Inequality, Technology and Job Polarization of the Youth Labor Market in Europe.

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Abstract

This paper presents a connecting methodology in order to trace the emerging dynamics of inequality for the youth populace of Europe. We determine that the development of these dynamics are directly affected by the advancement of technology, and especially related to Information and Communication Technologies (ICTs), owing to their broad encompassing effects on various sectors of employment, education and societal structures. Firstly, the drivers of technological progress were analysed comparing 28 European countries simultaneously over a period extending from 2007 to 2013. Secondly, the relative positioning of these countries with respect to their technological standing was analysed using macro socio-economic indicators, in order to trace the relationship between technological advancement and their comparative levels of inequality for the youth population of their countries. Finally, a methodology was developed in order to ascertain the validity of our findings with the aid of a comprehensive indicator that encapsulates the factors governing the technological standing of a country. These exercises were performed on a granular distribution of the European youth populace and over a range of sectors of employment, in order to provide a heuristic connection between education, employment, income levels and ICT.

Key works: Youth, Job Polarization, Inequality, Education, Wages, Sectors, ICT, Knowledge-Intensive services, Clustering.

1 - Introduction

The fall out of the economic and financial crisis has highlighted the risks for those with weakest labour market status – the young and those with the lowest levels of education. These impacts follow on a longer-term trend of increasing inequality with public debates increasingly focused on the earnings of the "Top 1%" in developed countries and the increasing share of national income attributed to this group. As world markets begin to see signs of improvement following the economic crisis of 2008, the pace of economic growth and the employment rate for young people in Europe has continued to stagnate (Cedefop, 2010). Coupled with this stagnation is the fact that income inequality has continued to rise in spite of the implementation of austerity measures (ETUI, 2014). As Europe enters a deflationary period for the first time since 1997, the European Central bank is in the process of adopting a €1.14 Trillion quantitative easing program. However, a more begetting question to be asked is what more do governments need to do in order to improve the labour conditions on the youth labour market?

The impact technology and more specifically ICT technology has had on inequality and changing the structural foundations of the labour market, has been a central theme for researchers (see, Acemoglu, 2010; Autor et al., 2003; Michaels, 2010). These studies have focused on understanding the impact of advancing technology on skills, education and job structures. In this regard, a number of arguments including the Skill-Biased Technological Change (SBTC) hypothesis and the Autor Levy Murnane (ALM) hypothesis have underlined how advancements in technology reduce the demand for unskilled labour and increase the income compensation for skilled labour. While Acemoglu (1998) established the correlation between skill acquisition and technological change, Autor and Acemoglu (2010), were able to show that improvements in technology were leading to the creation of a polarized labour market, where growth was seen in jobs sectors that required high skills. Autor (2014) also found that an increasing demand was seen in jobs that involved 'cognitive flexibility', while at the same time, the demand for low-skill jobs requiring 'non-routine manual tasks' also grew, creating a dip in the demand for jobs that involved tasks attributed to medium skill sets. However, more recent research from Beardy et al (2013) has shown that there is also a reversal in the demand for jobs requiring cognitive flexibility, owing to the advancement in Information and Communication Technologies (ICT).

Goos and Manning (2007) performed similar research in the context of Europe and found elements of similarity in their findings. They concluded that the routinization and polarization hypothesises formulated to measure the impact of ICT on Western economies, were having similar effects on European and OECD economies owing to the effects of globalization, offshoring and technological change. While these studies prove illuminating insights, the current bodies of research offer limited insights with regards to young people, particularly in the European context.

This paper aims to fill this gap by making a contribution along the several different dimensions related to the experience of inequality for the youth population. In order to gain insight into this segment of the European labour market, we examined the impact of technological change and the economic crisis with respect to the effect on inequality for young people. Our main objectives were

to document the patterns of change over this period and to identify the current situation of inequality that persists in European member states.

The rest of this paper is organized as follows: After this introduction, Section 2 offers a literature review in which the findings of previous researchers are summarized. Section 3 encompasses the whole range of our analysis drawing upon the literature at hand in order to determine the link between technological progress and inequality, for the youth of Europe, using a consolidated dataset of technological and labour market indicators for 28 EU countries. The countries were then compared to one another using Agglomerative Hierarchical Clustering techniques (AHC), in order to find the relative standing of one countries' technological situation to another.

Section 4 finally discusses the results of our finding and proposes the analysis of plausible mechanisms before concluding that beginning from a period before the crisis, technological advancement and ICTs in particular, are having an inextricable effect on the education levels, the employment opportunities and the earnings of young people and young adults of Europe

2 - Literature Review

Following the recent crisis, the subject of income inequality in Europe has prompted a current debate on the causes and consequences of higher inequality and its effects on future growth (Ostry et al., 2014). However concerns about inequality extend much further and have been at the forefront of EU policy debates since 2000.

Indeed, one of the challenges inherited by the Europe 2020 Strategy from the Lisbon strategy of 2000 was that of social exclusion (Ferrera et al., 2002).The concept of social exclusion captures the tensions between European economic growth and inequality. The primary motive behind addressing exclusion was to reduce poverty levels and the multi-faceted aspects of inequality, including access to opportunities, income levels, social security systems and economic mobility (R. Atkinson, 2000).

Since greater inequality is shown to make a greater proportion of the population vulnerable to poverty (Jaumotte et al., 2008), in the aftermath of the crisis it becomes increasingly pertinent to analyse social exclusion from the perspective of Kuznets Hypothesis[1] . The impact of inequality on the youth is particularly strong, as young people who face hardships in entering and staying in the workforce, consequently suffer from longer-term impacts with regards to individual wellbeing and social welfare (Irons, 2009).

In 2014, analysis by the European Trade Union Institute (ETUI[2]), showed that young people between the ages of 15 to 24 years in the EU27[3], had an '*extremely high level of unemployment'* when compared to prime age (25- 54 years) and older workers (55-64 years). Between 2008 and 2012, while total unemployment increased by 2.5 percentage points ('PP' from here on) in the EU, youth unemployment increased by over 5 PP, with over a quarter of the young people in over half of all European countries unemployed. The report terminated its findings by stating, '*unequivocally…young workers have been one of the groups most vulnerable to inequality, a situation that has been further aggravated by the crisis* (ETUI, 2014, [pp 29])*'.*

Further readings related to this subject reveal some stark outcomes. Recent research from the OECD[4] shows that following the crisis, the disposable income for all age groups in 24 EU countries[5] has fallen in real terms. However, with the exception of Poland, Norway and Austria, it was also seen that citizens in the EU member states between the ages of 18 to 25 years, have seen their disposable incomes greatly reduced when compared to rest of the population and especially when compared to

1 An economic hypothesis which states that as an economy develops; market forces first increase and then decrease economic inequality, following a bell curve trajectory.

2 ETUI is a Brussels based independent think-tank that focuses on research and training. ETUI is part of the European Trade Union Confederation (ETUC). Their analysis is based on data obtained from LFS and Eurostats.

3 According to Eurostat, there are over 94 million people aged between 15 and 29 years in Europe, of whom over 60 million are aged 15–24 years and over 33 million are aged 25–29 years.

4 'Rising Inequality: Youth and Poor fall further behind.' Insights from the OECD Distribution database, July 2014.

5 Countries considered in the 2014 OECD analysis include: Greece, Iceland, Ireland, Spain, Portugal, Estonia, UK, Italy, Hungary, Netherlands, Luxembourg, Slovenia, the Czech Republic, France, Denmark, Belgium, Germany, Norway, Finland, Turkey, Austria, Sweden, Poland and the Slovak Republic.

the elderly (over the age of 65 years). As a result, the distribution of pre-tax and transfer incomes remains significantly unequal after the crisis, especially in countries such as Greece and Spain.

The same report further goes on to emphasize that '*…over the last 25 years, the youth have replaced the elderly as the group experiencing the greatest risk of income poverty….(and) the recent crisis has accentuated that trend'* (OECD, 2014,[pp 6]). By analysing in detail the relative poverty rate for different age brackets of the OECD countries, the report also demonstrated how the risk of poverty has shifted from the elderly to the young, with the youth between the ages of 18 to 25 as the most adversely affected group. As 24 of the 34 countries included in this analysis are EU countries, the results are indeed quite relative to the EU context.

From the stand point of inequality in the EU, research from Stockhammer (2012) has also shown that income disparities within the EU27 have shown signs of reduction from 2008 to 2012. A surprising result of this analysis is that the group of countries in the end of the distribution with lowest income disparity do not include any member states that were greatly impacted by the crisis, e.g.: Greece, Cyprus, or Ireland; leading various researchers to hypothesise that increasing income inequality was one of the driving forces of the crisis (Goda, 2013) (OECD, 2011). These findings reveal that the situation on the youth labour market in Europe has been in a state of decline since the turn of the century, with market forces more favourable towards the prime age and older worker segments rather than the youth. (Degryse, 2013).

While previous literature focused on the causes of inequality have compared globalization (both trade and financial), offshoring[6] and technology as the three most common contributors to inequality[7], with the dominant view among labour economists being that technology was more important than trade as the driving force behind changes in the structure of employment (Desjonqueres, Machin and Van Reenen 1999; Autor and Katz 1999), and that technological change was biased towards skilled workers, leading to the hypothesis of skill-biased technological change (SBTC) (Berman, Bound and Machin 1998; Machin and Van Reenen 1998; Autor, Katz and Krueger,1998). More recently, studies have also focused on the role paid by wage premiums associated with higher education and cognitive ability (Osborne, 2013; Autor, 2014) and the effect of technology in offshoring employment.

To gain a better insight into the role of technology, offshoring and globalisation in accentuating inequality, studies such as those done by Jaumotte et al (2008) have examined survey data of the subcomponents of trade and financial globalisation, including comparative analysis of exports of

6 Offshoring differs from Outsourcing. While the former refers to the use of intermediate inputs imported from abroad, the latter refers to the use of intermediate inputs imported from abroad or produced domestically.

7There are numerous theoretical and empirical literatures with respect to income inequality. Some of the theoretical contributions reviewed include, Benabou (1996), Galor and Moav (2004), Galor and Zeira (1993), and Kremer and Chen (2002). The empirical contributions reviewed include Barro (2000), Forbes (2000), Roine and Waldenström (2008), Piketty (2003), and Piketty and Saez (2003) (2011) (2014).

manufacturing versus agriculture, and portfolio debt and equity flows versus foreign direct investment (FDI). They found that while trade liberalization and export growth are associated with income inequality, increased financial openness was associated with higher inequality.

However, the main finding of this line of research has been that the combined contribution of these factors towards income inequality was much lower than that of technological change, both in developed and developing countries[8]. While the spread of technology is by itself related to increasing globalisation, the study found that technological advancement was seen to have a unique and identifiable effect on inequality, especially in terms of wages, with greater technological progress increasing the premium paid on high-skill inputs and lowering the premium paid on low-skill inputs[9].

Technological change was thus observed to affect a significant segment (manufacturing and services) of the economy in developed countries by increasing the relative demand for higher skills and thereby intensifying income inequality. The study also found that better access to education and training could allow for sharing the benefits of globalization and technology as increased access to education was directly associated with more equal income distributions on average (Jaumotte et al, 2008).

While these studies were compiled to analyse the causes of inequality on a global scale, other studies by Goos et al (2011), have focused on analysing the causes of income inequality from the European context. The results of the study indicate that the rise in inequality across Europe is also largely attributable to technological change and that the results of globalization are relatively minor in comparison. However, both technological progress and globalization were seen to increase the relative demand for skills, and as a result, the main effect technology was having on the work structure in Europe, was the creation of a polarized workforce, in which employment shares for high- paid managers and low-paid personal services workers was rising, while the employment of shares of manufacturing and 'routine' office workers was seen to be falling. As with the global studies, this line of research has not taken into account the specificities of the effects of economic and technological change on the youth labour market.

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8 The data used for this study was assimilated from the *PovCal* database, and supplemented by data from the World Income Inequality (2005) and the Luxembourg Income Study (LIS) databases.

9 As per the European Migration Network (EMN), workers with a high skill level are those that create significant economic value through the work performed (human capital). Skilled labour is generally characterized by high education or expertise and high wages. Skilled labour involves complicated tasks that require specific skill sets, education, training and experience, may involve abstract thinking and are seen as complementary to ICT capital and the organizational forms that go with it. Examples include physicians, plumbers, attorneys, engineers, scientists, builders, architects and professors. Low skilled or Unskilled Labour includes the segment of the work force associated with a skill level of limited economic value for the work performed (human capital). Unskilled labour is generally characterized by low education levels and small wages.

The job polarising effects of these economic and technological changes was a topic of interest in the research community prior to the crisis (see, for example, Autor, Katz and Krueger, 1998). However, following the crisis, the subject gained increased traction with the work of Autor, Levy and Murnane, 2003 (ALM from here on) and Autor and Acemoglu (2010) playing leading roles with respect to advancing research in this domain.

The link between the relative demand for skills and technological advancement, in particular the 'skill bias' of technical change (SBTC), was first established with Tinbergen's (1974, 1975) founding work and the development of the canonical model (Autor and Acemoglu, 2010), which offered a structure to measure the changes in the return earned by workers with respect to their skill. The canonical model was especially useful in measuring the skill attribute of earnings as it offered a model to conduct comparative analysis of different worker groups simultaneously.

The evidence of the empirical success of the canonical model can be seen in the works of Katz and Murphy (1992), Autor, Katz and Krueger (1998), Autor, Katz and Kearney (2008), and Carneiro and Lee (2009), among others, where it helped account for salient changes in the distribution of earnings in the United States (Autor, 2010). However, despite the model's applicability, modern changes in labour markets and employment trends motivated the creation of a new model more attuned to the modern era, as one of the short comings found in the canonical model was its lack of a concrete definition for 'tasks'.

A task, as per Autor and Acemoglu (2010), is defined as a unit of work activity that produces an output, i.e.; good or service. In contrast, a skill is a workers endowment or capability to perform a task or various tasks. The author's went on to explain that the distinction between skill and task needed to formally addressed as a worker's skill to perform a task(s) was directly related to the quality of the good or service being produced and hence to the wages earned by the worker. They further went on to state that a worker's wages was thus related to his or her ability to perform multiple tasks, and to be able to change their skill set based on the changes in the labour market and the introduction of new technologies.

The classification and distinction between various tasks performed by workers was formally addressed by ALM in 2003. Their paper categorised tasks as 'routine' and 'non-routine', with routine tasks being defined as cognitive and manual activities that could be accomplished by following explicit rules, while non- routine tasks were defined as those tasks that required problem-solving and complex communication activities. Using this classification, they sub-divided all tasks performed by workers into four separate categories[10]: *(1) non-routine cognitive tasks, (2) routine cognitive tasks, (3) routine manual tasks and (4) non-routine manual tasks.*

10 As per the Occupational Information Network (ONET) database, Non-Routine or Abstract tasks are those that involve critical thinking, judgment/ decision making, complex problem solving, interacting with computers and thinking creatively. Routine task measures are by arm-hand steadiness, manual dexterity, finger dexterity, operation monitoring, and estimating the quantifiable characteristics of products, events, or information. Service task are further measured by

Using this classification ALM proposed the 'routinization' hypothesis and continued to argue convincingly that modern technology was capable of replacing human capital in routine tasks, i.e.; tasks that can be performed via step-by- step procedures or rules, but could not replace human capital in non-routine tasks. Furthermore, they provided evidence to support the fact that demand for labour input of routine cognitive and manual tasks in the U. S. economy had declined, while the demand for labour input of non-routine analytic and interactive tasks had risen.

By distinguishing and measuring the relative demand and supply mechanisms for tasks, the routinization hypothesis went on to prove that the effect of these demands on the labour market, had led to the creation of a 'polarized' work environment in which expansion was seen in the demand of high-skill and low-skills jobs, but coupled with a decline in the demand for routine or 'middle-skilled[11]' jobs, and that job polarization was leading to a shrinking concentration of employment in occupations in the middle of the skill distribution. The polarization effect also had an impact on the polarization of wage growth, with a relative growth in upper-tail and lower-tail earnings, relative to median or middle earnings. More recent research also shows that this process has gained pace in recent years, as per capita employment in middle-skill jobs continues to disappear (Jaimovich, 2014).

These changes in wage inequality over recent decades were not unique to the U.S.A. One of the main advantages in referring the work of Autor and Acemoglu (2010) is that the data used by them includes EU as well as US data. Furthermore, the authors focused on workers under the age of 40 years, as changes in occupation are typically first evident among workers closer to the stat of their career. Following this trajectory, Atkinson drew upon more recent and consistent data for 19 OECD countries, and reported that while there were substantial rises in upper-tail inequality across OECD countries, movements in the lower-tail varied more in sign, magnitude, and timing (Autor, 2010). From a European perspective Goos et al (2011), used data from 1993 -2006 for 16 European countries to establish that not only was job polarization pervasive, but also that the ALM routinization hypothesis had the most clarifying capability of understanding job polarization in Europe.

The growing body of empirical evidence exacerbating the leveraging effect technology has on inequality merits scrutiny in order to identify which gamut of technology is having the most influential role in this transitional shift. In this regards work done by Michaels, Natraj and van Reenen (2010), have attributed the dominant effect to Information and Communication

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social perceptiveness, service orientation, assisting and caring for others, establishing and maintaining interpersonal relationships, selling and performing for or working directly with the public.

11 Based on education and training levels, middle-skill jobs are those that generally require some education and training beyond high school but less than a bachelor's degree. These postsecondary education or training requirements can include associate's degrees, vocational certificates, significant on-the-job training, previous work experience, or some college, but less than a bachelor's degree. They are represented by the routine cognitive and manual tasks, defined in the earlier part of this paper.

Technologies (ICT) on the changing educational composition of employment at the international scale.

By analysing data from 11 different countries (including nine EU member states) over 25 years (1980 – 2004), this study can be compared to data analysed by Goos and Manning (2007) and Goos, Manning and Salomons (2010). As Goos and Manning (2007) considered occupations rather than educational groups, the results of their analysis were confined to explaining the polarization seen in the workforce. In order to account for these trends, Michaels et al, tested the ALM (2003) hypothesis and found that technology led inequality, was partly due to ICT complementing analytical tasks of high-skill workers and substituting routine tasks performed by middle skilled workers. Little effect was seen on low-skill jobs.

Based on their data[12], the authors also found that industries and countries with faster growth rates in ICT also experienced an increase in demand for college educated workers relative to workers with intermediate levels of education and that the falling quality-adjusted prices for ICT had a significant impact in causing this shift. The paper concluded that both ICT and Research and Development (R&D) had raised the relative demand for college educated workers and that consistent with the ICT-based polarization hypothesis, this increase had come mainly from the reduction in the relative demand for middle skilled workers rather than low skilled workers (Michaels et al, 2010).

The effects of technical change (proxied by ICT and R&D) on employment is consistent with other literature (see Draca, Bloom and van Reenen, 2009) that found that technology had a more explanatory capability in affecting skill demand. While the analysis by Michaels et al, further bolstered the routinization hypothesis, other work by Jaumotte et al (2008) had also shown that some of the key control variables in determining inequality included, technological development (measured by share of ICT capital in total capital stock), and access to education (measured by years spent in education by people 15 years and over and share of population with at least a secondary education).

Measuring this form of skill biased employment adaptability was the primary outcome of the work carried out by Autor and Acemoglu in 2010[13], where they introduced a framework to systematically understand the recent labour market trends and the impact of technology on earning premiums and employment opportunities. By building up on previous work (ALM, 2003); the authors explained that the necessity to create this new framework was quintessential to understand the effects of technological developments, and particularly the impact of (ICT), on middle skill workers.

This symbiotic relationship of technical change, skills and education is relative to the task dimension of employment and continues to be a significant predictor of employment flexibility and inequality. Thus, this makes the effect of ICT on education and employment a non-trivial effect (Goos et al, 2011).

12 The authors made use of the EUKLEMS database which provides information of workers based on college level, 'middle level' and low education levels.

13 To build a robust model, the author's used data related to skill demand and wage determination over five decades from USA and EU economies.

Although these studies establish the link between the effects of ICT on education and employment, the relationship between education and earnings is more nuanced. The polarization of employment coupled with the polarization of wages (Autor and Acemoglu, 2010), suggests that a workers occupation is the main determinant of their wages. This would suggest that a worker's educational level had a weaker role in determining occupation and earnings.

In order to gauge the explanatory power of educational attainment on wage determination, Autor and Acemoglu (2010), conducted their study by taking into consideration four control variables, which included years of schooling, educational attainment (some high school, high school grad, four-year college, post-college degree, etc) and dummy variables for 10 occupational categories[14] as well as 11 industry categories[15] , for both genders. By measuring the change in trends over a forty year period, they concluded that the occupation plays an increasingly important role in the evolution of both employment and earnings and that it was simply not a proxy for either education or industry[16] (Autor and Acemoglu, 2010)

The results of these findings allow us to draw parallels with the SBTC and ALM hypotheses along with other task-versus-skill literature. According to the SBTC hypothesis technology increases the demand for skilled labour and reduces the demand for unskilled labour thus lowering the wage compensation for the latter. The ALM Hypothesis on the other hand explains the routinization and polarizing effect of technology, while the Acemoglu and Autor (2010) study shows that it is skills and occupations that determine earnings and not just education. The pivotal role paid by education has been documented by various studies (see Jaumotte et al, 2008, Autor 2014). But the results of the past few studies show us that in the light of increasing technological change, skill adaptability and cognitive flexibility is playing an increasingly influential role in the inequality debate.

While the subject of inequality often looks at the 'top 1 percent', this approach overlooks the earning capacities of the remaining 99 percent and more specifically, the dramatic growth in wage premiums associated with higher education and cognitive ability. The past three decades of computerization and the profusion of ICT in organisations have increasingly raised the criticality of cognitive labour as it complements educated workers who excel at abstract problem solving and creative tasks. But when combined with the polarization effect, the net result is an increase in demand for formal education, technical expertise and cognitive flexibility and a devaluation of the skills of workers without a post-secondary education (Autor, 2014).

14 The occupational categories were selected as per the 4 task levels, namely: Non-Routine Cognitive Tasks- Managers, Professionals, Technicians; Routine Cognitive Tasks- Sales, Office and admin; Routine Manual Tasks- Production, craft and repair, Operators, fabricators and labourers; Non-routine Manual Tasks- Protective service, Food prep, buildings and grounds, cleaning, Personal care and personal services.

15 The industry categories were sub-divided as per the 4 tasks categories as well, namely: Non-Routine Cognitive Tasks- Professional, Managerial, and Technical Occupations; Routine Cognitive Tasks- Clerical, Administrative, and Sales Occupations; Routine Manual Tasks- Production, Craft, Repair and Operative Occupations; Non-Routine Manual Tasks - Service Occupations.

16 The authors also caution that as the measures for job tasks and offshorability are imperfect and differ across studies, the conclusions drawn at this stage of the literature should be viewed in a provisional light.

However, recent research (see Beaudry et al, 2013) is now indicating that although the supply of higher skilled workers has grown, a gradual slowing down in the demand for these workers is currently occurring. As a result, an increasing number of higher skilled workers are now performing tasks that qualify them as underemployed, while simultaneously pushing lower skilled workers out of the occupations that are associated with these tasks and in some cases, even pushing them out of the workforce completely.

By creating a model that emphasises technological change, the authors found that the skills downgrading process which forces high-educated workers into accepting routine jobs is because as technological progress has positive impacts on the productivity of cognitive tasks, it eventually leads to a decreasing path for the cognitive task employment rate. This contrasts with the evidence of an increase in demand in this sector (Autor et al, 1998).

The authors coin this development as a 'de-skilling' process since it involves cognitive workers with experience and already in the job market being obliged to move down the ladder in order to stay in employment. This has serious implications for new job seekers as not only is the entry bar raised higher for new entrants, but the number of opportunities available to them is also reduced (Beaudry et al, 2013).

From the youth perspective, the results of the Beaudry et al study clarify that from 1980 – 2000, the cognitive task intensity for college graduates increased gradually. However, following the year 2000, this trend has been in a state of decline which is further exemplified by an increasing number of college level workers finding themselves in routine and manual occupations rather than in cognitive occupations. The authors interpret this shift as young college graduates responding to the decline in demand for cognitive tasks by accepting alternative task assignments, which in turn has lowered the task price and thus adversely contributed to income inequality.

As individuals in routine cognitive occupations incur a higher probability of unemployment than individuals employed in non-routine cognitive occupations, the unemployment gap between these occupations is attributed to advancements in technology. However, more importantly, the question to be raised is if skill-biased technological change is being replaced by skill-substituting technological change, and if so, is education the answer to this change?

Returning to the 2014 ETUI report, we find that the changing trends with respect to de-skilling, the deleveraging of education, the reduction of employment opportunities and increasing wage inequality can be seen in Europe as well. This study found that both young people and young adults in the Baltic states with at least an upper secondary educational attainment displayed, on average at the EU28 level, a higher rate of NEETs than their peers with *lower* educational attainments. For young people in the EU, the situation overall was similar, with the gap between medium/high- skilled and low-skilled (at least lower secondary education, ISCED 0-2), groups found to have increased rapidly during the crisis.

The evidence from the literature reviewed empirically, shows us that from the perspective of inequality, the situation of the labour market in developed countries is currently being affected by

ICT technologies, the polarization effect of these technologies on tasks, and the increasing demand for rapid skill adaptability in the ambiance of the entrepreneurship-driven knowledge economy. In the next section we will attempt to analyse a majority of the EU countries with respect to these subjects and compare the positon of these EU member states from the standpoint of the youth labour market.

3 – The ICT led digital divide in European Economies

3.1 – Data, Indicators and Research Approach: This section analyses the EU's ICT standing and the youth labour market. Owing to the relevance of ICT to the employment market, we begin our analysis by clustering and relatively comparing the EU member states on the basis of their technological standing. For this purpose, we compiled a dataset of selected technology and labour market indicators for 28 EU member states[17], based on the insight gained from empirical research. By assessing the countries on their individual values for the technology indicators, allowed us to gain an awareness regarding the relative positioning of the countries with regards to technological advancement and helped identify spheres of commonality. The technology indicators were selected on the principles of ICT's impact on: (a) the economy; (b) employment; (c) societal usage; (d) usage in different industries/sectors. The data for this set was extracted from Eurostats. Table 1 lists the technology indicators.

Table 1- Technology Indicators. Source: Eurostats

Key	Variable	Unit	Source
T 1	Gross value added by Information and Communication Industry.	Percentage of gross domestic product (GDP)	Eurostats
T 2	Employment in technology and knowledge-intensive sectors at the national level.	Percentage of total employment	Eurostats
T 3	Employment in technology and knowledge-intensive sectors - Information and communication (ICT) industry.	Percentage of total employment	Eurostats
T 4	Individuals who used the internet for selling goods or services.	Percentage of individuals	Eurostats
T 5	Individuals who used the internet to purchase goods or services for private use in the 12 months.	Percentage of individuals	Eurostats
T 6	Employment in knowledge-intensive activities.	Percentage of total employment	Eurostats
T 7	Total high-tech Imports in million euros and as a percentage of total trade.	Percentage of total	Eurostats
T 8	Total high-tech Exports in million euros and as a percentage of total trade.	Percentage of total	Eurostats
T 9	Total R&D expenditure (GERD) in Business Enterprise, Government and Higher Education Sectors.	Percentage of gross domestic product (GDP)	Eurostats

17 The countries were selected on the basis of data availability for the relevant indicators. They include: Belgium, Bulgaria, the Czech Republic, Denmark, Germany ,Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and the United Kingdom.

As mentioned, the primary source for the data is from the Eurostats database, which includes other indicators relevant to the subject of ICT. However, owing to missing data for the years selected (before and after the crisis) or, in some cases, for the countries considered, some of these indicators could not be included into the dataset as our approach to data selection hinged on an effort to include the largest number of EU member states for the most recent time periods. A similar reasoning was administered when considering the exclusion of relevant ICT data from the OECD and ITU[18] databases, although the data from these sources will be compared with the findings of our analysis in later sections of this paper.

3.1.1 - Methodology of analysis

In an effort to compare the performance of countries with respect to technology related competitiveness and usage at institutional and at individual levels, Agglomerative Hierarchical Clustering (AHC) techniques were used on national-level data for the selected 28 EU member states. Firstly, the countries were clustered using Ward's method in order to group the countries according to the similitude of their values for the selected variables. The clusters where then further analysed using the Centroid Method in an effort to identify the influence of the afore-mentioned variables on each cluster. The process was carried out on data for 2007 and 2013, in order to trace the transitions of the country clusters over time.

AHC analysis allows us to identify the structure among a defined set of variables and identify country groups that share common characteristics. This makes it ideally suited for defining groups of countries with maximum homogeneity within the countries, while also having maximum heterogeneity between the countries. Ward's method was selected as the similarity is calculated as the Sum of Squares between clusters summed over all their variables. Hence, this method allows for the creation of country clusters with minimal intra- group variation. Having grouped the countries into clusters, the centroid method was then used to compare the character of the clusters with respect to the variables. The centroid method uses the cluster variate[19] to compare clusters as the variate is the set of variables that represents the clustered countries and hence measures the similarity between the clusters. The AHC analysis for 2007 and 2013 technology variables data resulted in the formation of 3 distinct clusters in both cases. The Dendogram's seen in Figure's 1.1 and 2.1 shows the position of the countries based on their dissimilarity, measured in Euclidean distance, as seen in the proximity matrices (Refer Appendices 1 & 2). Figures 1.2 and 2.2 show the profile of these clusters with respect to the technology indicators for 2007 and 2013. Tables 2 and 3 summarise the country groupings for both these periods.

18 The International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies. As a specialized agency for ICTs, ITU is an official source for global ICT statistics.

19 Cluster variate is the set of variables that represents the countries in a cluster and is used to measure the similarity between the clusters. As the variate only uses the variables to compare, it determines the character of the countries in a cluster. The cluster centroid is the average value of the countries contained in a cluster on all the variables in the cluster variate. This is the basis for the Centroid method, in which similarity between the clusters is measured as the distance between cluster centroids.

Figure 1.1

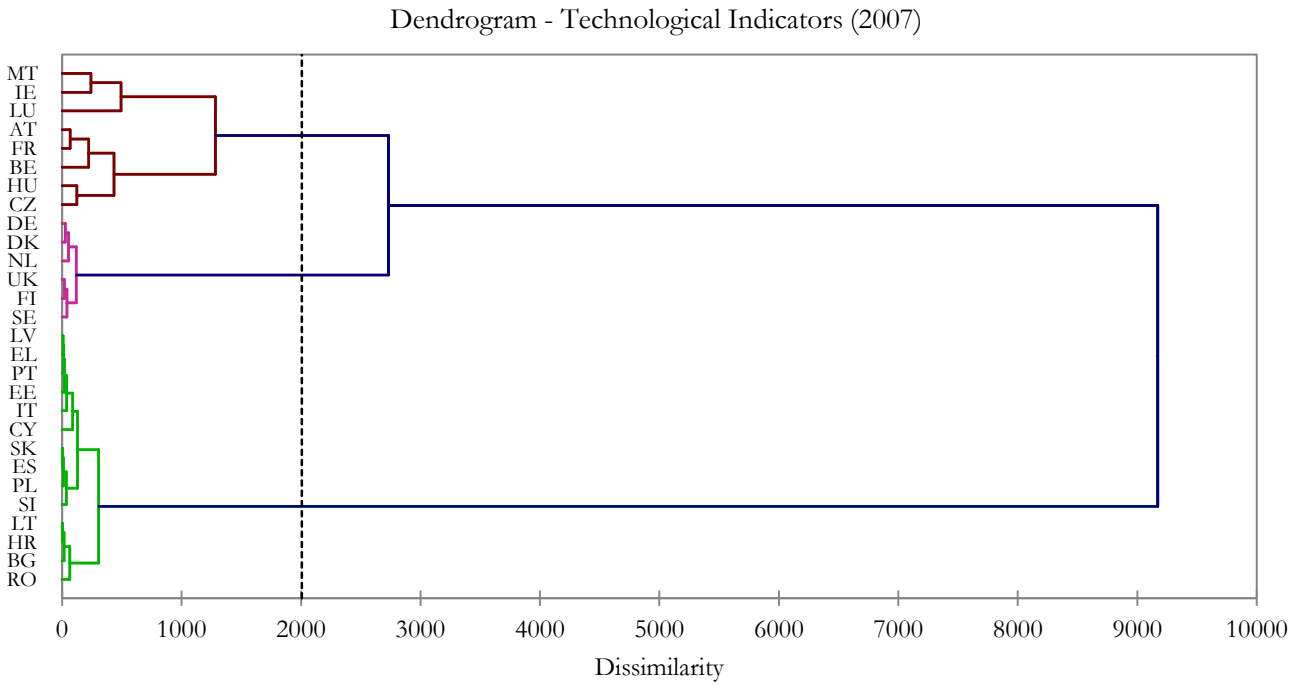


Table 2 - Clusters of EU member states based on individual values of Technology variables for 2007:

Cluster 1	BE	CZ	IE	FR	LU	HU	MT	AT						
Cluster 2	BG	EE	EL	ES	HR	IT	CY	LV	LT	PL	PT	RO	SI	SK
Cluster 3	DK	DE	NL	FI	SE	UK								

Figure 1.2

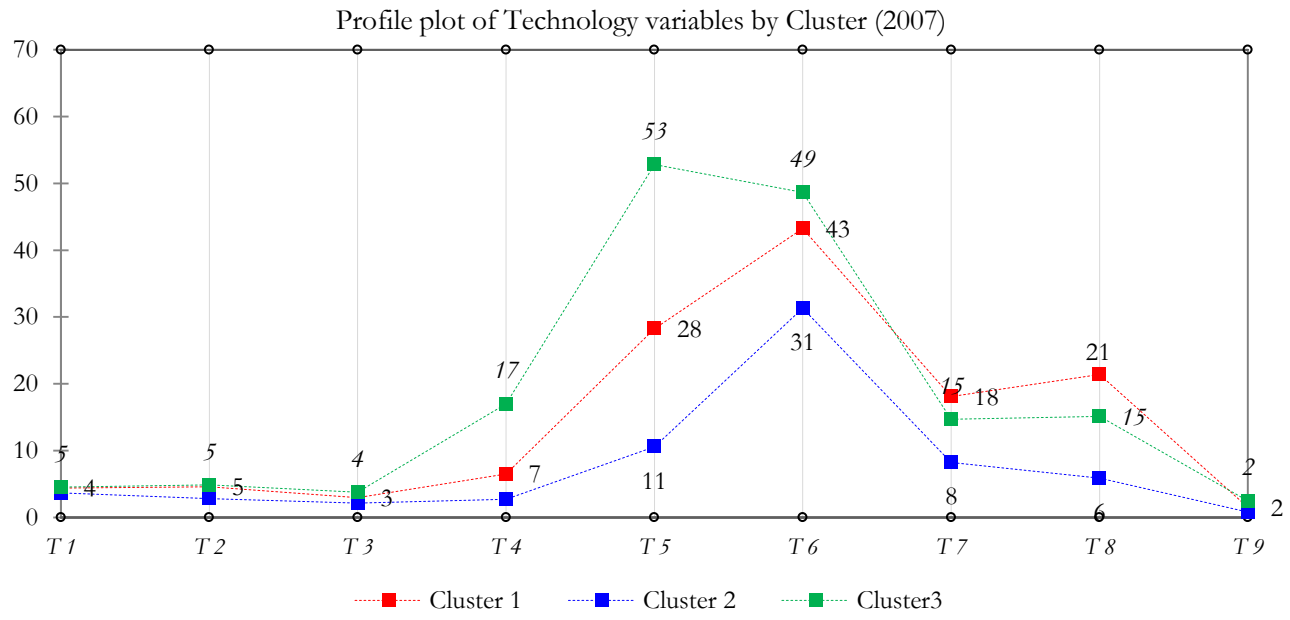


Figure 2.1

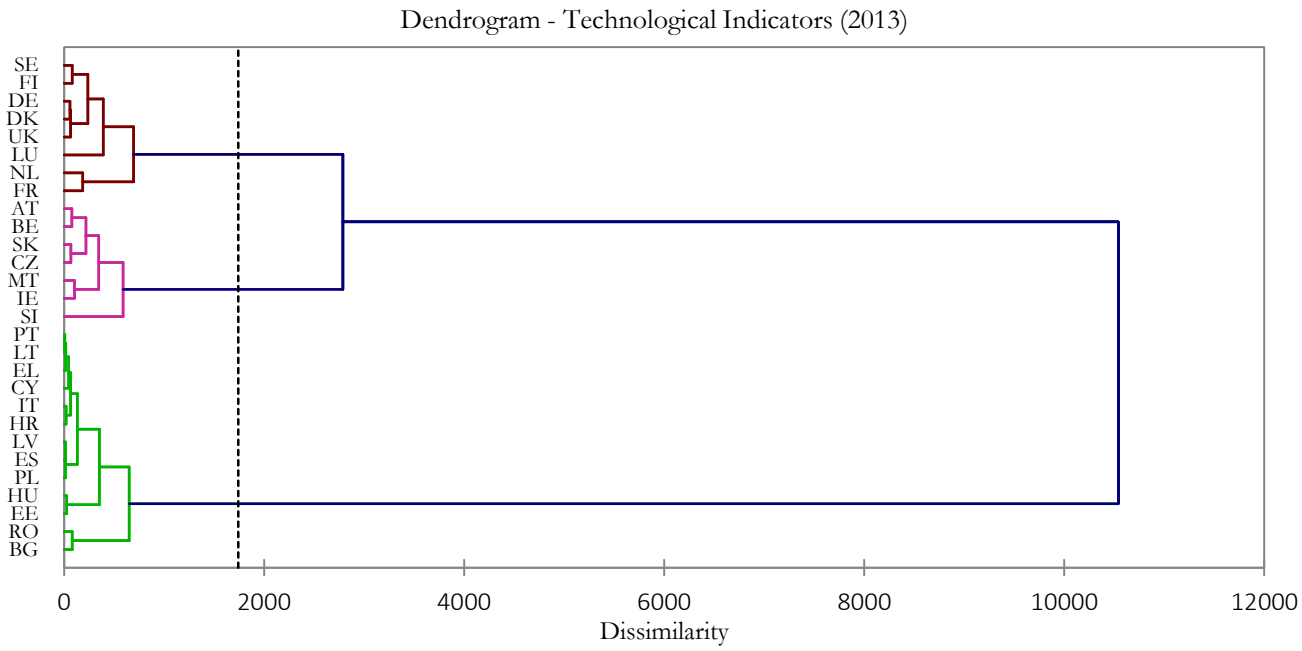
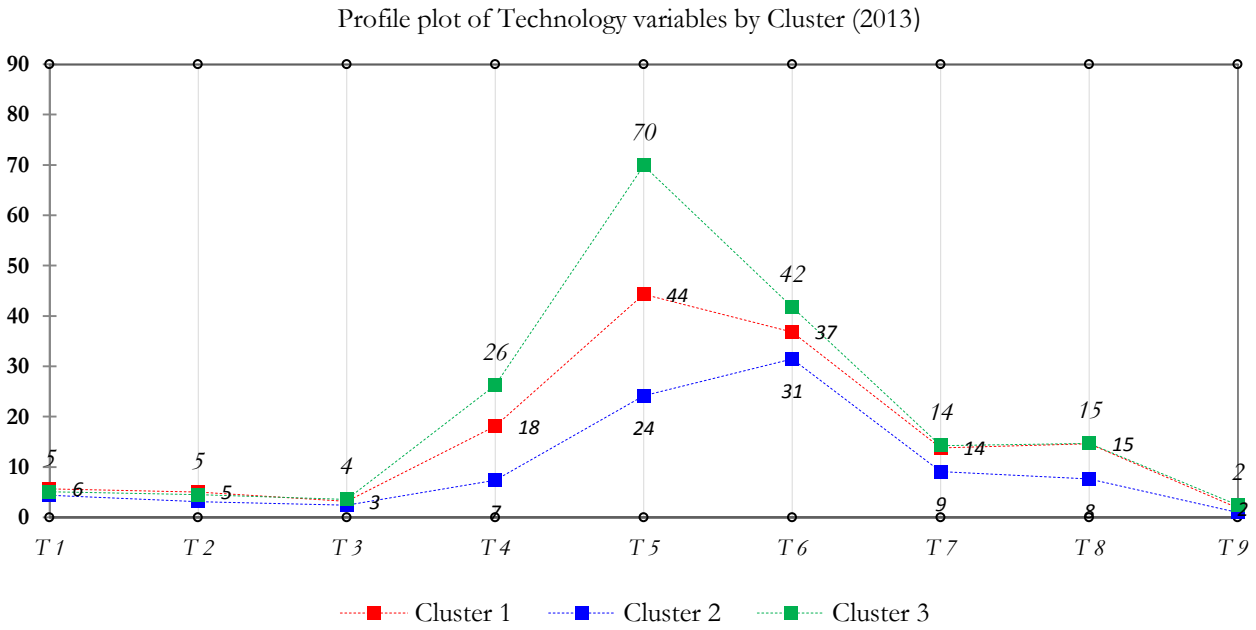


Table 3 - Clusters of EU member states based on individual values of Technology variables for 2013:

Cluster 1	BE	CZ	IE	MT	AT	SI	SK						
Cluster 2	BG	EE	EL	ES	HR	IT	CY	LV	LT	HU	PL	PT	RO
Cluster 3	DK	DE	FR	LU	NL	FI	SE	UK					

Figure 2.2



3.1.2 - Statistical Interpretation of Results

In AHC analysis, the Euclidean distance between the countries represents the similarity between them with regards to the variables. As the proximity of one country to another is based on the values of the variables, the smaller the distance between two countries, the greater is the similarity between them. Thus the countries joined together in this hierarchical fashion represent those that are closest to each other while those that are the furthest apart represent greater differences in terms of the aspect being measured.

By referring the Dendogram's and figures 1.1 & 2.1, it can be seen that between 2007 and 2013 there has been a change in the position of certain countries along with the number of countries in each Cluster. In 2007, Clusters 1, 2, and 3 consisted of 8, 14 and 6 EU member states respectively. However, in 2013, the same clusters now consisted of 7, 13, and 8 countries respectively.

As the centroid method also allows us to estimate the central value of each cluster for each variable, it allows a greater level of scrutiny. In the tables below, each cluster is represented by a *single* country that exhibits the central distance of one country cluster to another:

Table 4- Distances between the central objects

2007	*Cluster 1 (FR)*	*Cluster 2 (LV)*	*Cluster 3 (UK)*
Cluster 1 (FR)	0	32.442	20.251
Cluster 2 (LV)	32.442	0	49.919
Cluster 3 (UK)	20.251	49.919	0

Table 5 - Distances between the central objects

2013	*Cluster 1 (BE)*	*Cluster 2 (HR)*	*Cluster 3 (DE)*
Cluster 1 (BE)	0	26.284	24.303
Cluster 2 (HR)	26.284	0	48.018
Cluster 3 (DE)	24.303	48.018	0

Tables 4 and 5 allow us to compare the relative positioning of the clusters. As it can be see, in the period between 2007 to 2013, the distances between Clusters 1 and 2 has reduced and so has the distance between Clusters 2 and 3. However, the distance between Cluster 1 and 3 has increased, indicating that the values of the technology indicators for the countries in Cluster 3 have grown relatively more than the indicators values for the countries in Cluster 1.

This growth in cluster 3 is attributed to the inclusion of two additional countries to Cluster 2. While the Scandinavian economies along with Germany and the UK made up Cluster 3 in both periods, at the end of 2013, they were joined by France and Luxembourg, which were in Cluster 1 prior to the recession, indicating a betterment of the indicator values for these two countries or a relative degradation in the values of the Scandinavian countries. The same line of questioning can be extended to Cluster 1 which loses Hungary to Cluster 2 in this timeframe, but at the end of 2013, now includes Slovenia and Slovakia which were in Cluster 2 prior to the recession. The remaining countries maintain their positions over this period.

To determine the cause for these changes necessitates a view of the movement of the countries within the clusters with respect to their indicator values. Table 6 provides us with a summary of the descriptive statistics for each cluster and compares these values for 2007 and 2013.

Table 6 –Descriptive Statistics of Clusters (2007 & 2013):

Measure	**Cluster 1 (2007)**	**Cluster 1 (2013)**	**Cluster 2 (2007)**	**Cluster 2 (2013)**	**Cluster 3 (2007)**	**Cluster 3 (2013)**
Objects	8	7	14	13	6	8
Sum of weights	8	7	14	13	6	8
Within-cluster variance	409.1	234.0	57.0	119.3	51.8	244.7
Minimum distance to centroid	*9.6*	*9.4*	*2.7*	*3.5*	*4.7*	*5.5*
Average distance to centroid	*17.9*	*13.5*	*6.6*	*9.4*	*6.5*	*13.6*
Maximum distance to centroid	*28.6*	*22.5*	*13.4*	*21.0*	*7.6*	*22.5*

As it can be seen in the time period prior to and after the recession, the variance between countries for Cluster 1 has been largely reduced. The same however cannot be said for Clusters 2 and 3 which show relatively large increases. By referring profile plots of the variables (figures 1.2 & 2.2), we can determine that the reason for these changes within and between Clusters is mostly driven by the large changes in the values of Indicators *T4* and *T5* and the reduction in the values of indicators *T6*, *T7* and *T8*. As Indicators *T4* and *T5* measure retail trade via the internet, it shows that an increasing population of Europeans now conduct commerce via the internet. Indicators *T7* and *T8* measure imports and exports of high-tech products, and the evolution of these variables shows that while high-tech imports across most countries have reduced, the reduction of high-tech exports has shown a greater drop.

However, the most significant result of the cluster analysis is seen in the change in the value of indicator *T6* which measures employment in 'Knowledge Intensive' activities. The significant drop of this indicators value's for the Scandinavian countries could thus explain the expansion of Cluster 3. As the changes of the indicator values encapsulate the subjects of employment, trade, different economic sectors and technology, the following segment in this section, will analyse the different structural mechanisms of the EU, in order to ascertain the relevance of the clusters and to determine how ICT is impacting inclusive growth for the EU youth labour market

3.2 - Accessing Inequality for the Youth in European Economies

As remarked in the previous section, inequality is tied tightly to social exclusion owing to its multi-faceted impact on opportunities, income levels, social security systems and economic mobility (R. Atkinson, 2000). Following the rhetoric expressed in the empirical analysis, we attempted to gauge the current situation of youth inequality by analysing the subjects reviewed in the literature review in the similar order

3.2.1 - Research Approach and Indicators

As the range of indicators related to measuring inequality and the impact of ICT technology before and after the recession is reasonably vast, the indicators and relevant data were analysed and classified according to the following subgroups:

- Employment.
- Earnings.
- Education.
- Institutions.
- ICT.

Each subgroup is analysed with a strong focus on the youth perspective across the 28 selected EU member states. The data used in this segment of the section was obtained from Eurostats, OECD, World Bank, ITU and the World Economic Forum. Relevant references to the data sources will be made as necessary.

3.2.2 - Employment

Employment levels have declined sharply with the onset of the recession with the overall unemployment rate in the EU28 increasing by 3.9 PP between 2007 to 2013[20]. However, young people (aged 15-24 years) have been the most adversely affected group during this period in terms of employment. The figures in Appendices 3 to 6 show the change in employment rates over this period for three age groups: 15 to 24 years; 25 to 54 years and 55 to 64 years; in PP (annual averages) for the selected 28 EU member states.

In this time period, the average employment rate for young people within the 28 countries, reduced by 5.67 PP, while the 'prime age' group also saw a decline, albeit less pronounced, of 2.34 PP. However, the employment rate for older workers increased by 3.76 PP within this period, showing that older workers have fared relatively well during the crisis. In an attempt to ascertain whether this change in employment rate could be attributed directly to the crisis, we also measured the change in employment rates for the three groups between 2002 to 2013. The results of our analysis showed that while the employment rate for young people and prime age workers had reduced by 5.57 PP and 1.45 PP respectively, older workers had seen a 11.33 PP increase in that decade, showing that the situation of youth employment has been in a state of decline prior to the recession.

[20] Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Unemployment_statistics

The member states also have different employment rates among the 15 to 24 age group. Denmark, Germany, the Netherlands, Finland, Sweden and the UK have the highest employment rates for this age bracket both in 2007 and 2013, with the Netherlands being the best performer (69.8% employment rate for young people). These countries also belong to Cluster 3 (2013), which had the highest values across all the technology variables. Greece, Hungary, and Bulgaria have the lowest employment rates with Hungary bringing up the rear (less than 24% of young people in employment). These countries were also seen in Cluster 2 (2013) which had the lower values for the technology indicators.

The remainder of the member states have employment rates that vary between 30% to 40% for this age group. When older age groups are compared, we find that the situation is not as dire for citizens of Hungary with over 90% of its prime age population in employment. Spain which also belongs to Cluster 2, has the lowest values for this age group (70.4%) while Slovenia has the lowest employment rate for the mature age group (41.8%).

It could be argued that employment in the youth category may be low, owing to a higher participation in education and a varying tendency to combine work and education in different member states. Also countries exhibiting a higher employment rate among the 15 to 24 age group can be explained by a developed system of apprenticeship, as seen in Germany which had 53.6% of its young employed simultaneously in education or training in 2012 (ETUI, 2014). However, irrespective of these arguments, the falling employment rate on average for all EU countries between 2007 and 2013 as well between 2002 and 2013 signifies that low employment rates are not explained by a high participation in education and training and may be attributable to higher rates of unemployment or inactivity (Refer Appendix 6).

Continuing on this line of inquiry regarding inactivity, raises questions about the incidence of NEETs for young people and young adults in the EU. Our analysis found that from 2007 to 2013, young adults have shown an increased rate of very high NEETs, and in many cases much higher than those of young people. In both cases, Bulgaria, Greece, Croatia and Italy, all of which belong to Cluster 2, score the highest figures for both age groups. The situation for these countries remains unchanged for the older spectrum of this population, especially for women, who consistently have higher NEET rates than men. The gap varies across the countries and is close to zero in Spain and Ireland, where the rates for men and women are high.

However most countries show high gender biased NEET rates towards young women, further confirming the findings of Degryse, 2013. The Netherlands, and Denmark, which belong to Cluster 3, display the lowest rates when relatively compared, but the other countries in this cluster display moderate NEET rates. However, it should be remembered that as countries like the Netherlands, Austria and Germany allow young people to take up employment in conjunction with their studies, this could account for their elevated values. A key point to be emphasized is that across all countries, the population of young people and young adults with at least an upper secondary educational

attainment (Levels 3-6[21]), have *higher* NEET rates than their peers with lower (Levels 0-2) educational attainments. This result draws strong parallels with the polarization findings of Goos and Manning (2007) and the ALM (2003) hypothesis which found that technology led inequality, had little effect was seen on low-skill jobs, as ICT began replacing the analytical tasks of medium/high-skill workers.

To gain an understanding of this polarization effect from the perspective of education and skill levels, we measured the changes in employment across seven major sectors of employment between 2007 and 2013, including-

- Agriculture; fishing; mining and quarrying
- Electricity, gas and water supply; Construction
- Manufacturing
- Health and social work
- Education
- Land transport; transport via pipelines; water transport; air transport; supporting and auxiliary transport activities; activities of travel agencies
- Services

As services sector accounts for up to 70% of the employment in most EU countries (Cedefop, 2014), this sector was further analysed under three sub-groups –

- Wholesale and retail trade; hotels and restaurants; activities of households
- High-technology sectors
- Knowledge-intensive services

The results of our analysis (Refer Appendices 7, 8 and 9), show that from 2007 to 2013, while the highest growth in employment occurred in the services sector across all EU countries, the dispersion of this employment has been unequally felt by young people, especially for jobs in the Clerical support and Sales services (Refer Appendix 10), which are the sectors that offer entry level jobs for the young people and young adults with at least an upper secondary educational attainment (Autor, 2014). This further indicates that the routinization and polarising effects of ICT are adversely affecting employment opportunities for the youth populace in Europe.

Greece, Spain and Romania show the highest PP point changes for youth employment in Mid-Skill level jobs along with and a majority of the countries belonging to Cluster 2. Finland and the Netherlands of Cluster 3 show optimistic figures, but overall this sector has shown negative growth rates across all countries. The other sectors also show a reduction in the employment of young people, but are not as stark when compared to the mid-skill level jobs, which adds further weight to the polarization results of Michaels and van Reenen, 2010.

Overall, it can be said that the situation of unemployment is less dramatic for the younger age group (15-19) when compared to young adults. However, the gap between these two groups when

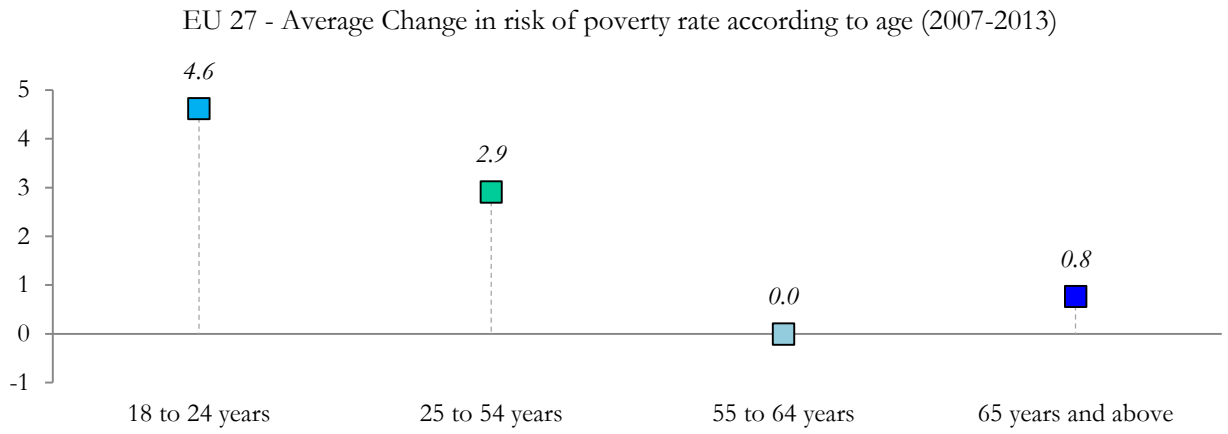
[21] Corresponding to the International Standard Classification of Education - ISCED

reviewed in unison with the groups educational attainment levels, show that there has been a continuous widening since the recession This suggest that the impact of the recession was more pronounced on the better skilled young adult population in these countries, and that in light of these variances, educational attainment does not provide shelter against unemployment and inactivity for the youth populace of Europe.

3.2.3 - Earnings

Analysing data from the Eurostats measure, 'At-risk-of-poverty rate before social transfers' allows us to understand the concept off inequality in terms of poverty risk between the youth in Europe and the rest of the population. Figure 3 and Appendix 11; trace the change in risk of poverty rate (in PP) for different populations of the 28 member states for varying age groups between 2007 to 2013.

Figure 3:



Calculations based on Eurostats data- source:SILC [ilc_li09]

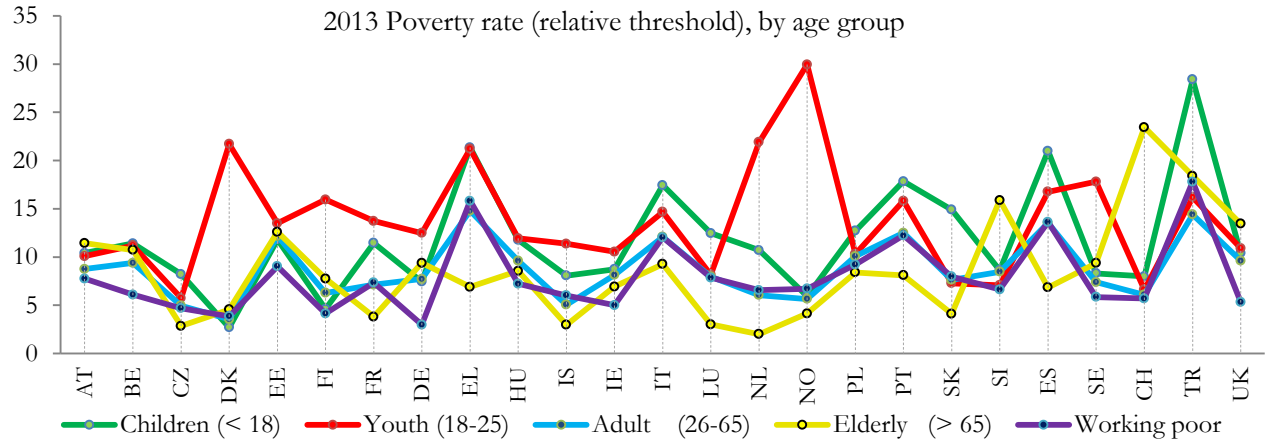
As it can be seen, young people and a portion of young adults have seen significant changes in the risk of poverty rate in the period following the crisis. To gain a better understanding of how the youth population has been impacted in the aftermath of the crisis, we conducted an analysis on young people's 'At-risk-of-poverty or exclusion' rate for the population aged between 16 to 29 years for both Males and Females (Refer Appendix 12).

The results of this analysis show us that the largest increases in risk occurred in those countries hit hardest by the crisis, such as, Ireland, Greece, Spain, Cyprus and Portugal, but also in advanced economies like the UK and Denmark. While Greece had the highest poverty rate increases for both men and women, the UK had the second highest figures for women between the ages of 16 to 24. These findings also coincide with the high NEET rates found for women in the UK belonging to the same age group, when compared to other countries of Cluster 3. Understanding the rise in poverty rates creates the need to understand the evolution in earnings of young people since the recession. By comparing the 'median equivalised net income' for the same age groups as the risk in poverty rate

analysis, we found that in terms of Purchasing Power Standards (PPS)[22] , young people between the ages of 16 to 24 years, have seen the lowest percentage increase in median income when compared to older age groups since 2007 for most EU countries (Refer Appendix 13).

Most of the countries in Cluster 2 showed the lowest increases in earnings in this period, with the figures for Ireland and Greece falling by 19% and 38% for the 16 to 24 age bracket, and by 14% and 30% for the 25 to 54 age bracket respectively. The older populations were largely shielded from these effects of the crisis. These differential patterns of income growth are reflected in the evolution of the In-Work-At-risk-of-poverty-rate (Refer Appendix 14), which shows that since the crisis, the older population has faced a significantly lower risk of poverty than the younger population average, as seen in the figure 4 below[23]. Over the EU, young people between the ages of 18 to 24 had an average In-Work-At-risk-of-poverty-rate of 11.4% by the end of 2013, 8.8% for the prime age adults (25-54) and 8.5% for older workers (55-64).

Figure 4



Source OECD: The poverty rate (relative threshold) indicator is one of the key indicators on the distribution of household disposable income and poverty. Data updated and accessed on 19/05/2015.

Besides these changes in poverty levels for unemployed, NEET and active young workers, restrictive wage policies as part of the austerity measures implemented in 21 EU countries where national minimum wage exists (Schulten, 2014) has resulted in cuts and freezes of minimum wages in countries belonging to Cluster 2, such as Greece, Ireland, Portugal, Romania , Latvia and Spain. As a result of these policies, real hourly minimum wages have reduced in a range of countries where as a rule; minimum wages was closely linked to economic development, affecting even advanced economies like the UK (Cluster 1) (Kampelmann et al., 2014).

These changes in- at-risk-of-poverty and wage stagnation precipitates the question if education could be the answer to reducing the inequality of the youth in Europe. This subject will be analysed in the next segment.

[22] The decision to select earnings in Median Income (and not Mean Income) expressed in PPS (and not Euros/National Currency) was done in order to maintain maximum homogeneity when comparing the countries.
[23] The OECD data includes findings for 20 of the 28 countires considered in our analysis.

3.2.4 - Education and Skills

Although the results seen in section 3.2.2, indicate that job polarization is effecting the employment rates of medium/high skilled workers in the services sectors, our analysis shows us that the population most effected by the crisis, in terms of employment based on educational levels, were those with lower educational attainment levels (Refer Appendix 15),

Our analysis traced the change of 'In-work-at-risk-of-poverty' on the basis of educational attainment and showed that the population with lower education face greater inequality risks, especially in countries like Romania, Bulgaria, Lithuania, Poland and Greece, all of which belong to Cluster 2. The lowest increases in risk rates were for the population with the highest educational levels across all countries. The findings in the previous segments of this section and the unambiguous disparity between the risk of poverty rates based on educational levels over this period, implies that the crisis had different impacts on the youth with low skills and youth with medium/high skills.

Most of the countries analysed saw increases in NEET rates for both young people and young adults. However it was also remarked that low skilled young people recorded lower NEET rates when compared to medium/high skilled workers. For young adults, the changes between NEET rates for low and medium/high-skilled workers was even more pronounced, with the average increase of NEET rates at 1.1PP for the lower educated and 7PP for the medium/high skilled. The relationship between NEETs and educational engagement is best seen in the table below which traces the changes in the participation rate of young people in formal or non-formal education by educational level, gender and labour status including NEET rates:

Table 7

Work Group	2007	2013
Total Population (15-19)	87.2	89.6
Employed (15-19)	12.9	11.3
Not Employed (15-19)	74.2	78.4
Total Population (20-24)	45.8	50
Employed (20-24)	16.1	16.5
Not Employed (20-24)	29.7	33.6
Total Population (20-24)	19.3	21.9
Employed (25-29)	12.3	13.5
Not Employed (25-29)	7	8.5

Work Group	2007	2013
Total Males (15-19)	85.9	88.8
Males Employed (15-19)	13.5	11.5
Males Not Employed (15-19)	72.4	77.3
Total Males (20-24)	42.9	47.2
Males Employed (20-24)	15.5	15.9
Males Not Employed (20-24)	27.4	31.4
Total Males (25-29)	18.6	21.3
Males Employed (25-29)	12	13
Males Not Employed (25-29)	6.6	8.2

Work Group	2007	2013
Total Females (15-19)	88.5	90.5
Females Employed (15-19)	12.3	11
Females Not Employed (15-19)	76.2	79.5
Total Females (20-24)	48.8	53
Females Employed (20-24)	16.7	17.1
Females Not Employed (20-24)	32	35.8
Total Females (25-29)	20	22.6
Females Employed (25-29)	12.7	13.9
Females Not Employed (25-29)	7.4	8.7

As it can be seen, the participation rate of unemployed young people and unemployed young adults, both Male and Female, has consistently risen across all groups following the crisis. At first glance, these findings could lead one to believe that the increased participation in education and training could be because the growing number of unemployed youth prefers to stay in education, and because active labour market policies (ALMPs) are encouraging education and training while in employment. However, between 2007 to 2013, while the total number of employed persons participating in education and training grew by 0.4 PP and 1.2PP for the 20 to 24 and 25 to 29 age groups respectively, a reduction of 1.6PP was seen in the 15 to 19 age bracket, negating the overall growth in participation. Furthermore, recent research shows that there has been a steady *decrease* in young adults receiving on-the-job training while being employed (ETUI, 2014).

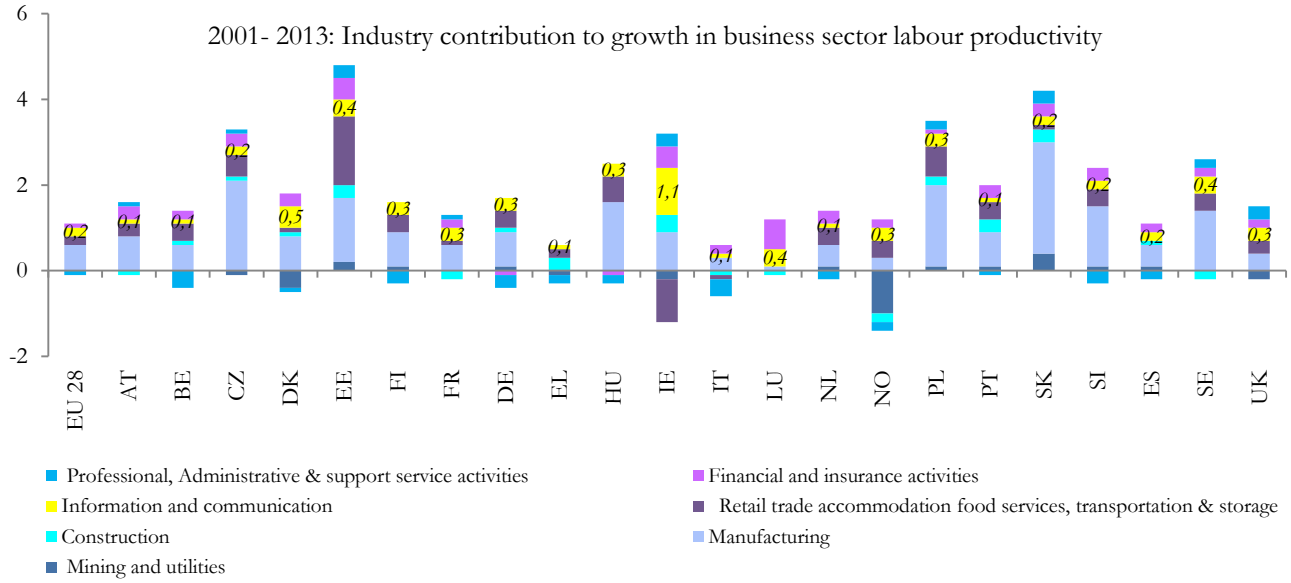
By conducting a closer inspection of these groups on the basis of the level of education, we found that the increased participation rate is fuelled by a larger group of the young adults participating in Higher Educational Levels i.e.; Levels 5 and 6, and Levels 5 to 8 (Refer Appendix 16). A surprising result of this analysis showed us that the countries which exhibited the highest rates of educational attainment for Levels 5 and 6 for the young adult age group, were those belonging to Cluster 2, which were hardest hit by the crisis, including Greece, Cyprus, Ireland and Poland. While the average attainment level for the advanced economies in Cluster 3 hovered at 41.9%, the afore mentioned countries belonging to Cluster 2 showed attainment levels closer to 44.5%. These findings raise further questions of education being the answer to bridging inequality for the youth in Europe.

In an attempt to understand the complexities of jobs requiring high education and technical skills, we continued our analysis using the educational indicators and found that young adults enrolled in Levels 5-6 have shown increased participation in STEM[24] fields, including: science, mathematics, computing, engineering, manufacturing and construction (Refer Appendix 17)[25]. These findings are significant as in the European Union, employment of STEM skilled labour is increasing in spite of the economic crisis and demand is expected to grow. With high numbers of STEM workers approaching retirement age, estimates predict that around 7 million job openings are forecast until 2025 for European workers (Caprile et al., 2015).

[24] STEM: Science, Technology, Engineering and Mathematics.
[25] For this section of the analysis, 2012 data was used owing to missing values for 2013.

As it can be seen, since 2000, the contribution of STEM jobs in the ICT sector has been gaining prevalence:

Figure 5:



Source: OECDStatExtracts- Productivity and ULC by main economic activity (ISIC Rev.4)

This analysis shows that ICT technologies have consistently been drivers of productivity growth across all country clusters from the turn of the century. At the same time, the fact that the services sector has seen sustained employment growth over this time period (refer appendices 18 & 19) and especially in knowledge intensive services, has also made ICT a consistent contributor to employment. An even more interesting finding is that the large contribution in labour productivity made by in the manufacturing sector was accomplished with falling employment rates in this sector during this period, with the exception of Poland (Refer Appendix 18). These facts add further weight to the routinization hypothesis proposed by ALM (2003) and strongly indicate that modern technology is capable of replacing human capital in routine tasks, in the European context.

Keeping the findings of the knowledge intensive services in sight, recent research also shows that while the majority of member states have experienced recruitment difficulties in relation to STEM skilled labour in recent years, the shortages are more pronounced for technological occupations including engineering and ITC. While the unemployment rate for STEM skilled labour has been very low and well below the total unemployment rate since the beginning of the 2000s, even in countries particularly hit by the crisis, such as Greece, Portugal and Spain, these facts show there is a high demand for workers with these skills (Caprile et al., 2015).These studies thus demonstrate that education by itself does not serve as a tool for breaking away from unemployment and income inequality. With forecasts predicting the increased impact of ICT technologies in work, education and skill development, changes which will help the youth adapt to technological change, whilst aiding in reducing inequality, need to be addressed from an institutional level across all EU member states.

3.2.5 - Institutions

As we move towards a knowledge based economy with is driven by ICT, the role played by institutions in advancing skill attainment and entrepreneurship could play an increasingly important role in reducing inequality at the societal level, as the rhetoric of solely using educational as a crutch to boost individual progress begins to falter. The fact that findings from Turati[26] (2011) and Vanderberghe (2000) show that lower educational and skill attainment results are associated both with schooling *and* the socio-economic background, adds pertinence to this statement. The following segment will thus dwell upon these subjects in order to measure the impact they have on reducing inequality for the youth in Europe.

From an institutional setting, the progress made by EU member states varies greatly across countries in terms of Active Labour Market Policies (ALMPs). As per the OECD, ALMPs are defined as "*Activation strategies" that help ensure jobseekers have a better chance of finding employment*". Key features of such strategies help advance work-availability and are based on mutual obligation requirements. Benefit recipients are expected to engage in active job search and improve their employability, in exchange for receiving efficient employment services and benefit payment.

In this context, Appendix 20[27] shows the expenditures made on European member states (in percentage of GDP) based on the type of LMP activity[28]. The activities include: (1) Labour market services; (2) Training; (4) Employment incentives; (5) Supported employment and rehabilitation; (6) Direct job creation; (7) Start-up incentives; (8) Out-of-work income maintenance and support; (9) Early retirement.

As this classification includes 'passive' as well as 'active 'policies, a breakdown of the expenditure focused on active policies reveals that while Estonia leads the list of countries as having made the most sizeable increases in ALMP spending (in terms of % of GDP), it is also the country that has made the most significant increases in contribution towards Training, Employment and Start-up initiatives. While Ireland, Bulgaria, Spain and Portugal have also increased their LMP expenditures, these countries are seen to have directed these funds towards 'Out-of-work income maintenance and support'. In most cases, these countries show feeble, and in some cases even reduced spending, on more active policies. The Baltic States of Cluster 2, show increased spending in direct job creation initiatives, whilst simultaneously reducing spending on training. Germany and Slovenia also show substantial increases in their spending towards employment and start-up incentives respectively, over this period.

The relative inactivity of the EU member states towards business development initiatives such as start-up initiatives is a source of worry, especially as funding from private sources to create start- ups has also fallen across most counties. With falling investments in ALMPs, we turn out attention to the contribution of private enterprises with regards to this subject. The tables in Appendices 21 and 22

[26] Findings related to France, Germany, Italy, Greece, Norway, Portugal, Spain, Sweden and the UK.
[27] Owing to data availability limitations, this analysis was conducted on 2007 and 2012 data.
[28] As per the classification given by the European Commission's department of Employment, Social Affairs & Inclusion.

respectively measure the Venture Capital (VC) Investment for seed, start-up and later stage, and the number of newly registered companies with limited liability per 1,000 working-age people (ages 15-64) respectively, between 2007 and 2012. As it can be seen, Venture Capital (VC) Investment for seed, start-up and later stage ventures has fallen over this period, which has been accompanied with a reduction in the number of entrepreneurial businesses created over this period.

Apart from the funding of creating entrepreneurial enterprises, a lack of funding can also mean a reduced emphasis in helping the already existing start-ups to stay in business. These findings offer worrying outcomes from the point of view of youth inequality, as with ICTs changing the definition of jobs and the skills necessary to perform tasks, entrepreneurial activity is a pillar of economic growth and employment tailored to the knowledge economy. Also it is not just the pursuit of enterprise creation that is put at risk, but more importantly, reduced investments in enterprise creation threatens the development of entrepreneurial skills and behaviours that are learned and transferred during such processes, such as situational contextualization, idea generation and resourcefulness, which are beneficial for established organisations.

One of the findings from the study done by Beaudry et al (2013), was that except during a bust, there has been a continued increase in returns for the entrepreneurial class. These results resonate with the findings of Fernald (2014), who found that embedded in the productivity function of modern economic growth, was the fact that non-rivalry of ideas lead to increasing returns. In other words, income per person depended on total number of ideas being generated in the economy and not on the number of ideas per person (Fernald, 2014). The paper further goes on to state that in the long run, the stock of ideas is proportional to the number of researchers, and thus, scale of producing new ideas matters for knowledge based economies. This production of ideas, they found, was related to the human capital per person and the research intensity or the investment made towards the hunt for new ideas. For evidence of the economic power of entrepreneurship, comparisons can be made with the United States, where young firms have been shown to be a more important source of net job creation than incumbent firms (Klapper, 2010).

Apart from these institutional latencies, the relationship between entrepreneurship and the role of ICT in the evolving business environment requires the need to better understand the relationship between the ease of creating new firms, the regulatory environment, and the access to funds from the perspective of empowering entrepreneurship. However the combined analysis of these aspects with relevant indicators is an arduous task owing to the lack of available data encompassing the whole range of these subjects on the scale of our country selection.

Although the OECD and Eurostats do provide indicators with respect to Entrepreneurship, employment protection legislation, industrial production and survival rates of enterprises via the OECD-Eurostat Entrepreneurship Indicators Programme (EIP), the range and scope of these indicators is limited and offers a narrow margin of inspection. Thus, owing to these reasons, and in order to gain a better understanding of the institutional framework regarding ICT and entrepreneurship, we rely upon the research findings published by the World Economic Forum and more specifically, their Network Readiness Index (NRI).

3.2.6 - ICT

The NRI is a composite indicator that is composed of 4 main categories (sub-indexes), 10 subcategories and 53 individual indicators distributed across different pillars. The indicator gauges individual countries regulatory and business environment, their 'ICT readiness' as measured by affordability, skills and infrastructure, the impact of ICT on the socio-economic condition of the country policies that ensure network readiness (WEF, 2015). The complete breakdown of the 53 indicators can be seen in Appendix 23. The computation of the overall NRI score is based on successive aggregations of scores: individual indicators are aggregated to obtain pillar scores, which are then combined to obtain sub-index scores. The sub-index scores are in turn aggregated to produce a country's overall NRI score.

About half of the indicators used in the NRI are sourced from organization such as the ITU, UNESCO, World Bank, OECD and Eurostats This makes the NRI particularly favourable for our research as it reduces data heterogeneity. The other half of the NRI indicators are derived from the World Economic Forum's Executive Opinion Survey which measures concepts that are qualitative in nature or for which internationally comparable statistics are not available for enough countries. The indicators that are derived from external sources are transformed into a 1-7 scale in order to align them with the results of the survey and a min-max transformation is used in order to preserve the order and the relative distances between scores (WEF, 2015). Finally the scores each individual indicator is aggregated using an arithmetic mean, first at the pillar level, and then at the sub-index levels as well.

As the NRI offers a holistic and detailed perspective of ICTs impact on local economies, we performed a cluster analysis using the 2013 NRI scores of our 28 European economies, in an attempt to verify the results of our previous cluster analysis based on selected technology indicators. When comparing the results of the clusters formed on the basis of the 2013 NRI scores, we find that apart from a few variations in the positions of the Baltic states, 71% of the 28 EU countries that were analysed using out technology indicators have similar country cluster groupings with the NRI cluster.

Table 8 – Clusters of EU Member states based on NRI scores for 2013:

Cluster 1	BE	EE	IE	FR	LT	MT	AT	PT					
Cluster 2	BG	CZ	EL	ES	HR	IT	CY	LV	HU	PL	RO	SI	SK
Cluster 3	DK	DE	LU	NL	FI	SE	UK						

Source: The values and the statistical results related to the construction of the Dendogram can be found in Appendices 24 and 25.

Table 9 - Clusters of EU member states based on individual values of Technology variables for 2013:

Cluster 1	BE	CZ	IE	MT	AT	SI	SK						
Cluster 2	BG	EE	EL	ES	HR	IT	CY	LV	LT	HU	PL	PT	RO
Cluster 3	DK	DE	FR	LU	NL	FI	SE	UK					

The results of our analysis show that those country's with a high ICT ranking offer better opportunities of employment and earnings for young people. While most countries in Cluster 3 showed lower rates in inequality when looked at from the point of view of education, earnings and entrepreneurship, those countries with lower performances like a majority of the countries in Cluster 2, also showed lower ICT scores when measured by the NRI. Also countries like Slovenia and Slovakia, which continue to have comparatively low ICT scores, have been able to move out of Cluster 2 (Refer table 9), by implementing progressive entrepreneurship policies and training programs (Refer Appendix 20). While the results of this analysis can be interpreted in different ways, it does indicate a strong relationship between advancing ICTs in order to advance economies. In other words, working with technology in order to empower the youth, could aid European economies in reducing inequality for their youth populaces by advancing policies to boost entrepreneurship and thus giving the youth the learn new skills on the job, thus allowing them to adapt to the changes of skill demand in the labour market. .

As the empirical analysis on employment and education suggests that an increase in the average years of education allows access to high skill and managerial jobs, thus reducing the risk of unemployment, this is most likely because it enables young people and young adults to benefit from the opportunities offered by technological progress. This finding has growing relevance to the youth population with lower educational attainment and for workers in low-skilled jobs (depending on the sector of employment), as technological improvement over all of the EU countries is seen to increase the premium on skills and tends to substitute for low-skill inputs (Refer Appendices 18 and 19).

The situation of employment is further complicated for the youth with low educational attainment, as rising employment shares for high-skill professionals is coupled with falling employment shares low-skilled jobs for the youth in Europe (Refer Appendix 9). While some growth has been seen in the mid-level services sector, the large increase in the services sector and the small effect this has had on improving the employment share for middle-skilled youth in services and clerical routine office jobs, further proves the effects of routinization hypothesis of ALM (2003) on the youth populace.

By comparing the In-work-at-risk-of-poverty data (Refer Appendix 14) with the scores of the NRI (Refer Appendix 24), the results of our analysis also show that while technology, notably ICT, and education make important contributions to income at different sub-groups of the population, better access to education and training by leveraging ICT and active labour market policies bolstering entrepreneurship (WEF, 2015), allow for the benefits of technological progress to be shared more broadly. As ICT's continue to contribute to total labour productivity via the reorganization of manner in which goods and services are created and distributed, technology led industries and economies with large capital investments in ICT's are seeing rising labour productivity (ICF GHK and Cedefop, 2014). As a result, understanding the impacts and mechanisms by which ICTs can drive economic growth for lower skilled groups is crucial to understanding how they can benefit from it.

The question of ICT's role in reducing inequality was analysed in earlier research that found that technological progress, measured in share of ICT capital stock, had a statistically significant impact on inequality, and that the effect of technological change was greater than that of financial globalization (Jaumotte et al., 2008; Milanovic, 2013[29]). These findings are of particular pertinence to the lower-skilled youth population, as better access and understanding of ICTs can enable them to improve their education, research new ideas, gain access to tangible inputs like venture capital and collaborate to start new entrepreneurial ventures. These ingredients would play a role in reducing inequality as it will enable them to overcome obstacles such as low income, gender bias, educational attainment and physical disabilities.

[29] Authors analyzed data from the *PovCal* database over two decades.

Section 4 - Conclusion

The findings of our analysis indicate that the trends in polarization are likely to continue. It is anticipated that between 2013 and 2025, that there will be additional 19.4 million jobs requiring high-level qualifications, this growth is accompanied with an overall reduction in the number of jobs-requiring medium-level (-2.6 million) and low-level (-9.3 million) qualification (Cedefop, 2014). These predictions represent a loss of one fifth of all jobs requiring low-level qualifications, while more recent research also shows that in tandem with these changes for the middle and low skilled workers, we are beginning to witness a reversal in cognitive skill demand as well (Beaudry et al, 2013). Hence, the potential impact on young people, inequality and educational investment are widespread,

Furthermore, additional radical changes in technology are anticipated with increased automation, joined with rapid advancements in machine/deep learning, mobile robotics, and the exponential increase in the computerization of tasks. These changes are beginning to challenge our relationship with technology, as machines that were created as tools to increase the productivity of workers are now turning into the workers. The effect of these trends on inequality and employment is quite stark for the youth in Europe, where roughly 30 percent of graduates are currently overqualified for their jobs (Cedefop, 2010). As a result, employment for many skilled professionals - including lawyers, journalists, scientists, and pharmacists - is being significantly eroded by advancing information technology (Ford, 2015). The findings of our analysis show that the routinization and polarization effects of ICT on job employment, earnings and social inequality are particularly relevant to the youth population of the EU.

Having compiled a cross country grouping according to exposure to technology we analysed indicators related to inequality. These analyses were further complemented by the World Economic Forum's Network Readiness Index (NRI) as a measure, which captures the ICT prowess and competitiveness of 149 countries. The findings of our analysis shows that beginning from a period before the crisis, technological advancement and ICTs in particular, are associated with changing education levels, employment opportunities and earnings of young people. Secondly, not only ICT has to become a *force majeure* in modifying the services sector over this period , but hardly any sector or service exists today that has not been affected directly by ICT. Lastly, we suggest that increased emphasis on advancing education is not the only solution to reducing inequality for the youth in Europe.

It is in this changing environment that we find the paradox between technology and technical knowledge. It would seem that while technology improves labour productivity and creates aggregate wealth for a country by using new ideas to replace labour at low cost, technology also acts as a source of opportunity and income for the people of a nation by requiring them to learn new technical and non-technical knowledge that cannot be easily replicated or automated. These features have the potential to pave the way between technical usage and significant human capital input, which could lead to significant returns to workers immersed in a knowledge based economy. The relationships and elements of similitude depicted in our cluster analysis of countries offer evidence in this regard.

As the balance between the scarcity of jobs and the scarcity of skills begins to undergo a shift, the relationship between technology, education, and skill development is becoming more complex a challenge than can be resolved by a single emphasis on schooling. Evolving business needs, technological advances and new work structures, among other factors, are redefining what are regarded as valuable skills for the future.

Policy makers thus need to encourage development of diverse skills for workers whilst in employment to complement formal schooling. In this regard, polices aimed at promoting coordinated programs with employers, targeted to sectors with growing opportunity and incorporating a work-study component to promote learning on the job can promote the availability of the necessary technical education.

At the same time, ICTs can be used at the community level in order to help localised or segregated communities with job retraining programs for unemployed workers. The private sector could make increased financial support available for these workers while they are being retrained in order to have access to a more adaptable skill force. In exchange, flexible hiring policies which do not burden employers ought to be put in place in order to develop a virtuous cycle of quick job transitions and adaptable skill attainment. To facilitate this process, policies aimed at giving employers tax incentives to encourage on-the-job training and flexible and secure contractual agreements can play crucial roles.

While there exists a plethora of research that examines the advantages of the fore mentioned factors, policy changes and organisational evolutions that are needed to adapt to these transitions are time-consuming and offer little respite to unemployed and under-employed youth of today. It is for these reasons that active labour market policies and social security systems need to also create a cushion to absorb the effects of technologically led unemployment. These conversations need to take place between governments, policy makers, businesses and citizens, in order to ensure a rethinking of the labour market for the youth, and to prepare them for this new era.

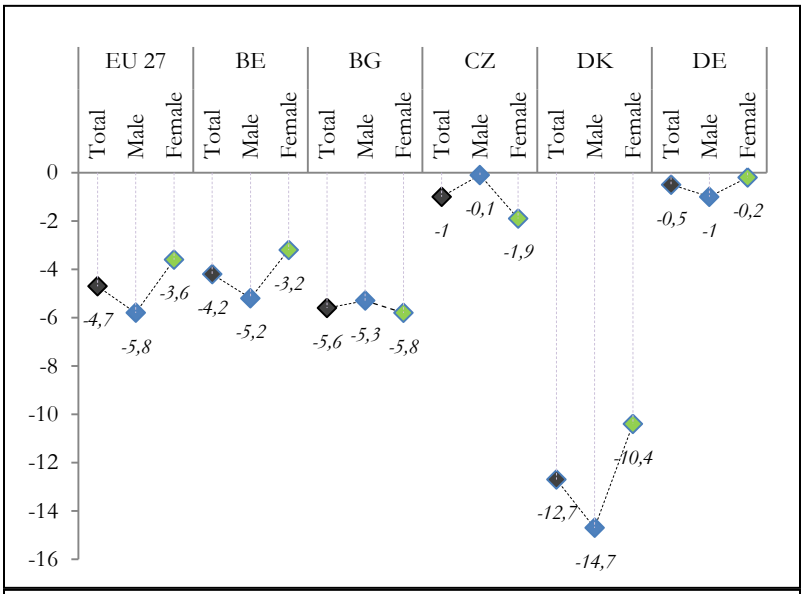
Appendix 1: 2007 Technology variables - Proximity matrix (Euclidean distance)

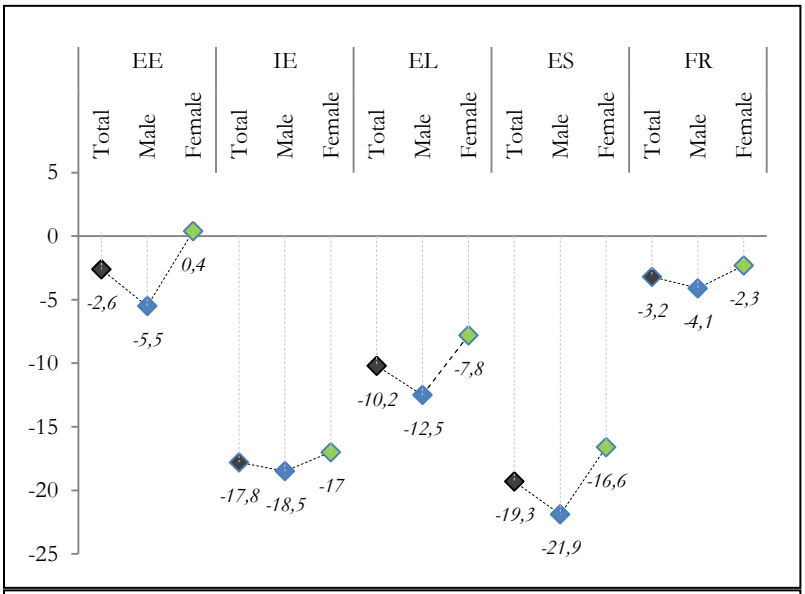
	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK
BE	0.0	28.8	21.1	38.3	35.4	22.4	30.4	21.4	18.2	17.9	26.0	17.0	19.7	23.7	26.1	43.1	25.3	42.0	39.6	20.3	21.0	22.2	35.3	16.9	19.7	30.8	33.8	35.2
BG	28.8	0.0	25.6	61.5	56.5	8.9	43.9	8.5	16.0	39.3	5.3	12.2	15.6	8.2	4.9	64.8	24.4	49.4	62.2	35.7	14.0	11.3	8.6	16.2	14.1	52.6	58.2	57.5
CZ	21.1	25.6	0.0	40.7	34.8	18.0	20.1	19.0	13.2	18.0	20.5	18.2	17.4	18.7	21.7	41.5	15.8	32.7	39.2	14.5	15.4	14.8	27.6	15.9	13.4	29.5	36.8	34.4
DK	38.3	61.5	40.7	0.0	7.4	53.5	36.5	53.9	46.3	27.4	57.2	51.3	52.3	53.9	58.2	30.9	51.6	52.7	9.9	27.8	48.5	51.8	64.6	45.7	48.5	14.2	10.5	11.8
DE	35.4	56.5	34.8	7.4	0.0	48.3	31.3	49.0	41.3	23.3	52.0	46.7	47.6	48.8	53.1	29.5	46.0	47.8	9.5	22.6	43.3	46.5	59.0	40.8	43.4	10.6	12.3	10.3
EE	22.4	8.9	18.0	53.5	48.3	0.0	36.3	5.9	10.1	31.3	4.6	6.7	10.2	5.4	5.6	56.6	18.2	42.7	53.9	28.2	8.7	6.3	13.7	9.2	8.5	44.4	50.4	49.5
IE	30.4	43.9	20.1	36.5	31.3	36.3	0.0	37.2	32.1	16.4	39.0	34.9	31.9	37.9	39.8	24.4	24.0	22.0	30.6	21.9	34.9	33.6	46.4	34.2	32.4	22.9	30.6	26.6
EL	21.4	8.5	19.0	53.9	49.0	5.9	37.2	0.0	8.6	31.4	5.9	5.8	11.2	4.2	6.1	57.4	20.9	45.4	54.5	28.1	8.1	5.3	14.5	10.4	6.8	44.9	50.2	49.6
ES	18.2	16.0	13.2	46.3	41.3	10.1	32.1	8.6	0.0	25.3	12.1	9.5	14.3	8.3	13.3	51.9	21.2	43.6	47.2	20.3	4.3	6.6	19.6	6.9	2.9	37.5	42.9	42.2
FR	17.9	39.3	18.0	27.4	23.3	31.3	16.4	31.4	25.3	0.0	34.8	28.5	27.4	32.4	35.3	27.8	26.4	33.0	25.5	11.6	28.6	29.2	43.5	26.2	26.7	15.6	21.3	20.3
HR	26.0	5.3	20.5	57.2	52.0	4.6	39.0	5.9	12.1	34.8	0.0	9.5	12.4	4.7	2.8	60.1	20.4	45.1	57.6	31.2	10.3	6.8	9.8	12.8	10.0	48.0	54.0	52.9
IT	17.0	12.2	18.2	51.3	46.7	6.7	34.9	5.8	9.5	28.5	9.5	0.0	9.3	8.9	9.6	54.0	18.4	42.6	51.7	26.8	10.1	8.4	18.8	9.0	8.6	42.3	47.5	47.2
CY	19.7	15.6	17.4	52.3	47.6	10.2	31.9	11.2	14.3	27.4	12.4	9.3	0.0	13.0	11.4	51.5	14.0	36.7	51.8	27.2	15.7	11.3	21.5	14.8	13.0	42.0	47.9	47.0
LV	23.7	8.2	18.7	53.9	48.8	5.4	37.9	4.2	8.3	32.4	4.7	8.9	13.0	0.0	5.9	58.5	21.9	46.1	54.8	27.9	6.5	4.8	12.2	9.9	6.7	45.1	50.8	49.9
LT	26.1	4.9	21.7	58.2	53.1	5.6	39.8	6.1	13.3	35.3	2.8	9.6	11.4	5.9	0.0	60.6	20.8	45.4	58.5	32.1	11.9	8.0	10.7	14.0	11.3	48.8	54.7	53.8
LU	43.1	64.8	41.5	30.9	29.5	56.6	24.4	57.4	51.9	27.8	60.1	54.0	51.5	58.5	60.6	0.0	45.0	33.5	22.1	36.3	54.8	54.7	68.4	52.6	52.9	23.1	25.6	22.8
HU	25.3	24.4	15.8	51.6	46.0	18.2	24.0	20.9	21.2	26.4	20.4	18.4	14.0	21.9	20.8	45.0	0.0	25.4	48.7	28.4	22.3	18.4	27.7	21.8	19.7	39.8	47.1	44.9
MT	42.0	49.4	32.7	52.7	47.8	42.7	22.0	45.4	43.6	33.0	45.1	42.6	36.7	46.1	45.4	33.5	25.4	0.0	46.2	39.4	45.4	42.3	51.8	44.0	42.9	40.3	48.2	44.4
NL	39.6	62.2	39.2	9.9	9.5	53.9	30.6	54.5	47.2	25.5	57.6	51.7	51.8	54.8	58.5	22.1	48.7	46.2	0.0	28.2	49.5	51.9	65.1	47.1	49.0	11.3	11.1	8.1
AT	20.3	35.7	14.5	27.8	22.6	28.2	21.9	28.1	20.3	11.6	31.2	26.8	27.2	27.9	32.1	36.3	28.4	39.4	28.2	0.0	23.0	25.2	38.5	21.8	22.3	18.2	24.3	22.7
PL	21.0	14.0	15.4	48.5	43.3	8.7	34.9	8.1	4.3	28.6	10.3	10.1	15.7	6.5	11.9	54.8	22.3	45.4	49.5	23.0	0.0	6.4	16.7	6.5	4.4	40.3	45.8	44.9
PT	22.2	11.3	14.8	51.8	46.5	6.3	33.6	5.3	6.6	29.2	6.8	8.4	11.3	4.8	8.0	54.7	18.4	42.3	51.9	25.2	6.4	0.0	14.8	10.2	4.2	42.2	48.1	47.0
RO	35.3	8.6	27.6	64.6	59.0	13.7	46.4	14.5	19.6	43.5	9.8	18.8	21.5	12.2	10.7	68.4	27.7	51.8	65.1	38.5	16.7	14.8	0.0	20.5	17.7	55.7	62.0	60.6
SI	16.9	16.2	15.9	45.7	40.8	9.2	34.2	10.4	6.9	26.2	12.8	9.0	14.8	9.9	14.0	52.6	21.8	44.0	47.1	21.8	6.5	10.2	20.5	0.0	8.0	37.9	43.3	42.8
SK	19.7	14.1	13.4	48.5	43.4	8.5	32.4	6.8	2.9	26.7	10.0	8.6	13.0	6.7	11.3	52.9	19.7	42.9	49.0	22.3	4.4	4.2	17.7	8.0	0.0	39.3	45.0	44.0
FI	30.8	52.6	29.5	14.2	10.6	44.4	22.9	44.9	37.5	15.6	48.0	42.3	42.0	45.1	48.8	23.1	39.8	40.3	11.3	18.2	40.3	42.2	55.7	37.9	39.3	0.0	9.6	6.0
SE	33.8	58.2	36.8	10.5	12.3	50.4	30.6	50.2	42.9	21.3	54.0	47.5	47.9	50.8	54.7	25.6	47.1	48.2	11.1	24.3	45.8	48.1	62.0	43.3	45.0	9.6	0.0	6.8
UK	35.2	57.5	34.4	11.8	10.3	49.5	26.6	49.6	42.2	20.3	52.9	47.2	47.0	49.9	53.8	22.8	44.9	44.4	8.1	22.7	44.9	47.0	60.6	42.8	44.0	6.0	6.8	0.0

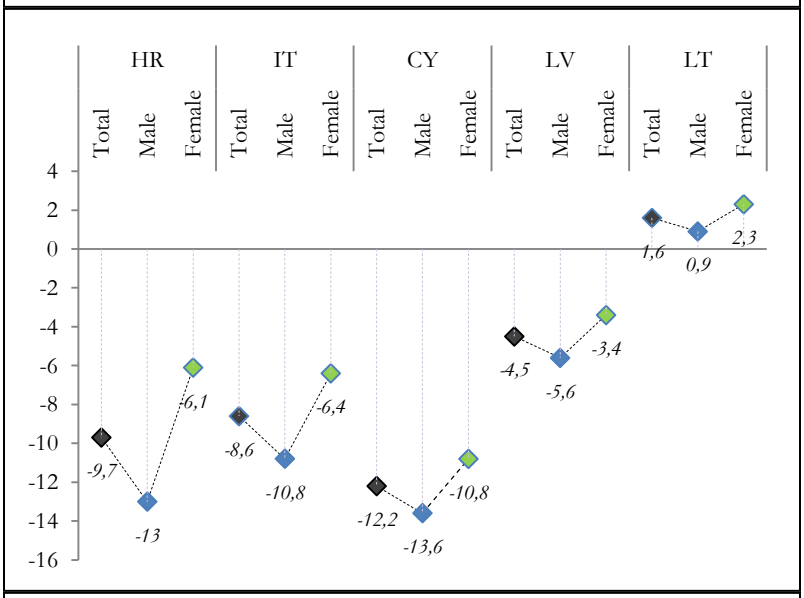
Appendix 2: 2007 Technology variables - Proximity matrix (Euclidean distance)

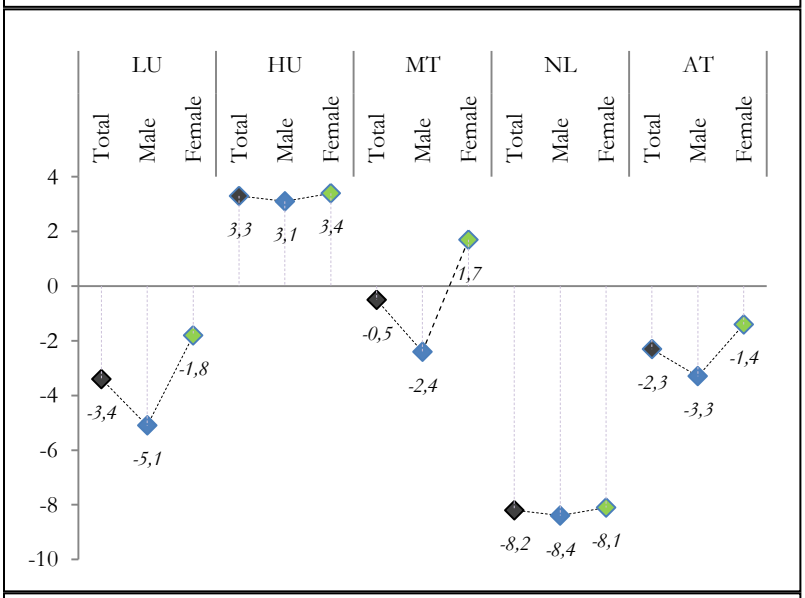
	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK
BE	0.0	40.1	18.3	29.6	24.3	28.2	16.9	28.8	21.7	21.2	26.3	31.1	29.6	23.1	29.0	31.2	23.3	22.3	37.8	12.5	23.0	29.2	48.8	21.8	16.4	18.0	26.3	33.0
BG	40.1	0.0	29.4	68.1	61.8	19.2	42.2	16.8	20.9	56.1	14.8	10.5	19.6	22.0	16.3	68.7	23.7	47.8	71.4	44.8	21.0	14.2	12.7	35.4	34.1	54.6	64.2	71.7
CZ	18.3	29.4	0.0	43.1	35.3	14.0	18.1	23.5	16.6	28.9	17.2	21.3	23.7	16.4	21.9	43.4	8.9	21.0	45.8	19.6	14.0	21.6	35.8	23.0	11.7	31.7	39.3	44.9
DK	29.6	68.1	43.1	0.0	10.9	55.9	36.1	56.6	48.7	22.8	53.9	59.6	57.2	49.6	56.0	24.6	50.5	37.6	27.3	26.8	49.1	56.4	75.4	43.3	37.3	14.6	12.1	11.4
DE	24.3	61.8	35.3	10.9	0.0	48.6	30.4	51.9	43.7	12.7	48.0	53.5	52.5	44.5	51.0	25.4	42.9	29.4	20.6	22.0	43.4	51.2	69.2	35.8	31.5	14.8	16.2	11.1
EE	28.2	19.2	14.0	55.9	48.6	0.0	26.4	17.6	16.3	41.3	12.3	11.9	16.6	15.1	16.5	53.5	7.2	29.6	58.1	31.3	14.5	16.4	25.6	28.8	22.6	43.8	51.2	57.8
IE	16.9	42.2	18.1	36.1	30.4	26.4	0.0	31.6	25.8	25.8	29.2	32.9	29.6	24.3	31.6	29.9	21.9	14.5	43.8	15.6	25.6	32.5	48.4	32.7	18.1	25.9	29.0	37.2
EL	28.8	16.8	23.5	56.6	51.9	17.6	31.6	0.0	9.1	48.0	8.8	8.8	6.4	9.8	5.6	55.4	19.8	40.0	64.7	32.8	11.9	5.7	24.2	33.2	24.2	42.6	51.1	61.2
ES	21.7	20.9	16.6	48.7	43.7	16.3	25.8	9.1	0.0	40.3	7.0	12.2	11.9	5.2	8.2	49.7	16.0	34.1	56.9	25.1	5.3	7.9	28.3	27.4	16.0	34.8	43.9	53.4
FR	21.2	56.1	28.9	22.8	12.7	41.3	25.8	48.0	40.3	0.0	43.2	48.0	48.1	40.8	47.0	27.9	35.7	20.3	19.3	21.7	39.6	47.3	63.9	29.2	29.3	22.1	24.7	19.5
HR	26.3	14.8	17.2	53.9	48.0	12.3	29.2	8.8	7.0	43.2	0.0	6.5	11.9	8.5	7.0	54.7	14.1	35.9	59.5	30.1	7.1	5.4	22.8	27.4	20.0	40.4	49.7	57.9
IT	31.1	10.5	21.3	59.6	53.5	11.9	32.9	8.8	12.2	48.0	6.5	0.0	11.3	13.0	8.9	58.7	15.6	39.0	64.3	35.4	12.7	7.2	19.4	30.8	25.5	46.1	54.9	63.1
CY	29.6	19.6	23.7	57.2	52.5	16.6	29.6	6.4	11.9	48.1	11.9	11.3	0.0	9.8	8.0	54.0	19.6	37.9	65.8	32.3	13.7	10.4	25.4	36.3	24.9	43.5	50.8	61.5
LV	23.1	22.0	16.4	49.6	44.5	15.1	24.3	9.8	5.2	40.8	8.5	13.0	9.8	0.0	7.7	49.2	15.8	32.7	58.3	24.6	5.4	9.4	27.8	30.7	15.9	35.8	43.9	54.1
LT	29.0	16.3	21.9	56.0	51.0	16.5	31.6	5.6	8.2	47.0	7.0	8.9	8.0	7.7	0.0	56.2	19.3	39.2	64.0	31.7	9.3	4.2	22.3	32.9	22.6	42.1	50.9	60.8
LU	31.2	68.7	43.4	24.6	25.4	53.5	29.9	55.4	49.7	27.9	54.7	58.7	54.0	49.2	56.2	0.0	48.2	30.5	37.9	28.6	50.3	57.1	75.9	49.4	39.8	26.6	17.4	22.8
HU	23.3	23.7	8.9	50.5	42.9	7.2	21.9	19.8	16.0	35.7	14.1	15.6	19.6	15.8	19.3	48.2	0.0	25.0	52.2	26.7	14.2	18.6	30.9	24.9	18.2	38.7	46.1	51.9
MT	22.3	47.8	21.0	37.6	29.4	29.6	14.5	40.0	34.1	20.3	35.9	39.0	37.9	32.7	39.2	30.5	25.0	0.0	37.7	21.4	32.8	40.1	54.2	33.0	25.5	31.5	32.8	35.3
NL	37.8	71.4	45.8	27.3	20.6	58.1	43.8	64.7	56.9	19.3	59.5	64.3	65.8	58.3	64.0	37.9	52.2	37.7	0.0	39.4	56.4	63.6	79.7	39.3	46.1	34.1	35.3	19.7
AT	12.5	44.8	19.6	26.8	22.0	31.3	15.6	32.8	25.1	21.7	30.1	35.4	32.3	24.6	31.7	28.6	26.7	21.4	39.4	0.0	24.5	32.6	50.8	31.4	13.2	15.3	20.8	31.0
PL	23.0	21.0	14.0	49.1	43.4	14.5	25.6	11.9	5.3	39.6	7.1	12.7	13.7	5.4	9.3	50.3	14.2	32.8	56.4	24.5	0.0	9.1	26.8	28.3	13.8	35.5	44.3	53.4
PT	29.2	14.2	21.6	56.4	51.2	16.4	32.5	5.7	7.9	47.3	5.4	7.2	10.4	9.4	4.2	57.1	18.6	40.1	63.6	32.6	9.1	0.0	21.3	31.4	22.6	42.5	51.7	61.0
RO	48.8	12.7	35.8	75.4	69.2	25.6	48.4	24.2	28.3	63.9	22.8	19.4	25.4	27.8	22.3	75.9	30.9	54.2	79.7	50.8	26.8	21.3	0.0	46.0	39.3	61.8	70.8	79.3
SI	21.8	35.4	23.0	43.3	35.8	28.8	32.7	33.2	27.4	29.2	27.4	30.8	36.3	30.7	32.9	49.4	24.9	33.0	39.3	31.4	28.3	31.4	46.0	0.0	27.9	34.5	44.8	44.6
SK	16.4	34.1	11.7	37.3	31.5	22.6	18.1	24.2	16.0	29.3	20.0	25.5	24.9	15.9	22.6	39.8	18.2	25.5	46.1	13.2	13.8	22.6	39.3	27.9	0.0	24.6	32.6	41.2
FI	18.0	54.6	31.7	14.6	14.8	43.8	25.9	42.6	34.8	22.1	40.4	46.1	43.5	35.8	42.1	26.6	38.7	31.5	34.1	15.3	35.5	42.5	61.8	34.5	24.6	0.0	12.8	22.5
SE	26.3	64.2	39.3	12.1	16.2	51.2	29.0	51.1	43.9	24.7	49.7	54.9	50.8	43.9	50.9	17.4	46.1	32.8	35.3	20.8	44.3	51.7	70.8	44.8	32.6	12.8	0.0	18.1
UK	33.0	71.7	44.9	11.4	11.1	57.8	37.2	61.2	53.4	19.5	57.9	63.1	61.5	54.1	60.8	22.8	51.9	35.3	19.7	31.0	53.4	61.0	79.3	44.6	41.2	22.5	18.1	0.0

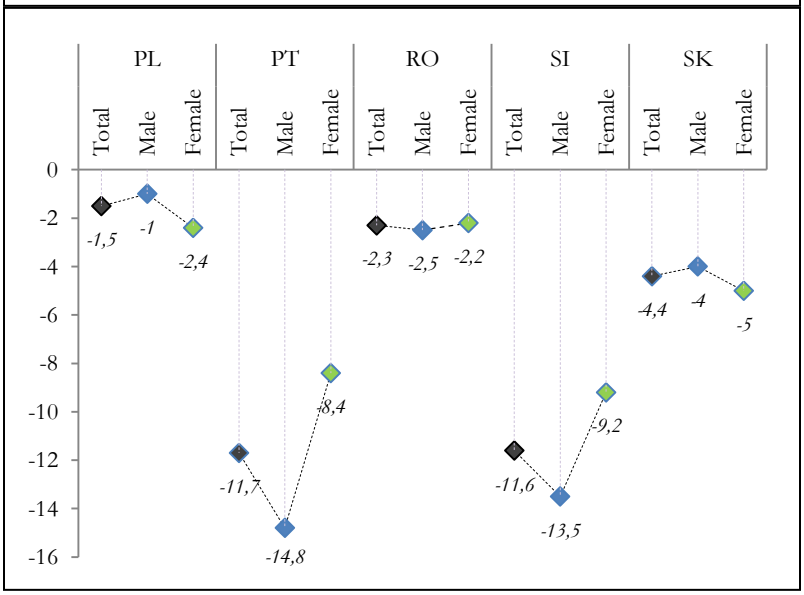
Appendix 3: Change in Employment Rates between 2007 to 2013 (15 to 24 years)

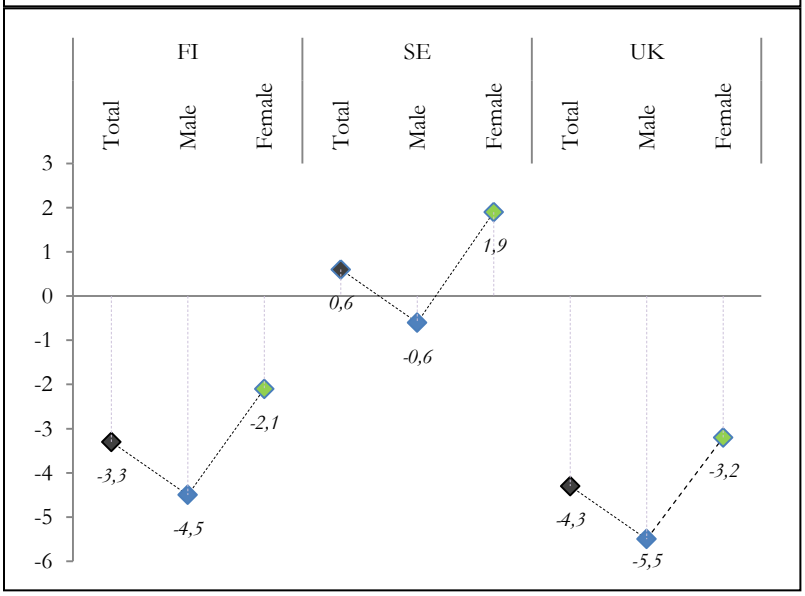




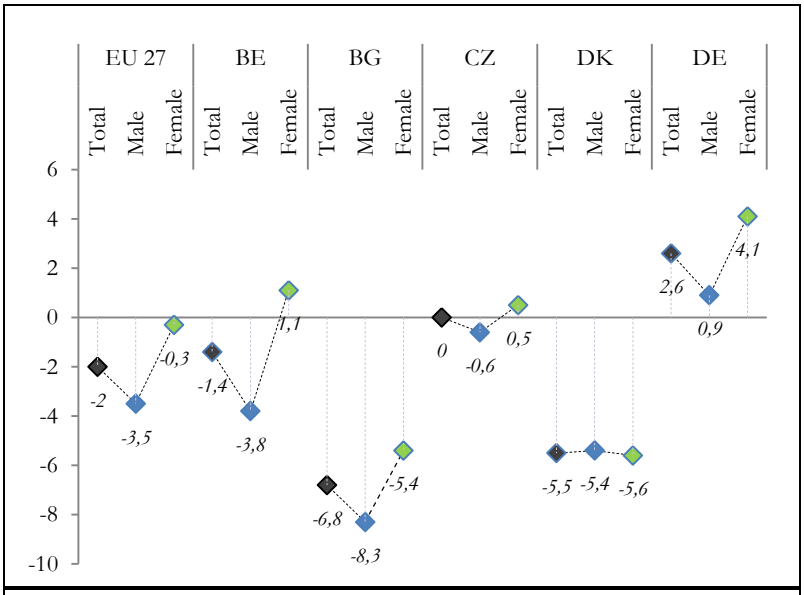


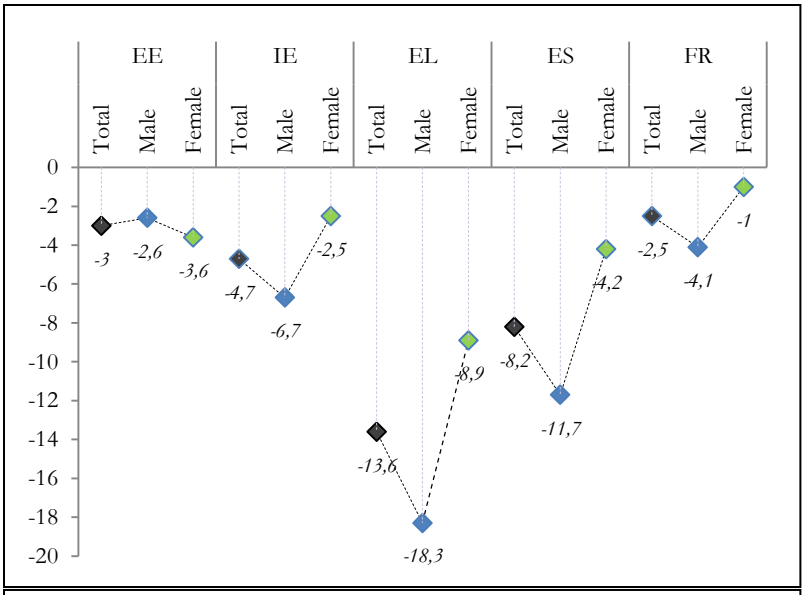


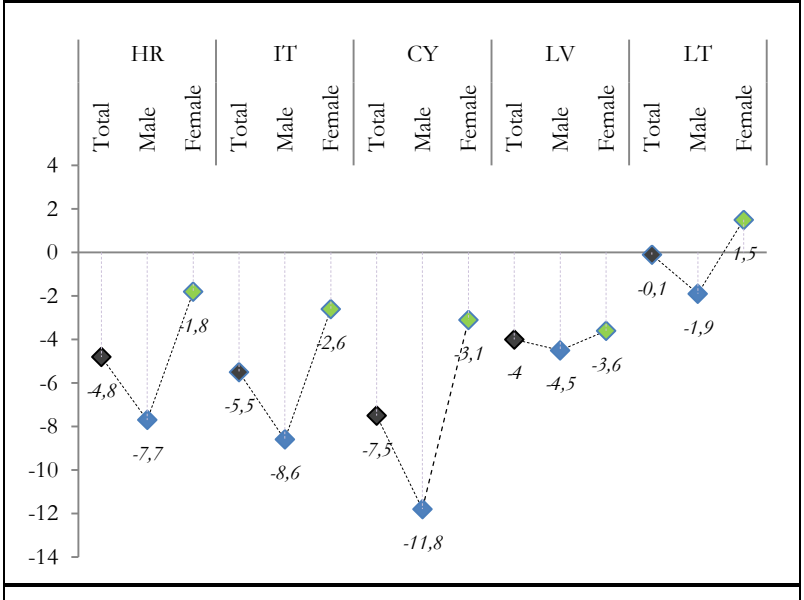


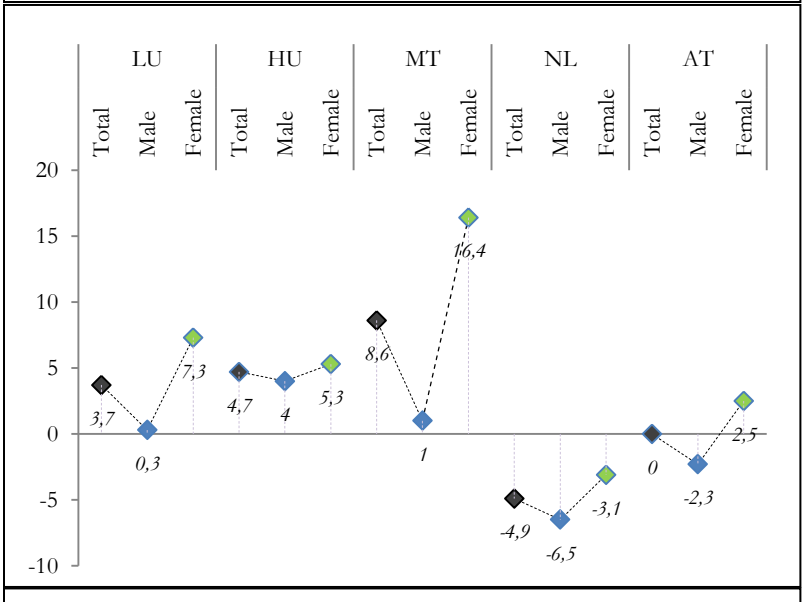


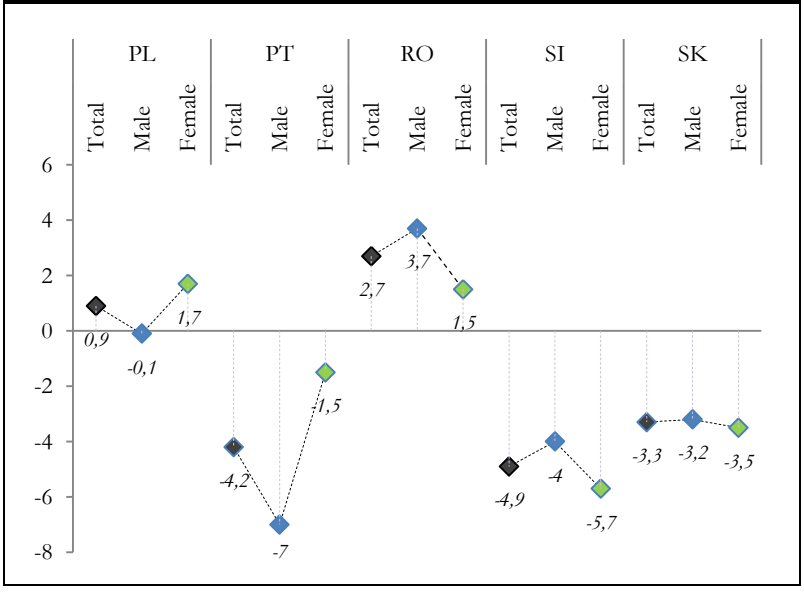
Appendix 4: Change in Employment Rates between 2007 to 2013 (25 to 54 years).

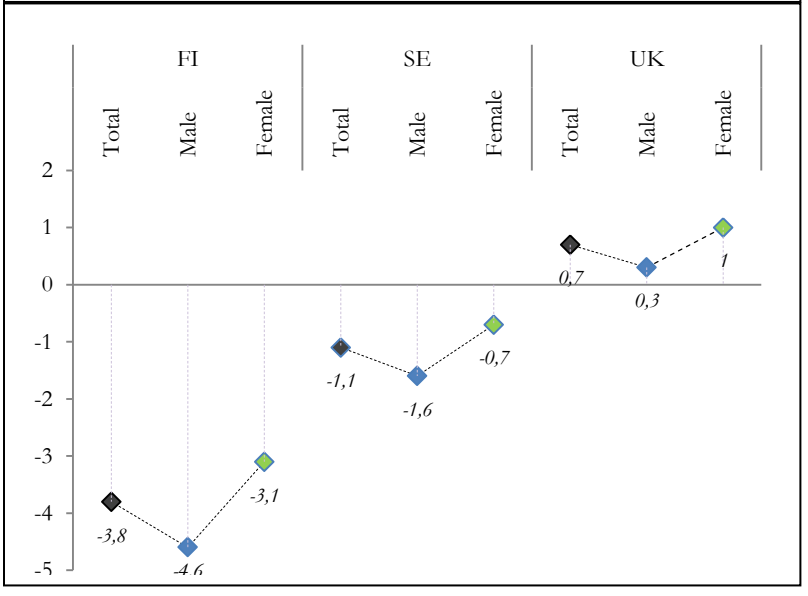




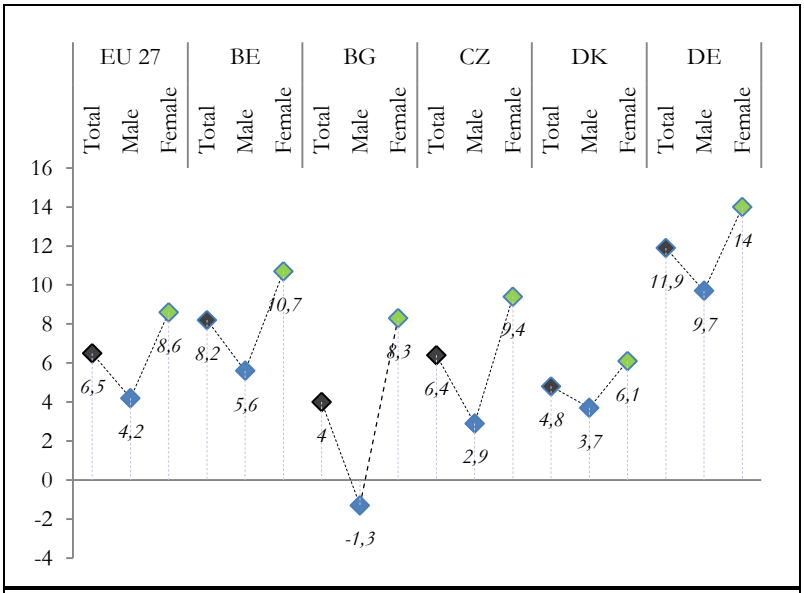


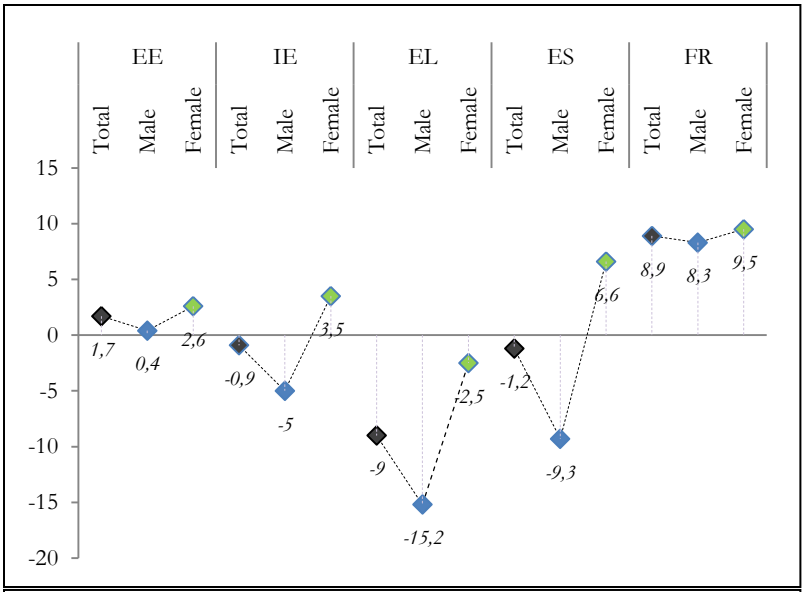


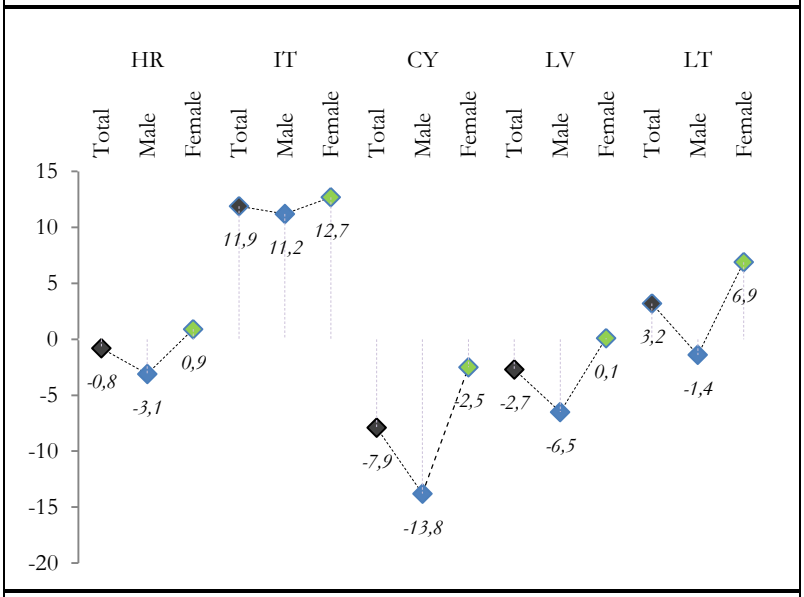


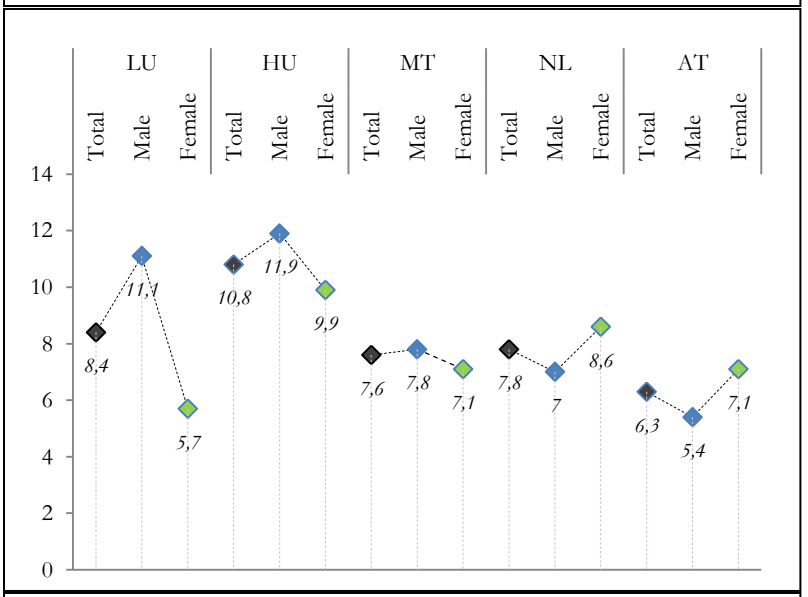


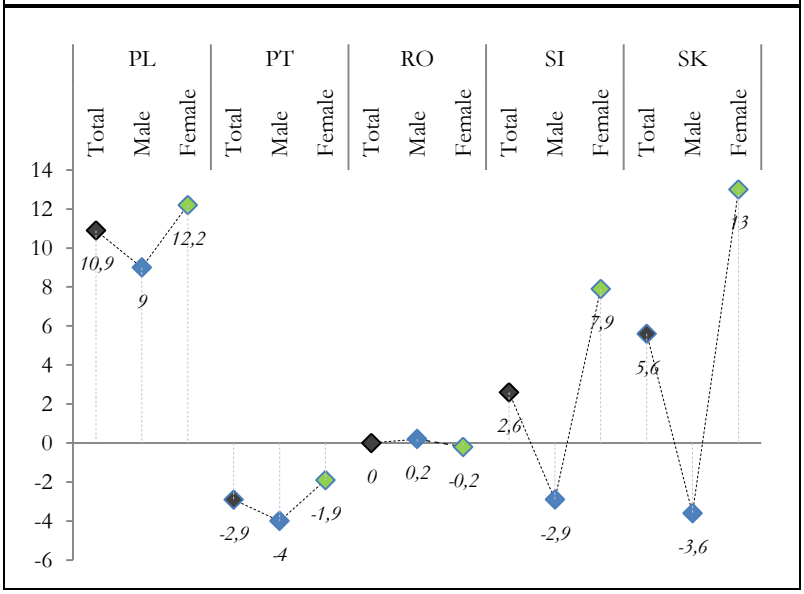
Appendix 5: Change in Employment Rates between 2007 to 2013 (55 to 64 years).

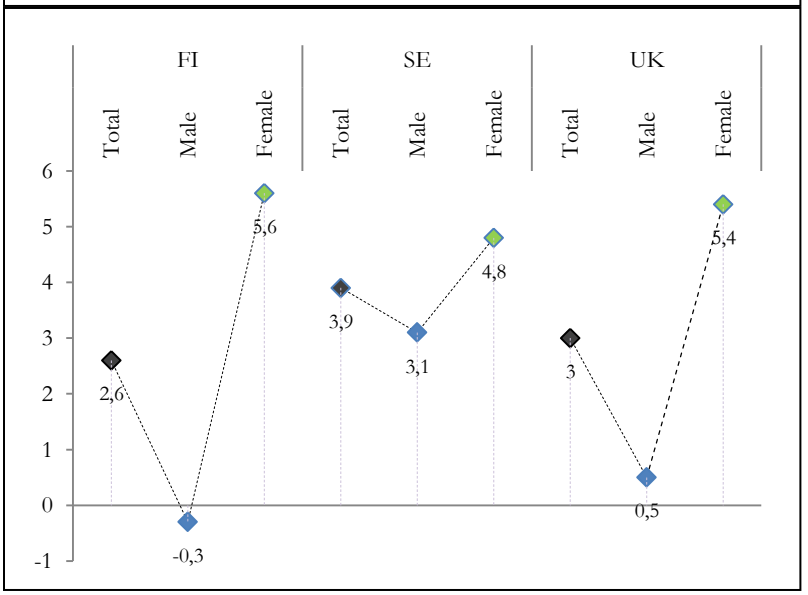




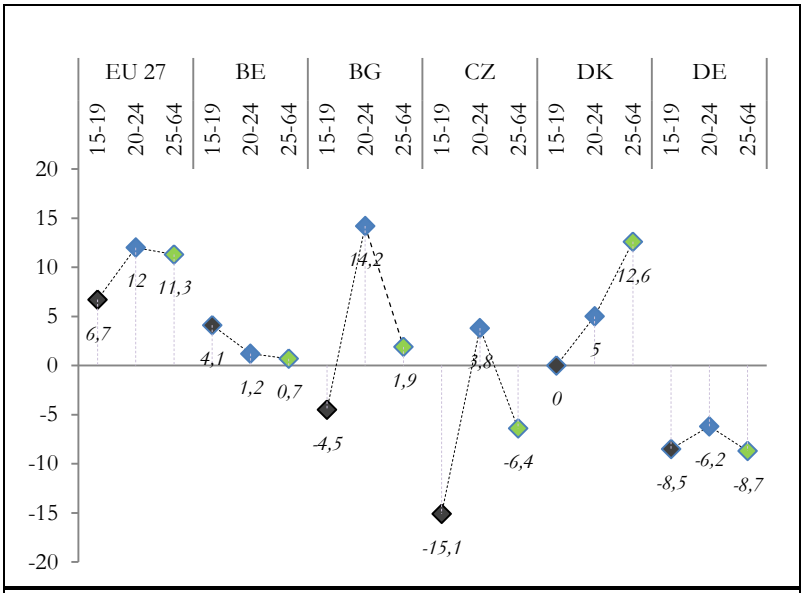


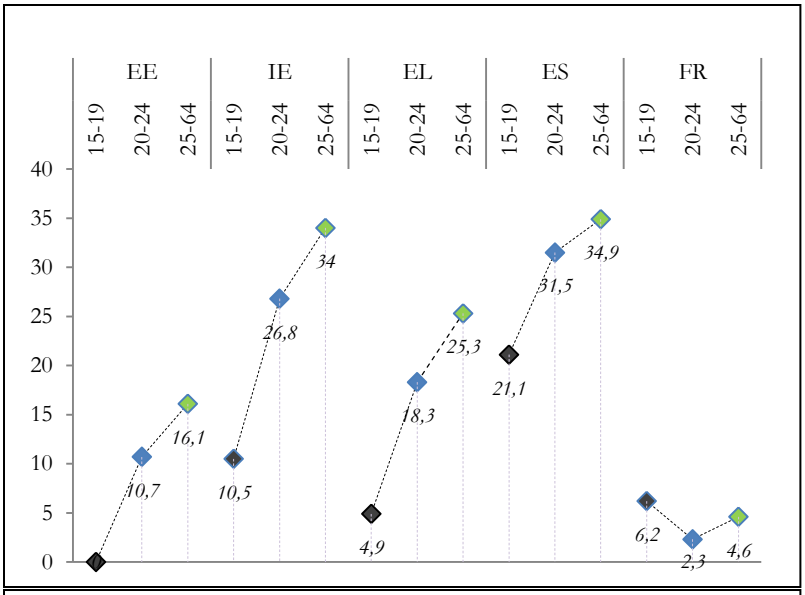


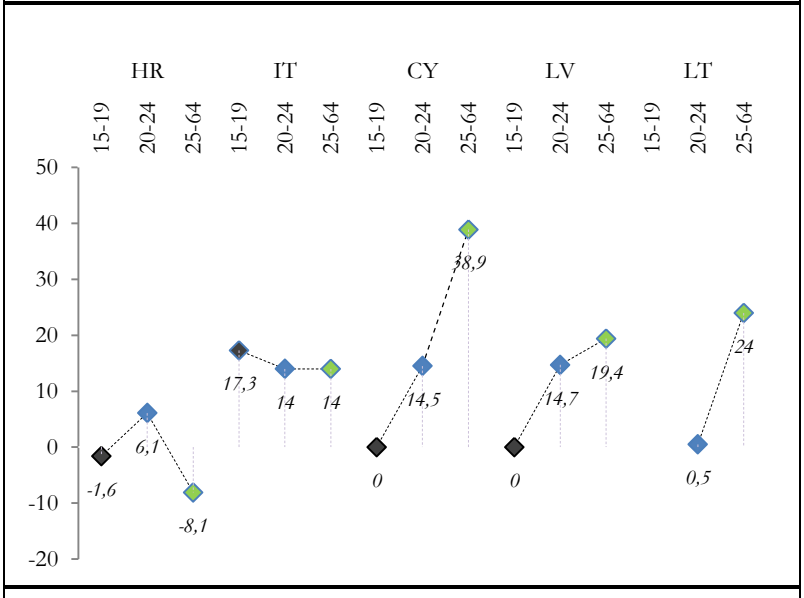


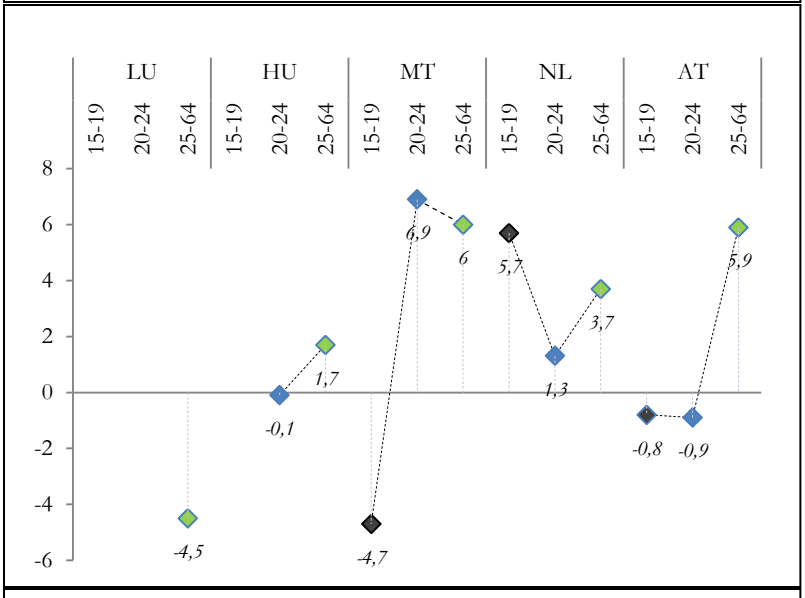


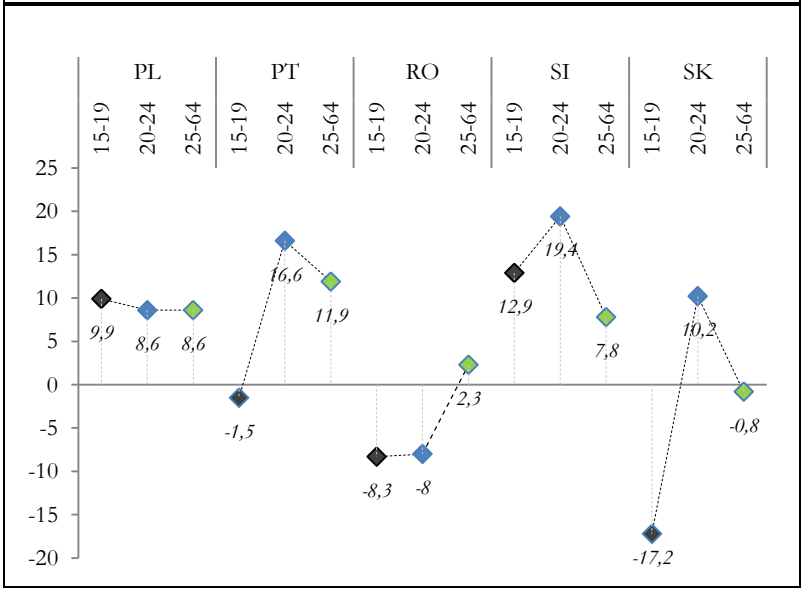
Appendix 6: Change in Long Term unemployment Rates between 2007 to 2013

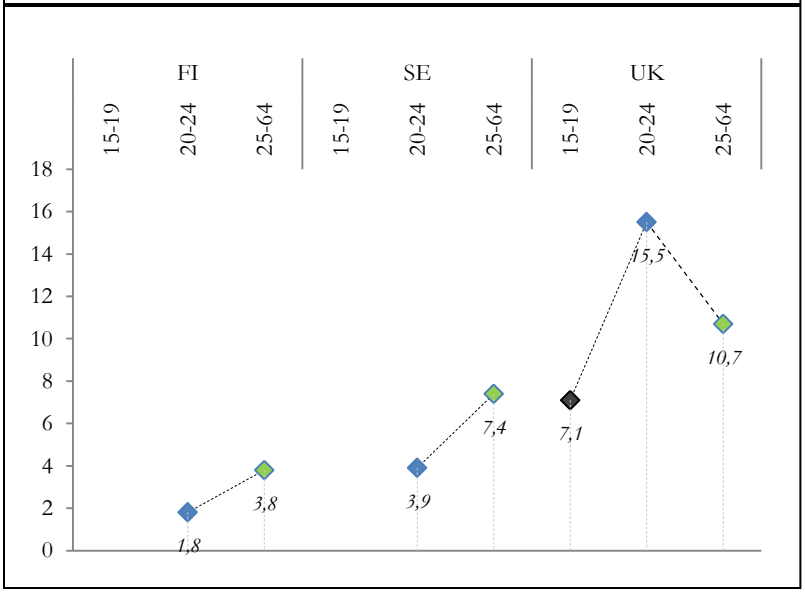




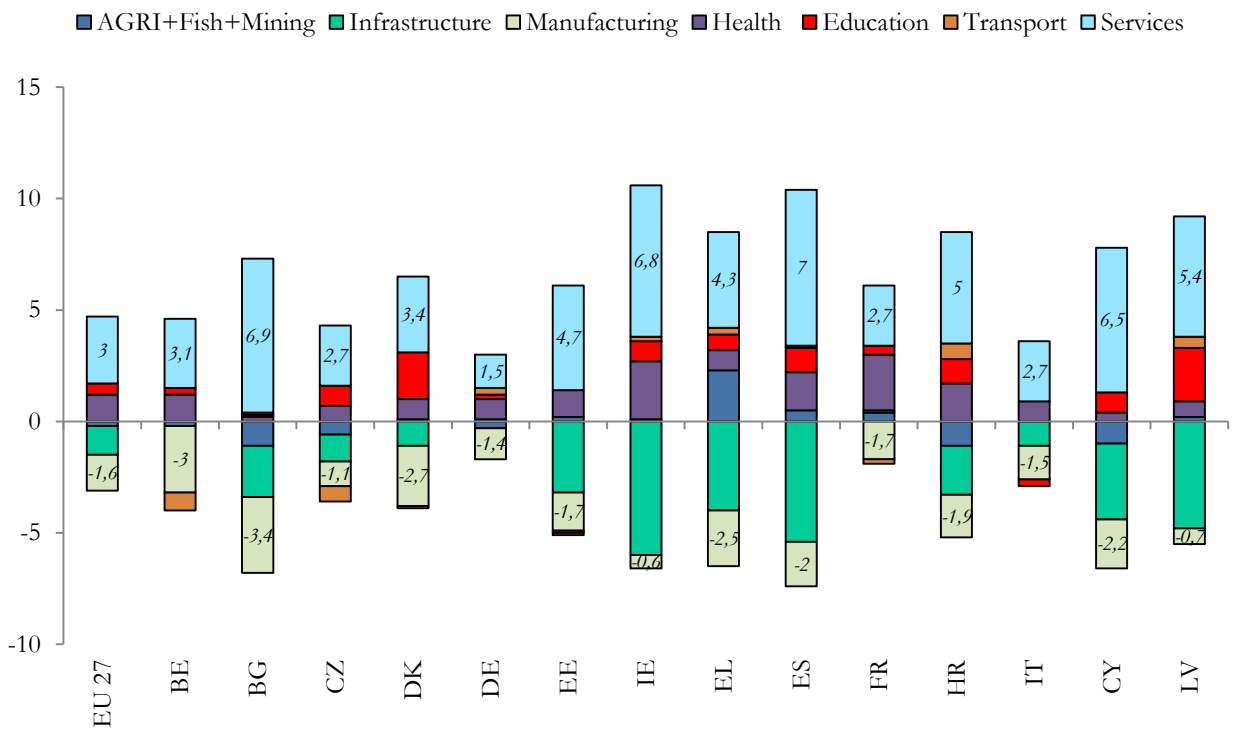


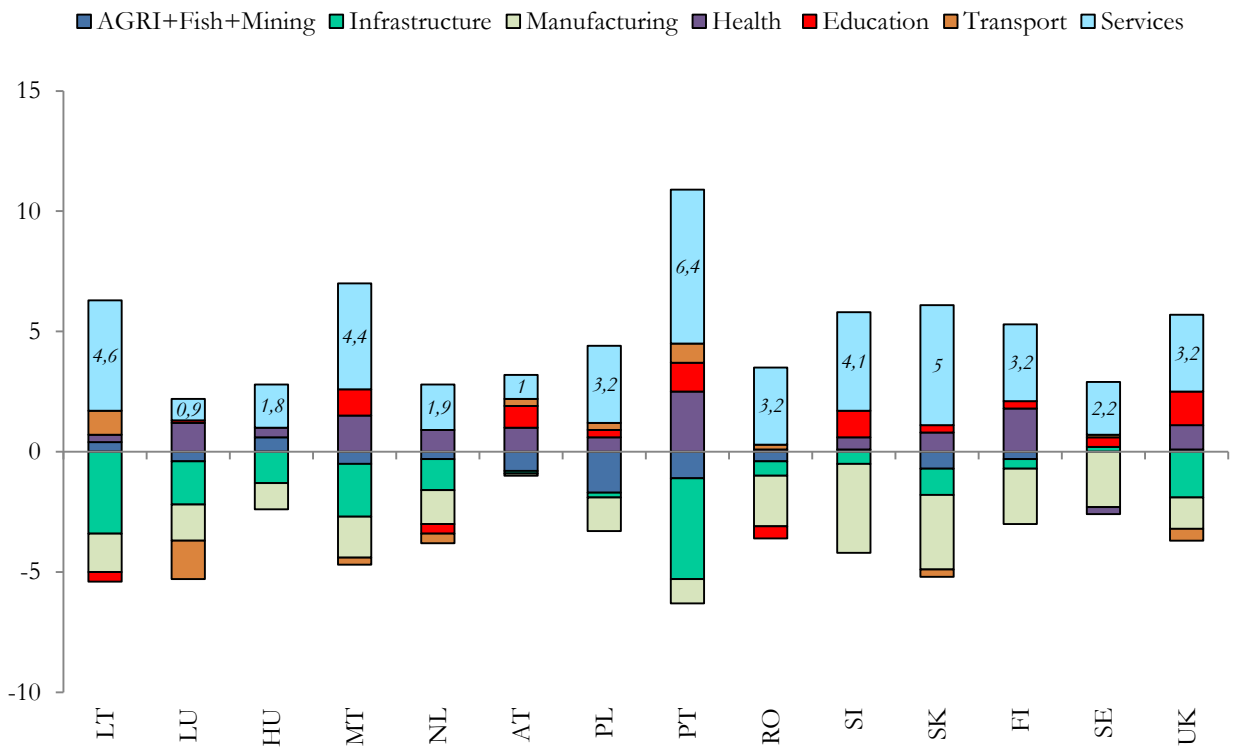






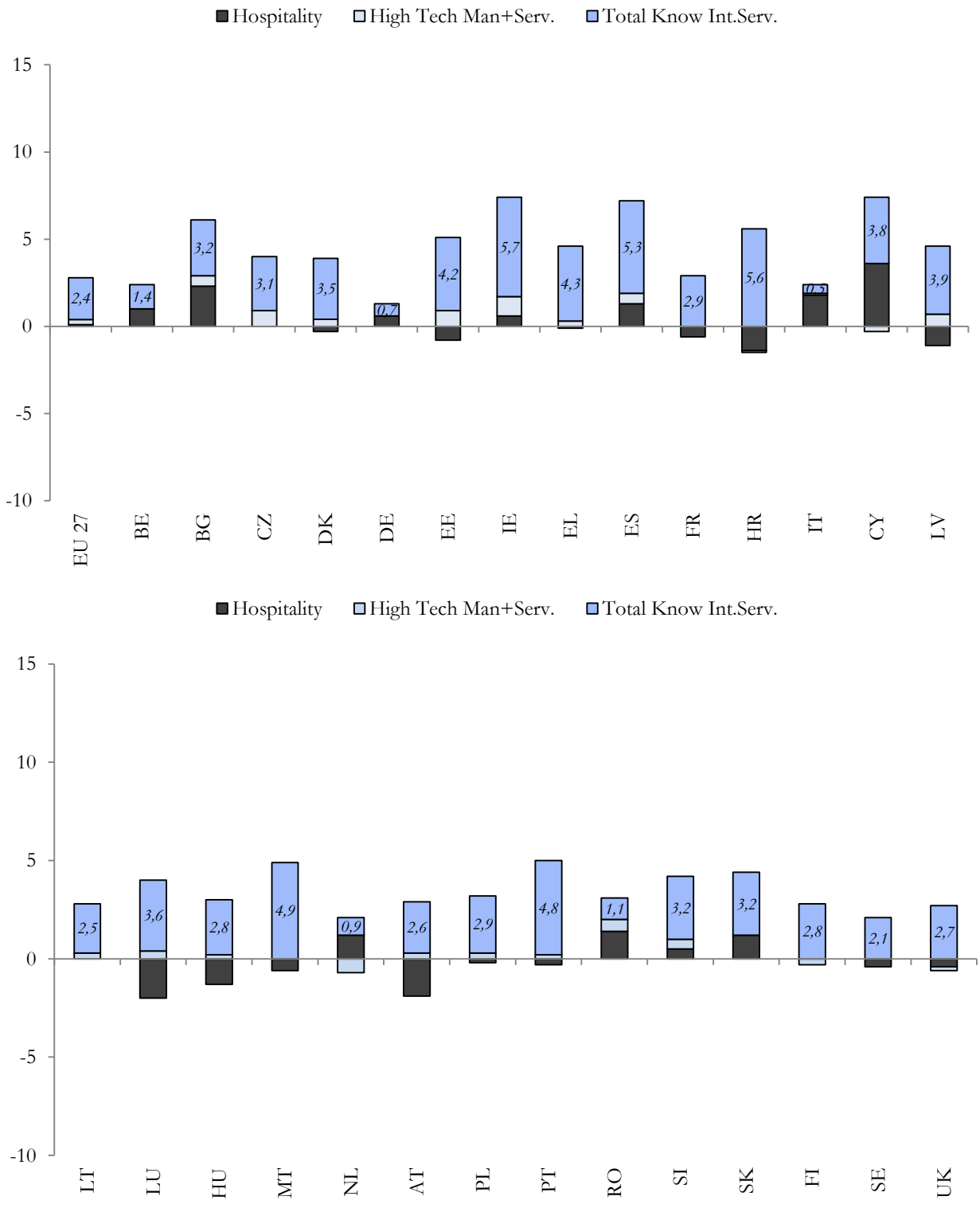
Appendix 7: PP Change in share of sectorial employment from 2007 to 2013





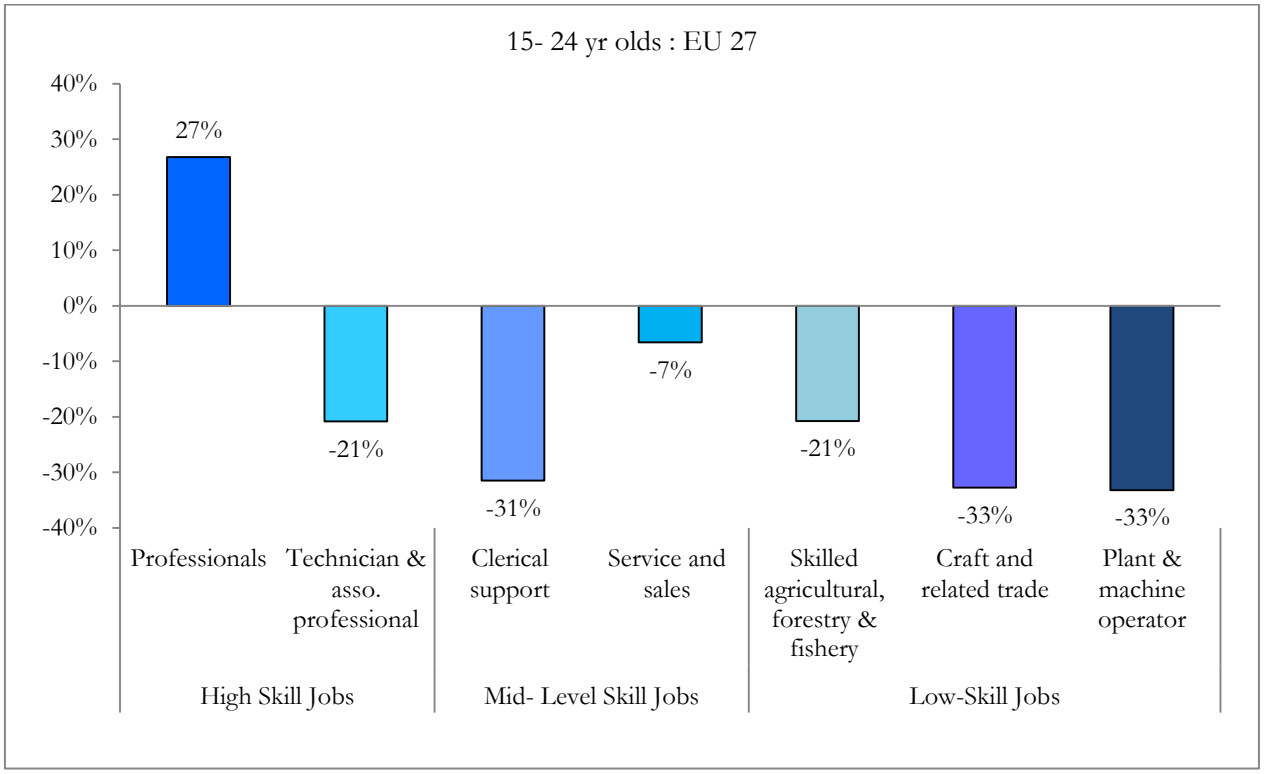
Source- Calculations made based on data extracted from Eurostats

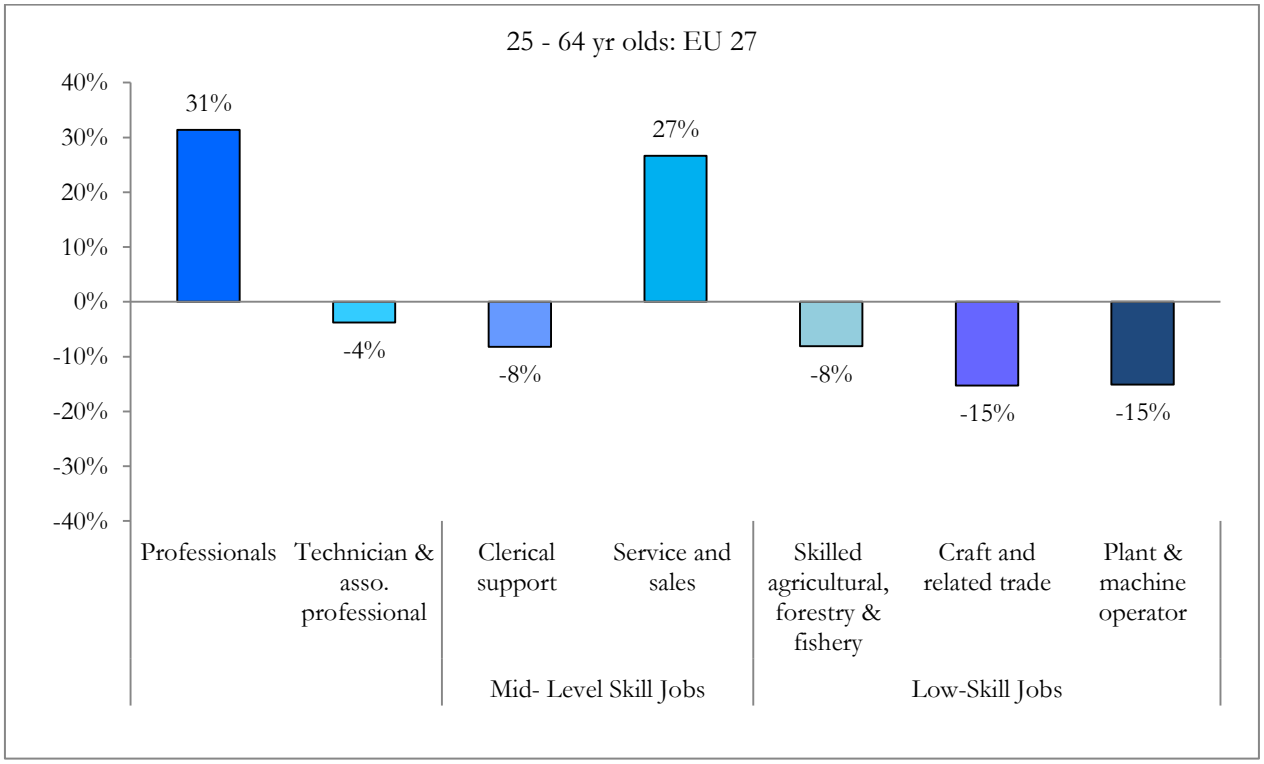
Appendix 8: PP Change in employment rate within three groups of the services sector from 2007 to 2013



Source- Calculations made based on data extracted from Eurostats

Appendix 9: PP change in employment across sectors from 2007 to 2013 (classified by skill level)





Source- Calculations made based on data extracted from Eurostats

Appendix 10: Percentage change in job employment for youth (15 to 25) from 2007 to 2013

Country	High Skill Jobs		Mid- Level Skill Jobs		Low-Skill Jobs		
	Professionals	Technicians and associate professionals	Clerical support workers	Service and sales workers	Skilled agricultural, forestry and fishery workers	Craft and related trades workers	Plant and machine operators and assemblers
EU 27	27%	-21%	-31%	-7%	-21%	-33%	-33%
BE	-17%	10%	-40%	10%	-33%	-19%	-41%
BG	-22%	-38%	-51%	-27%	-6%	-54%	-47%
CZ	-20%	-48%	-31%	-1%	43%	-19%	-21%
DK	40%	-19%	-25%	8%	-38%	-24%	-45%
DE	29%	-8%	-1%	-3%	-31%	-15%	-16%
EE	-16%	-37%	-10%	-17%	0%	-59%	-32%
IE	-46%	-41%	-68%	-39%	-13%	-74%	-68%
EL	-15%	-60%	-73%	-26%	-21%	-77%	-76%
ES	-30%	-57%	-71%	-41%	-50%	-78%	-79%
FR	44%	-8%	-38%	0%	-18%	-32%	-10%
HR	53%	-43%	-54%	-22%	-36%	-43%	-69%
IT	-21%	-46%	-54%	-7%	-26%	-46%	-55%
CY	-10%	-28%	-52%	9%	0%	-64%	-38%
LV	-37%	-57%	-14%	-26%	-4%	-57%	-62%
LT	-22%	-12%	-26%	-2%	0%	-30%	34%
LU	36%	62%	-56%	10%	0%	-20%	-25%
HU	-7%	-1%	-11%	3%	55%	-7%	12%
MT	28%	-14%	-21%	27%	0%	-42%	-17%
NL	40%	-35%	-58%	21%	-28%	-24%	-21%
AT	154%	-1%	-8%	11%	7%	-20%	-32%
PL	1%	-42%	-37%	-15%	-38%	-27%	-17%
PT	12%	-35%	-59%	-29%	-9%	-66%	-15%
RO	-15%	-63%	-56%	-27%	-8%	-50%	-44%
SI	-6%	-62%	-59%	-40%	-42%	-30%	-66%
SK	-47%	-67%	-18%	-15%	0%	-42%	-27%
FI	-14%	-3%	-19%	11%	-23%	-27%	-8%
SE	111%	19%	-37%	23%	-11%	-11%	-34%
UK	84%	-12%	-21%	-6%	0%	-20%	-49%

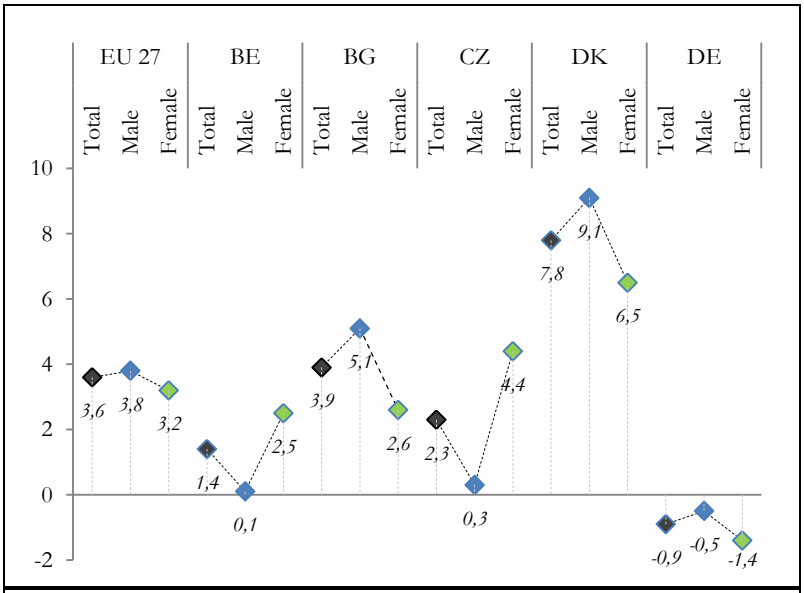
Source- Calculations made based on data extracted from Eurostats

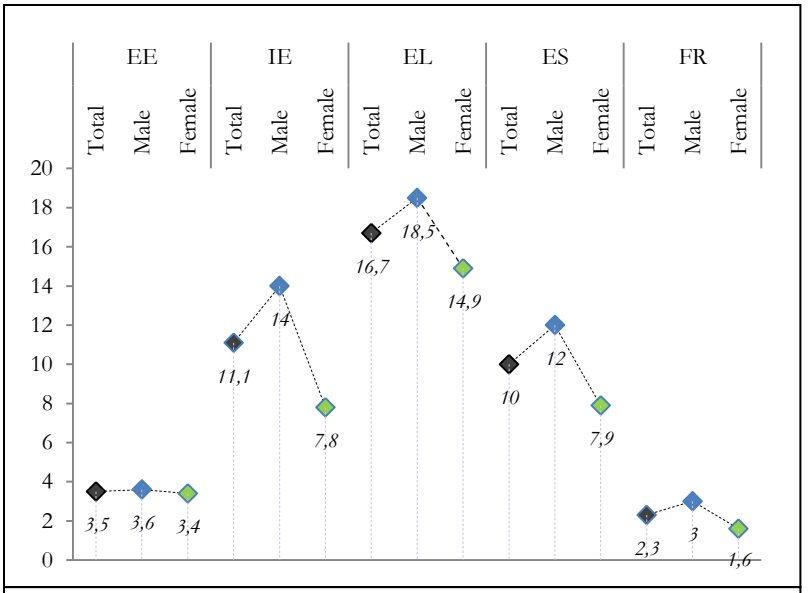
Appendix 11: PP Change in At-risk-of-poverty rate before social transfers (pensions included) by poverty threshold from 2007 to 2013

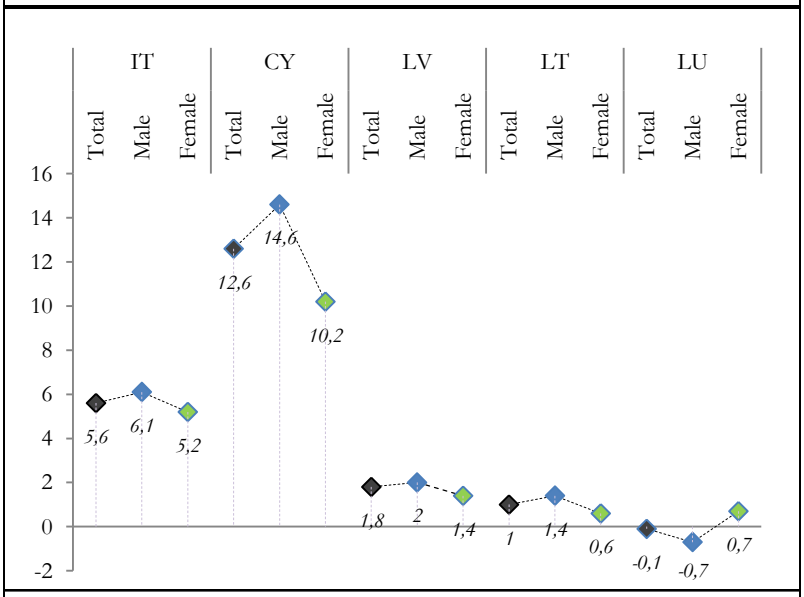
Country	18 – 24 years	25 – 54 years	55 – 64 years	65+ years
EU 27	3.9	2.6	-1.5	0.4
BE	-3.8	1.9	-8.4	0.8
BG	0.3	1.2	-4.5	-0.2
CZ	0.6	-1.5	-1.3	-0.6
DK	10.2	3.9	-1	-0.9
DE	-2.7	0.4	-4.5	0.1
EE	6.3	3.4	4.4	2.3
IE	18.5	8	7.5	2.4
EL	16.3	11	14.3	6
ES	11.5	9.2	-0.3	-2
FR	3.2	2.3	-1.8	2.7
HR	5	2.9	-1.8	0
IT	7.3	8	4.8	2.6
CY	7.8	3.6	5.2	6.3
LV	6	6.4	3.3	2.3
LT	5.6	4.7	6.5	-2.3
LU	-3.9	-4.1	-7.7	0.5
HU	4.7	2.6	-1.7	1
MT	2.7	2.4	-6.3	-1.5
NL	-0.1	0.7	-3.8	1.7
AT	-1	-1.3	-6.8	-2.9
PL	7.2	4	7.6	2.5
PT	7	0.7	-5.8	0
RO	5.4	2.2	2.8	5
SI	4.6	2.2	-5.6	-3.3
SK	0	1.7	0.7	-0.1
FI	0.5	-1.2	-3.4	-1.1
SE	9.4	3.4	3.6	1.2
UK	8.1	7	9.7	2.8

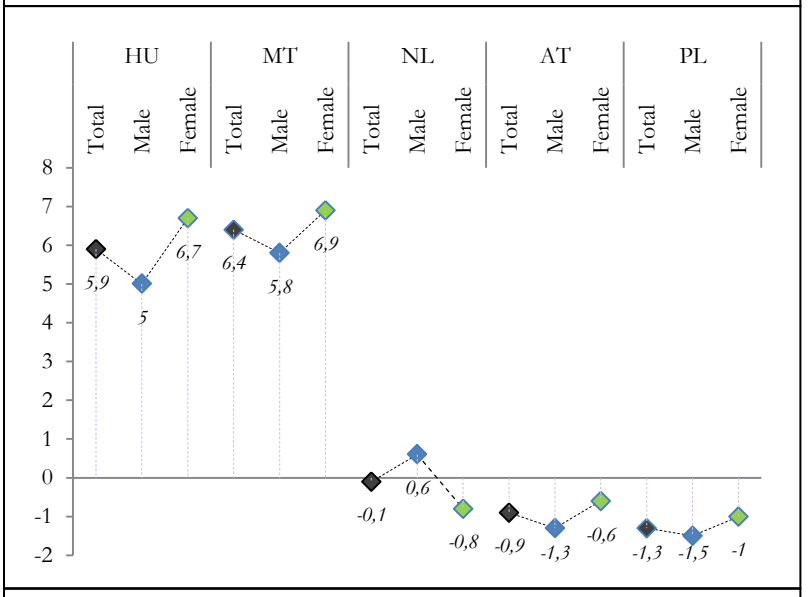
Source- Calculations made based on data extracted from Eurostats

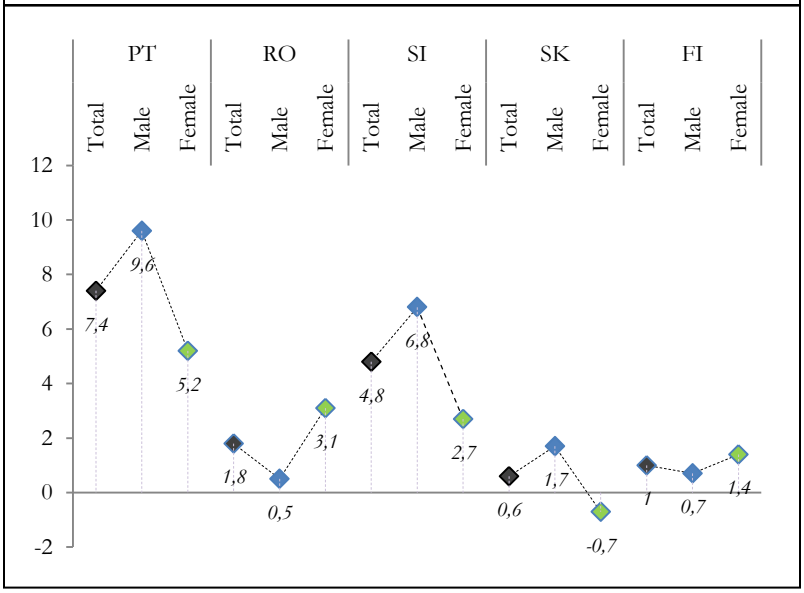
Appendix 12: PP change for Young people's at-risk-of-poverty or exclusion rate from 2007 to 2013

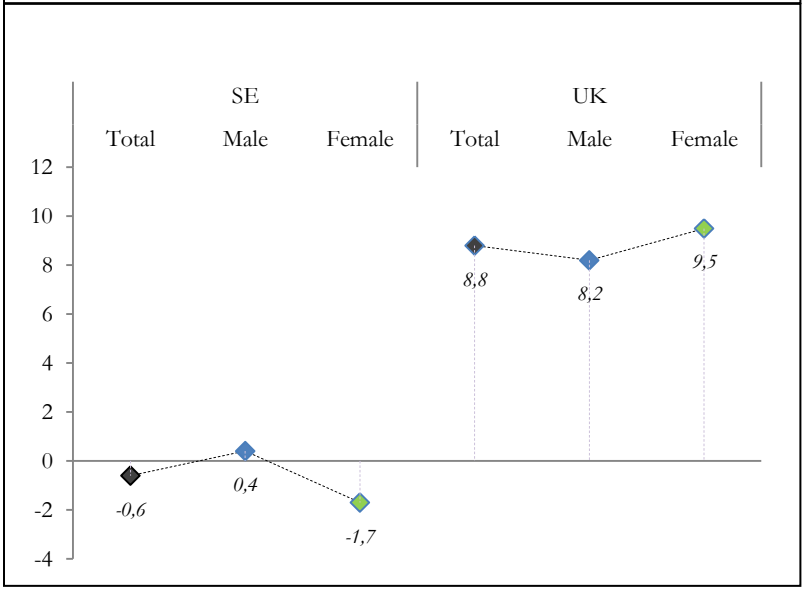




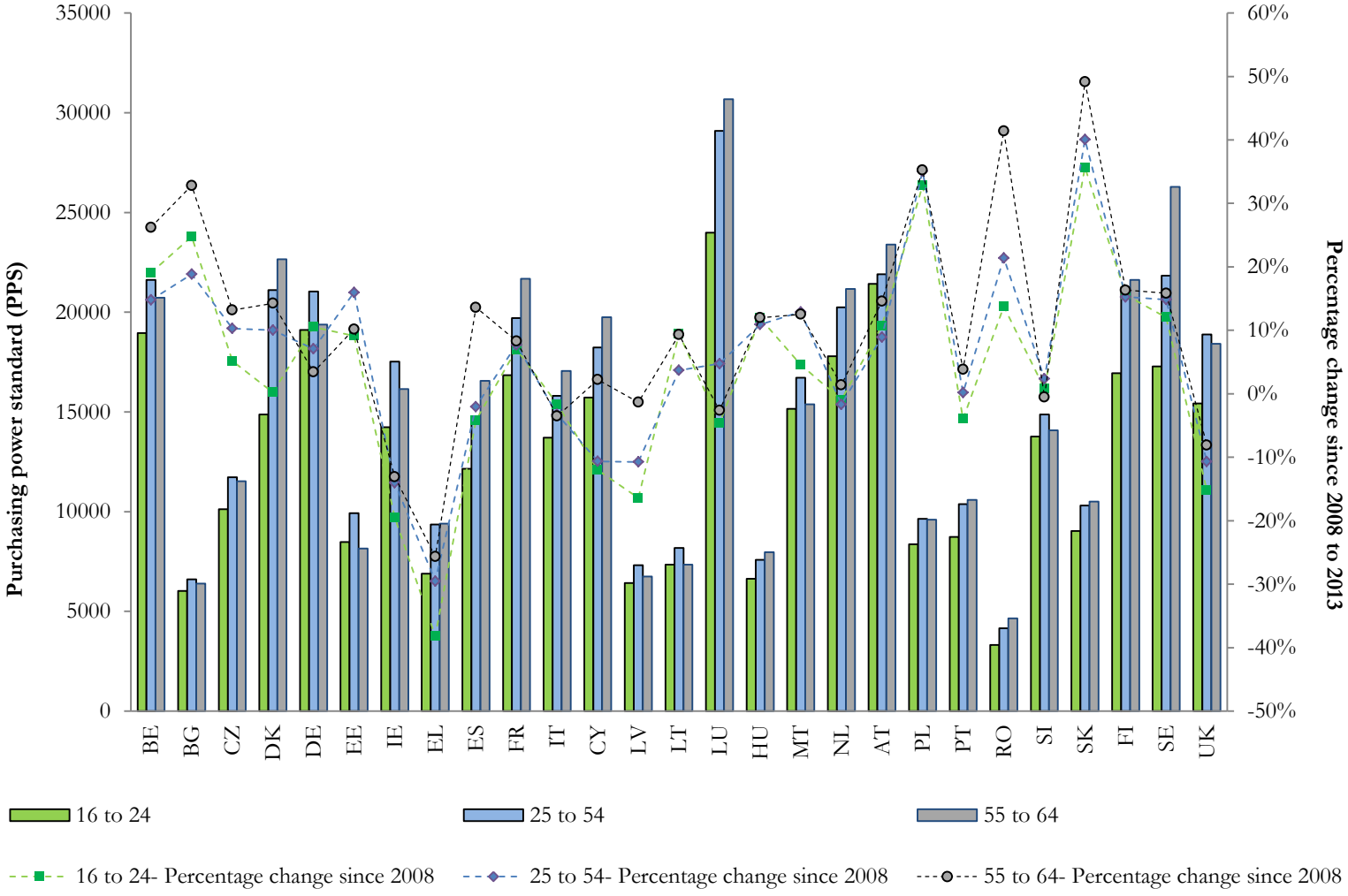








Appendix 13: Change in Median equivalised net income from 2007 to 2013 by age group. Unit of measurement - Purchasing power standard (PPS)



Source- Calculations made based on data extracted from Eurostats

Appendix 14: Change from 2007 to 2013 for In-work-at-risk-of-poverty-rate for 3 age groups

Country	Age Group	2007	2013	Change (2007 to 2013) In-work-at-risk-of-poverty-rate
EU 27	18-24	10.1	11.4	1.3
	25-54	8.3	8.8	0.5
	55-64	7.6	8.5	0.9
BE	18-24	5.4	2.7	-2.7
	25-54	4.3	4.5	0.2
	55-64	3.7	4.4	0.7
BG	18-24	6	6.5	0.5
	25-54	6	7.2	1.2
	55-64	5.2	7.7	2.5
CZ	18-24	2.9	3.1	0.2
	25-54	3.6	4.1	0.5
	55-64	1.6	4.1	2.5
DK	18-24	20.4	15.9	-4.5
	25-54	3.3	3.9	0.6
	55-64	2.2	3	0.8
DE	18-24	11.1	11.5	0.4
	25-54	7.3	8.4	1.1
	55-64	6.3	8.5	2.2
EE	18-24	4.4	7.2	2.8
	25-54	8.7	7.5	-1.2
	55-64	5.8	9.2	3.4
IE	18-24	5.4	2.6	-2.8
	25-54	5.2	4.2	-1
	55-64	7.4	7	-0.4
EL	18-24	13.8	18.1	4.3
	25-54	13.7	11.9	-1.8
	55-64	17	19.2	2.2

Source- Eurostats

Appendix 14: (Continued)…

Country	Age Group	2007	2013	Change (2007 to 2013) In-work-at-risk-of-poverty-rate
ES	18-24	7.5	15.5	8
	25-54	10.5	10.7	0.2
	55-64	10	8.3	-1.7
FR	18-24	6.5	13.5	7
	25-54	6.3	7.6	1.3
	55-64	7.4	7.4	0
IT	18-24	14.1	13.7	-0.4
	25-54	9.8	10.9	1.1
	55-64	7.7	8.5	0.8
CY	18-24	5.2	10.7	5.5
	25-54	6.4	9.5	3.1
	55-64	5.9	5.3	-0.6
LV	18-24	4.5	9.6	5.1
	25-54	10.1	9.1	-1
	55-64	10.1	8.8	-1.3
LT	18-24	4.7	7	2.3
	25-54	8.4	9.9	1.5
	55-64	8.8	6.6	-2.2
LU	18-24	11.1	11.9	0.8
	25-54	9.7	11.4	1.7
	55-64	4.6	9.5	4.9
HU	18-24	4	9.9	5.9
	25-54	6.3	6.5	0.2
	55-64	3.2	5.9	2.7
MT	18-24	2.3	4.1	1.8
	25-54	5.2	6.6	1.4
	55-64	3.6	3.5	-0.1
NL	18-24	1.7	5.8	4.1
	25-54	4.7	4.3	-0.4
	55-64	4.4	4.8	0.4
AT	18-24	5	9.8	4.8
	25-54	6.1	7.9	1.8
	55-64	7.4	6.6	-0.8

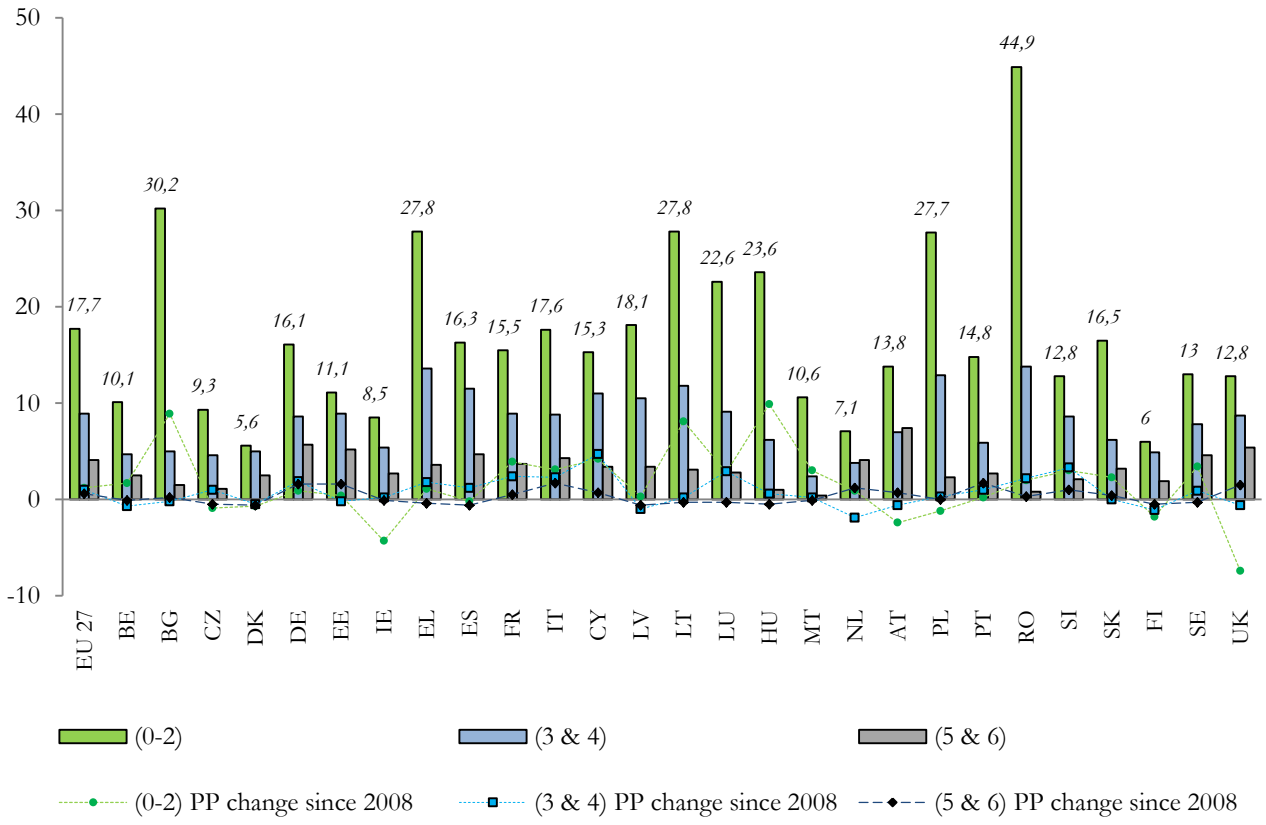
Source- Calculations made based on data extracted from Eurostats

Appendix 14: (Continued)…

Country	Age Group	2007	2013	Change (2007 to 2013) In-work-at-risk-of-poverty-rate
PL	18-24	12.1	11.7	-0.4
	25-54	12	10.8	-1.2
	55-64	8.3	10.3	2
PT	18-24	10.7	13.6	2.9
	25-54	8.4	9.8	1.4
	55-64	14.4	13.3	-1.1
RO	18-24	23.1	29.8	6.7
	25-54	15.9	16.7	0.8
	55-64	25.8	19	-6.8
SI	18-24	4.1	7.5	3.4
	25-54	4.7	7	2.3
	55-64	3.8	7.1	3.3
SK	18-24	4.3	3.3	-1
	25-54	5.3	6.2	0.9
	55-64	2	4	2
FI	18-24	12.3	7.6	-4.7
	25-54	4.5	3.4	-1.1
	55-64	3.8	3.6	-0.2
SE	18-24	19.4	19.4	0
	25-54	6.2	6.5	0.3
	55-64	2.2	4	1.8
UK	18-24	10.5	7.5	-3
	25-54	7.6	7.9	0.3
	55-64	7.7	10	2.3

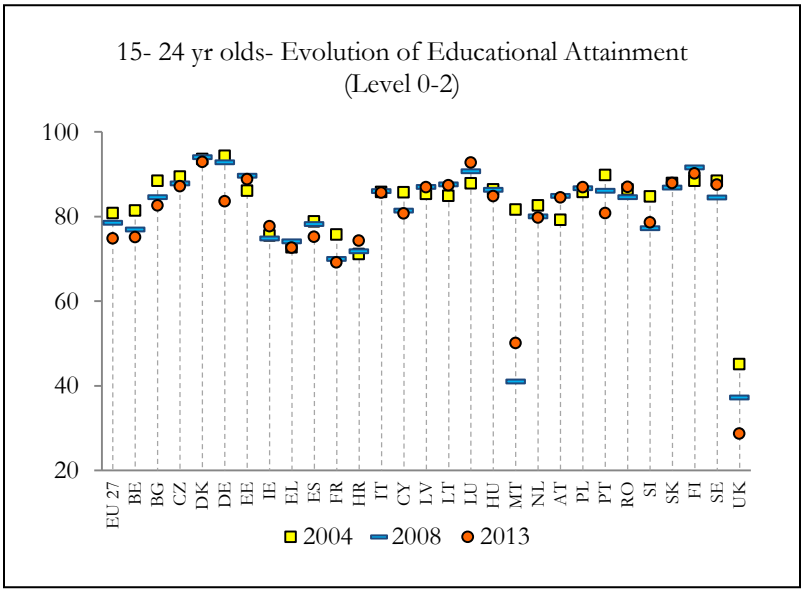
Source- Calculations made based on data extracted from Eurostats

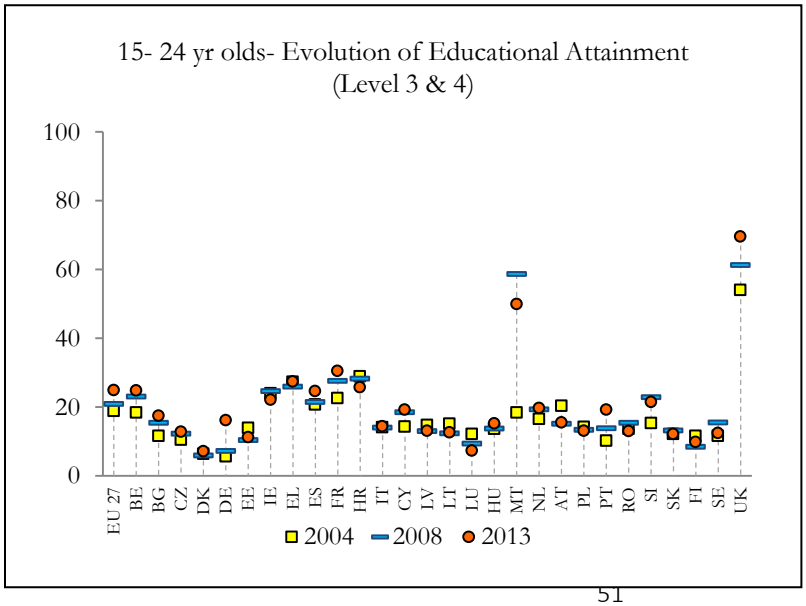
Appendix 15: PP change from 2007 to 2013 for In-Work-at-risk-of-poverty, based on level of education



Source- Calculations made based on data extracted from Eurostats

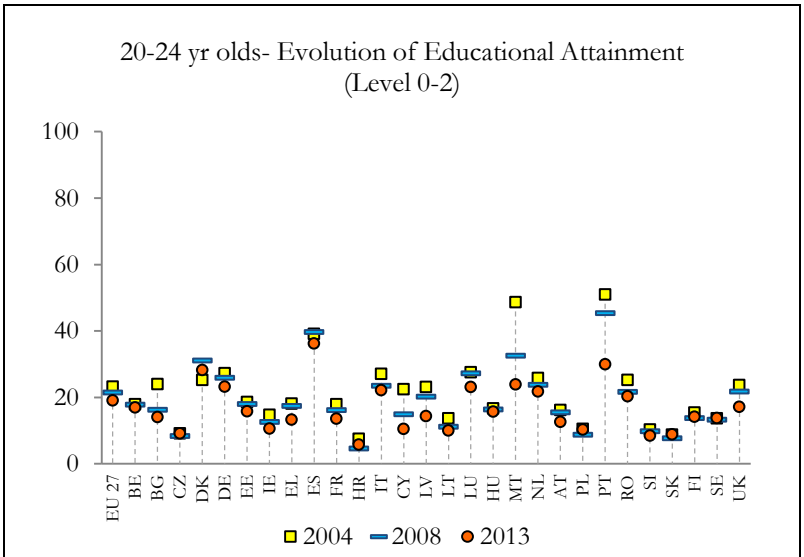
Appendix 16: Evolution of educational attainment for youth population across all levels of education

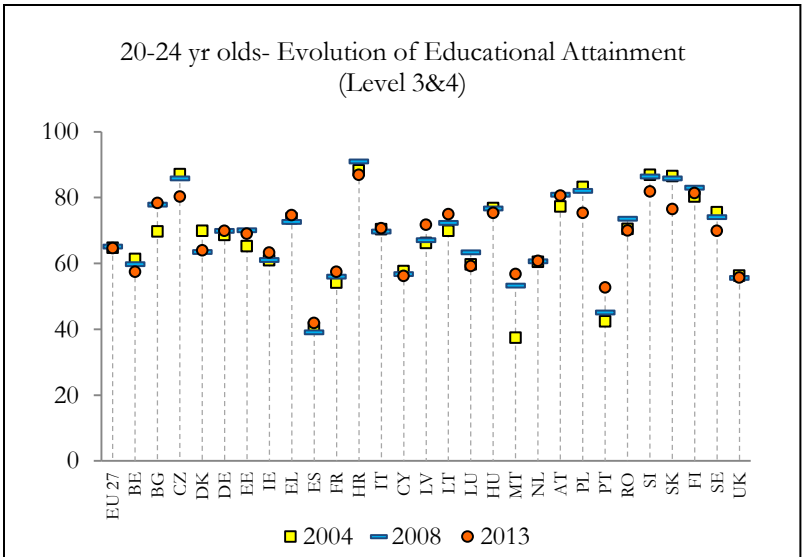


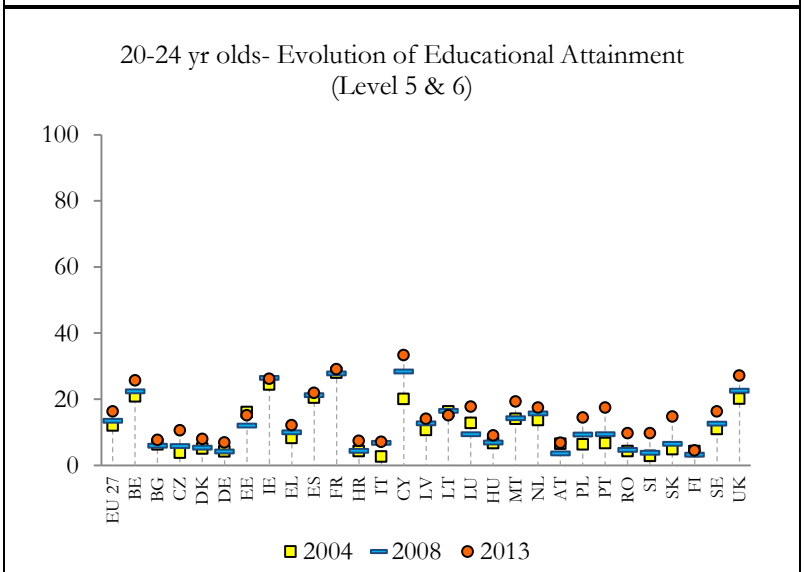


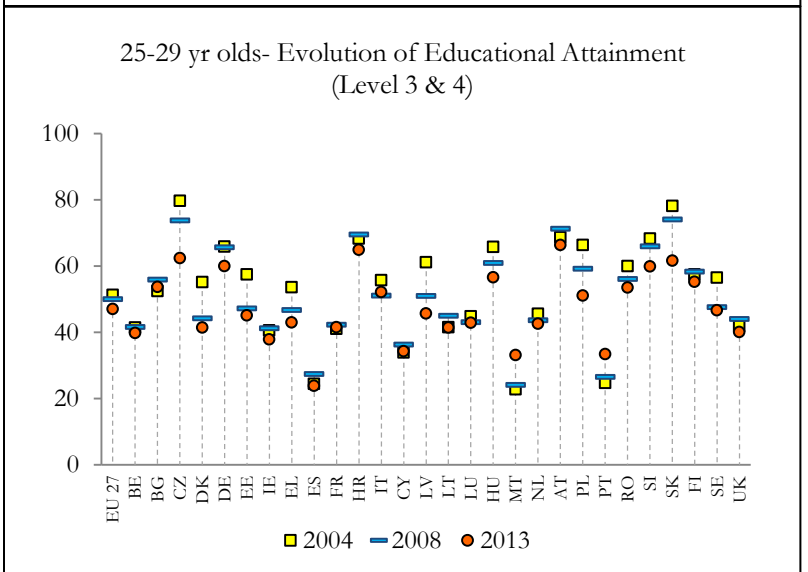
***Note**: Analysis for the 15 to 24 population for levels 5 and 6 was not made owing to missing data*

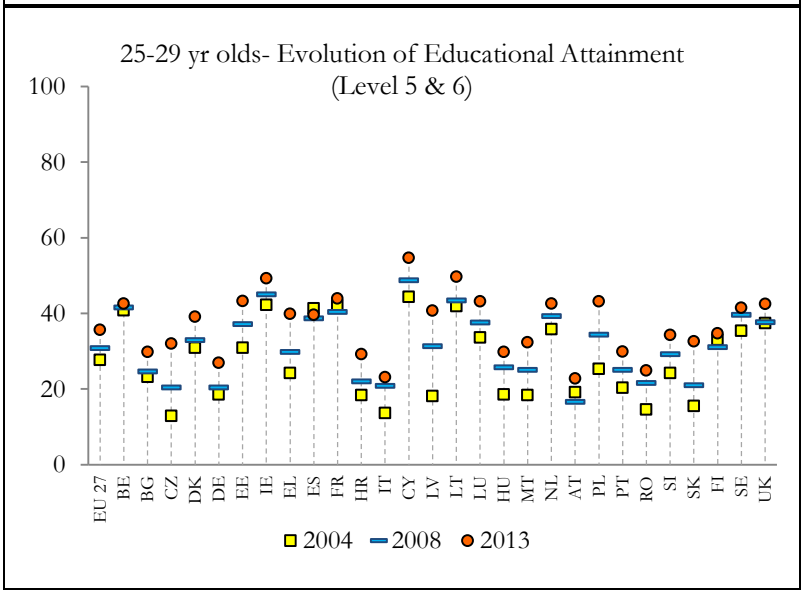
Appendix 16: Continued…

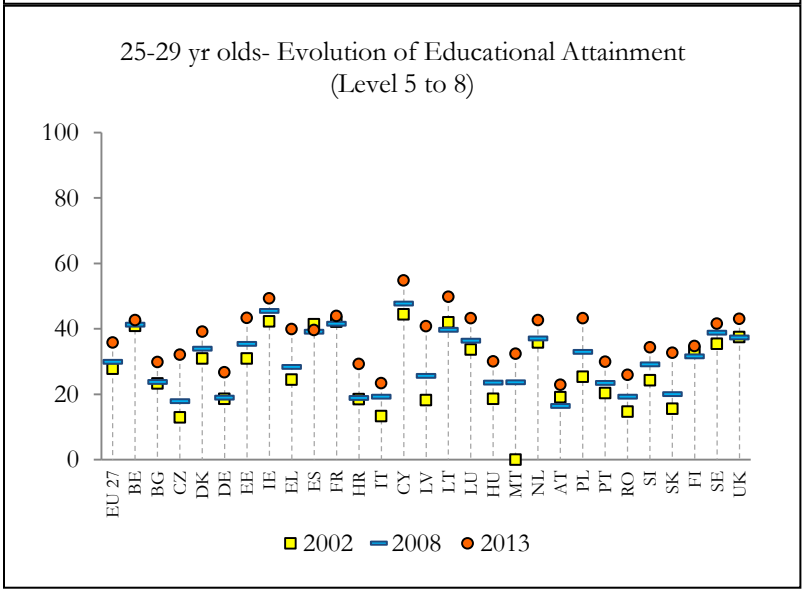












Appendix 17: Comparison of Students at ISCED levels 5-6 enrolled in the fields of: science, mathematics, computing, engineering, manufacturing, construction - as % of all students. 2012 data was used owing to missing values for 2013

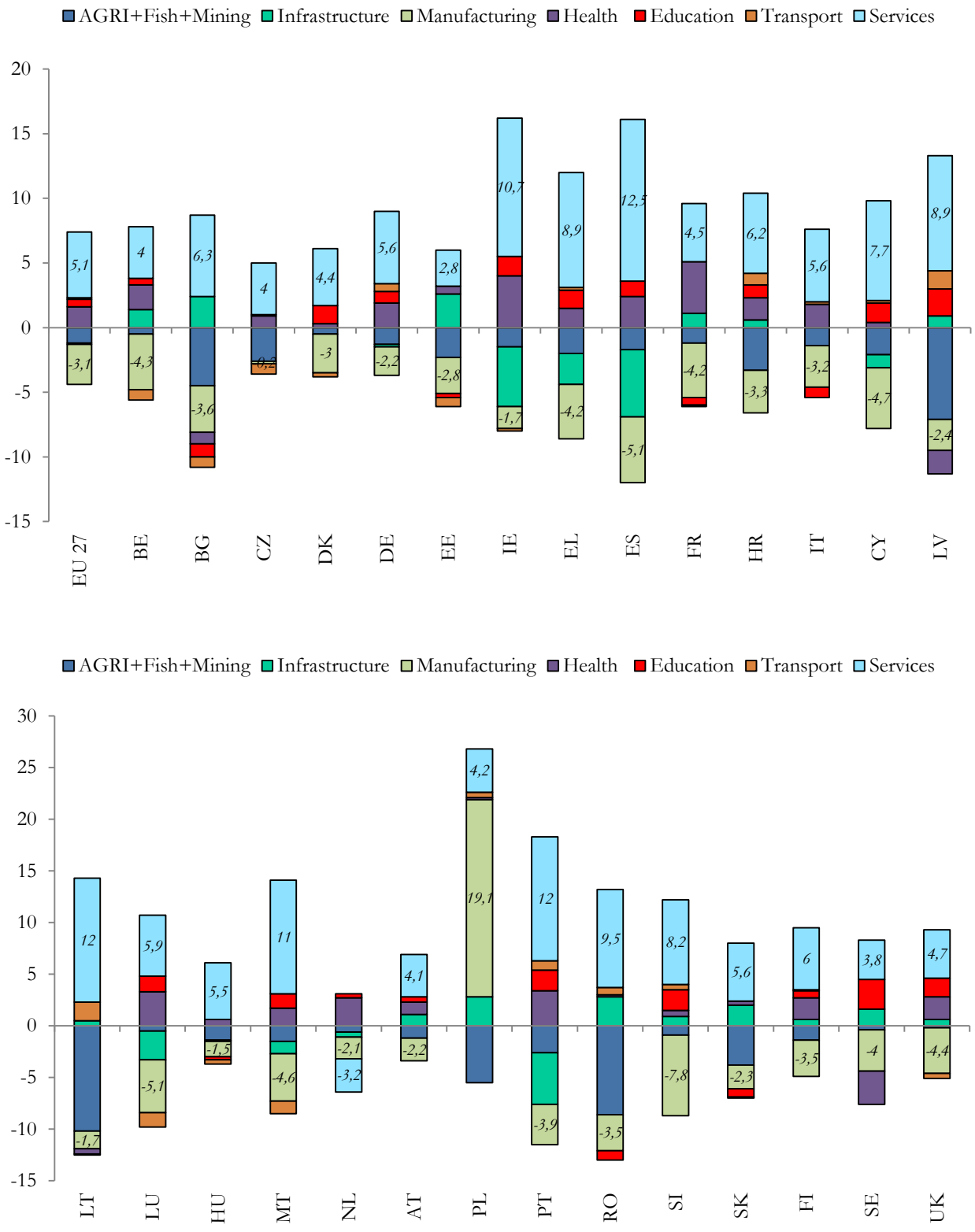
Country	Gender	2007	2012
EU 27	EU (27)	24.9	25.7
	EU (27) Males	38.9	39.9
	EU (27) Females	13.6	14.1
BE	Belgium	17.3	16.8
	Belgium Males	29.3	29.5
	Belgium Females	7.5	6.8
BG	Bulgaria	24.9	25.1
	Bulgaria Males	35.3	37.1
	Bulgaria Females	15.9	15.2
CZ	Czech Republic	24.8	25.3
	Czech Republic Males	41	41.7
	Czech Republic Females	12.2	13.4
DK	Denmark	18.8	19.1
	Denmark Males	29.1	29.5
	Denmark Females	11.2	11.3
DE	Germany	30.8	32.9
	Germany Males	45	48.8
	Germany Females	16.5	17
EE	Estonia	23	26.3
	Estonia Males	40.8	44.6
	Estonia Females	11.7	13.7
IE	Ireland	25.7	28.3
	Ireland Males	39.9	41.5
	Ireland Females	14.2	15.5
EL	Greece	30.6	:
	Greece Males	42.6	:
	Greece Females	18.8	:
ES	Spain	28.5	26.4
	Spain Males	43.4	40.5
	Spain Females	15.9	14.3
FR	France	25.4	25.1
	France Males	39.9	38.7
	France Females	13.7	13.8
HR	Croatia	23.5	24.3
	Croatia Males	35	37.7
	Croatia Females	13.7	14
IT	Italy	23.6	24.7
	Italy Males	35.3	36.1
	Italy Females	14.8	16.2
CY	Cyprus	18.7	20.8
	Cyprus Males	26.5	29
	Cyprus Females	10.9	13.6

Note – (:) represents missing data. Source- Eurostats

Appendix 17: Continued…

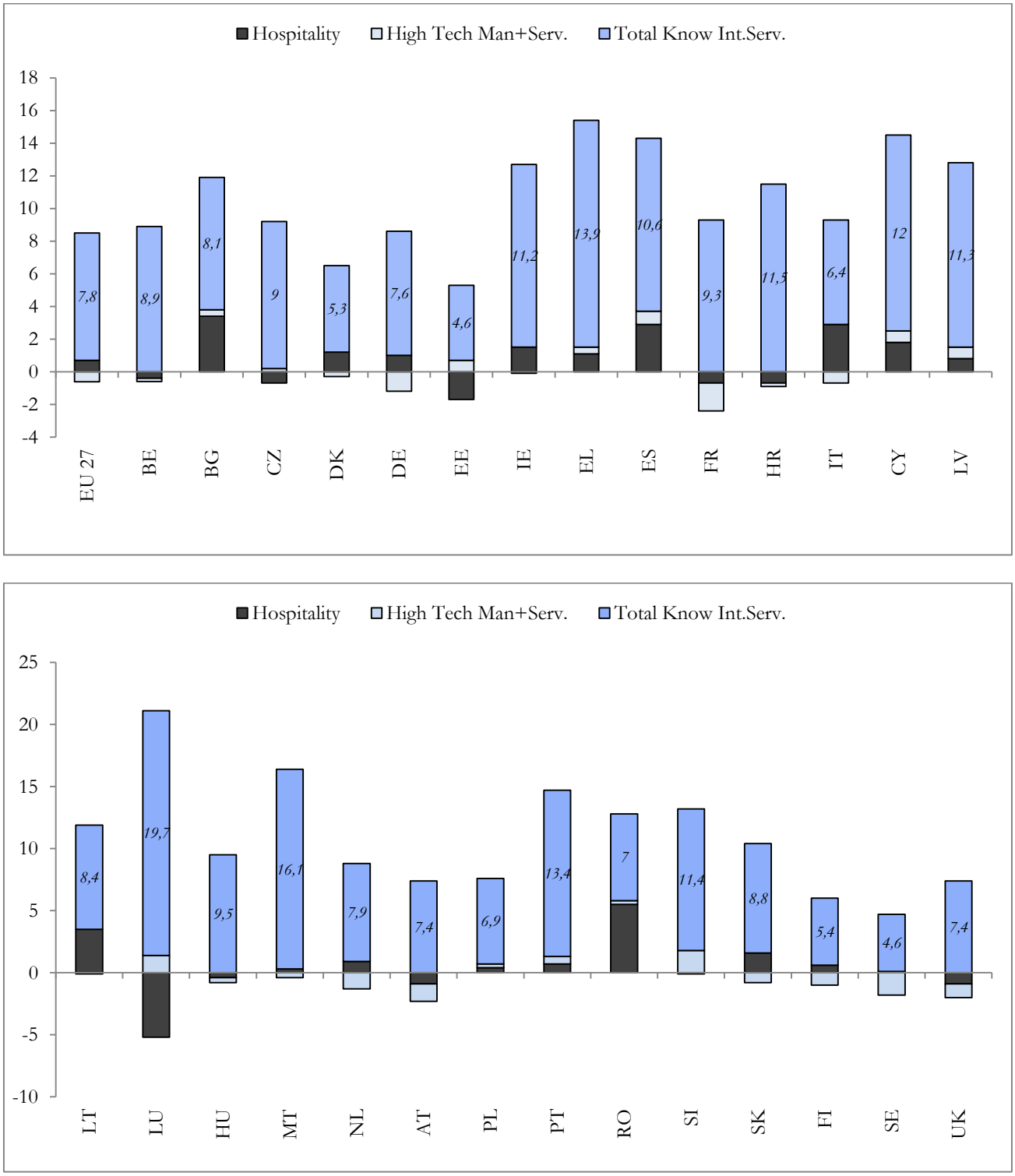
Country	Gender	2007	2012
LV	Latvia	15.6	21.1
	Latvia Males	32.8	39.2
	Latvia Females	5.9	8.8
LT	Lithuania	24.1	22.1
	Lithuania Males	44.6	40.5
	Lithuania Females	10.4	9.1
LU	Luxembourg	:	18.2
	Luxembourg Males	:	27.8
	Luxembourg Females	:	9.4
HU	Hungary	18.3	22.5
	Hungary Males	34.3	38.7
	Hungary Females	7	9.6
MT	Malta	18.2	20.9
	Malta Males	28.9	34.1
	Malta Females	10.2	10.5
NL	Netherlands	14.7	14.7
	Netherlands Males	25.6	24.2
	Netherlands Females	4.5	5.8
AT	Austria	24.7	25.6
	Austria Males	38.2	38.8
	Austria Females	13.1	14
PL	Poland	22	22.7
	Poland Males	35.6	36.9
	Poland Females	11.9	13.2
PT	Portugal	29.6	29.2
	Portugal Males	44.5	43.2
	Portugal Females	16.9	17.1
RO	Romania	23.5	28.6
	Romania Males	33.7	40.7
	Romania Females	15.6	18.4
SI	Slovenia	22.3	26.7
	Slovenia Males	39	44.6
	Slovenia Females	10.3	13.7
SK	Slovakia	24.6	23.2
	Slovakia Males	40.8	38.1
	Slovakia Females	13.3	13.1
FI	Finland	36.6	33.9
	Finland Males	59.6	55.5
	Finland Females	17.1	15.3
SE	Sweden	25.5	25.9
	Sweden Males	42.2	42.4
	Sweden Females	14.4	14.8
UK	United Kingdom	22.9	23.2
	United Kingdom Males	37	37.2
	United Kingdom Females	12.3	12.3

Appendix 18: PP Change in share of sectorial employment from 2002 to 2013



Source- Calculations made based on data extracted from Eurostats

Appendix 19: PP change in employment rate change in 3 branches of services sector from 2002- 2013



Source- Calculations made based on data extracted from Eurostats

Appendix 20: Changes in ALMP expenditure by type of action from 2007 to 2012: Unit of measurement- Percentage of gross domestic product (GDP)

Country	Total Categories (1-9)		Training		Employment incentives		Supported employment and rehabilitation		Direct job creation		Start-up incentives	
	2007	2012	2007	2012	2007	2012	2007	2012	2007	2012	2007	2012
EU 28	1.6	:	0.2	:	0.1	:	0.1	:	0.1	:	0.0	:
BE	2.7	2.9	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0
BG	0.5	0.7	0.0	0.0	0.0	0.0	:	:	0.2	0.1	0.0	0.0
CZ	0.4	0.5	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
DK	2.7	3.7	0.3	0.5	0.1	0.4	0.6	0.6	:	:	:	:
DE	2.1	1.7	0.3	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0
EE	0.1	0.7	0.0	0.1	0.0	0.0	:	:	:	0.0	0.0	0.0
IE	1.6	3.4	0.2	0.4	0.0	0.1	0.0	0.0	0.2	0.3	:	:
EL	0.5	1.0	0.1	:	0.1	:	0.0	:	0.0	:	0.0	:
ES	2.2	3.7	0.1	0.2	0.3	0.2	0.1	0.0	0.1	0.0	0.1	0.1
FR	2.2	2.4	0.3	0.3	0.1	0.0	0.1	0.1	0.2	0.1	0.0	0.0
HR	:	0.6	:	0.0	:	0.0	:	0.0	:	0.1	:	0.0
IT	1.1	2.0	0.2	0.1	0.2	0.2	:	:	0.0	0.0	0.0	0.0
CY	0.6	1.0	0.0	:	0.1	:	0.0	:	:	:	0.0	:
LV	0.5	0.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
LT	0.4	0.5	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	:	:
LU	0.9	1.9	0.1	0.0	0.2	0.4	0.0	0.0	0.0	0.1	0.0	0.0

Note – (:) represents missing data. Owing to data availability issues, analysis was made between 2007 and 2012. Source- Eurostats

Appendix 20: Continued...

Country	Total Categories (1-9)		Training		Employment incentives		Supported employment and rehabilitation		Direct job creation		Start-up incentives	
	2007	2012	2007	2012	2007	2012	2007	2012	2007	2012	2007	2012
HU	0.7	1.2	0.1	0.0	0.1	0.1	:	:	0.1	0.5	0.0	0.0
MT	0.5	0.5	0.0	0.0	0.0	0.0	:	:	0.0	0.0	0.0	0.0
NL	2.3	2.7	0.1	0.1	0.2	0.1	0.5	0.5	:	:	:	:
AT	1.9	2.0	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
PL	1.0	0.8	0.1	0.0	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0
PT	1.5	2.1	0.2	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
RO	0.3	0.3	0.0	0.0	0.0	0.0	:	:	0.0	0.0	0.0	0.0
SI	0.5	1.1	0.0	0.0	0.0	0.0	:	:	0.1	0.1	0.0	0.0
SK	0.6	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
FI	2.3	2.4	0.4	0.5	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.0
SE	1.7	1.9	0.1	0.1	0.5	0.7	0.2	0.3	:	:	0.0	0.0
UK	0.5	0.6	0.0	:	0.0	:	0.0	:	0.0	:	:	:

Note – (:) represents missing data. Owing to data availability issues, analysis was made between 2007 and 2012. Source- Calculations made based on data extracted from Eurostats

Appendix 21: VC investment (in millions of Euros) for seed, start-up and later stage ventures:

Country	2007	2013
European Union (15 countries)	5.5	3.1
Belgium	0.2	0.1
Bulgaria	0.0	0.0
Czech Republic	0.0	0.0
Denmark	0.2	0.2
Germany	0.9	0.7
Ireland	0.1	0.1
Greece	0.0	0.0
Spain	0.4	0.1
France	1.0	0.8
Italy	0.1	0.0
Luxembourg	0.0	0.0
Hungary	0.0	0.0
Netherlands	0.3	0.1
Austria	0.0	0.0
Poland	0.0	0.0
Portugal	0.0	0.0
Romania	0.0	0.0
Finland	0.1	0.1
Sweden	0.4	0.2
United Kingdom	1.6	0.5

Source: Eurostats. Data was available only for the listed EU member states. Data for Norway and Switzerland have been eliminated from this analysis.

Appendix 22: Change in the number of newly registered companies with limited liability per 1,000 working-age people (ages 15-64).

Country	2007	2012
Austria	0.64	0.50
Belgium	3.00	2.48
Croatia	3.61	2.82
Cyprus	39.00	22.51
Czech Republic	2.85	2.96
Denmark	7.21	4.36
Estonia	7.92	:
Finland	3.95	2.32
France	3.52	2.88
Germany	1.20	1.29
Greece	1.12	0.77
Hungary	3.95	4.75
Ireland	6.23	4.50
Italy	2.32	1.91
Latvia	7.76	11.63
Lithuania	2.83	4.71
Luxembourg	6.48	20.98
Malta	9.41	13.61
Netherlands	5.29	4.44
Poland	0.51	0.53
Romania	6.80	4.12
Slovak Republic	4.11	5.11
Slovenia	3.52	4.36
Spain	4.51	2.71
Sweden	4.67	6.41
United Kingdom	11.14	11.04

Source: World Bank entrepreneurship project. To measure entrepreneurial activity, annual data was collected directly from 139 company registrars on the number of newly registered firms. (:) signifies missing data.

Appendix 23: Decomposition of the Network Readiness Index:

Networked Readiness Index	
A. Environment sub-index	
1st pillar: Political and regulatory environment	**2nd pillar: Business and innovation environment**
1.01 Effectiveness of law-making bodies*	*2.01* Availability of latest technologies*
1.02 Laws relating to ICTs*	*2.02* Venture capital availability*
1.03 Judicial independence*	*2.03* Total tax rate, % profits
1.04 Efficiency of legal system in settling disputes*	*2.04* No. days to start a business
1.05 Efficiency of legal system in challenging reg*	*2.05* No. procedures to start a business
1.06 Intellectual property protection*	*2.06* Intensity of local competition*
1.07 Software piracy rate, % software installed.	*2.07* Tertiary education gross enrolment rate, %
1.08 No. procedures to enforce a contract	*2.08* Quality of management schools*
1.09 No. days to enforce a contract	*2.09* Gov't procurement of advanced tech*

Networked Readiness Index		
B. Readiness sub-index		
3rd pillar: Infrastructure	**4th pillar: Affordability**	**5th pillar: Skills**
3.01 Electricity production, kWh/capita	*4.01* Prepaid mobile cellular tariffs, PPP $/min	*5.01* Quality of educational system*
3.02 Mobile network coverage, % pop.	*4.02* Fixed broadband Internet tariffs, PPP $/month	*5.02* Quality of math & science education*
3.03 Int'l Internet bandwidth, kb/s per user	*4.03* Internet & telephony competition, 0–2 (best)	*5.03* Secondary education gross enrolment rate, %
3.04 Secure Internet servers/million pop.		*5.04* Adult literacy rate, %

Networked Readiness Index		
C. Usage sub-index		
6th pillar: Individual usage	**7th pillar: Business usage**	**8th pillar: Government usage**
6.01 Mobile phone subscriptions/100 pop	*7.01* Firm-level technology absorption*	*8.01* Importance of ICTs to gov't vision*
6.02 Individuals using Internet, %	*7.02* Capacity for innovation*	*8.02* Government Online Service Index, 0–1 (best)
6.03 Households w/ personal computer, %	*7.03* PCT patents, applications/million pop	*8.03* Gov't success in ICT promotion*
6.04 Households w/ Internet access, %	*7.04* Business-to-business Internet use*	
6.05 Fixed broadband Internet subs/100 pop	*7.05* Business-to-consumer Internet use*	
6.06 Mobile broadband subs/100 pop	*7.06* Extent of staff training*	
6.07 Use of virtual social networks*		

Appendix 23: Continued…

Networked Readiness Index	
D. Impact sub-index	
9th pillar: Economic impacts	10th pillar: Social impacts
9.01 Impact of ICTs on new services & products*	*10.01* Impact of ICTs on access to basic services*
9.02 ICT PCT patents, applications/million pop.	*10.02* Internet access in schools*
9.03 Impact of ICTs on new organizational models*	*10.03* ICT use & gov't efficiency*
9.04 Knowledge-intensive jobs, % workforce	

* These indicators are measured on a scale of 1 – 7 and correspond on the results of the WEF's Executive Opinion Survey. Source: WEF, Global Information Technology Report 2013.

Appendix 24: NRI scores for 28 EU member states, extracted from the Global Information Technology Report, 2013:

Country	Networked Readiness Index 2013 Scores	Country	Networked Readiness Index 2013 Scores
BE	5.1	LT	4.7
BG	3.9	LU	5.4
CZ	4.4	HU	4.3
DK	5.6	MT	4.9
DE	5.4	NL	5.8
EE	5.1	AT	5.2
IE	5.1	PL	4.2
EL	3.9	PT	4.7
ES	4.5	RO	3.9
FR	5.1	SI	4.5
HR	4.2	SK	4
IT	4.2	FI	6
CY	4.6	SE	5.9
LV	4.4	UK	5.6

Appendix 25: 2013 NRI Scores Proximity matrix (Euclidean distance)

	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK
BE	0.0	1.2	0.7	0.5	0.3	0.0	0.0	1.2	0.6	0.0	0.9	0.9	0.5	0.7	0.4	0.3	0.8	0.2	0.7	0.1	0.9	0.4	1.2	0.6	1.1	0.9	0.8	0.5
BG	1.2	0.0	0.5	1.7	1.5	1.2	1.2	0.0	0.6	1.2	0.3	0.3	0.7	0.5	0.8	1.5	0.4	1.0	1.9	1.3	0.3	0.8	0.0	0.6	0.1	2.1	2.0	1.7
CZ	0.7	0.5	0.0	1.2	1.0	0.7	0.7	0.5	0.1	0.7	0.2	0.2	0.2	0.0	0.3	1.0	0.1	0.5	1.4	0.8	0.2	0.3	0.5	0.1	0.4	1.6	1.5	1.2
DK	0.5	1.7	1.2	0.0	0.2	0.5	0.5	1.7	1.1	0.5	1.4	1.4	1.0	1.2	0.9	0.2	1.3	0.7	0.2	0.4	1.4	0.9	1.7	1.1	1.6	0.4	0.3	0.0
DE	0.3	1.5	1.0	0.2	0.0	0.3	0.3	1.5	0.9	0.3	1.2	1.2	0.8	1.0	0.7	0.0	1.1	0.5	0.4	0.2	1.2	0.7	1.5	0.9	1.4	0.6	0.5	0.2
EE	0.0	1.2	0.7	0.5	0.3	0.0	0.0	1.2	0.6	0.0	0.9	0.9	0.5	0.7	0.4	0.3	0.8	0.2	0.7	0.1	0.9	0.4	1.2	0.6	1.1	0.9	0.8	0.5
IE	0.0	1.2	0.7	0.5	0.3	0.0	0.0	1.2	0.6	0.0	0.9	0.9	0.5	0.7	0.4	0.3	0.8	0.2	0.7	0.1	0.9	0.4	1.2	0.6	1.1	0.9	0.8	0.5
EL	1.2	0.0	0.5	1.7	1.5	1.2	1.2	0.0	0.6	1.2	0.3	0.3	0.7	0.5	0.8	1.5	0.4	1.0	1.9	1.3	0.3	0.8	0.0	0.6	0.1	2.1	2.0	1.7
ES	0.6	0.6	0.1	1.1	0.9	0.6	0.6	0.6	0.0	0.6	0.3	0.3	0.1	0.1	0.2	0.9	0.2	0.4	1.3	0.7	0.3	0.2	0.6	0.0	0.5	1.5	1.4	1.1
FR	0.0	1.2	0.7	0.5	0.3	0.0	0.0	1.2	0.6	0.0	0.9	0.9	0.5	0.7	0.4	0.3	0.8	0.2	0.7	0.1	0.9	0.4	1.2	0.6	1.1	0.9	0.8	0.5
HR	0.9	0.3	0.2	1.4	1.2	0.9	0.9	0.3	0.3	0.9	0.0	0.0	0.4	0.2	0.5	1.2	0.1	0.7	1.6	1.0	0.0	0.5	0.3	0.3	0.2	1.8	1.7	1.4
IT	0.9	0.3	0.2	1.4	1.2	0.9	0.9	0.3	0.3	0.9	0.0	0.0	0.4	0.2	0.5	1.2	0.1	0.7	1.6	1.0	0.0	0.5	0.3	0.3	0.2	1.8	1.7	1.4
CY	0.5	0.7	0.2	1.0	0.8	0.5	0.5	0.7	0.1	0.5	0.4	0.4	0.0	0.2	0.1	0.8	0.3	0.3	1.2	0.6	0.4	0.1	0.7	0.1	0.6	1.4	1.3	1.0
LV	0.7	0.5	0.0	1.2	1.0	0.7	0.7	0.5	0.1	0.7	0.2	0.2	0.2	0.0	0.3	1.0	0.1	0.5	1.4	0.8	0.2	0.3	0.5	0.1	0.4	1.6	1.5	1.2
LT	0.4	0.8	0.3	0.9	0.7	0.4	0.4	0.8	0.2	0.4	0.5	0.5	0.1	0.3	0.0	0.7	0.4	0.2	1.1	0.5	0.5	0.0	0.8	0.2	0.7	1.3	1.2	0.9
LU	0.3	1.5	1.0	0.2	0.0	0.3	0.3	1.5	0.9	0.3	1.2	1.2	0.8	1.0	0.7	0.0	1.1	0.5	0.4	0.2	1.2	0.7	1.5	0.9	1.4	0.6	0.5	0.2
HU	0.8	0.4	0.1	1.3	1.1	0.8	0.8	0.4	0.2	0.8	0.1	0.1	0.3	0.1	0.4	1.1	0.0	0.6	1.5	0.9	0.1	0.4	0.4	0.2	0.3	1.7	1.6	1.3
MT	0.2	1.0	0.5	0.7	0.5	0.2	0.2	1.0	0.4	0.2	0.7	0.7	0.3	0.5	0.2	0.5	0.6	0.0	0.9	0.3	0.7	0.2	1.0	0.4	0.9	1.1	1.0	0.7
NL	0.7	1.9	1.4	0.2	0.4	0.7	0.7	1.9	1.3	0.7	1.6	1.6	1.2	1.4	1.1	0.4	1.5	0.9	0.0	0.6	1.6	1.1	1.9	1.3	1.8	0.2	0.1	0.2
AT	0.1	1.3	0.8	0.4	0.2	0.1	0.1	1.3	0.7	0.1	1.0	1.0	0.6	0.8	0.5	0.2	0.9	0.3	0.6	0.0	1.0	0.5	1.3	0.7	1.2	0.8	0.7	0.4
PL	0.9	0.3	0.2	1.4	1.2	0.9	0.9	0.3	0.3	0.9	0.0	0.0	0.4	0.2	0.5	1.2	0.1	0.7	1.6	1.0	0.0	0.5	0.3	0.3	0.2	1.8	1.7	1.4
PT	0.4	0.8	0.3	0.9	0.7	0.4	0.4	0.8	0.2	0.4	0.5	0.5	0.1	0.3	0.0	0.7	0.4	0.2	1.1	0.5	0.5	0.0	0.8	0.2	0.7	1.3	1.2	0.9
RO	1.2	0.0	0.5	1.7	1.5	1.2	1.2	0.0	0.6	1.2	0.3	0.3	0.7	0.5	0.8	1.5	0.4	1.0	1.9	1.3	0.3	0.8	0.0	0.6	0.1	2.1	2.0	1.7
SI	0.6	0.6	0.1	1.1	0.9	0.6	0.6	0.6	0.0	0.6	0.3	0.3	0.1	0.1	0.2	0.9	0.2	0.4	1.3	0.7	0.3	0.2	0.6	0.0	0.5	1.5	1.4	1.1
SK	1.1	0.1	0.4	1.6	1.4	1.1	1.1	0.1	0.5	1.1	0.2	0.2	0.6	0.4	0.7	1.4	0.3	0.9	1.8	1.2	0.2	0.7	0.1	0.5	0.0	2.0	1.9	1.6
FI	0.9	2.1	1.6	0.4	0.6	0.9	0.9	2.1	1.5	0.9	1.8	1.8	1.4	1.6	1.3	0.6	1.7	1.1	0.2	0.8	1.8	1.3	2.1	1.5	2.0	0.0	0.1	0.4
SE	0.8	2.0	1.5	0.3	0.5	0.8	0.8	2.0	1.4	0.8	1.7	1.7	1.3	1.5	1.2	0.5	1.6	1.0	0.1	0.7	1.7	1.2	2.0	1.4	1.9	0.1	0.0	0.3
UK	0.5	1.7	1.2	0.0	0.2	0.5	0.5	1.7	1.1	0.5	1.4	1.4	1.0	1.2	0.9	0.2	1.3	0.7	0.2	0.4	1.4	0.9	1.7	1.1	1.6	0.4	0.3	0.0

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