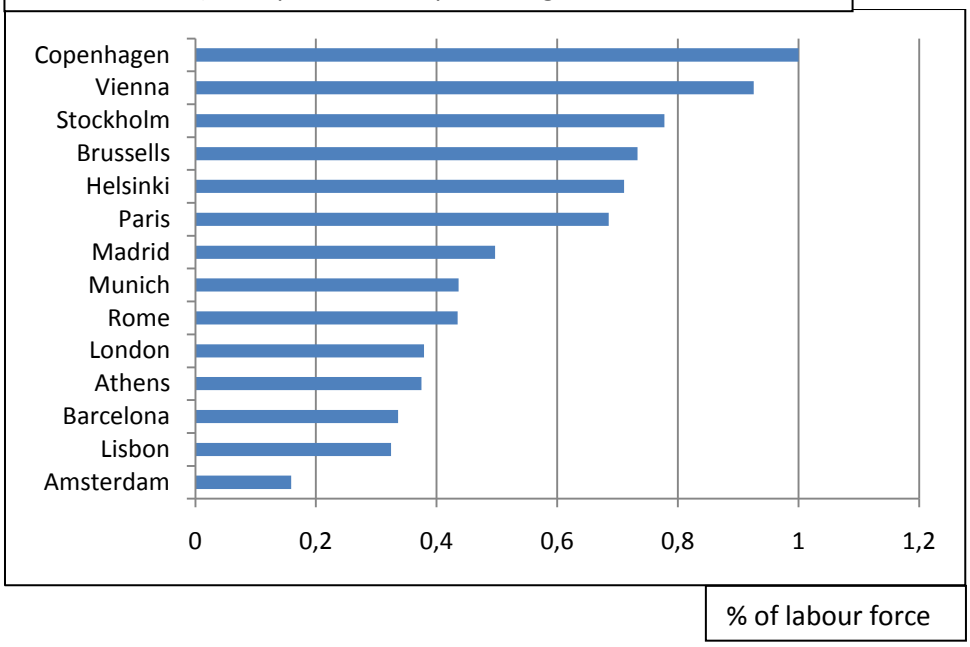
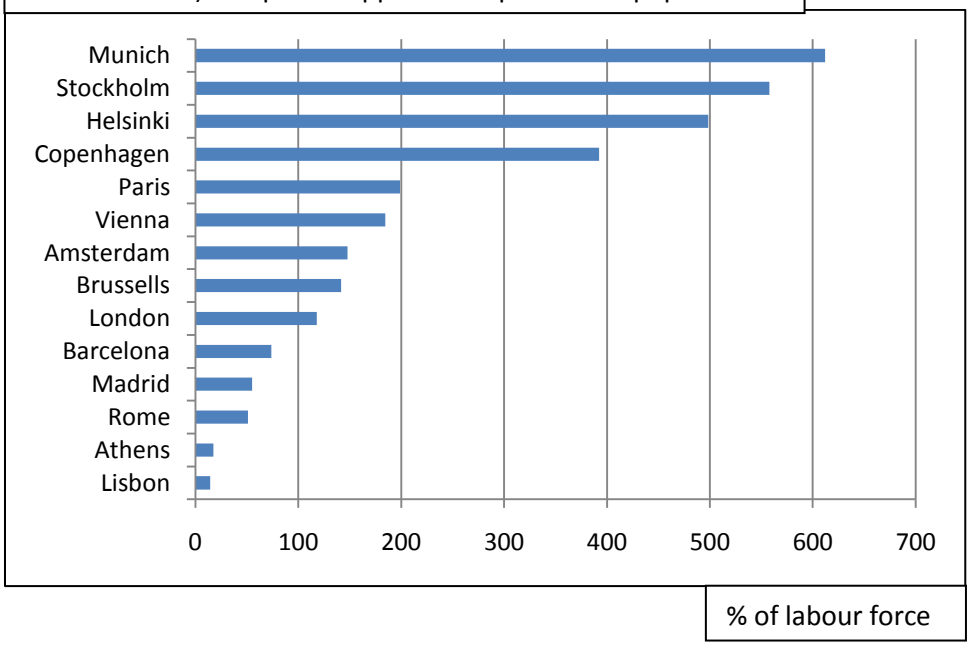


Table 3.2.1.3.f) PCT patent applications per million population



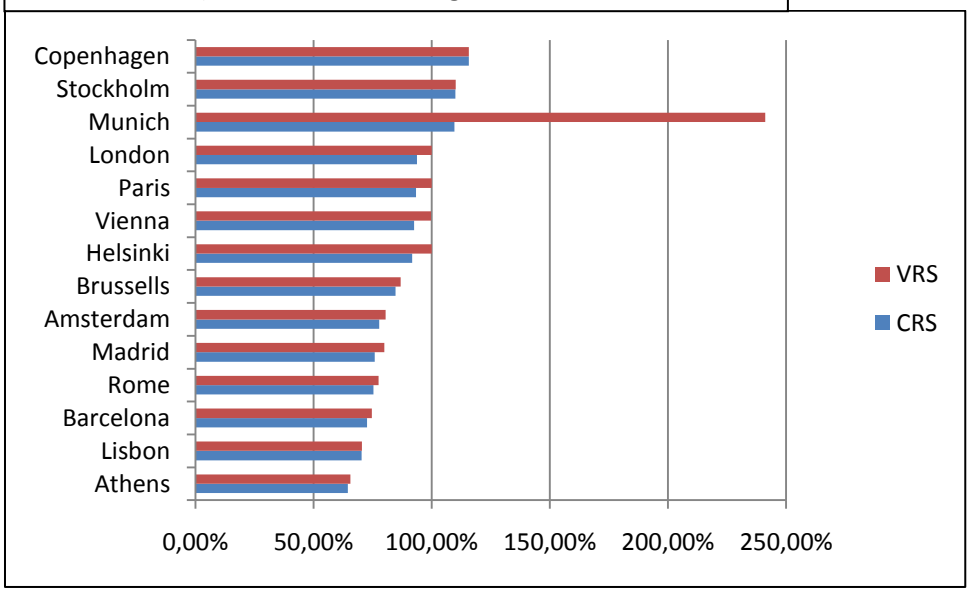
Munich scores best and has a small edge over the northern European cities. Those cities work on the top end of their fields of excellence.

Technology score

Table 3.2.1.3.g] All indicators scaled to 1 and the respective level2 scores “Sophisticated jobs”. For the CRS scores the “output CCR” model has been used for the calculation; for the VRS scores the “input BBC” model.

City	Population	R&D personnel	Patents	Soph. Jobs (CRS)	Soph. Jobs (VRS)	Technology (CRS)	Technology (VRS)
Vienna	2265524	0,93	0,30	84,29%	84,51%	92,56%	99,69%
Brussells	3407432	0,73	0,23	84,67%	86,89%	84,78%	86,89%
Copenhagen	1825814	1,00	0,64	99,68%	100,00%	115,68%	115,79%
Helsinki	1467453	0,71	0,81	91,81%	100,00%	91,81%	124,69%
Paris	11598866	0,69	0,32	93,33%	100,00%	93,33%	big
Munich	2714015	0,44	1,00	100,00%	100,00%	109,70%	241,18%
Athens	4032456	0,37	0,03	64,53%	65,68%	64,53%	65,68%
Rome	4013057	0,43	0,08	75,32%	77,49%	75,32%	77,49%
Amsterdam	3583930	0,16	0,24	77,77%	80,50%	77,77%	80,50%
Lisbon	2794226	0,32	0,02	70,35%	70,48%	70,35%	70,48%
Madrid	6052583	0,50	0,09	75,94%	79,96%	75,94%	79,96%
Barcelona	5257062	0,34	0,12	72,62%	74,66%	72,62%	74,66%
Stockholm	1918104	0,78	0,91	100,00%	100,00%	110,10%	110,17%
London	13156242	0,38	0,19	93,81%	100,00%	93,81%	big

Table 3.2.1.3.h) CRS and VRS ranking



Copenhagen, Stockholm and Munich are CRS efficient. Copenhagen scores highest defining the optimal city size for "Technology". Considering variable returns to scale Helsinki, London and Paris are efficient due to VRS methodology. Vienna slightly fails to be VRS efficient. Analysing the results Munich's extremely high VRS score is remarkable. Even by flattening the high super-efficiency score of the factor "sophisticated jobs" to 100% (CRS: 173,75%, VRS: 174,53%), Munich's VRS super-efficiency score goes beyond 240%. This is because cities with a size comparable to that of Munich score very low, underlining the technological importance of Munich for Europe.

3.2.1.4. Attraction and cultural participation

With globalisation young academics have become more flexible for their workplace. Social networks and Skype make it possible to be on the other side of the globe and still be strongly connected to friends and family at home, through political measures, moving to another country has become a lot easier for this young generation of the so-called 1st world countries and international enterprises search worldwide for new talent. Cities' economic perspectives do not only depend on local human resources, but also on their capabilities to attract and retain educated people from around the globe.

Apart from the fact that foreigners should get the impression of being welcomed and there is a chance of participation within society, there also needs to be a healthy job market to attract foreigners and to prevent locals to feel that foreigners take their jobs. A relaxed labour market also makes employees less job-dependent leading to fewer worries and more

courage on the job. A great fear to lose the job often hinders innovation, as risks are not taken.
Culture enhances as well attraction as innovativeness. People taking notice of a rich cultural context and participating in cultural life might transfer or develop innovative ideas. As said earlier, being open-minded not only helps for integration, but also for knowledge spillovers from other fields of excellence.
Attraction and cultural participation is treated altogether in one point as it is strongly connected with innovation.

- Integration

  Integration is a very complex matter. How foreigners are welcomed, how they merge with local people and to which extend they adopt local customs and get the chance to live them their way determines if talented foreigners can be retained on a long term. To identify the integration assets and weaknesses two indicators define the point Integration:

  - "Presence of foreigners is good for the city" (synthetic index 0-100)
  - "Foreigner here are well integrated" (synthetic index 0-100)

  Those two indicators are drawn from the Eurostat's perception survey, where in each city people were asked about their perception of various aspects of the quality of life in "their" city.[28]

  Regarding the above statements "Presence of foreigners is good for the city" and "foreigners here are well integrated" they said whether they "strongly agree", "somewhat agree", "somewhat disagree" and "strongly disagree". The two indicators are the synthetic index of the respective results and show how many people think that foreigners' presence is good and that they are well integrated. It could also be observed that those two indicators were highly influenced by the percentage of foreigners in the city. As it can be assumed that only "non-foreigners" responded to this survey, the input data here is the native population.

[28] European Comission (2010), Survey on perception of quality of life in 75 European cities, March 2010

Table 3.2.1.4.a) percentage of foreigners

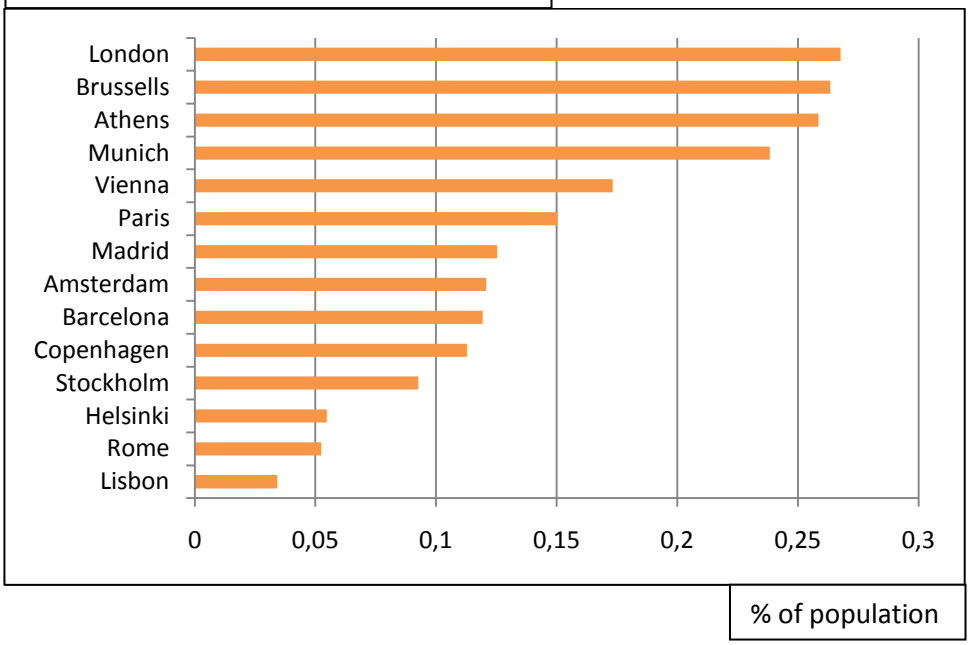
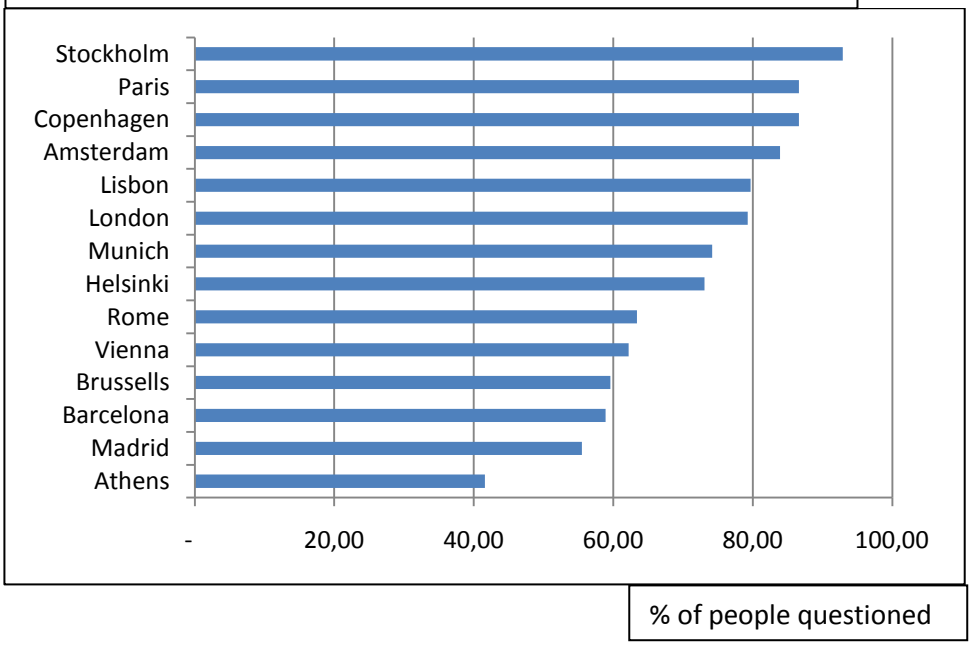


Table 3.2.1.4.b) people thinking that foreigners are good for the city



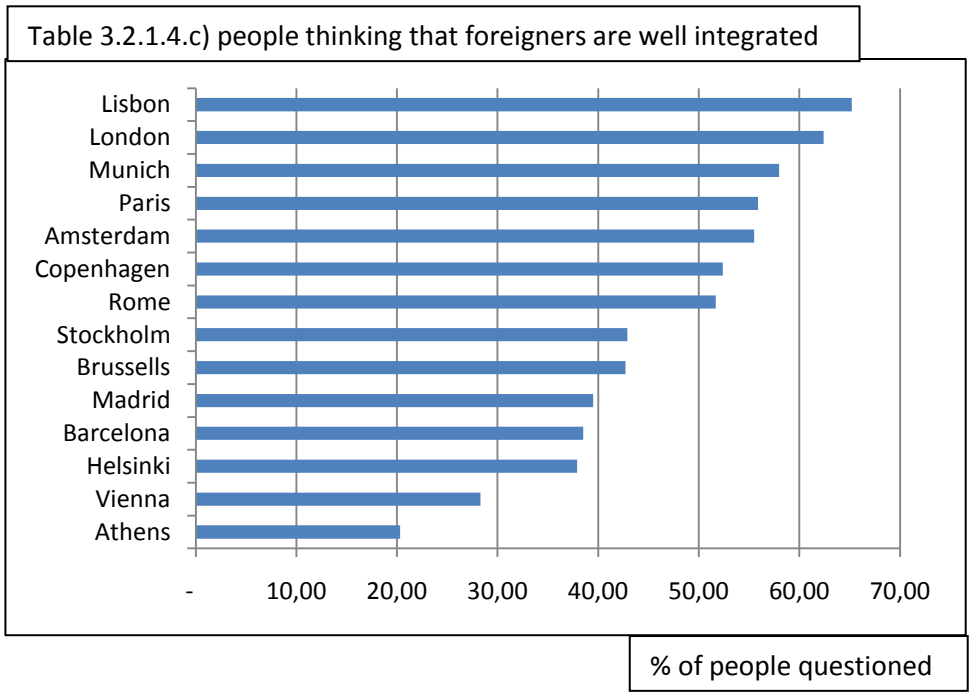
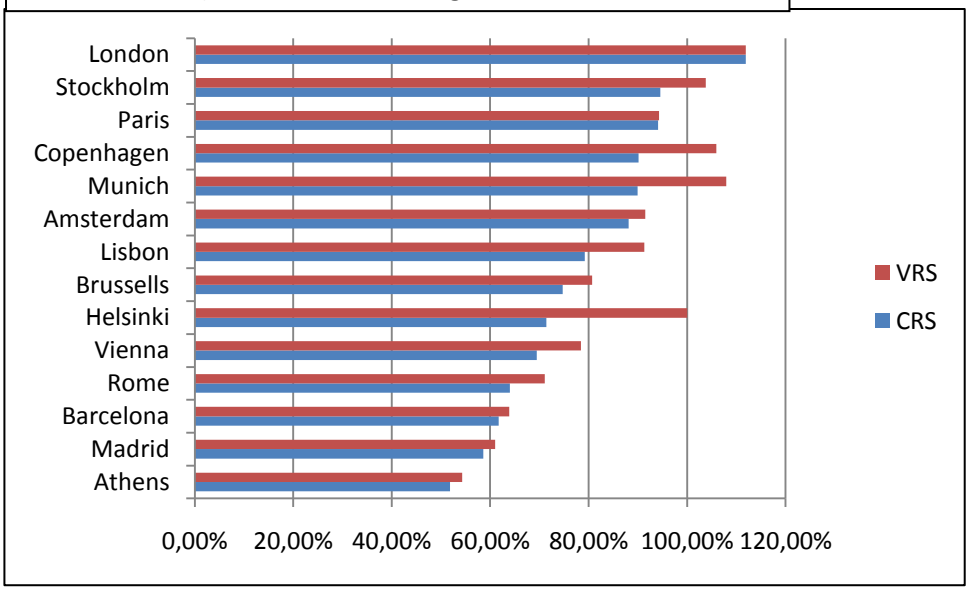


Table 3.2.1.4.d] All indicators scaled to 1 and the respective level2 scores “Integration”. For the CRS scores the “output CCR” model has been used for the calculation; for the VRS scores the “input BBC” model.

City	Population	percentage of natives	perception that foreigners are good for the city	perception that foreigners are well integrated	Integration (CRS)	Integration (VRS)
Vienna	2265524	0,82674872	0,69	0,40	69,48%	78,44%
Brussells	3407432	0,736522389	0,75	0,68	74,73%	80,71%
Copenhagen	1825814	0,887141593	0,90	0,69	90,15%	105,92%
Helsinki	1467453	0,945317106	0,71	0,47	71,41%	124,42%
Paris	11598866	0,849730949	0,94	0,77	94,12%	94,30%
Munich	2714015	0,761689306	0,90	0,89	89,96%	107,99%
Athens	4032456	0,741423732	0,52	0,32	51,82%	54,34%
Rome	4013057	0,94762634	0,62	0,64	64,03%	71,12%
Amsterdam	3583930	0,879247034	0,88	0,74	88,12%	91,54%
Lisbon	2794226	0,965830584	0,76	0,79	79,23%	91,33%
Madrid	6052583	0,874707162	0,59	0,53	58,60%	61,01%
Barcelona	5257062	0,880666765	0,62	0,51	61,76%	63,89%
Stockholm	1918104	0,907336151	0,95	0,55	94,55%	103,80%
London	13156242	0,732328562	1,00	1,00	111,90%	big

Table 3.2.1.4.e) CRS and VRS ranking

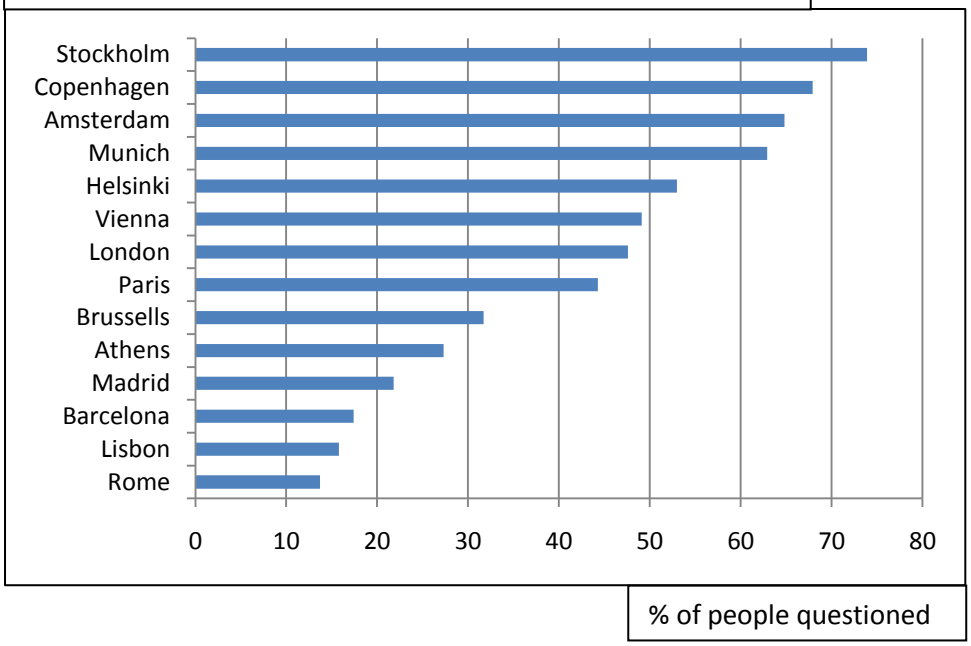


Considering the percentage of foreigners, London scores best in both foreigner perception and foreigner integration and therefore dominates the DEA results. Athens scores worst on both indicators, having a large percentage of foreigners from countries with a low Human Development Index (See Appendix 5.5). London also has the best VRS score regarding that VRS scores are always equal or bigger than CRS scores, even if the super-efficiency score in VRS cannot be computed. London seems to have a great attitude towards foreigners and effective integration policies. This might be because of the long migration tradition in the British Empire making London a melting pot with a lot of experience. London definitely is a Benchmark regarding Integration.
Stockholm, Copenhagen, Munich and Helsinki are also VRS efficient, Helsinki due to methodology.

- Job availability

Job availability serves for attraction of foreigners on the one hand, on the other it gives employees self confidence to take risks and be innovative. The data is also drawn from the Eurostat survey and is a synthetic index of the reaction to the statement “it is easy to find a new job here”.

Table 3.2.1.4.f) people thinking that it is easy to find a new job



People in the northern European cities Stockholm and Copenhagen are most confident about their job market. People in southern cities are least confident.

- Cultural Participation

Without a doubt the cultural life a city offers enhances the living standard. The main reason for this point to be integrated in this model is the notion of Creative Industries. As it was already said in the Criticism on Tanagli/Florida's paper, Creative Industries per se don't contribute enormously to the GDP, on the other hand they might influence society and lead to more and qualitatively higher innovation. The goal is to portray the creativity transfer from Creative Industries to other, more profitable segments. It would have been desirable to have a list of a representative cross section of cultural activities taking place and their respective attendance. Unfortunately only data on museum visits and cinema visits of nearly all cities could be found (London's data on cinema visits was not available). These two figures can barely reflect the full cultural scope of a city. Cinema visits might not reflect the high-cultural aspect which is looked for and museum visits are biased by the number of tourists. But as these tourists come for cultural reasons, this figure might be an indicator for the city's cultural life, being determined by its population.

Table 3.2.1.4.g) cinema visits per year and inhabitant

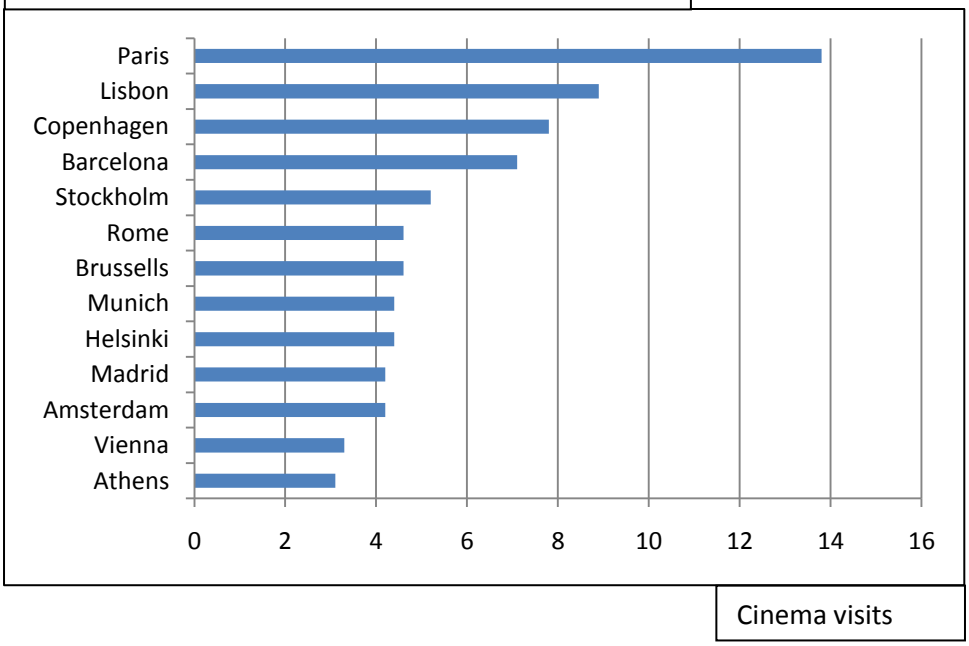


Table 3.2.1.4.h) museum visits per year and inhabitant

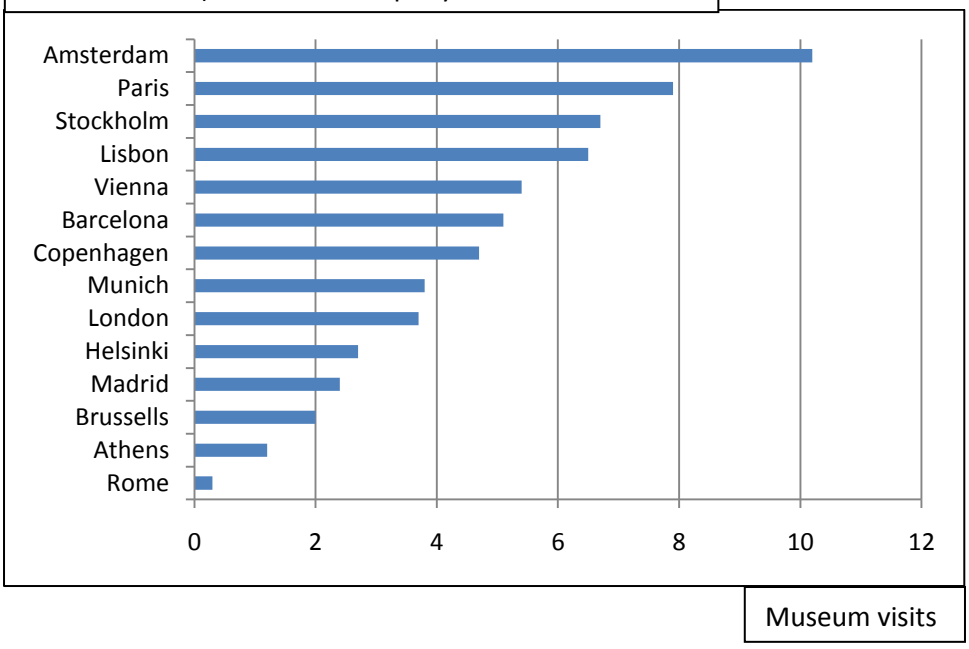
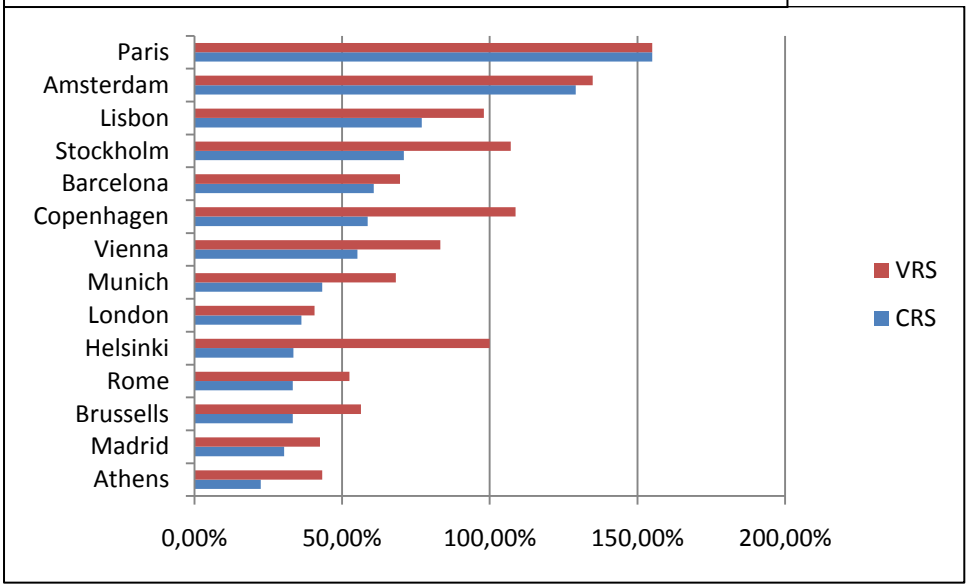


Table 3.2.1.4.i) All indicators scaled to 1 and the respective level2 scores “Cultural Participation”. For the CRS scores the “output CCR” model has been used for the calculation; for the VRS scores the “input BBC” model.

City	Population	Cinema visits	Museum visits	Cultural Participation (CRS)	Cultural Participation (VRS)
Vienna	2265524	0,24	0,53	55,24%	83,28%
Brussells	3407432	0,33	0,20	33,33%	56,40%
Copenhagen	1825814	0,57	0,46	58,62%	108,79%
Helsinki	1467453	0,32	0,26	33,50%	124,42%
Paris	11598866	1,00	0,77	155,06%	big
Munich	2714015	0,32	0,37	43,32%	68,22%
Athens	4032456	0,22	0,12	22,46%	43,29%
Rome	4013057	0,33	0,03	33,33%	52,54%
Amsterdam	3583930	0,30	1,00	129,11%	134,80%
Lisbon	2794226	0,64	0,64	77,03%	97,96%
Madrid	6052583	0,30	0,24	30,43%	42,54%
Barcelona	5257062	0,51	0,50	60,69%	69,62%
Stockholm	1918104	0,38	0,66	70,91%	107,14%
London	13156242	-	0,36	36,27%	40,65%

Table 3.2.1.4.j) CRS and VRS ranking



Paris clearly sets the benchmark scoring best on cinema visits and second on museum visits. This reflects the image of Paris being the cultural hot spot.
Amsterdam is also CRS efficient scoring best on museum visits.
Considering variable returns to scale Stockholm, Helsinki and Copenhagen become

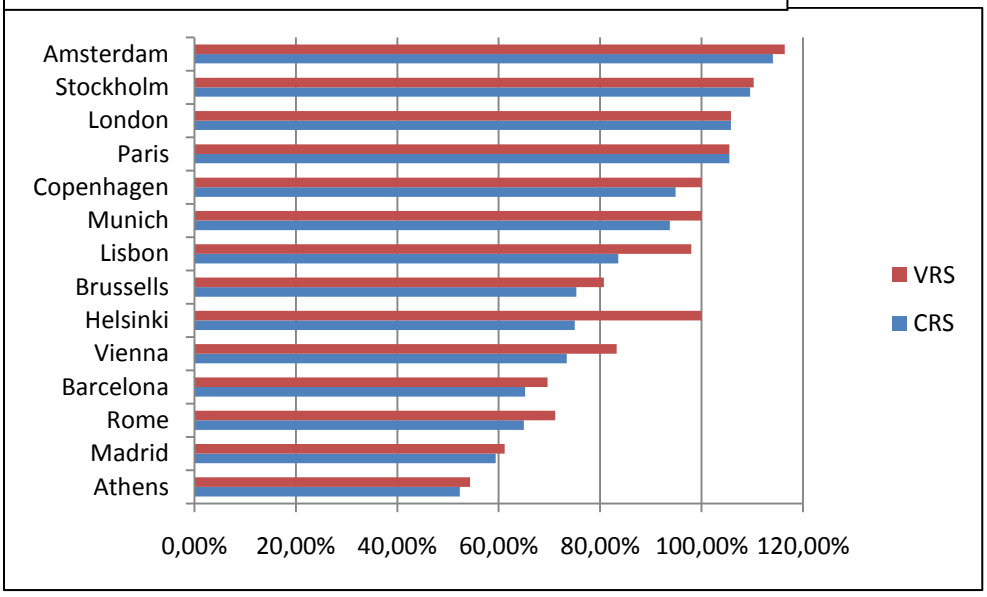
efficient. Helsinki again is efficient due to methodology. Stockholm and Copenhagen are favoured because of their small size given the fact that Paris appears to have the optimal size for culture.

Attraction and Cultural participation score

Table 3.2.1.4.k) All indicators scaled to 1 and the respective level1 scores "Attraction and Cultural Participation". For the CRS scores the "output CCR" model has been used for the calculation; for the VRS scores the "input BBC" model.

City	Population	Integration (CRS)	Integration (VRS)	Jobs availabilty	Cultural Participation (CRS)	Cultural Participation (VRS)	Attraction and Cultural Participation (CRS)	Attraction and Cultural Participation (VRS)
Vienna	2265524	69,48%	78,44%	0,66	55,24%	83,28%	73,38%	83,28%
Brussells	3407432	74,73%	80,71%	0,43	33,33%	56,40%	75,29%	80,71%
Copenhagen	1825814	90,15%	100,00%	0,92	58,62%	100,00%	94,86%	100,00%
Helsinki	1467453	71,41%	100,00%	0,72	33,50%	100,00%	75,00%	124,42%
Paris	11598866	94,12%	94,30%	0,60	100,00%	100,00%	105,44%	big
Munich	2714015	89,96%	100,00%	0,85	43,32%	68,22%	93,75%	100,00%
Athens	4032456	51,82%	54,34%	0,37	22,46%	43,29%	52,35%	54,34%
Rome	4013057	64,03%	71,12%	0,19	33,33%	52,54%	64,93%	71,12%
Amsterdam	3583930	88,12%	91,54%	0,88	100,00%	100,00%	114,04%	116,35%
Lisbon	2794226	79,23%	91,33%	0,21	77,03%	97,96%	83,54%	97,96%
Madrid	6052583	58,60%	61,01%	0,29	30,43%	42,54%	59,42%	61,19%
Barcelona	5257062	61,76%	63,89%	0,24	60,69%	69,62%	65,18%	69,62%
Stockholm	1918104	94,55%	100,00%	1,00	70,91%	100,00%	109,57%	110,24%
London	13156242	100,00%	100,00%	0,64	36,27%	40,65%	105,76%	big

Table 3.2.1.4.l) CRS and VRS ranking



Amsterdam, Stockholm and the two global centres London and Paris dominate the point "Attraction and cultural participation", with London being top within Europe in Integration policies, with Stockholm having the most promising job market and Amsterdam and Paris dominating culture.
Considering variable returns to scale Munich and Copenhagen are also weakly efficient, Helsinki due to methodology.
Amsterdam has the highest CRS score and as a consequence has the optimal size for "attraction and cultural participation" promoting high cultural values, being able to deal with integration like a global city does and having a relaxed labour market. London and Paris are attractive and handle integration well, but have a tight job market; maybe just because of their popularity. Amsterdam with the highest and Stockholm with the second highest CRS score seem to be a good compromise for people seeking both an attractive city and a decent job.

3.2.1.5. Sustainability

All the indicators we have seen are directly connected to economic capabilities. But how well are cities prepared for the future? Are cities prepared for the upcoming challenges? Do they responsibly use their resources? The point "Sustainability" provides a benchmark focusing on the three dimensions "Environmental, Social and Economic" sustainable development established by the OECD. [29]. For each dimension one indicator referring to a burning issue is used. The indicators were taken from the list of proposed indicators in the above mentioned article.

- Environmental Sustainability

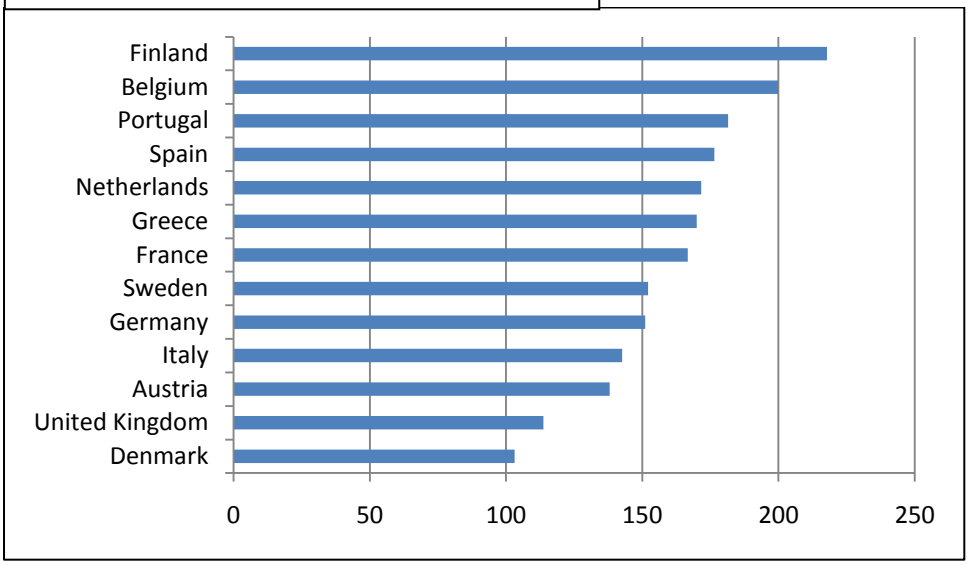
  Energy efficiency

  Energy efficiency is an important indicator for sustainability. It shows how responsible an economy uses its resources without jeopardising the future. It also shows an awareness of moderation and efficiency among the population.
  As the industry is mostly outside the city borders, the region to where data corresponds has to be enlarged. Therefore the data for energy consumption of countries has been used and adopted for the respective cities. The indicator's unit drawn from Eurostat was "Energy consumption per GDP "and has been multiplied with the respective cities' "GDP per capita" to have the proportional "Energy

[29] OECD (2005), OECD Statistics in Brief, Measuring Sustainable Development by Candice Stevens, September 2005

consumption per capita". As the GDP per capita in cities is higher, inhabitants of cities are also responsible for more Energy consumption than the rural population. In the "State of European Cities Executive Report" from May 2007 is says that *"For cities with more than 1 million inhabitants, GDP figures are 25% higher than in the EU as a whole and 40% higher than their national average."*[30] The "Energy consumption per capita" has then been inverted to get the "Energy Efficiency per capita".

Table 3.2.1.4.m) Energy consumption per GDP



Denmark is most efficient using the least Energy per GDP and therefore is Copenhagen is considered the most energy efficient city.

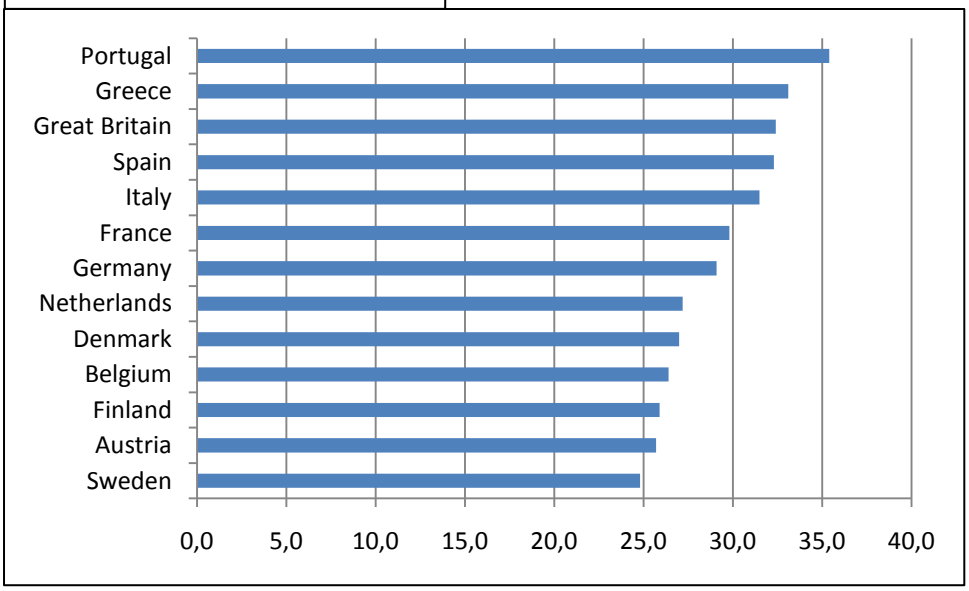
- Social Sustainability

"Gini" Coefficient

The "Gini" coefficient is an indicator for social inequality. It indicates how much the income distribution differs from a normal distribution.
Today the gap between rich and poor is growing, leading inevitably to social tensions. Cities need to monitor and control social inequality to guarantee a sustainable coexistence.
Data on the "Gini" coefficient was not available for cities, so countries' data was used again and adopted for the respective cities. To get an indicator for social equality the "Gini" coefficient has been subtracted from 1 and then scaled to one for the calculation.

[30] European Comission (2007), State of European Cities Executive Report May 2007

Table 3.2.1.4.o) “Gini” coefficient



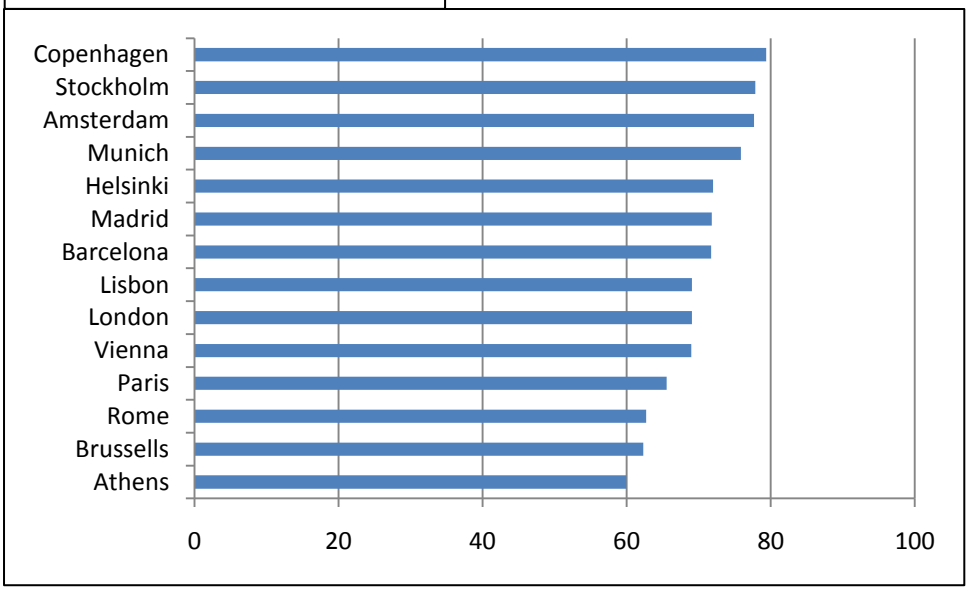
In Portugal inequality is strongest with the highest “Gini” coefficient. On the other hand Sweden has the most balanced income.

- Economic Sustainability

Employment rate

For economic growth we depend on population growth and productivity growth. Besides the rising wealth economic growth is also important to support people in their retirement phase. As population growth is slowing down and the population is getting older in the western countries we need as many people as possible to participate in the labour market to guarantee a wealthy society and assure the retirement payments are backed.
The employment rate gives the percentage of people being employed among the working age population from 15 to 65.

Table 3.2.1.4.o) employment rate



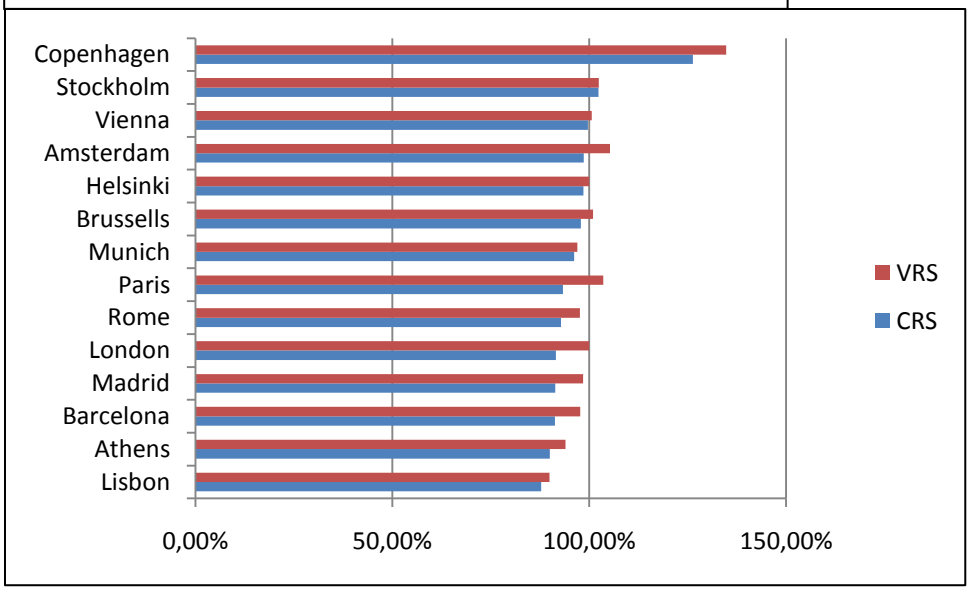
The northern European cities Copenhagen and Stockholm together with Amsterdam and Munich have the highest employment rate. It is known the retirement age in northern European countries is higher and this also affects the employment rate.

Sustainability score

Table 3.2.1.4.p) All indicators scaled to 1 and the respective level1 scores “Attraction and Cultural Participation”. For the CRS scores the “output CCR” model has been used for the calculation; for the VRS scores the “input BBC” model.

City	Population	Energy-efficiency	Social equality	Employment rate	Sustainability (CRS)	Sustainability (VRS)
Vienna	2265524	0,71	0,99	0,87	99,66%	100,69%
Brussells	3407432	0,52	0,98	0,78	97,87%	100,94%
Copenhagen	1825814	1,00	0,97	1,00	126,32%	134,81%
Helsinki	1467453	0,43	0,99	0,91	98,54%	124,42%
Paris	11598866	0,53	0,93	0,83	93,35%	103,54%
Munich	2714015	0,52	0,94	0,96	96,18%	97,02%
Athens	4032456	0,68	0,89	0,76	90,04%	93,98%
Rome	4013057	0,79	0,91	0,79	92,82%	97,61%
Amsterdam	3583930	0,56	0,97	0,98	98,60%	105,26%
Lisbon	2794226	0,78	0,86	0,87	87,79%	89,96%
Madrid	6052583	0,62	0,90	0,90	91,36%	98,44%
Barcelona	5257062	0,68	0,90	0,90	91,30%	97,69%
Stockholm	1918104	0,60	1,00	0,98	102,32%	102,43%
London	13156242	0,78	0,90	0,87	91,56%	big

Table 3.2.1.4.q) CRS and VRS ranking



Copenhagen is the most sustainable city scoring best in “Energy-efficiency” and “Employment rate”. Stockholm, being first on “Social equality”, is also CRS efficient. Considering variable returns to scale Vienna, Amsterdam, Helsinki, Brussels, Paris and London are all efficient. This is because Copenhagen is the second smallest city and has the optimal size in the DEA calculation. As a result most of the cities are in the region of decreasing returns to scale and therefore VRS efficient.

3.2.2. Results and "Cities having the edge"

All level1 CRS and VRS scores have been computed, reflecting each city's performance in the fields "Talent", "Technology", "Attraction and Cultural Participation" and "Sustainability". In this chapter, the results for the model "are best" are presented. As the VRS and CRS level1 scores differ, the CRS and VRS analysis is presented separately, using different data.

CRS

Here the input data is the population and the outputs are the level1 scores. As the level1 scores can still be seen as score per capita, input still is 1 in CRS. This can be seen as how well a city manages its population in order to score well in the four fields listed above, giving the final score of this analysis.

The table 3.2.2.a) shows the population, the level1 CRS scores and the final CRS "TTA" score. The "output CCR" model has been used.

City	Population	Talent (CRS)	Technology (CRS)	Attraction and Cultural Participation (CRS)	Sustainability (CRS)	TTA (CRS)
Vienna	2265524	95,26%	92,56%	73,38%	99,66%	99,66%
Brussells	3407432	100,00%	84,78%	75,29%	97,87%	100,00% *
Copenhagen	1825814	92,47%	100,00%	94,86%	100,00%	100,00%
Helsinki	1467453	97,18%	91,81%	75,00%	98,54%	98,54%
Paris	11598866	94,04%	93,33%	100,00%	93,35%	100,00%
Munich	2714015	100,00%	100,00%	93,75%	96,18%	100,00% *
Athens	4032456	89,02%	64,53%	52,35%	90,04%	90,04%
Rome	4013057	84,25%	75,32%	64,93%	92,82%	92,82%
Amsterdam	3583930	86,42%	77,77%	100,00%	98,60%	100,00% *
Lisbon	2794226	52,08%	70,35%	83,54%	87,79%	87,79%
Madrid	6052583	90,46%	75,94%	59,42%	91,36%	91,36%
Barcelona	5257062	71,36%	72,62%	65,18%	91,30%	91,30%
Stockholm	1918104	100,00%	100,00%	100,00%	100,00%	103,72%
London	13156242	100,00%	93,81%	100,00%	91,56%	100,00% *

Stockholm, being efficient on all levels seen before, logically dominates the results and all other cities. Copenhagen and Paris are also dominant. Brussels, Munich, Amsterdam and London are marked with a star indicating that they are efficient, but not dominant. This leads to the following result:

Group Euro dominant: Stockholm, Copenhagen, Paris
Group Euro efficient: Brussels, Munich, Amsterdam, London
Group Euro catch-ups: Vienna, Helsinki
Group Southern catch-ups: Rome, Madrid, Barcelona, Athens, Lisbon

VRS

The level1 scores can also be seen as score per capita. Therefore for the VRS analysis the data was multiplied with the population again. As Helsinki, Paris and London were efficient because of the methodology on some scores, they were excluded from this last analysis.

The table 3.2.2.b) shows the population, the level1 VRS scores and the final VRS "TTA" score. The "input BCC" model has been used.

City	Population	Talent (VRS)	Technology (VRS)	Attraction and Cultural Participation (VRS)	Sustainability (VRS)	TTA (VRS)
Vienna	2265524	100,00%	99,69%	83,28%	100,00%	101,17%
Brussells	3407432	100,00%	86,89%	80,71%	100,00%	102,70%
Copenhagen	1825814	95,73%	100,00%	100,00%	100,00%	105,05%
Munich	2714015	100,00%	100,00%	100,00%	97,02%	113,95%
Athens	4032456	91,39%	65,68%	54,34%	93,98%	94,31%
Rome	4013057	96,24%	77,49%	71,12%	97,61%	99,00%
Amsterdam	3583930	87,74%	80,50%	100,00%	100,00%	140,98%
Lisbon	2794226	56,22%	70,48%	97,96%	89,96%	97,96%
Madrid	6052583	91,45%	79,96%	61,19%	98,44%	big
Barcelona	5257062	72,37%	74,66%	69,62%	97,69%	98,86%
Stockholm	1918104	100,00%	100,00%	100,00%	100,00%	103,06%

Considering variable returns to scale only southern European cities are inefficient for the exception of Madrid due to methodology. This shows that southern European cities are behind as stated before, even without considering their GDP. Stockholm has the optimal size, as like in the CRS analysis Stockholm is efficient on every score. Stockholm is also the second smallest city in this table having the effect that almost all cities are in the region of decreasing returns to scale leading to the high VRS scores of Amsterdam and Munich. This leads to the following result:

Group Euro VRS efficient: Amsterdam, Munich, Copenhagen, Stockholm, Brussels, Vienna
Group Euro VRS catch-ups: Rome, Barcelona, Lisbon, Athens

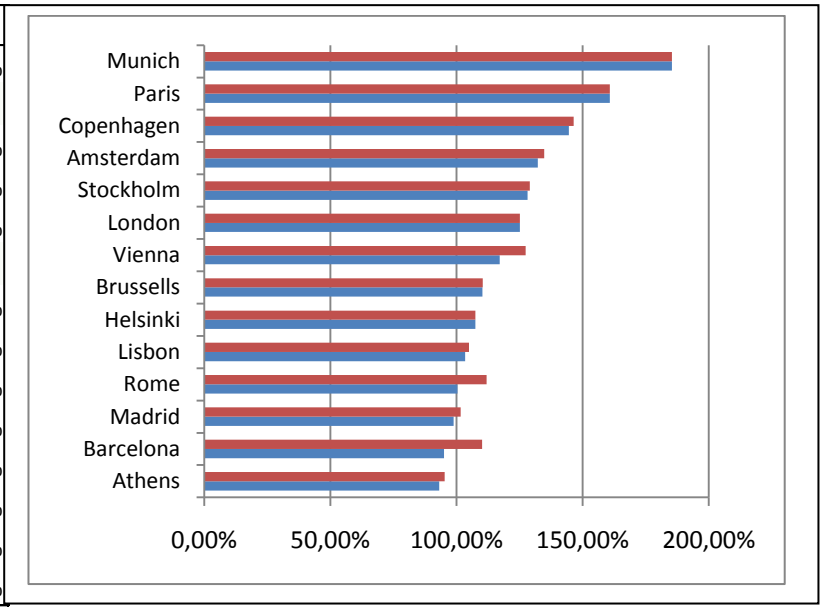
3.2.2.1. "Cities having the edge"

It has been shown that many cities are efficient regarding their preferences, which is a good result. Cities are different and should keep their identities and fields of excellence. Cities are too diverse for establishing a clear ranking. But global nomads and enterprises may draw information from this analysis and look for the city that most suites them. Cities could draw information from this benchmark, in what areas they lag behind other cities and decide whether they want to improve in those fields or not.

Many cities are efficient regarding their preferences, but which city is especially strong in their fields of excellence? Which city has the edge over other cities because they have sharpened their identity and excel in their core areas?
By taking the super-efficiency score of all the indicators as outputs, it can be seen how far cities do distinguish themselves from other cities and how a ranking may be established.

Table 3.2.2.1.a) shows the results from an analysis with the population as input and all the indicators as outputs. For the CRS scores the "output CCR" model has been used for the calculation; for the VRS scores the "input BBC" model. On the basis of this analysis a ranking is established:

City	CRS score	VRS score
Munich	185,45%	241,18%
Paris	160,79%	big
Copenhagen	144,51%	146,43%
Amsterdam	132,29%	134,80%
Stockholm	128,23%	129,05%
London	125,12%	big
Vienna	117,16%	127,38%
Brussells	110,29%	110,45%
Helsinki	107,48%	125,45%
Lisbon	103,49%	104,92%
Rome	100,35%	111,89%
Madrid	98,86%	101,73%
Barcelona	95,02%	110,17%
Athens	93,19%	95,37%



Munich, being the only city with a strong industry differs most from the other cities. Paris and Copenhagen also have a strong identity excelling in their core areas. Considering variable returns to scale only Athens fails to be efficient. Both scores have a correlation to the GDP per capita of 78% (CRS: 78,54%, VRS: 78, 56%). This result shows the direct connection to the GDP per capita assumed before.

City	Population	I34	I56	I36	R&D	Pat	Hte	HKn	forGo	forIn	Job	Cin	Mus	EEff	SocE	Empl	CRS score	VRS score
Vienna	2265524	0,94	0,53	0,93	0,93	0,30	0,40	0,75	0,69	0,40	0,66	0,24	0,53	0,71	0,99	0,87	117,16%	127,38%
Brussells	3407432	0,48	1,00	0,86	0,73	0,23	0,17	0,85	0,75	0,68	0,43	0,33	0,20	0,52	0,98	0,78	110,29%	110,45%
Copenhagen	1825814	0,65	0,85	0,89	1,00	0,64	0,40	0,93	0,90	0,69	0,92	0,57	0,46	1,00	0,97	1,00	144,51%	146,43%
Helsinki	1467453	0,74	0,85	0,96	0,71	0,81	0,52	0,77	0,71	0,47	0,72	0,32	0,26	0,43	0,99	0,91	107,48%	125,45%
Paris	11598866	0,59	0,90	0,89	0,69	0,32	0,47	0,81	0,94	0,77	0,60	1,00	0,77	0,53	0,93	0,83	160,79%	big
Munich	2714015	1,00	0,54	0,97	0,44	1,00	1,00	0,59	0,90	0,89	0,85	0,32	0,37	0,52	0,94	0,96	185,45%	241,18%
Athens	4032456	0,76	0,68	0,89	0,37	0,03	0,30	0,57	0,52	0,32	0,37	0,22	0,12	0,68	0,89	0,76	93,19%	95,37%
Rome	4013057	0,84	0,46	0,82	0,43	0,08	0,34	0,68	0,62	0,64	0,19	0,33	0,03	0,79	0,91	0,79	100,35%	111,89%
Amsterdam	3583930	0,79	0,59	0,85	0,16	0,24	0,23	0,77	0,88	0,74	0,88	0,30	1,00	0,56	0,97	0,98	132,29%	134,80%
Lisbon	2794226	0,35	0,49	0,50	0,32	0,02	0,34	0,62	0,76	0,79	0,21	0,64	0,64	0,78	0,86	0,87	103,49%	104,92%
Madrid	6052583	0,47	0,89	0,80	0,50	0,09	0,32	0,70	0,59	0,53	0,29	0,30	0,24	0,62	0,90	0,90	98,86%	101,73%
Barcelona	5257062	0,44	0,69	0,66	0,34	0,12	0,58	0,52	0,62	0,51	0,24	0,51	0,50	0,68	0,90	0,90	95,02%	110,17%
Stockholm	1918104	0,82	0,82	1,00	0,78	0,91	0,27	1,00	0,95	0,55	1,00	0,38	0,66	0,60	1,00	0,98	128,23%	129,05%
London	13156242	0,65	0,96	0,95	0,38	0,19	0,18	0,94	1,00	1,00	0,64	-	0,36	0,78	0,90	0,87	125,12%	big

Table 3.2.2.1.b) all indicators and the CRS and and VRS scores

3.2.3. Understanding "TTA" with a Principal Component Analysis

The model "TTA" was established with the goal to reveal the indicators determining a strong GDP with a sustainable outlook. But do those indicators really reflect the economic power of those cities? To explore this question a PCA has been conducted.

The Principal Component Analysis is a statistical method to reduce the dimension of a problem to see reasons or outcomes lying underneath. A method very suitable to understand what the "TTA" result describes.

For this analysis the statistics software SAS has been used. First the principal components of all data used in this paper were computed. The first eigenvalue is responsible for 35% of the data variation. Together with the second eigenvalue they are responsible for more than 50% of the data variation.

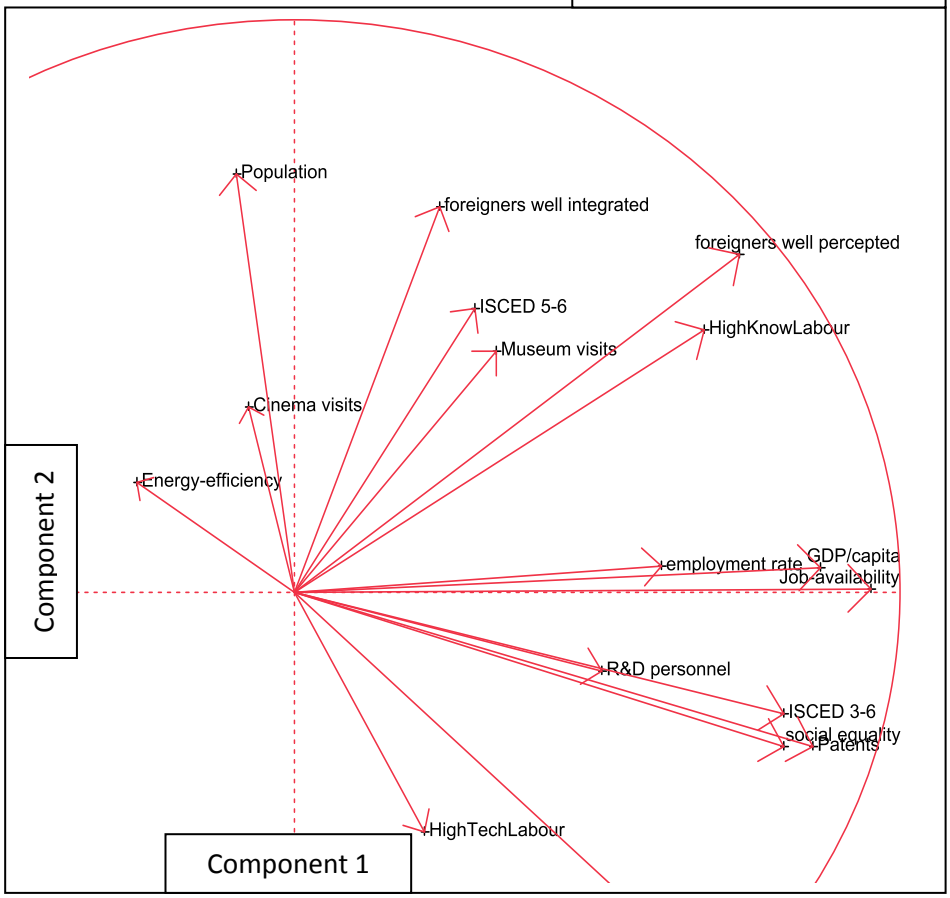
Hauptkomponenten: auf Korrelationen

Zahl	Eigenwert	Prozent	20 40 60 80	Kum. Prozent
1	6,0494	35,585		35,585
2	2,8218	16,599		52,183
3	2,3175	13,632		65,816
4	1,8493	10,878		76,694
5	1,3761	8,095		84,788
6	1,0266	6,039		90,827
7	0,7469	4,393		95,220
8	0,4354	2,561		97,781
9	0,1691	0,995		98,776
10	0,0891	0,524		99,300
11	0,0855	0,503		99,803
12	0,0306	0,180		99,983
13	0,0028	0,017		100,000

Table 3.2.3.a) Eigenvalues

Table 3.2.3.b) Loading plot

Second a loading plot is used to get an idea what those principal components could be. It can be observed that the GDP per capita, the employment rate and the Job availability are strongly linked to the first principal component. This fact suggests that the first principal component which is responsible for 35% of the data variation, could describe the "economic health" of a city.
The second principal component is strongly linked to a high population value, to



successful integration and to high education. The other indicators being linked positively with the second principal component are indications of the importance of cultural life and the values of an open-minded population. This suggests that the second principal component might indicate a big, open-minded city and culturally rich city, “a global city”.

And third the cities’ values in the principal components are plotted in score plot.

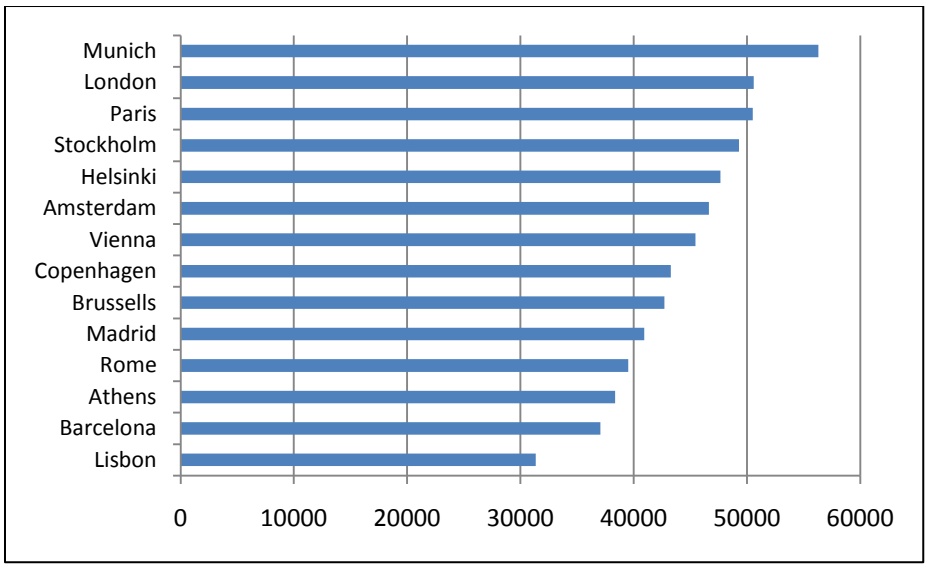
Table 3.2.3.c) Score plot

This result confirms the model being and indicator for economic prosperity and the correct choice of the indicators. Moreover this result might be used to quantify to what extend the label “global city” applicable for a certain city.

3.2.4. "Capitalise best"

"Capitalise best" is to show how well a city transforms their assets into a high GDP for the population. It has been proved that most European cities are efficient. Here input data are the indicators; output is the GDP per capita.

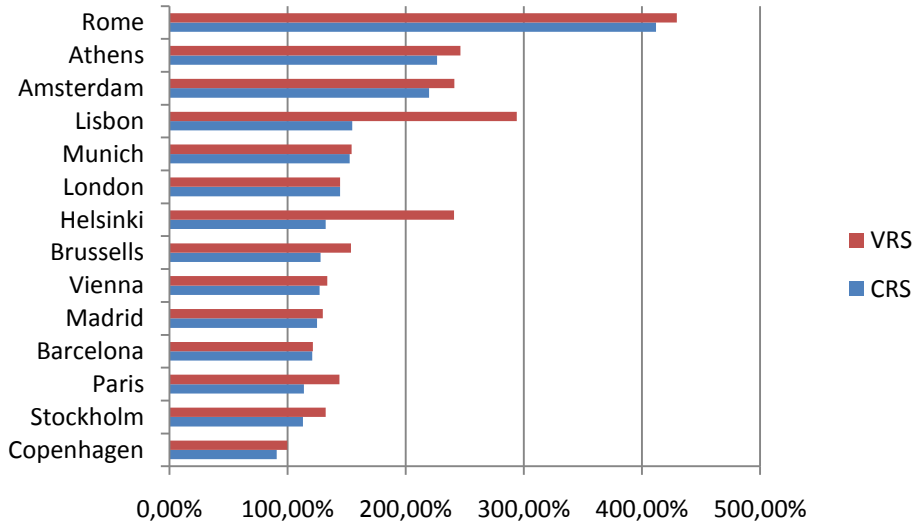
The table 3.2.4.a) shows the GDP per capita in Purchasing Power Parities (See chapter 2.3.2.3)



The table 3.2.4.b) shows the population, the TTA scores (input), the GDP per capita (output) and the final "capitalise best" scores. For the CRS scores the "output CCR" model has been used for the calculation; for the VRS scores the "input BBC" model.

City	Population	Indicators	GDP per capita	Capitalise best (CRS)	Capitalise best (VRS)
Vienna	2265524	all indicators are inputs	0,81	127,08%	133,58%
Brussells	3407432		0,76	127,94%	153,68%
Copenhagen	1825814		0,77	90,84%	99,88%
Helsinki	1467453		0,85	132,30%	241,05%
Paris	11598866		0,90	113,99%	143,86%
Munich	2714015		1,00	152,61%	154,35%
Athens	4032456		0,68	226,61%	246,37%
Rome	4013057		0,70	412,01%	429,58%
Amsterdam	3583930		0,83	219,84%	241,10%
Lisbon	2794226		0,56	154,75%	294,08%
Madrid	6052583		0,73	125,14%	130,01%
Barcelona	5257062		0,66	120,90%	121,47%
Stockholm	1918104		0,88	113,07%	132,31%
London	13156242		0,90	144,57%	big

Table 3.2.4.c) CRS and VRS score



Rome has a very high score. This shows that either Rome very efficiently transforms the indicators into GDP, or they profit from factors that are not integrated in the "TTA" model. Surprisingly Copenhagen and Stockholm fall behind, not being able to generate a high GDP per capita with their assets. Maybe their high values on the indicators doesn't contribute as much to their GDP as assumed. Considering variable returns to scale, Lisbon Helsinki and Stockholm score better due to methodology. Here variable returns to scale assume that it is harder to create a higher GDP with bigger city size as well as greater indicators.

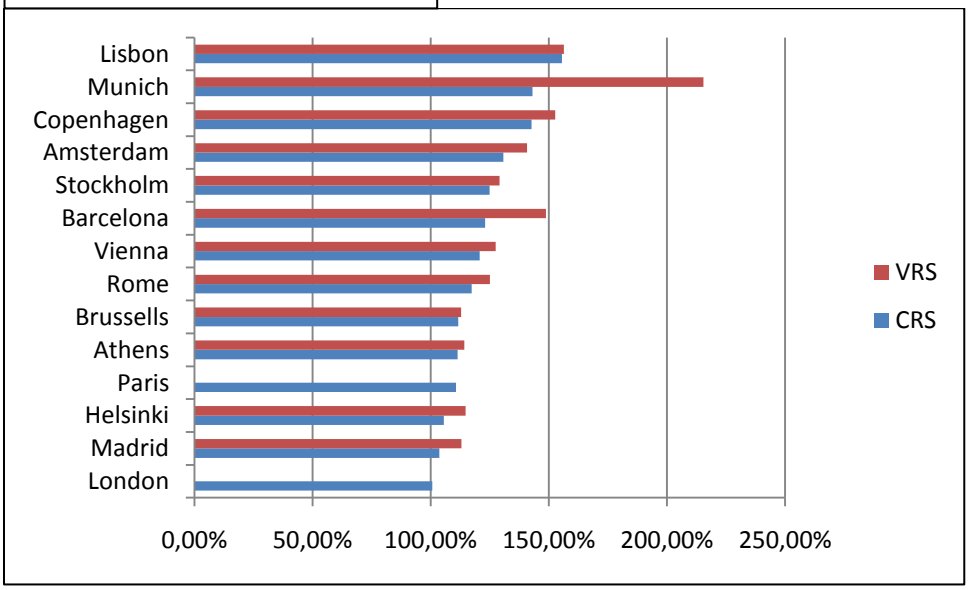
3.2.5. "Invest best"

This chapter explores how well cities use their GDP. Input data here is the GDP per capita; the outputs are all the indicators. This way it can be made visible how well cities invest in the right fields leading to high indicators. As every city has their own preferences, all indicators are considered evenly. Again a CRS and VRS analysis has been conducted. VRS input data is the GDP and outputs are the net values of the indicators (All data has been multiplied with the respective population).

The table 3.2.5.a) shows the GDP per capita and the final "invest best" scores

City	Population	GDP per capita	Indicators	Invest best (CRS)	Invest best (VRS)
Vienna	2265524	0,81	all indicators are outputs	120,79%	127,53%
Brussells	3407432	0,76		111,72%	112,85%
Copenhagen	1825814	0,77		142,70%	152,73%
Helsinki	1467453	0,85		105,53%	114,73%
Paris	11598866	0,90		110,79%	big
Munich	2714015	1,00		143,11%	215,50%
Athens	4032456	0,68		111,35%	114,19%
Rome	4013057	0,70		117,30%	125,09%
Amsterdam	3583930	0,83		130,80%	140,82%
Lisbon	2794226	0,56		155,60%	156,42%
Madrid	6052583	0,73		103,68%	113,06%
Barcelona	5257062	0,66		123,06%	148,85%
Stockholm	1918104	0,88		124,93%	129,10%
London	13156242	0,90		100,73%	big

Table 3.2.5.b) CRS and VRS score



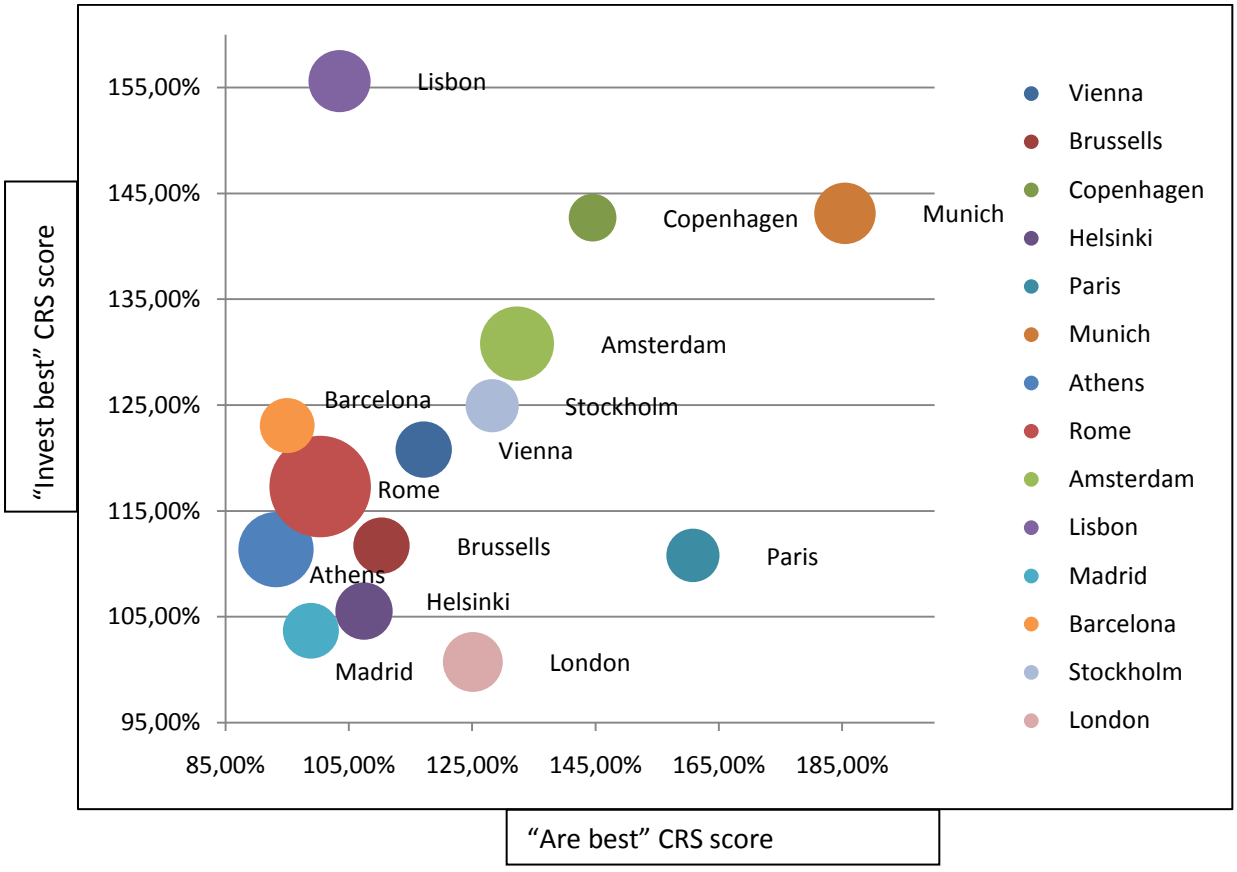
Lisbon is the most efficient to invest in the “TTA” indicators. Least money is spent elsewhere or is wasted. On the bottom we find Paris, Helsinki, Madrid and London. They might invest their GDP elsewhere or are governed less efficiently.
Considering variable returns to scale, Munich, being in the region of decreasing returns to scale, is far ahead in relation to the other cities. Here, the amount of the gross GDP is considered, as the cities’ GDP per capita is multiplied with the respective population. Applying the VRS calculation without multiplying with the population doesn’t produce suitable results, as nearly all cities are first on at least one indicator and therefore a VRS score is not computable (See 2.4.3.1).

4. Conclusion

The various possibilities of DEA in city benchmarks have been shown. With the indicators per capita, the GDP per capita and the population several analysis are possible.

- The first analysis, "**are best**", is a detailed examination of strengths and weaknesses of a city and has the highest information value.
- The second analysis, "**capitalise best**", investigates how effectively the individual assets are transformed into monetary value. Inhomogeneous results reveal that not all determining factors are considered.
- The third analysis, "**invest best**", shows how efficiently money is invested in the indicators. The results reminds of the GDP growth, but as there are many factors determining GDP growth that are not considered in this model, the result can only be taken as an approximation.

The chart 4.a) shows all 3 analyses combined



Here the results of the 3 Benchmarks are rendered visible. The x-axis presents the CRS "are best - edge" scores, the y-axis presents the "invest best" scores and the bubble size presents the "capitalise best" scores. Compared to the table 2.2.b, the southern European cities Madrid, Athens, Rome and Barcelona are behind on GDP growth. It has been said in chapter 2.2 that those cities are at a different stage of development than the other European cities.

In terms of GDP growth, different factors play also a significant role other than the investment in the indicators. Also the influence of the size of the GDP per capita was not integrated. Therefore the "invest best" score can only be seen as an approximation of the GDP-growth. Nevertheless a comparison to chart 2.2b) shows a strong resemblance.

The main analysis, the "are best" analysis, provides an insight of the cities' strengths and weaknesses for multiple purposes: Here Cities see where they stand for eventual improvements, urban nomads may look into that analysis and chose a city to work and live according to their preferences and enterprises may get a clear picture of where to invest, given their needs and preferences.

Furthermore the analysis allows establishing two sets of groups

Neglecting variable returns to scale:

Group Euro dominant: Stockholm, Copenhagen, Paris
Group Euro efficient: Brussels, Munich, Amsterdam, London
Group Euro catch-ups: Vienna, Helsinki
Group Southern catch-ups: Rome, Madrid, Barcelona, Athens, Lisbon

Considering variable returns to scale:

Group Euro VRS efficient: Amsterdam, Munich, Copenhagen, Stockholm, Brussels, Vienna
Group Euro VRS catch-ups: Rome, Barcelona, Lisbon, Athens

City	CRS score	VRS score
Munich	185,45%	241,18%
Paris	160,79%	big
Copenhagen	144,51%	146,43%
Amsterdam	132,29%	134,80%
Stockholm	128,23%	129,05%
London	125,12%	big
Vienna	117,16%	127,38%
Brussells	110,29%	110,45%
Helsinki	107,48%	125,45%
Lisbon	103,49%	104,92%
Rome	100,35%	111,89%
Madrid	98,86%	101,73%
Barcelona	95,02%	110,17%
Athens	93,19%	95,37%

Chart 4b)

From the additional analysis, where all indicators are outputs, the ranking in chart 4b) is drawn.

Here Munich heads the ranking, followed by Paris and Copenhagen. In chapter 3.2.3 it has been shown that besides economic strength, the attributes of a global city could be identified to influence this score. Chart 4c) shows again the values of all the cities on the two principal components "economic health" and "global city". Chart 4d) shows the cities' score on the "Global city index" presented in chapter 1.1.2. and the cities' GDP. Only the cities listed in the "Global city index" are shown here.

Chart 4c) Principal Components of the TTA-Model

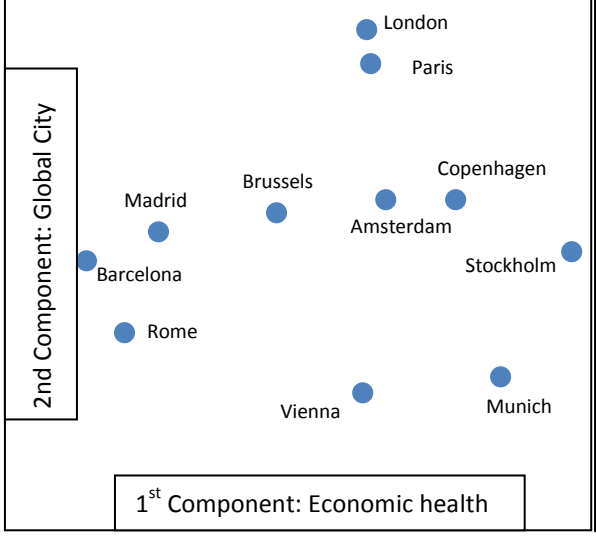
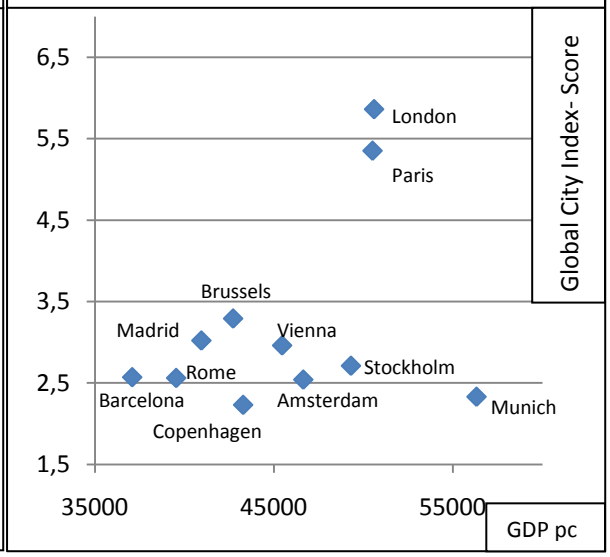


Chart 4d) GDP/Global City Index



The comparison of those two charts reinforces the interpretation of the principal components as there is a lot of resemblance. Only Amsterdam, Stockholm and Copenhagen perform considerably better in the TTA ranking. This might be due to the influence of the sustainability score (3.2.1.5.) where those three cities together with Vienna head the ranking.

To conclude, DEA is very suitable for city benchmarks and provides good results compared to existing and recognized rankings with comparably low effort. The “3 Benchmark” analysis goes beyond simply producing a ranking and respects diversity and individual preferences. It is rich in information and provides in depth analysis, even if some results need to be taken with caution. Furthermore in this paper the various possibilities of DEA in city benchmarking have been portrayed. This paper has shown that the Data envelopment analysis is an adequate tool for city benchmarking and hopefully paves the way for more analyses.

Regarding the “TTA” model, the benchmark still needs to be improved.

- The data on regions is still inhomogeneous. A benchmark where alls indicators are drawn either from the Eurostat’s “Urban Audit” or the OECD’s “Metropolitan region” dataset would be desirable.
- Data for attraction and cultural participation is incomplete. Either there needs to be found a way to complete existing datasets or alternative indicators need to be found.
- Munich’s strong results show it is misleading to take the selection of cities as a representative cross section. In this set of cities Munich is the only city with an extremely strong industry. Therefore it scores much higher than the other cities. If for example Milan would be included in this benchmark, the results would be more balanced. Unfortunately data was incomplete.
- It would also be desirable to establish a global benchmark, taking into account all major cities in the world. This benchmark could provide dominant cities for every economic stage, aspect and preference of a city.

5. Appendix

5.1. Mercer's quality of living study[31]

5.1.1. Factors determining the score

1. Consumer goods
    a. Food (Meat and Fish)
    b. Food (Fruit and vegetables)
    c. Daily consumption items
    d. Alcolic beverages
    e. Automobiles
2. Economic environment
    a. Currency Exchange regulations
    b. Banking Services
3. Housing
    a. Housing
    b. Household appliances and furniture
    c. Household maintenance and repair
4. Medical and health considerations
    a. Hospital Services
    b. Medical Supplies
    c. Infectious diseases
    d. Water potability
    e. Waste removal
    f. Sewage
    g. Air pollution
    h. Troublesome and destructive animals and insects
5. Natural environment
    a. Climate
    b. Record of natural disasters
6. Political and social environment
    a. Relationship with other countries
    b. Internal Stability
    c. Crime
    d. Law enforcement
    e. Ease of entry and exit
7. Public services and transport
    a. Electricity
    b. Water availability
    c. Telephone
    d. Mail
    e. Public Transport
    f. Traffic congestion
    g. Airport

……

[31] Mercer, Quality of Living worldwide city rankings 2010 – Mercer survey, http://www.mercer.com/press-releases/quality-of-living-report-2010#City_Ranking_Tables (23rd of March 2011)

a. Variety of restaurants
b. Theatrical and musical performances
c. Cinemas
d. Sport and leisure activities

9. Schools and education
10. Socio-cultural environment
    a. Limitations on personal freedom
    b. Media and censorship

5.1.2. Mercer Quality of living Ranking

Rank 2010	City	Country	Qol index 2010
1	VIENNA	AUSTRIA	108,6
2	ZURICH	SWITZERLAND	108
3	GENEVA	SWITZERLAND	107,9
4	VANCOUVER	CANADA	107,4
5	AUCKLAND	NEW ZEALAND	107,4
6	DUSSELDORF	GERMANY	107,2
7	FRANKFURT	GERMANY	107
7	MUNICH	GERMANY	107
9	BERN	SWITZERLAND	106,5
10	SYDNEY	AUSTRALIA	106,3
11	COPENHAGEN	DENMARK	106,2
12	WELLINGTON	NEW ZEALAND	105,9
13	AMSTERDAM	NETHERLANDS	105,7
14	OTTAWA	CANADA	105,5
15	BRUSSELS	BELGIUM	105,4
16	TORONTO	CANADA	105,3
17	BERLIN	GERMANY	105
18	MELBOURNE	AUSTRALIA	104,8
19	LUXEMBOURG	LUXEMBOURG	104,6
20	STOCKHOLM	SWEDEN	104,5
21	PERTH	AUSTRALIA	104,2
21	MONTREAL	CANADA	104,2
23	HAMBURG	GERMANY	104,1
24	NURNBERG	GERMANY	103,9
24	OSLO	NORWAY	103,9
26	CANBERRA	AUSTRALIA	103,6
26	DUBLIN	IRELAND	103,6
28	CALGARY	CANADA	103,5
28	SINGAPORE	SINGAPORE	103,5
30	STUTTGART	GERMANY	103,3

31	HONOLULU	UNITED STATES	103,1
32	ADELAIDE	AUSTRALIA	103
32	SAN FRANCISCO	UNITED STATES	103
34	PARIS	FRANCE	102,9
35	HELSINKI	FINLAND	102,6
36	BRISBANE	AUSTRALIA	102,4
37	BOSTON	UNITED STATES	102,2
38	LYON	FRANCE	101,9
39	LONDON	UNITED KINGDOM	101,6
40	TOKYO	JAPAN	101,4
41	MILAN	ITALY	100,8
41	KOBE	JAPAN	100,8
41	YOKOHAMA	JAPAN	100,8
44	BARCELONA	SPAIN	100,6
45	LISBON	PORTUGAL	100,3
45	CHICAGO	UNITED STATES	100,3
45	WASHINGTON	UNITED STATES	100,3
48	MADRID	SPAIN	100,2
49	NEW YORK CITY	UNITED STATES	100
50	SEATTLE	UNITED STATES	99,8

5.2. Global Cities Index – The Urban elite[32]

An Index of Foreign policy together with AT Kearney and the Chicago Council on Global Affairs

1. Business activity (weight 30%)
    a. value of its capital markets
    b. number of Fortune Global 500 firms headquartered
    c. number of international conferences held
    d. flow of goods (via airports and ports)
    e. volume of the goods that pass through the city
2. Human Capital, (weight 30%)
   or how well the city acts as a magnet for diverse groups of people and talent
    a. size of a city's immigrant population
    b. quality of the universities
    c. number of international schools
    d. international students population
    e. percentage of residents with university degrees
3. Information exchange (weight 15%)
   -how well news and information is dispersed about and to the rest of the world
    a. number of international news bureaus
    b. level of censorship
    c. amount of international news in the leading local papers
    d. the broadband subscriber rate
4. cultural experience, (weight 15%)
   or the level of diverse attractions for international residents and travellers
    a. how many major sporting events a city hosts
    b. the number of museums
    c. the number of performing arts venues
    d. the number of diverse culinary establishments it boasts
    e. sister city relationships it maintains
5. political engagement (weight 10%)
   -measures the degree to which a city influences global policymaking and dialogue
   Number of
    a. embassies and consulates
    b. major think tanks
    c. international organizations and local institutions with international reach
    d. political conferences

[32] AT Kearney, The AT Kearney Global Cities Index 2010 – The Urban Elite

5.2.1. Global City Index Ranking[33]

Rank 2010	Cities	Score	Rank 2010	Cities	Score
1	New York	6,22	33	Munich	2,33
2	London	5,86	34	Miami	2,33
3	Tokyo	5,42	35	Sao Paulo	2,32
4	Paris	5,35	36	Bangkok	2,31
5	Hong Kong	4,14	37	Copenhagen	2,23
6	Chicago	3,94	38	Houston	2,2
7	Los Angeles	3,9	39	Taipei	2,19
8	Singapore	3,45	40	Atlanta	2,17
9	Sydney	3,44	41	Istanbul	2,14
10	Seoul	3,4	42	Milan	2,06
11	Brussels	3,29	43	Cairo	1,96
12	San Francisco	3,26	44	Dublin	1,84
13	Wahington, D.C.	3,25	45	New Delhi	1,73
14	Toronto	3,13	46	Mumbai	1,69
15	Beijing	3,12	47	Osaka	1,65
16	Berlin	3,03	48	Kuala Lumpur	1,62
17	Madrid	3,02	49	Rio de Janeiro	1,6
18	Vienna	2,96	50	Tel Aviv	1,59
19	Boston	2,78	51	Manila	1,48
20	Frankfurt	2,78	52	Johannesburg	1,47
21	Shanghai	2,78	53	Jakarta	1,44
22	Buenos Aires	2,73	54	Bogota	1,3
23	Stockholm	2,71	55	Caracas	1
24	Zurich	2,68	56	Nairobi	0,93
25	Moscow	2,61	57	Guangzhou	0,81
26	Barcelona	2,57	58	Bangalore	0,76
27	Dubai	2,56	59	Lagos	0,69
28	Rome	2,56	60	Karachi	0,67
29	Amsterdam	2,54	61	Ho Chi Minh City	0,66
30	Mexico City	2,41	62	Shenzhen	0,63
31	Montreal	2,38	63	Kolkata	0,61
32	Geneva	2,36	64	Dhaka	0,57
			65	Chongqing	0,25

[33] AT Kearney, The AT Kearney Global Cities Index 2010 – The Urban Elite, 2010

5.3. Influence of the participation rate

Table 5.3.a) shows the difference of the CRS “are best “score considering the participation rate. For the CRS scores the “output CCR” model has been used for the calculation.

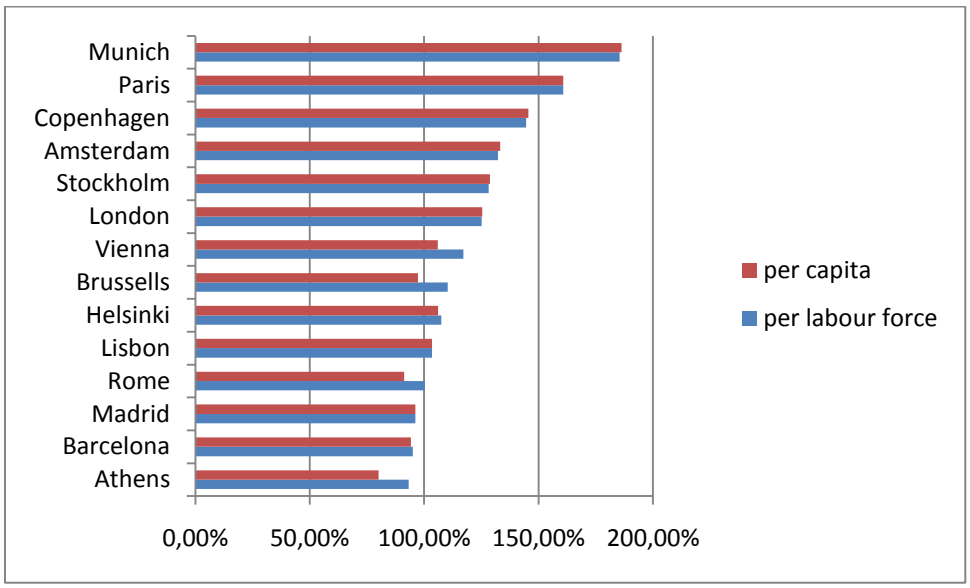
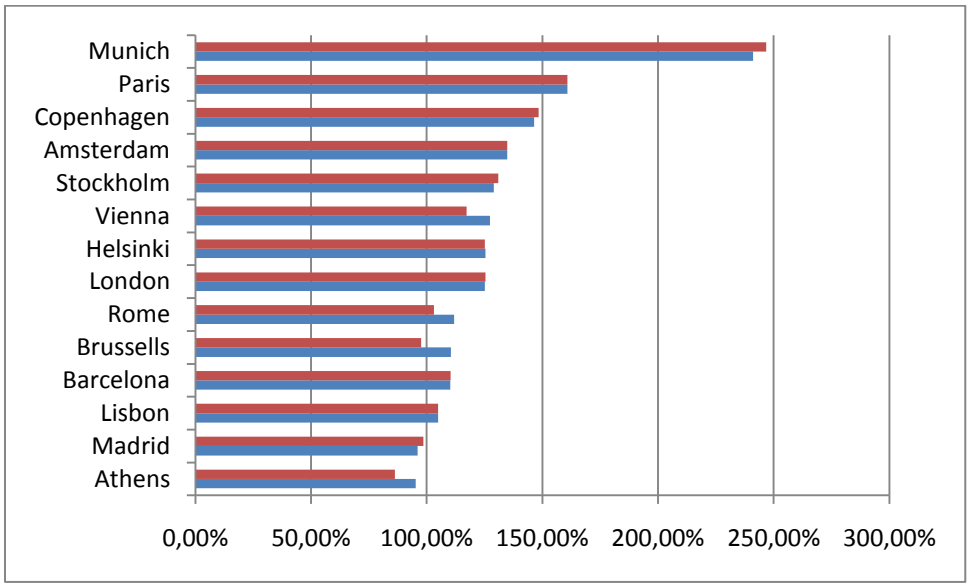


Table 5.3.b) shows the difference of the VRS “are best “score considering the participation rate. For the VRS scores the “input BBC” model has been used for the calculation.



5.4. High and medium high technology manufacturing

The OECD innovation indicators are drawn from the Eurostat's "High-technology" and "knowledge based services" aggregations. The data is based on NACE Rev. 2 (Nomenclature statistique des activités économiques dans la Communauté européenne). "*NACE is the acronym used to designate the various statistical classifications of economic activities developed since 1970 in the European Union"* [34]

Aggregations of manufacturing based on NACE Rev. 2

Eurostat uses the following aggregation of the manufacturing industry according to technological intensity and based on NACE Rev. 2 at 3-digit level for compiling aggregates related to high-technology, medium high-technology, medium low-technology and low-technology.

High-technology
***21** Manufacture of basic pharmaceutical products and pharmaceutical preparations*
***26** Manufacture of computer, electronic and optical products*
***30.3** Manufacture of air and spacecraft and related machinery*
Medium-high-technology
***20** Manufacture of chemicals and chemical products*
***25.4** Manufacture of weapons and ammunition*
***27 to 29** Manufacture of electrical equipment, Manufacture of machinery and equipment n.e.c.,*
Manufacture of motor vehicles, trailers and semi-trailers
***30** Manufacture of other transport equipment **excluding 30.1** Building of ships and boats, and*
***excluding 30.3** Manufacture of air and spacecraft and related machinery*
***32.5** Manufacture of medical and dental instruments and supplies* [35]

[34] Eurostat, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/NACE_backgrounds (23rd of March 2011)
[35] Eurostat, 'High-technology' and 'knowledge based services' aggregations based on NACE Rev. 2, January 2009 available at http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/htec_esms_an3.pdf (23rd of March 2011)

5.5. Perception of foreigners

This chapter is added to the Annex treating the perception of foreigners depending on percentage and origin. This chapter is very delicate and shows the complexity of the problem and should give incentive for further research.

In order for a city to compete internationally, it needs to attract and retain global talent. But what makes people show a positive attitude towards foreigners, for example stating that foreigners are good for their city?

First of all there is a high correlation between the perception that foreigners are good for the city and that they are well integrated (r=69,5%, see table 5.5.a)). The more foreigners are integrated, mingle with locals, participate in cultural activities and contribute to common values, the better they are perceived. It also seems that the more foreigners there are in a city, the worse they are perceived (table 5.5.b)). This becomes even clearer if only foreigners from a country with a low Human development Index (HDI, explained in the next chapter) are considered (table 5.5.c)). These figures are to be treated very carefully – one might get a feel for the delicacy and complexity of the issue.

Table 5.5.a) Correlation between integration and perception

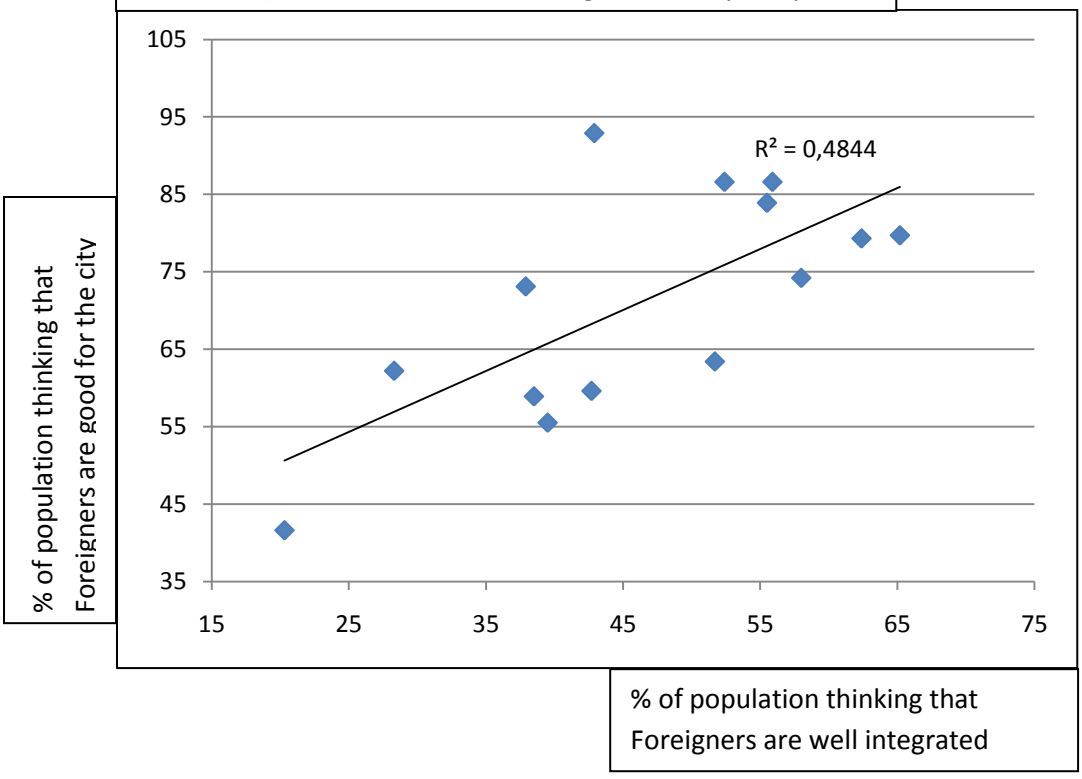


Table 5.5.b) Correlation between percentage of foreigners and perception

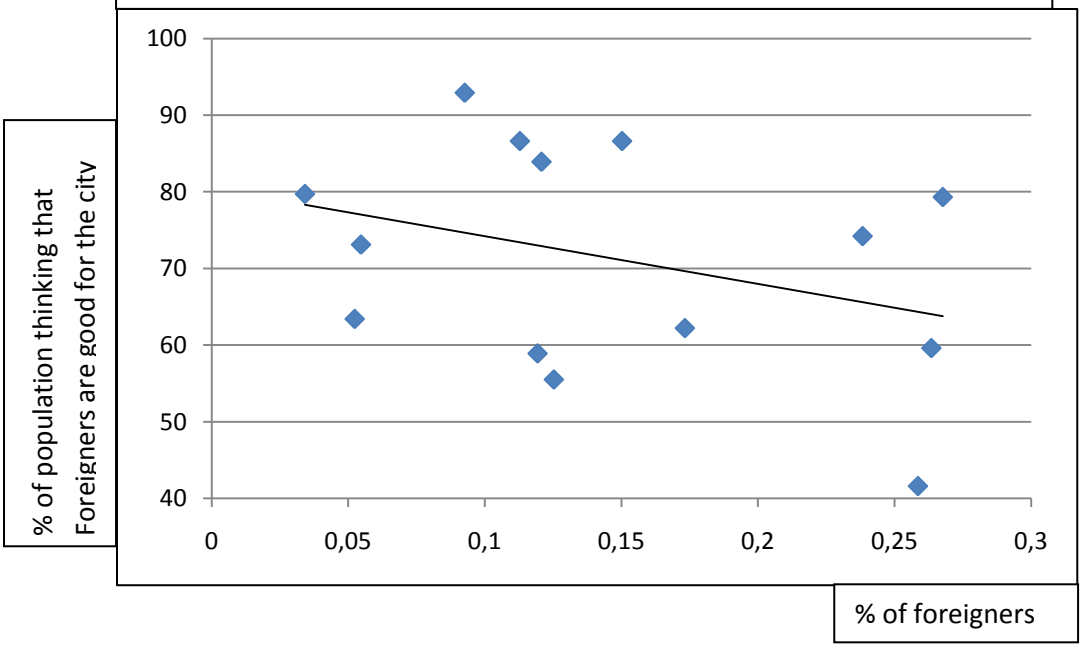
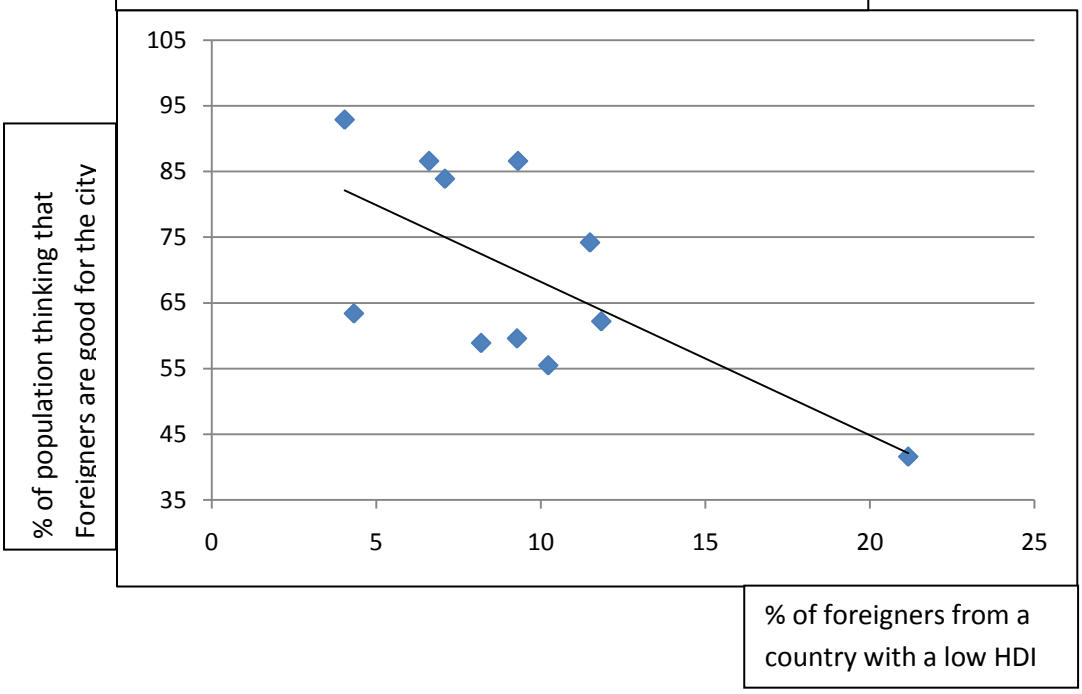


Table 5.5.c) Correlation between percentage of foreigners from a country with a low HDI and perception



5.5.1. Human Development Index (HDI)

The Human development Index is an index for the development of a country by the United Nations.

"The first Human Development Report introduced a new way of measuring development by combining indicators of life expectancy, educational attainment and income into a composite human development index, the HDI. The breakthrough for the HDI was the creation of a single statistic which was to serve as a frame of reference for both social and economic development. The HDI sets a minimum and a maximum for each dimension, called goalposts, and then shows where each country stands in relation to these goalposts, expressed as a value between 0 and 1."[27]

[36] United Nations, Human Development Reports, http://hdr.undp.org/en/statistics/hdi/ (23rd of March 2011)

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