Towards a Benchmark on the Contribution of Education and Training to Employability: Methodological Note. EUR 24616 EN

Christelle Garrouste

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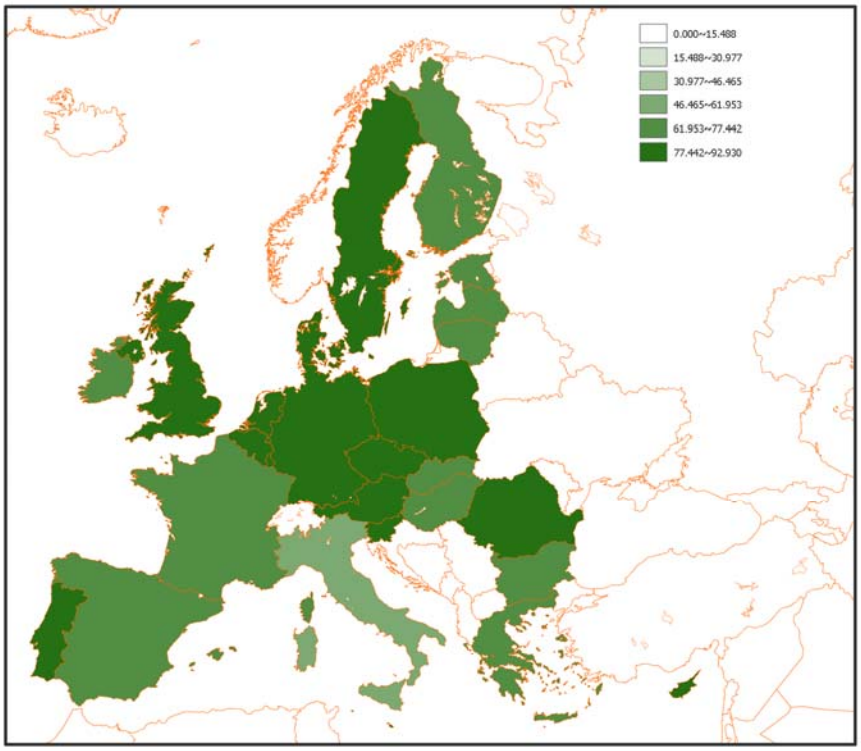

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ABBREVIATIONS

EU27 (European Union of 27 Member States from 1 January 2007), Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Denmark (DK), Germany (DE), Estonia (EE), Ireland (IE), Greece (EL/GR), Spain (ES), France (FR), Italy (IT), Cyprus (CY), Latvia (LV), Lithuania (LT), Luxembourg (LU), Hungary (HU), Malta (MT), the Netherlands (NL), Austria (AT), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK), Finland (FI), Sweden (SE) and the United Kingdom (UK), Turkey (TR), Croatia (HR), Former Yugoslav Republic of Macedonia (MK), Iceland (IS), Norway (NO).

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EXECUTIVE SUMMARY

Following the request from the Council Conclusions of 12 May 2009 on "Education and Training 2020" (2009/C 119/06) to submit a proposal for a possible European benchmark on the importance of enhancing employability through education and training, the Directorate-General for Education and Culture (DG EAC) commissioned to the Centre for Research on Lifelong Learning (CRELL) a series of analyses of the contribution of Education and Training systems (E&T) to employability.

The present report presents the methodological framework applied to define the benchmark on education for employability to be proposed to European Council in 2012: "By 2020, there should be an increase by at least 5 percentage points in the employment rate of graduates (20-34 years old) having left education, measured as an average of employment rates 1, 2 and 3 years after graduation" (European Commission, 2011).

The report opens with a brief discussion of the relevance of an indicator on the transition from education to work as a proxy of the contribution of education and training systems to employability. In turn, section 2 presents the construct of the indicator and section 3 displays the corresponding 2004-2010 historical trend data computed by EUROSTAT, using the EU-LFS survey (extracted on September 14, 2011). Moreover, section 4 reports results from preliminary robustness checks, confirming the validity of that data to measure employability.

Further, section 5 explains the methods applied to define the target value at the horizon 2020. Three deterministic forecasting methods and one stochastic method were retained for their relevance to the present exercise, namely the traditional linear trend forecasting technique, the compound annual growth rate (CAGR), the conditional linear trend model and the Monte Carlo simulation technique. These methods are presented and applied in order of the least to the most sensitive to volatility and uncertainty of the estimates. Each of the deterministic forecast methods has been computed on four broad scenarios, applying the logic of "worst case, best case and most likely".

Scenario 1, which is the worst case scenario, assumes a long term persistence of the deterioration in employment rates reached during the economic crisis. Scenario 2, which is the 1st best case scenario, assumes that European labour markets revert to the employment growth rates prevailing before the crisis. Scenario 3, which is the 2nd best case scenario, assumes a strong recovery, at least equivalent to the employment growth of the best performers prior to the crisis. Finally, scenario 4, i.e. the most likely scenario, disregards the crisis and considers the period 2004-2010 as homogeneous.

The results from the forecasting models are presented in section 6. They reveal that, overall, the deterministic forecasting methods estimate an increase between 2010 and 2020 by 3.79 percentage points, with significant variations across scenarios and across individuals with different educational attainment levels. The only educational group for which a positive increase is predicted by all three methods is the high educated. In turn, the stochastic Monte Carlo simulations produce the range [-0.6; +7.7] of plausible percentage point changes between 2010 and 2020.

Finally, section 7 concludes the analysis by combining all results, demonstrating that they yield a reduction of the range of plausible values to [3.79; 7.7]. Within that statistically supported range, DG EAC ultimately made the political decision to select a 5 percentage points increase as the target level for its proposed benchmark on education for employability.

INTRODUCTION

"Given the importance of enhancing employability through education and training in order to meet current and future labour market challenges, the Commission is invited to submit to the Council *a proposal for a possible European benchmark in this area by the end of 2010"* (Council Conclusions of 12 May 2009 on "Education and Training 2020", 2009/C 119/06).

Following this request, the Directorate-General for Education and Culture (DG EAC) commissioned to the Centre for Research on Lifelong Learning (CRELL) a series of analyses of the contribution of Education and Training systems (E&T) to employability.

The first CRELL report proposed an analytical framework and indicators to measure E&T systems provision of essential skills, facilitation of the school-to-work transition and support of lifelong learning (LLL), (Arjona Perez, Garrouste and Kozovska, 2010a). Based on this study, the Member States Expert Group on Employability Benchmarks concluded on March 3, 2010 that i) Vocational Education and Training (VET) plays a key role in supplying skills that are valued in the labour market; ii) the duration of the transition from education to work and the (mis)match between education and occupation are both topics of policy interest; iii) participation in LLL of older and low qualified workers and returns to education at a later age were also two possible areas for educational benchmarks supporting employability. The Expert Group requested an in-depth analysis of each of the above topics, with information on data availability and a list of indicators from which a benchmark could be chosen. The resulting work was compiled in a second CRELL report (Arjona Perez, Garrouste and Kozovska, 2010b). CRELL prepared a preliminary statistical report presenting different methods to conduct forecast estimations on transition phase indicators which was presented to DG EAC, EUROSTAT, DG EMPL and CEDEFOP at an inter-service consultation meeting on Septembre 13, 2010.

Based upon the comments from the Standing Group on Indicators and Benchmarks (SGIB)[1] and suggestions from EUROSTAT, DG EMPL and CEDEFOP,

[1] The benchmark proposal was discussed with MS experts at the SGIB meeting of Madrid, May 2010; SGIB meeting of Brussels, October 2010, SGIB meeting of Brussels, June 2010.

DG EAC decided to focus the benchmark proposal on one sole indicator of transition from education to employment that would target a percentage increase of the employment rate of 20-34 years old graduates. The present report describes the methodological framework applied to define the proposed benchmark. Section 1 briefly discusses the relevance of an indicator on the transition from education to work as a proxy of the contribution of education to employability. In turn, section 2 presents in details the nominator and denominator of the retained benchmark indicator and section 3 displays the corresponding 2004-2010 historical trend data computed by EUROSTAT. Moreover, in section 4 we report results from preliminary robustness checks, confirming the validity of that data to measure employability. Further, section 5 explains the method applied to define the target value at the horizon 2020. Results from the three deterministic forecasting methods retained are presented in section 6 along side with the results from Monte Carlo simulations. Finally, section 7 concludes with a benchmark proposal on education for employability.

The analysis presented in this report is based upon the September 14, 2011 extractions from EUROSTAT's EU-LFS annual data from 2004 to 2010.

1. RELEVANCE OF THE CHOSEN BENCHMARK INDICATOR[2]

Employability has been defined as: "The combination of factors which enable individuals to progress towards or get into employment, to stay in employment and to progress during their career." Each individual's characteristics, skills, attitudes and motivation are important. External factors (e.g. labour market conditions, business cycle, the regulatory framework, overall economic situation etc.), which vary across countries and regions and which change over time – and which lie beyond the scope of education and training - influence a person's chances to get a job or to improve their employment situation.

Education and Training – formal, non-formal and informal - is a key determinant of a person's human capital, both initially and, through lifelong learning, in its updating and improvement over the working life. Good education and training should also stimulate motivation, build generic skills that are important for the workplace and facilitate job search.

Chart 1 below illustrates the complexity of the concept and the many factors that influence an individual's employability. The grey-shaded areas illustrate where education and training plays a role, namely through the creation of human capital. Education and Training (E&T) also influence ability and motivation. Moreover, E&T systems facilitate the job search process by providing concrete guidance and counselling and by making qualification systems more understandable to employers across Europe.

[2] This section syntheses the motivation presented in the Staff Working Paper on the Proposals for Benchmarks on Education for Employability and Learning Mobility SEC(2011) 670 final.

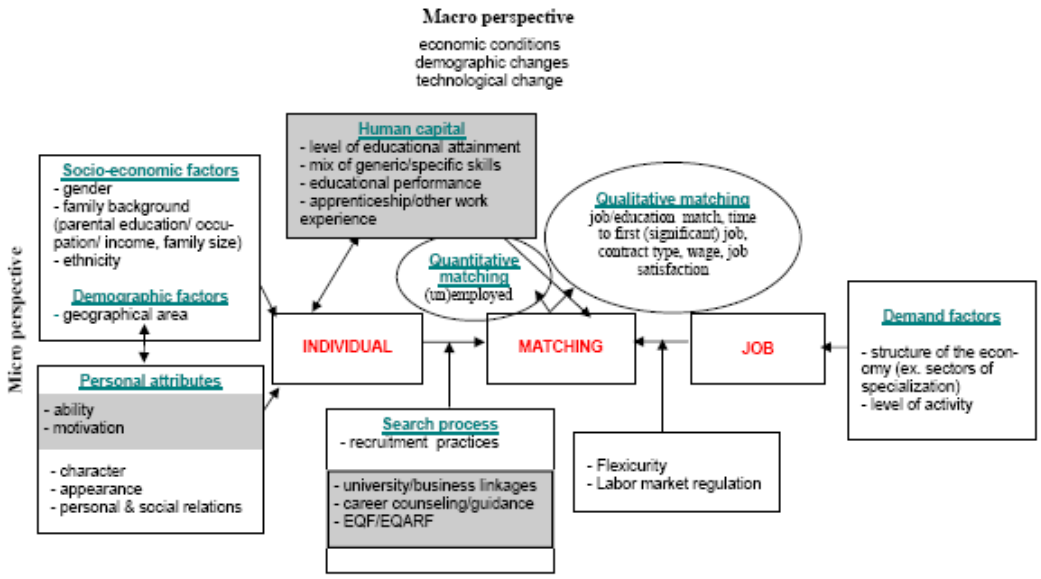

Chart 1. Conceptual Framework towards a Benchmark on Education for Employability

(Source: CRELL, 2010a)

In the context of the wider societal goals of education and training systems, they should provide the best possible support for the labour market success of citizens. A “benchmark on education for employability" would therefore aim at promoting debate on what education and training can do to boost employment success.

Education's support for employability can be seen in three distinct phases (CEDEFOP, 2008):

- "preparation for employment" within the continuum of formal education from pre-primary to end of the compulsory phase and to tertiary level. Irrespective of the level attained, all young people should have received a good degree of preparation for their future entry and progression in the labour market.

- "transition from education to employment": this refers to the end of the "preparation for employment" phase. The transition from education should, for example, include career guidance and counselling; all qualifications should be transparent and understandable to potential employers.

- "stay in employment and progress in career": this refers to adult participation in training and education interspersed throughout their working lives. Education and training systems should be open to and, indeed, reaching out to adult learners.

Of these three phases, there is already an extensive framework for monitoring two. "Preparation for employment" is covered by 4 of the 5 benchmarks under the ET 2020, while "Stay in employment and progress in career" is covered by the fifth benchmark on adult participation in lifelong learning. The phase "transition from education to work" is not yet addressed. This is where a young person's employability will depend most directly on the quality and relevance of what they have learned in their formal education. Hence, it is proposed to focus the benchmark on that phase.

Two aspects of the transition are key: 1) does the young person succeed in getting a first job and how quickly? and 2) is the quality of the first job commensurate with the education qualifications the young person has attained? Both issues have important long-term implications.

Success in getting a job and the duration of transition are potentially life-changing moments. Young people who face unemployment or a slow transition may experience long-term adverse effects on personal morale, future labour market success, earnings and future family life if it delays or prevents departure from the parental home or family formation. The quality of the first job is also important: mismatches between qualifications attained in education and the skill level of the first job have implications in terms of economic cost and returns to education, labour productivity and the ability of a person to make labour market progress in the future. The recent European Commission Communication "An Agenda for new skills and jobs" underlines that “delivering the right mix of skills is important, but equally important is avoiding the under-utilisation of people’s talents and potential".

The current economic crisis accentuates the importance of the transition. The cost of seeing the group which are currently in transition from education to employment suffer such long-term damage is too high. This is particularly true in view of demographic ageing, which demands that Europe's increasingly scarce young people integrate quickly and effectively in the labour market.

As illustrated in section 3, the challenges of integrating young people increased during the recession. The share of active 20-34 year olds in employment has deteriorated between 2008 and 2010. While for the high educated, the share in employment has decreased by approximately 5 percentage points between 2008 and 2010 (from 87% to 83%) it has decreased by close to 4.5 percentage points for the medium level educated (from 76.7% to 72.1%). Likewise, more than half of the 10 percentage points decrease suffered by the low educated since 2006 (from 62% in 2006 to 52% in 2010) occurred between 2008 and 2010 (cf. Figure 2, section 3). Hence, the higher the level of educational attainment a young person has, the greater her chance of a successful transition to employment.

Proposing a benchmark on the contribution of education and training to employability in this current economic situation is particularly challenging as the labour market outcomes of graduates are highly dependent upon the general macro-economic conditions. Whether the economic recovery will result in the creation of a significant amount of new jobs or jobless growth will depend upon the exit strategies and public policies and their success in reaching a balance between flexibility and security on the labour market.

In addition, the forecasted demographic changes for the next 10-20 years will change the composition of the labour force and consequently the labour market opportunities for the different groups. The percentage of younger people (15-29) is forecasted to fall from 28.2% in 2008 to 25.4% in 2020, while that of older people (50-64) to increase from 28.1% to 32.0% (DG EMPL, 2010). The change in the demographic situation and the ageing population calls for a much stronger emphasis on the successful integration of young people in the labour market in order to achieve effective and full use of all resources. As demonstrated by CEDEFOP's (2010) mid-term forecasts, these demographic changes are expected to have a direct impact on the share of employment by level of qualifications. While the proportion of higher educated among the employed population is forecasted to continue to increase by 2.1% between 2010 and 2020 to reach 34.4%, the proportion of medium educated is expected to remain stable (+0.4%) at 50.6% and the one of lower educated to decrease by 3% between 2010 and 2020 (to reach 15.1%). These results imply that by 2020, the requirement for low qualification will be of 14.4% (as a proportion of the base year

2010), the one for medium qualifications of 33.2% and the one for high qualifications of 51.2%.

Any indicator/benchmark on education for employability should therefore differentiate employment prospects according to educational attainment and should reflect the objective of upgrading attainment levels. With regard to people with low skills, whose employability has suffered the most in the recession and is likely to further deteriorate in the labour market of the future, the primary aim for education and training systems is to reduce the number falling into this category. Nevertheless, they should leave education with good levels of attainment across all key competences to facilitate success and later progress in the labour market.

Interventions from the E&T systems could be timely, aiming at introducing new ways for facilitating a smoother transition from education (e.g. better career counselling activities, closer contact with enterprises, etc.). At the same time, reallocation of workers due to the economic crisis and the rate of creation of new jobs depending upon the speed of recovery will strongly affect the employment rates of graduates and consequently any indicator on the success of transition. Furthermore, with regards to matching the labour market needs, reform of curricula could take much more time and the impact could be observed with a much longer lag.

Hence, the proposed benchmark measures successful transition by focusing on employment. Given existing data availability, it is not possible at this stage to monitor the relationship between educational attainment level and the quality of the first job. This will only be possible if there is a better matching of ISCED classifications for educational qualifications with the ISCO job classification which could allow the analysis of the quality of the first job and the development of a benchmark on the "quality of transition" from education to early-stage employment. The measure focuses therefore only on the quantity of employment (rather than its quality) right after graduation.

2. DEFINITION OF THE CHOSEN BENCHMARK INDICATOR

In the definition of this brand new indicator, a number of choices have been made with regards to the time period and the age bracket for evaluating the successful transition from education to work. In the following, we offer some clarifications for the choices made and define the nominator and denominator of the proposed benchmark indicator.

As explained in section 1, an ideal measure of the transition from education to employment would compute the speed of transition, controlling for a set of individual and institutional explanatory factors. Unfortunately, the lack of longitudinal panel data at the EU27 level obliged us to opt for an alternative measure that could be computed using the annual cross-sectional European Union Labour Force Survey (EU-LFS). The EU-LFS is a quarterly (annually aggregated), large sample survey providing information about the education attainment and labour status of individuals in private households in the EU, EFTA (except Liechtenstein), and the Candidate Countries.[3]

Given the nature of the EU-LFS data, a number of data-driven choices had to be made with regard to the definition of the school-to-work transition, starting with the year of initiation of the transition period, and following with the age bracket of the cohort under evaluation and the duration of the period of observation of that cohort.

First of all, the starting time of the transition period had to be proxied by the year when a person receives his/her highest educational diploma/degree (variable *HATYEAR* in the core annual EU-LFS). In order to avoid counting individuals currently enrolled in further education or training activities, a control was added for

[3] For the computation of this benchmark indicator, we can only use the annual sample. Conscripts in military or community service are not included in the results. The sampling rates vary between 0.14% and 1.68%. The figures in this report are not seasonally adjusted. The concepts and definitions used in the survey follow the guidelines of the International Labour Organisation. Further information is available at the Eurostat website:
http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_unemployment_lfs/introduction.

non-enrolment in education or training activities in the four weeks preceding the interview using both the variables *COURATT* and *EDUCSTAT*.[4]

Secondly, in terms of the definition of the age bracket for this indicator, consistency with current development related to the EU2020 and ET2020 headline targets has been taken into account. On the one hand, the lower bound of 20 years was adopted in correspondence to the new age bracket of 20-64 years old introduced with the employment rate headline target of the Europe 2020 strategy[5]. On the other hand, the current ET2020 headline target on tertiary attainment is evaluated for 30-34 years old. In order to include the tertiary education cohort, the targeted cohort has therefore been defined as 20-34 years old.

The educational attainment levels are defined in accordance with the ISCED classification[6] and presented here in three aggregated levels:

- **Low:** below the second cycle of secondary education (ISCED levels 0-3c short);
- **Medium:** upper secondary and post-secondary non-tertiary education (ISCED levels 3-4 excluding 3c short);
- **High:** tertiary education (ISCED levels 5-6).

It is worthwhile mentioning that progress in EU statistics on outcomes of education can offer some interesting further breakdowns by educational level and characteristics. For instance, the implementation of ISCED 2011 in EU social surveys should allow a division of educational attainment results by orientation (general/vocational) at ISCED levels 3 and 4, as well as more details at tertiary level

[4] In a paper co-authored in 2011 with Sylvain Jouhette and Sadiq Kwesi Boateng from EUROSTAT, we investigated the sensitivity of this indicator to a change in the variable measuring the starting time of the transition (HATYEAR). Details of that work are presented in section 3.1. Overall, we find that in 92.9% of the cases the information collected from the core annual LFS survey coincides with the information collected by a counterfactual variable (STOPDATE) from the ad-hoc LFS module on transition from education to employment. This means that our proxy variable HATYEAR generates a potential underestimating estimation of the actual school leaving year for less than 7% of the sampled population.

[5] This change over the previous 15-64 years old age bracket was introduced to meet the objectives of raising educational levels and lowering school dropout rates and were justified by the fact that the employment rate for the categories 15-19 is very low as this is a group often still in education.

[6] ISCED classification URL: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/International_standard_classification_of_education_(ISCED).

(B.A.-M.A. structures). Employment rates by educational levels could therefore be presented with more breakdowns than the three main groups available as of today.

Moreover, the classification of fields of study is under review to allow an implementation at the same time as ISCED 2011 in 2014. This classification is of particular use for results on tertiary graduates, as already suggested in the 2009 publication on the Bologna process in higher education in Europe (EUROSTAT, 2009)[7].

Based on each of the above dimensions, the nominator and denominator of our benchmark indicator were formulated as follows.

Numerator:

The numerator counts the number of individuals aged 20-34 not in education nor in training in the four weeks preceding the time of the interview[8] and who are employed. We collect that information for those who graduated at their highest level 1 year before the interview, 2 years before the interview or 3 years before the interview. The numerator is thus the average number of employed young individuals over these 3 graduation time-lags. It measures the average stock of youth employed in the 3 years following graduation, excluding the very first months to avoid any underestimation biases potentially caused by the nature of the data or the nature of the first professional experience.

To better understand the motivation for choosing this 1 to 3 years after graduation time frame, Figure 1 presents the employment rate of the 20-34 years old

[7] Bologna process in higher education in Europe: Key indicators on the social dimension and mobility Report.(http://www.ond.vlaanderen.be/hogeronderwijs/bologna/conference/documents/2009_Eurostat_Eurostudent_social_dimension_and_mobility_indicators.pdf). Some interesting indicators have already been indeed proposed based on occupation and the current classification of fields of education and training (see chapter D) for educational attainment. These are for example the distribution of persons with tertiary education by field of study for a given labour status and occupation or the distribution of employees with tertiary education by occupation for a given field of study. http://epp.eurostat.ec.europa.eu/portal/page/portal/education/bologna_process

[8] Eurostat defines the employed as aged 15 years and over – 16 and over in ES, UK and SE (1995-2001); 15-74 years in DK, EE, HU, LV, FI, NO and SE (from 2001 onwards); 16-74 in IS - who during the reference week performed work, even for just one hour a week, for pay, profit or family gain or were not at work but had a job or business from which they were temporarily absent because of, e.g. illness, holidays, industrial dispute and education and training.

by number of years since completion of their highest educational attainment among those not currently enrolled in any further education or training. It reveals the existence of an “insertion year” immediately after leaving education during which more than one third of the youth is not employed. This result can be both data-driven and institutionally driven.

Indeed, the EU-LFS core survey asks the respondents about the year of highest graduation and the year of first significant job. Hence, if a respondent graduated in December 2007 and got first employed in January 2008, he will be registered as employed 1 year after graduation. Moreover, in some countries, it is common for graduates to enrol in unpaid traineeship directly after graduation, which can neither be reported as part of their education and training (unless included formally in the prerequisites for the gaining of a diploma) nor as a first employment contract (because of their non-remunerated nature). These limitations can, therefore, produce an underestimation bias of the actual number of young people employed “less than one year after completion of highest education”.

Then, when looking at the employment rates of the 20-34 years old at least 1 year after graduation, we observe a progressive increase up to 4 years after graduation and a significant drop beyond 4 years. Overall, what Figure 1 reveals is that the largest number of 20-34 years old is employed within a time lag of 1 year to 4 years after graduation.

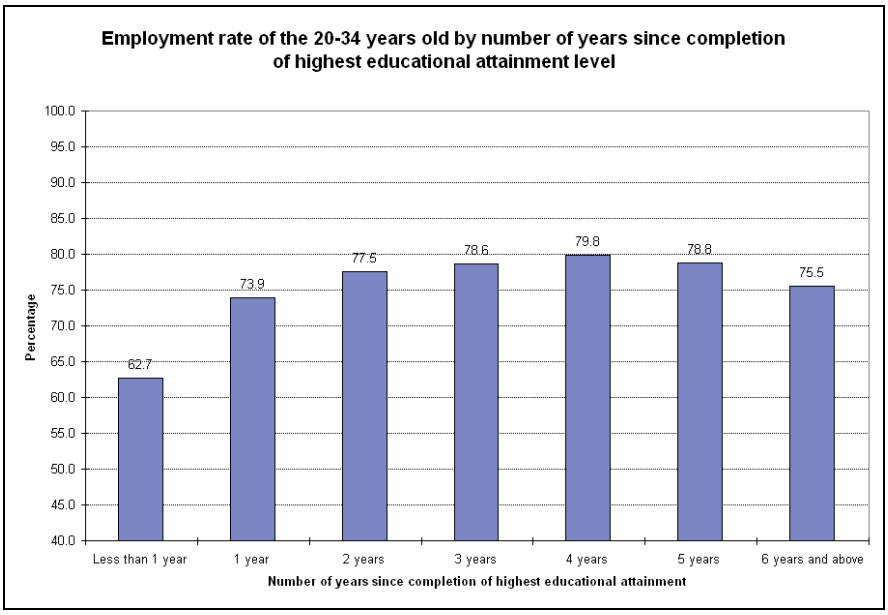

Figure 1. Employment rate of the 20-34 years old not currently enrolled in further education or training, by number of years since completion of the highest educational attainment (EU27 average), 2009
(Source: Boateng, Garrouste and Jouhette, 2011. Authors' computations based upon the core annual EU-LFS, 2009)

While it is tempting to misread this figure as a representation of the employment spells of one specific 20-34 year-old cohort, it should be kept in mind that the first vertical bar actually illustrates the share of employed individuals aged 20-34 years old in 2009 that graduated within one year of time, the second bar the number of employed individuals aged 20-34 years old in 2009 that graduated 1 year before, the third bar the number of employed individuals aged 20-34 years old in 2009 that graduated 2 years before, etc. Hence, we are observing individuals that entered the labour market in different years and may have been affected by different structural and conjectural settings. Among these individuals, some may have been in employment ever since the day of their graduation, without interruption, while others may have suffered multiple unemployment spells. Within the same country, 20-34 years old that reached their highest educational attainment level the longest time ago may have graduated from an E&T system that did not provide the same curricular options as the one from which their 20-34 year-old peers graduated more recently.

Despite the obvious weakness of such stock measure, the information illustrated in Figure 1 is to some extent confirmed by empirical research based upon longitudinal panel data (e.g., ECHP or EU-SILC), namely that, on average, young

graduates take 24 months to find their first permanent job, with important variations across countries and educational attainment levels, ranging from 13.2 to 34.6 months (Quintini, 2007). Moreover, it has been demonstrated that a transition from education to first job associated with a long period of unemployment can have significant implications for future labour market outcomes. It can adversely affect future earnings and work experience (e.g., Arulampalam et al., 2000). The 'scarring' theory of unemployment suggests that possible reasons are depreciation of human capital through atrophy (i.e. not using skills leads to losing them), or the fact that employers tend to use an individual's previous labour market experience as a screening mechanism. A way of assessing whether E&T systems have the capacity to support a "successful" transition to the labour market may therefore be by measuring whether their graduates manage to avoid falling into a long-term unemployment trap within 3 years after leaving their E&T institution.

For all the reasons listed above, the share of employed 20-34 years old was finally collected only for those who graduated at least 1 year before the interview and at most 3 years before the interview[9].

Denominator:

The denominator counts the total number of 20-34 years old not currently attending any education or training (either active[10] or inactive[11] on the labour market). Hence, in addition to the age bracket and observation period constraints included at the numerator, the presence of a filter on current education status at both the numerator and denominator contribute to differentiating significantly our measure of young graduates' employment from the EU2020 employment rate indicator[12].

[9] This stock measure of employment has the advantage of ascertaining sufficient sample sizes at country level, which is a prerequisite for an EU27 benchmark indicator.
[10] Active population: The economically active population includes those who are employed, and those who are unemployed.
[11] Inactive persons are those who neither classified as employed nor as unemployed.
[12] The EU2020 employment rate indicator measures the share of 20-64 years old that is employed.

3. 2004-2010 HISTORICAL TRENDS

The trend series of the generated indicator on education for employability are presented in Figure 2[13]. They reveal that the employability of the low educated (ISCED 0-2) has been at least 20 percentage points lower than the one of high educated (ISCED 5-6) youth over the period 2004-2010. It is interesting from that figure to see that this gap increased to 30 percentage points difference during the crisis (see 2008-2010 values).

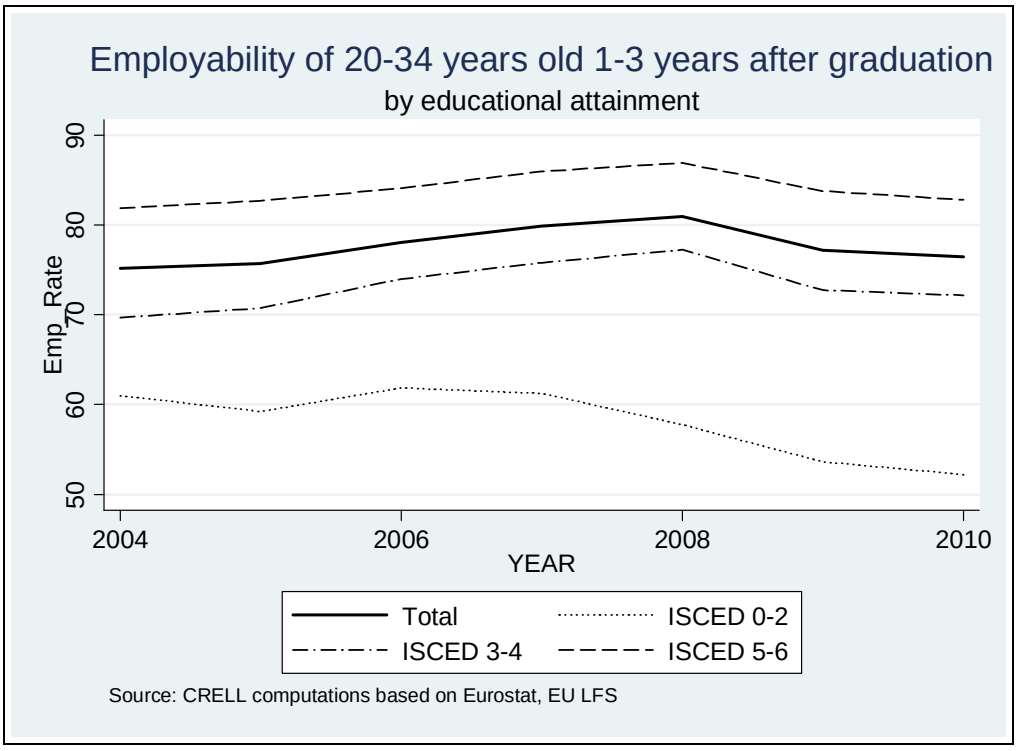

Figure 2. Percentage of 20-34 year-olds employed during the 3 years following their highest graduation, by level of educational attainment

Note: Lower than Upper Secondary Education corresponds to ISCED levels 0-2 (including 3c short); Upper Secondary and Post-secondary Non-tertiary Education to ISCED levels 3-4; and Tertiary Education to ISCED levels 5-6.

[13] The data values plotted in Figure 2 are presented in Table A.1 in Annex. The data presented in this section are based upon the September 14, 2011 extractions from EUROSTAT's EU-LFS annual data from 2004 to 2010.

Still, as revealed by Figure 3 (for 2010 data) and Annex Table A.1 (for trend data 2004-2010), there is a strong variation in country-specific performances. For instance, while the HU, MT and the UK had the best medium educated performers in 2004, after the crisis, UK dropped to the 8th position, HU to the 16th position and MT to the 27th position, replaced by NL, AT and LU 2010. Similarly, while the UK, HU and MT had the best high educated performers in 2004, by 2010 the UK had fallen to the 9th position and HU to the 17th , at the profit of the NL and LU (2010 ranking: MT, the NL, LU).

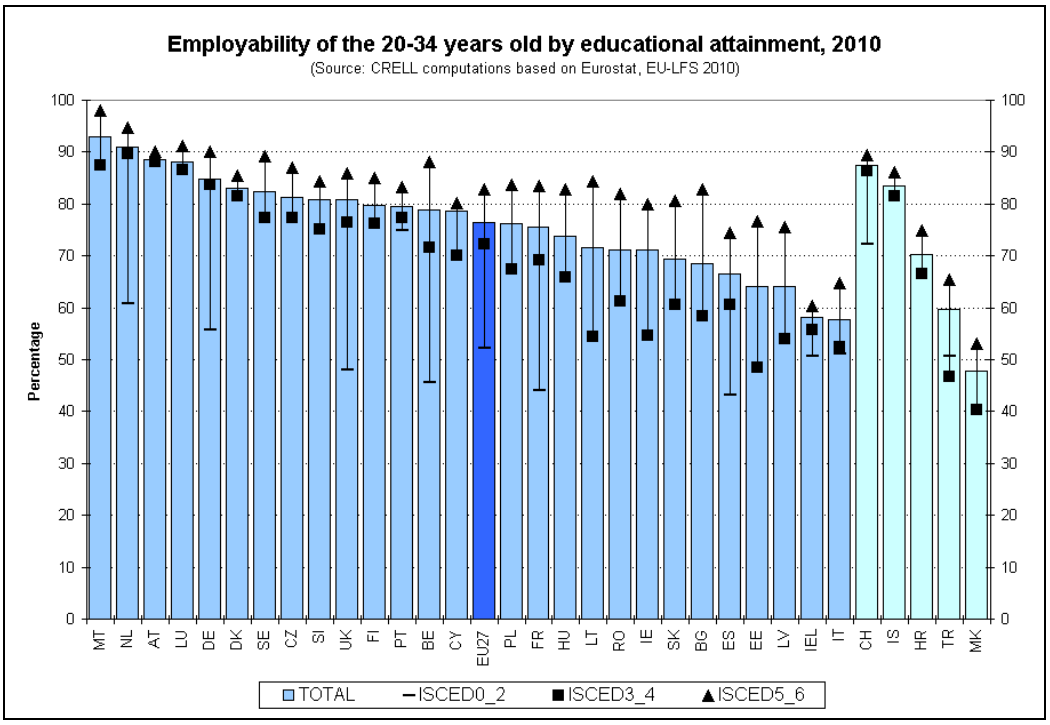

Figure 3. Employability rate by educational attainment level and by country, 2009

Notes: Below upper secondary education corresponds to ISCED levels 0-2 (including 3c short); Upper secondary and post-secondary non-tertiary education to ISCED levels 3-4; and Tertiary education to ISCED levels 5-6. Data for EE, MT and SI suffer lack of reliability across levels of educational attainment. Data for GR and SE suffer lack of reliability due to small sample sizes at the lower education level.

Moreover, Table A.1 in Annex highlights some data issues. When looking specifically at the low educated (ISCED 0-2), missing or inconsistent data are present across the

trend series for almost all countries[14]. The lack of data for the low educated sample can easily be explained by the nature of the benchmark indicator, which combines strict selection filters based on the age bracket (20-34 years old) and on the observation time frame (1-3 years after graduation). With such a restricted frame, the education for employability benchmark assumes that the observed cohort graduated earliest at the age of 17 (i.e. 2 years after the average age of end of compulsory education in Europe)[15]. Hence, those who have actually exited the E&T system at the end of the compulsory education period with only an ISCED 0-2 degree are excluded from this measure. The ISCED 0-2 graduates that continued their education at least until the age of 17 without graduating at a higher level are also excluded. At the end, the only ISCED 0-2 graduates that are captured by this benchmark indicator are the ones that graduated from lower secondary education at least at the age of 17. Not surprisingly, this number is very low, even null, in most countries.

Because the lack of observations for the low educated constitutes an important reliability issue, the choice has been made to not communicate further results for the lower educated sample. In the reminder of the report, ISCED 0-2 graduates are only included in the aggregated computations labelled "all educational attainment levels" or "full sample" but not in the computations disaggregated by educational attainment level[16].

After excluding the low educated sample, we still find a number of countries with persistent missing or inconsistent data (e.g., EE, HU and RO) and few occasional unreliability (e.g., DE's medium education value in 2005; MT's medium education values in 2006 and 2010). The presence of these missing values may be explained by the fact that we are using the annual sample of the LFS survey, which is restricted to

[14] The lack of data for the low educated sample can easily be explained by the combination of the age bracket (20-34 years old) and the observation time frame (1-3 years after graduation) chosen for the benchmark indicator, which assume that the observed cohort graduated earliest at the age of 17. Hence, those who have actually exited the E&T system after completion of an ISCED 0-2 degree are excluded from this measure. The indicator only counts the ISCED 0-2 graduates that continued their education at least until the age of 17 without graduating at a higher level.

[15] See Garrouste (2010) for details on European reforms about compulsory education.

[16] Results disaggregated by educational attainment level will only be presented for the medium and high educated samples.

few waves in some countries because the variable *HATYEAR*[17] (year of graduation) is not available on a quarterly basis.

Further, Table A.2 in Annex presents the gender gap in country performances between 2004 and 2010[18]. It reveals the presence of a persistent gap in favour of men at the level of the EU27 average across the whole observation period (2004-2010). Nevertheless, we observe significant cross-country variations. In 2004, the country with the strongest gender gap in favour of men was EE (ratio Males/Females 1.43) and the country with the strongest gender-gap in favour of women (ratio Males/Females = 0.92) was RO. In 2010, the country with the strongest gender-gap in favour of men was still EE (ratio Males/Females = 1.22) but the country with the strongest gender-gap in favour of women was now LT (ratio Males/Females = 0.90). While in 2004, the most egalitarian countries were LT, SE and DE (ratio Males/Females = 1), by 2010, they got replaced by SK, HU and BE.

When disaggregating by educational attainment level, we see that SI and RO were in 2004 the most unequal countries in terms of employability of the young graduates at a medium educational level, respectively favouring men and women. By 2010, SI is still the most discriminative country against women but RO has been replaced by BG as the most discriminative country against men. The only country where young men and women were given equal opportunities was the NL in 2004, replaced by LT in 2010.

Finally, with regard to the young graduates from tertiary education, the most unequal countries in favour of men or women were in 2004, respectively, LV and LT. The most egalitarian ones were DK and BG. Comparatively, in 2010, the most unequal countries were EE (in favour of men) and IE (in favour of women) and the most egalitarian ones were PT and BE.

This evidence of the existence of a gender gap within EU MS (either in favour of men or women) may constitute an important source of information for countries adopting an active gender equity policy.

[17] See sections 2 and 4 for an explanation of the role of the HATYEAR variable in the computation of this benchmark.

4. PRELIMINARY ROBUSTNESS ANALYSIS[19]

This section presents some results from preliminary robustness checks testing (i) the sensitivity of the proposed employability benchmark to a change in the data source for the definition of the actual date of graduation and (ii) correlations between the employability benchmark estimates and some counterfactuals.

4.1 Sensitivity to a change in data source

As already mentioned in Section 2, some tests were conducted with EUROSTAT to estimate the sensitivity of the employability benchmark indicator to a change in the definition of the starting time of the transition period between education and employment according to the data source (Boeteng et al., 2011). We exploited the added variables of the EU-LFS Ad hoc module of 2009 to generate an indicator against which the benchmark results could be compared.

That joint paper (ibid.) shows the first preliminary results for countries with changes in employment rates in relation to the benchmark. It is important to note that the validation process of the LFS ad hoc module 2009 is still ongoing and country specific cases will be investigated taking into account educational patterns, educations levels, rates of early leavers and sample sizes. This is especially important in countries with significant differences in relation to the proposed benchmark.

Since 2000, a specific thematic module is attached each year to the EU-LFS. In 2000 and 2009, 11 additional variables on the transition of young people from school to work were proposed. Among the 11 additional variables provided by the ad hoc module, the one of interest for this exercise was the *STOPDAT* variable, which we used as a counterfactual for the variable *HATYEAR* from the Core LFS. On the one

[18] It is worth stressing the presence of missing and unreliable values in EE across levels, in SI at the medium and high education levels, in CY and IE only at the medium educated level and in LT and LU only at the high educated level.
[19] This section is based only on 2009 data.

hand, the variable *HATYEAR* refers to the year when the highest diploma was obtained, in other words the year of graduation. It is a standard way of collecting information on educational attainment in the Core LFS. On the other hand, the variable *STOPDAT* collected in the ad hoc module of 2009 refers to the year of leaving formal education for the last time. Although much more accurate, this question is more difficult to collect and can therefore not be included in the regular LFS.

We find that in 92.9% of cases, the information provided by the respondents to both questions coincide, which means that our proxy variable *HATYEAR* generates a potential biased estimate of the school leaving year for about only 7% of the sampled population. The analysis also reveals that the *HATYEAR* variable tends to underestimate the actual employed population (compared to the *STOPDAT* variable) by at least 1.4 percentage points with significant variations across countries.

While using the variable HATYEAR instead of STOPDAT underestimates by more than 10 percentage points the employment rate in Slovakia (under revision) and up to 5 percentage points in Belgium, Estonia and France, it overestimates it in the case of Latvia, Spain, Malta and Finland by up to 5.4 percentage points. Interestingly, the least sensitive countries to a change in data source are Czech Republic, Germany, Spain and the Netherlands, with less than 1 percentage point difference. For all other countries, the underestimation ranges between 1.0 and 5.4 percentage points, with the Netherlands, the Czech Republic and Bulgaria at the bottom and Romania, France and Belgium at the top of variation.

4.2 Correlation with counterfactual benchmark indicators

The main objective of this exercise is to verify whether the correlation between our estimated benchmark indicator with relevant existing counterfactual indicators has the sign we theoretically would assume. Hence, overall, this section aims at providing some evidence of the relevance of our proposed benchmark indicator on education for employability in relation to existing benchmark indicators.

Because the employment rate of the 20-34 year-olds measured by our employability benchmark constitutes a sub-sample of the employment rate of the total population at a working age, the first counterfactual benchmark indicator against which we correlate our proposed benchmark is the EU 2020 employment rate (measured on the population aged 20-64). Figure 4 confirms the existence of a strong correlation (close to 88%) between the two indicators, validating our assumption of a potential anchoring of the employability indicator to the employment rate benchmark. While up to 37% of the variation in young graduates' employability across countries is explained by the overall labour market's situation, 63% is explained by other factors, including the ability of E&T systems to provide for the demanded skills.

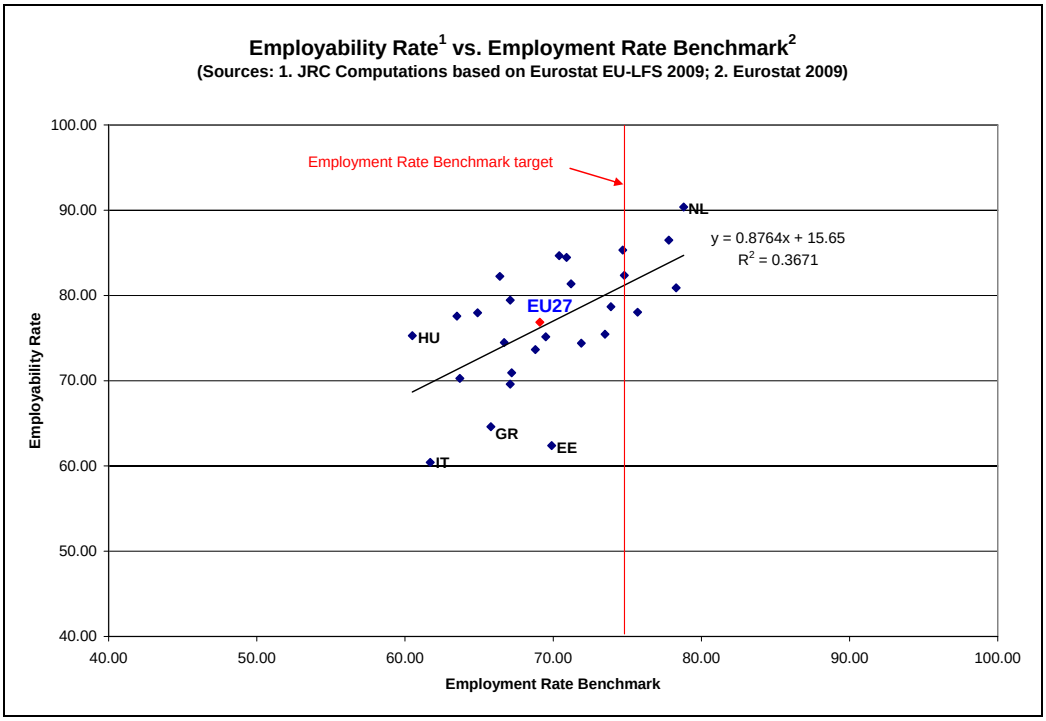

Figure 4. Employability Rate vs. Employment Rate, 2009

The second counterfactual against which we compare our employability benchmark is the GDP per capita in PPS. We expect a strong positive correlation between high GDP per capita and high youth employability levels, assuming that the employability of young people is driven by the economic wealth of a country. Figure 5 confirms the positive correlation between the two indicators (r = 36.4%). Still, it is worth noticing

the presence of outliers such as GR and IT who are performing surprisingly low in terms of youth employability given their relatively high GDP per capita rate (close to the EU27 average) and RO who is performing relatively high in terms of youth employability (above the EU27 average) given its low level of GDP per capita rate. In the case of GR and IT, this result shall be interpreted as a sign that young people are not beneficiating as much as they could from the growth of their respective economy.

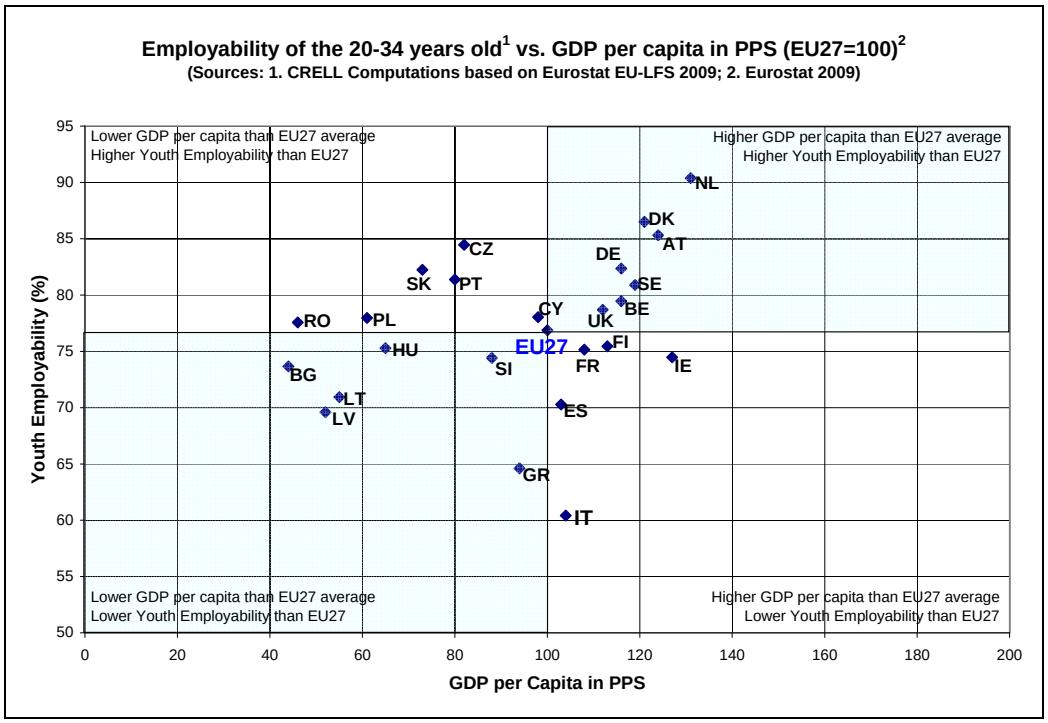

Figure 5. Employability Rate vs. GDP per capita in PPS, 2009

A different way of looking at the role played by the wealth of a country on the chances of young people to find a job soon after graduation is to look at the rate of people excluded (or at risk of being excluded) from the returns to economic growth. We assume that in countries where there is a large share of poverty and exclusion from the labour market, there should also be a lower rate of employability among the young cohort. Figure 6 plots the young graduates' employability against the EU2020 benchmark on population at-risk-of-poverty or exclusion and finds a significant negative correlation, which confirms once again the robustness of our indicator.

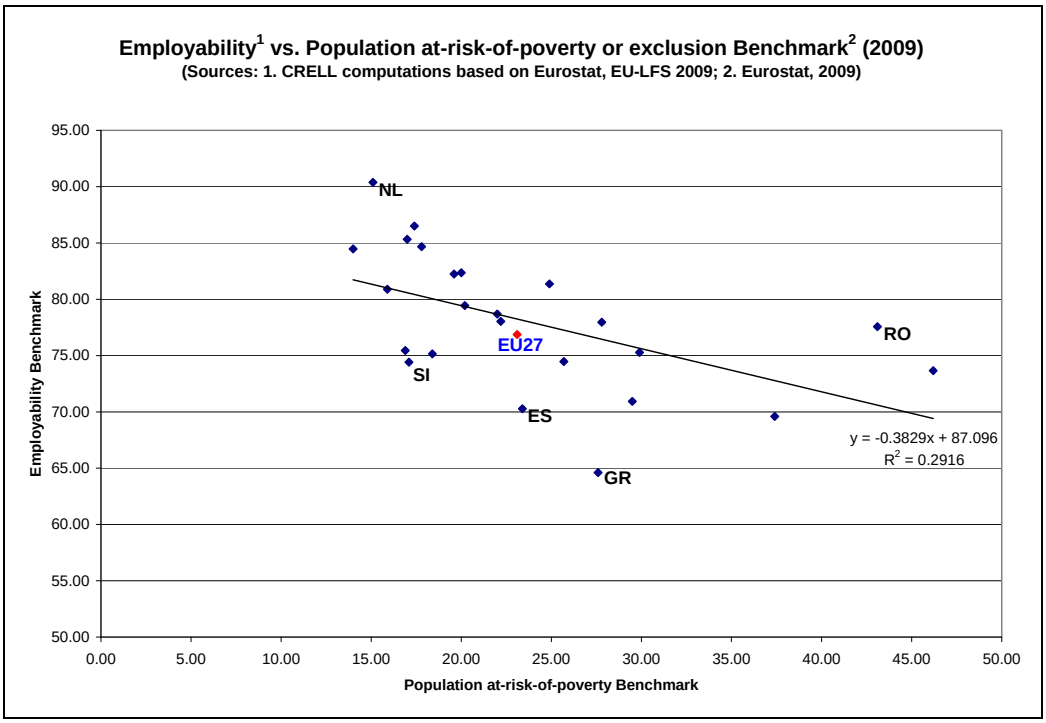

Figure 6. Employability Rate vs. Population at-risk-of-poverty or Exclusion Benchmark, 2009

The fourth counterfactual we explore is the EU2020 early school leaving benchmark indicator, which is used as a proxy of the capacity of E&T systems to retain their pupils until completion of compulsory education. We expect a strong negative correlation between this indicator and young graduates' employability, assuming that countries with high young graduates' employability rates are countries where a degree is valued by the labour market and, therefore, might also be countries preventing more efficiently early school leaving. Figure 7 confirms this assumption (r = -.66) and reveals that the share of early school leavers explains up to 23% of the variations in young graduates' employability across countries[20].

[20] In this example, ES represents an interesting outlier in the sense that it reports a relatively high employability rate of its young graduates given its very high rate of ESL. This could validate the argument that in few countries such as ES, young people may be incited to leave school before the end of compulsory education by the existence of a smooth absorption mechanism to the labour market.

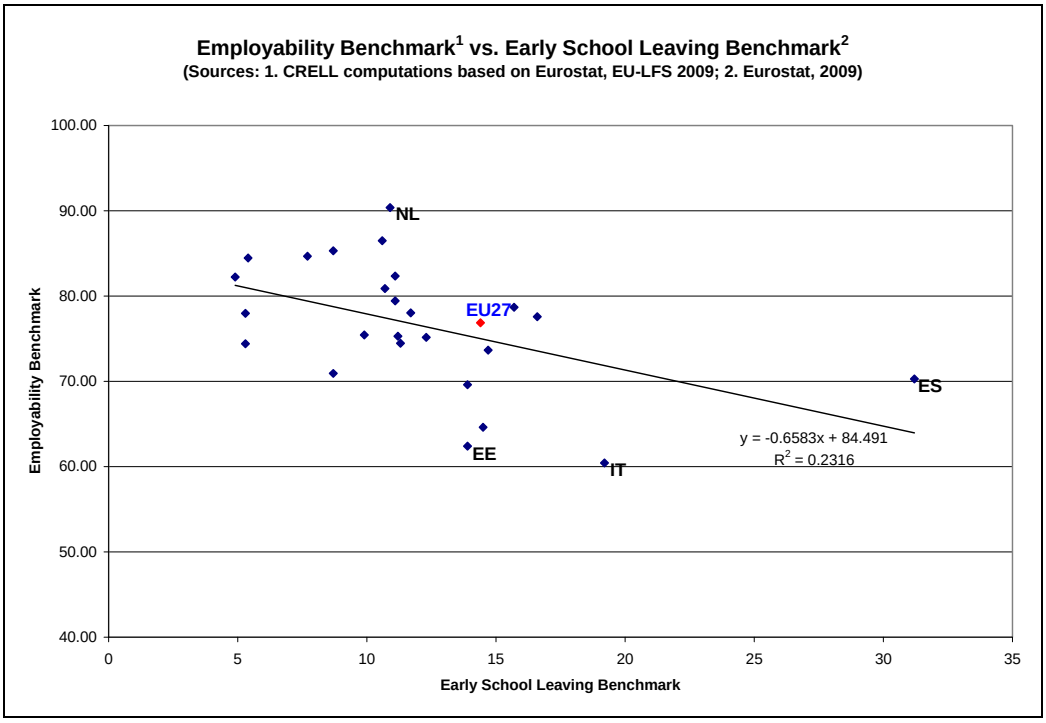

Figure 7. Employability Rate vs. Early School Leaving Indicator, 2009

Finally, we checked whether countries producing a higher share of tertiary graduates also perform better in terms of youth employability. Against all expectations, Figure 8 reveals no correlation between the two indicators (r = .09). This result is very important for our analysis as it demonstrates that higher youth employability can not be achieved simply by increasing the number of tertiary graduates. In other words, the employability benchmark can not be substituted by the tertiary educational attainment benchmark. Rather, increasing the young graduates' employability requires the provision by the E&T systems of all skills and competencies requested by the labour market. Such provision can and shall be ensured at all levels of educational attainment. For instance, some countries, such as the CZ, DE and AT, reach a high youth employability without producing a high share of tertiary educated pupils. Their high employability rate is indeed more due to the capacity of their E&T systems to provide for the necessary skills towards a smooth entrance into the labour market.

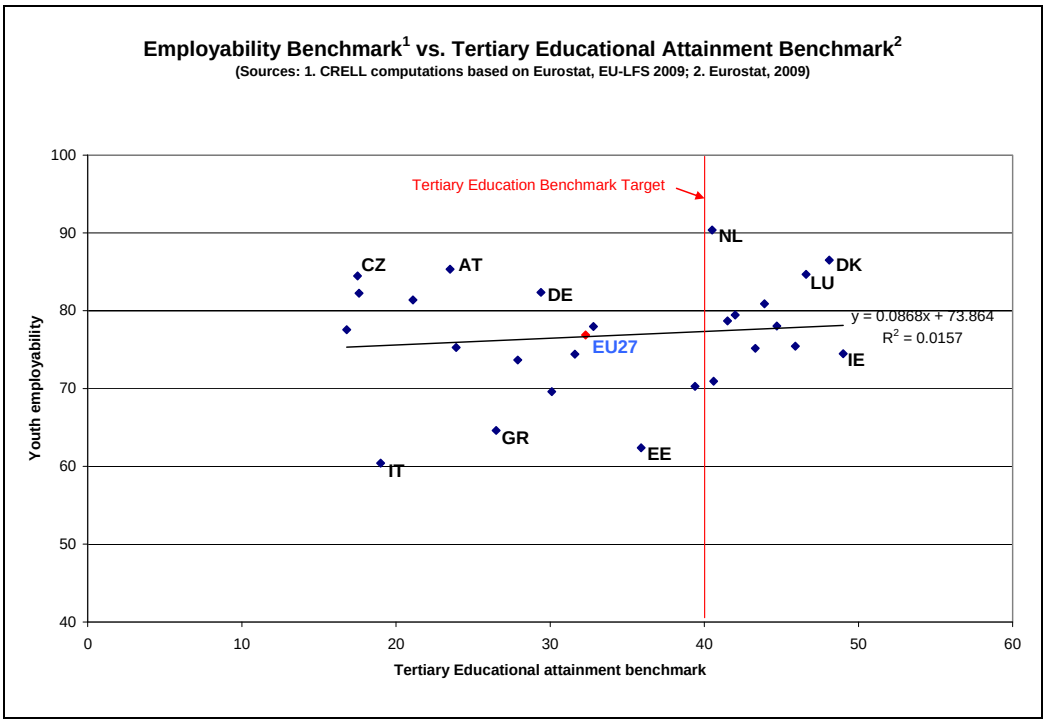

Figure 8. Employability Rate vs. Tertiary Educational Attainment Benchmark, 2009

Hence, it appears clearly from the above analysis that the employability of young graduates can partly be explained by the overall labour market situation, by the economic wealth (measured as GDP per capita in PPS and as the share of population at-risk-of-poverty or exclusion) and by the capacity of E&T systems to retain learners until the completion of compulsory education. Still, it is not at all explained by the EU2020 benchmark on tertiary educational attainment.

Overall, the proposed benchmark on Education for Employability comes out as a clear complement to all existing EU2020 and ET2020 benchmark indicators on education and employment.

5. TOWARDS A BENCHMARK TARGET: FORECASTING METHODS AT THE HORIZON 2020

This section presents the forecasting techniques adopted to define the target level of the proposed benchmark indicator on education for employability at the horizon 2020.

5.1 Deterministic forecast methods

The physicist Nils Bohr once said, “Prediction is difficult, especially when it’s about the future”. And George E. P. Box is reported to have maintained that “All models are wrong, but some are useful” (Box and Draper, 1987). Michael Clements and Sir David Hendry (2001) suggest some reasons why conditional models, misspecified in unknown ways, yield model error. They maintain that a model is an attempt to extract regularities while excluding irregularities from nature. Although modelling and forecasting require covariance stationarity, we live in a non-stationary and changing world. Our modelling theory, from which we derive our forecasts, must allow for intermittent structural breaks (ibid.). The data generating mechanism, from which our time series realization stems, can change over time. Furthermore, some data generating processes change more rapidly than others. Shifts in deterministic factors can cause shifts in equilibrium means over time.

Types of deterministic forecasts:

There are several classifications of forecasts: ex-post forecasts, ex-ante forecasts, one-step-ahead forecasts, static forecasts, dynamic forecasts and rolling origin forecasts (Yaffee, 2010). In this analysis we use a linear ex-ante forecast technique, which consists in forecasting beyond the end of the sample data at a particular time. The point of forecast origin in this type of forecast begins where the actual data cease to exist. Unless we have some conventional “gold standard” of forecast accuracy against which to compare these forecasts, we have no baseline for comparison at the time of forecast origin. For this reason, we generate a “naïve” forecast against which to

compare our forecasted estimates. Makridakis, Wheelwright and McGee (1983) refer to two kinds of naïve forecasts. The first kind is the one in which a random walk is extended from the value of the variable being forecasted, whereas the second kind is a deseasonalized extension of the variable being forecasted as a basis for comparison. In this work, we define our comparative naïve forecast in the later way, namely as a deseasonalized extension of the employability rate. According to the scenario tested (see Box 2), the forecast horizon will begin at a different point of forecast origin (Pindyck and Rubinfeld, 1997).

Furthermore, we assume that the previous forecast is actual data upon which the one-step ahead forecast is based (i.e. "one-step-ahead forecast" technique, applied with the Kalman filter). Because this forecast builds upon previous optimal estimates, it can generally be more accurate than a multi-step dynamic forecast[21] (Yaffee, 2010).

Moreover, we explore the potentials of forecasted growth rates as a constructive alternative to trend forecasting. The compound annual growth rate (CAGR) is calculated by taking the *n*-th root of the total percentage growth rate, where *n* is the number of years in the period being considered. It is useful when determining an annual growth rate on an indicator whose value has fluctuated significantly from one period to the next as it reduces the effect of volatility which can make arithmetic means irrelevant (see Box 1 for details).

Finally, because predictability is necessary but not sufficient for forecastability (Hendry, 1995), it is important to account for the hidden or unanticipated correlations with excluded or unknown variables and for unanticipated changes in variables over the forecast horizon. On the one hand, unconditional forecasts (ARIMA model) are often based on a single series and are not conditional on exogenous time series. On the other hand, conditional forecasts have a time series regression framework in the sense that an endogenous variable may be influenced by proximate, indirect, or direct effects associated with it. For instance, the employment rate of the newly graduated aged 20-34 years old depends upon the distribution of the employment rate of the entire adult population. Indeed, we base our assumption of a strong anchorage of our

[21] The multi-step dynamic forecast has been considered a simultaneous projection of h-steps based only upon the data prior to the forecast origin. It is therefore considered less accurate than the iterative one-step ahead projection of the Kalmar filter.

employability benchmark to the overall employment rate positive correlation rate (i.e. a strong positive correlation) on the evidence provided by Figure 4 in section 4.

Conditional forecasts entail the preliminary prediction of all exogenous or weakly exogenous variables over the forecast horizon before the forecast of the endogenous variable can be generated. In that effort, we use CEDEFOP's (2010) mid-term forecasts of the employment rate as our baseline (see Chart A.1 in Annex).

Consequently, we end up comparing results from three different deterministic forecasting techniques namely, unconditional linear trend analysis, compound annual growth rate (CAGR) and conditional (linear and exponential)[22] trend analysis (Box 1). Exploring these three methods enables us to test for the sensitivity of our forecasted values to a change in forecasting method.

Each of these deterministic forecast methods has been computed on four broad scenarios. These scenarios were defined to generate a range of forecast estimates largely inspired by the work of DG EMPL on the Employment rate targets for 2020 (DG EMPL, 2010), applying the logic of "worst case, best case and most likely". Box 2 presents these scenarios in detail.

Scenario 3, which is the second most optimistic scenario, is computed simply by imposing a common target value at the horizon 2020 to all MS at least equal to the average value of the highest level reached by the 3 best performing MS before the beginning of the crisis (i.e. during the period 2004-2007). While the estimations based on this scenario are not conditioned by the forecasting method, for the other three scenarios (namely, scenario 1, scenario 2 and scenario 4), the estimation method conditions the benchmark target at the horizon 2020.

Comparing these scenarios provides us with additional information on the sensitivity of our estimates to a change of hypothesis on the shape of future trends.

[22] In this report we only present the results from the linear conditional trend model. Results from the exponential conditional trend model are available upon request to the author. Note that the results assuming either a linear or an exponential distribution do not differ significantly.

BOX 1. DETERMINISTIC FORECASTING METHODS

Method 1: Unconditional Trend Analysis

The unconditional trend model is defined as:

$$T_t = g(Time_t) \text{ , where } Time_t \text{ is the time index.}$$

The most common trend models are linear trend, exponential trend, quadratic trend and trends with changing slope. In this application we consider only the linear trend.

Method 2: Compound annual growth rate (CAGR)

The compound annual growth rate is calculated by taking the *n*-th root of the total percentage growth rate, where *n* is the number of years in the period being considered. It is useful when determining an annual growth rate on an indicator whose value has fluctuated significantly from one period to the next as it reduces the effect of volatility which can make arithmetic means* irrelevant. The formula for calculating the CAGR is:

$$\text{CAGR}(t_0, t_n) = \left(\frac{V(t_n)}{V(t_0)} \right)^{\frac{1}{t_n - t_0}} - 1$$

where $V(t_0)$ is the start value, $V(t_n)$ is the finish value, $t_n - t_0$ is the number of years.

Method 3: Conditional Trend Analysis

The conditional trend model is defined as:

$$Y_t = f(knownY's, knownX's, newX's)$$

where $t = 0,\ldots,T$ and Y_t is the employability rate in year t, measured as a function of the slope of the interaction between the historical trend line (defined as linear or exponential) of *Y* and the historical and predicted trend line of an explanatory variable *X* (i.e. the employment rate of the total adult population).

* The arithmetic mean or average annual growth rate (AAGR) is the sum of annual changes (compared with the previous year) divided by the number of years:

$$\text{AAGR} = \bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i = \frac{1}{n}(x_1 + \ldots + x_n).$$

Note: When only 1 period is considered (i.e. growth rate between year 1 and year 2), then CAGR=AAGR. The AAGR method has largely been demonstrated to be inefficient to capture the effect of volatility. Therefore, we retain the CAGR for this analysis.

BOX 2. FORECAST SCENARIOS

- **Scenario 1 – Worst case scenario**: this scenario assumes a long-term persistence of the deterioration in employment rates reached during the economic crisis will remain constant; the estimated benchmark level is defined projecting the growth rate between 2008 and 2010;

- **Scenario 2 – 1st best case scenario**: this scenario assumes that EU labour markets revert to the employment rates prior to the crisis; the estimated benchmark level is defined projecting the growth rate between 2004 and 2007;

- **Scenario 3 – 2nd best case scenario**: this scenario assumes a strong recovery process which exceeds the average performance preceding the crisis; the benchmark level is defined as the average growth rate of the three best performers during the period 2004-2007.

- **Scenario 4 – Most likely scenario**: this scenario disregards the crisis and considers the period 2004-2010 as homogeneous. It defines the benchmark level projecting the growth rate between 2004 and 2010.

5.2 Stochastic forecasting: Monte Carlo Simulation

Although broadly applied by many organizations, deterministic forecast approaches suffer from major limitations. First of all, they consider only a few discrete outcomes, ignoring hundreds or thousands of others. Moreover, they ignore interdependence between inputs, impact of different inputs relative to the outcome and other nuances, which oversimplifies the models and reduces their accuracy.

A better way to perform forecasting analysis is by using Monte Carlo simulations. In Monte Carlo simulations, uncertain inputs in a model are represented using ranges of possible values known as probability distributions. By using probability distributions, variables can have different probabilities of different outcomes occurring, which is a more realistic way of describing uncertainty in variables. While probabilities can take almost any distribution shape (ranging from Normal to Discrete), in this specific work we assume a Uniform distribution, i.e. all

values (from any scenario) have an equal chance of occurring, and we simply define the minimum and maximum values based upon our estimates from the scenario-based deterministic forecasts.

During a Monte Carlo simulation, values are sampled at random from the input probability distributions. Each set of samples is called an iteration, and the resulting outcome from that sample is recorded. Monte Carlo simulation does this hundreds or thousands of times, and the result is a probability distribution of possible outcomes. In this way, Monte Carlo simulation provides a much more comprehensive view of what may happen. It tells us not only what could happen, but how likely it is to happen. Finally, the Monte Carlo simulation allows us to relax the hypothesis of equal weight to all scenarios which is implied by the deterministic modelling, by estimating the probability of different scenarios to occur (Vose, 2008)[23].

In an effort to estimate a 'realistic' benchmark target, we therefore also apply Monte Carlo simulations to test whether the simulated mean and range of plausible values (under different randomization hypotheses) are similar to the ones estimated by our three deterministic methods. Results are presented in section 6.2.

As a consequence, our methodological forecasting framework tests the sensitivity of the 2020 projections to a change in the estimation method and a change in the predictive scenario.

[23] Vose, D. (2008). *Risk Analysis, A Quantitative Guide* (Third ed.). New York, NY: John Wiley & Sons.

6. RESULTS

6.1 Scenario-based forecast estimations[24]

The historical trend data for each country were used to compute the scenario-based forecast estimations at the horizon 2020. As explained in section 5, each scenario takes a different stand with regard to the potential impact of the economic crisis, ranging from the most pessimistic scenario of no recovery prospects to the most optimistic scenario of a strong recovery towards the level of the three best achievers before the start of the crisis (assuming no impact at all of the crisis in the long-run) (Box 2).

Figures A.1 to A.4 present the variations (at the EU27 average level) in the forecasted employability rate according to the method applied, by scenario and by educational attainment. All detailed data are presented in Table A.3 and summarized in Table 1[25].

[24] All figures presented in this section are computed based upon Table A.3 in Annex.
[25] Note that scenario 3 is the only non-method-specific scenario. Therefore, Figure A.3 presents only the results disaggregated by educational attainment.

Table 1 Summative table of the deterministic forecasting results: Percentage-point change between the 2020 forecasted value and the 2010 value, by method, by scenario and by educational level

	Method 1	Method 2	Method 3			
	Linear	CAGR	Cond. Linear	Mean by scenario	*s.d. by scenario*	Aggregated mean by scenario
All Education Levels						
scenario 1	-22.97	-18.98	-23.10	**-21.68**	*2.34*	**-22.17**
scenario 2	23.50	21.52	15.94	**20.32**	*3.92*	**15.97**
scenario 3	14.20	14.20	14.20	**14.20**	*0.00*	**14.58**
scenario 4	5.68	2.24	-0.94	**2.33**	*3.31*	**2.95**
Mean by method	**5.10**	**4.75**	**1.53**	**3.79**	*1.97*	
s.d. by method	*17.39*	*17.70*	*18.08*	*18.55*		
Medium Education Level						
scenario 1	-26.16	-20.88	-26.31	**-24.45**	*3.09*	
scenario 2	27.83	21.24	-0.98	**16.03**	*15.09*	
scenario 3	17.58	17.58	17.58	**17.58**	*0.00*	
scenario 4	7.87	4.32	-2.47	**3.24**	*5.26*	
Mean by method	**6.78**	**5.56**	**-3.05**	**3.10**	*5.36*	
s.d. by method	*23.42*	*19.07*	*17.99*	*19.46*		
High Education Level						
scenario 1	-20.88	-17.79	-21.01	**-19.89**	*1.82*	
scenario 2	17.17	13.38	17.17	**15.91**	*2.19*	
scenario 3	11.57	11.57	11.57	**11.57**	*0.00*	
scenario 4	4.84	1.61	1.55	**2.67**	*1.88*	
Mean by method	**3.17**	**2.19**	**2.32**	**2.56**	*0.53*	
s.d. by method	*16.81*	*14.29*	*16.84*	*15.95*		
Aggregated mean by method	**4.98**	**3.88**	**-0.36**			

Source: CRELL computations based upon EUROSTAT, EU-LFS annual aggregated data (2004-2010).
Notes: For method 3 (conditional linear forecast), the forecast estimates of the employment rate indicator were computed using CEDEFOP's (2010) projected values of the employment, by level of qualification (000s) (IER's estimates from IER's qualifications model based on CE's forecasts for sectoral demand from the E3ME model) divided by CEDEFOP's estimated working age population, by level of qualification (000s) (Based on CE estimates from the E3ME model and using EUROSTAT data). See Chart A.1 in Annex for details.

Scenario 1:

As illustrated by Table 1 and Figure A.1, the most pessimistic scenario induces the largest percentage-point change between the forecasted value and the value of 2010. Considering the full sample, across methods, scenario 1 induces a decrease in employability of almost 22 percentage points from the 76.5% of 2010. The method forecasting the strongest decrease is method 3 (i.e., conditional linear trend model) with -23 percentage points and the mildest is method 2 (i.e. CAGR) with -19 percentage points. Looking specifically at the medium and high educated does not alter the role played by each method. Overall, scenario 1 appears to produce the least

volatile predictions across methods (if we exclude scenario 3, which per definition is method-invariant).

Scenario 2:

Our most optimistic scenario, that assumes an immediate return to the growth rates prevailing in the years preceding the economic crisis (i.e. 2004-2007), is the scenario for which our three methods produce the most different predictions (with a standard deviation of results by method equal to 15.09 percentage points in the case of the medium educated sample). With an overall increase of 20 percentage points compared to the 2010 value, it is method 1 (unconditional linear trend model) that produces the highest predicted value and method 3 (conditional linear trend model) producing the lowest one (in all cases, except for the high educated sample where the 2nd method predicts the lowest increase).

Scenario 3:

Figure A.3 shows that the third scenario of a 2020 target value equal to the average growth rate of the three best performing countries before the crisis (2004-2007) yields an estimated employability of 90.7%, i.e. an increase by 14.2 percentage points compared to the 2010 value. This increase ranges from +11.6 percentage points for the high educated to +17.6 percentage points for the medium educated.

Scenario 4:

Finally, the most realistic scenario (which assumes that the period of the economic crisis is 'business as usual' and should therefore not be considered separately or differently from the rest of the trend series) forecasts an overall increase of employability of only 2.3 percentage points by 2020. While methods 1 and 2 both predict an increase, method 1 yields the most ambitious raise with almost +6 percentage points. On the other hand, method 3 (which conditions its forecasts of the

employability rate on the predicted values of the employment rate) predicts a decrease of 0.9 percentage points. The difference between methods is even stronger when looking at the medium educated sample, where the standard deviation from the mean of results by method equals 5.26 percentage points. In the case of the high educated sample, all three methods yield an increase in the employability rate (ranging between +1.55 and +4.84 percentage points).

From Table 1 we can also see that, overall, if we assume equal weight to all scenarios, method 1 yields an average forecast of +5.10 percentage points from the 2010 value (= 76.5%), method 2 predicts +4.75 percentage points and method 3, +1.53 percentage points. Moreover, averaging across methods' mean values yields a gross predicted 2020 employability rate at 80.29%, i.e. +3.79 percentage points (s.d. = 1.97).

Although the unconditional linear trend model and the compound annual growth rate approach produce convergent forecast estimates at around 5 percentage points increase, they only rely upon past trend series and do not control for future demographic changes. The objective of the third forecasting method was, therefore, to reduce the volatility of the estimates across scenarios by anchoring them to the EU 2020 employment headline target, using the CEDEFOP computations of future employment rates that control for demographic changes (see Chart A.1 and Figure A.5 in Annex). After averaging over the 4 scenarios, method 3 forecasts an overall increase of the employability rate of the newly graduated 20-35 years old by only 1.53 percentage points (full sample) and even predicts an overall decrease by 0.36 percentage points when aggregating over the medium and higher educated sample (see Table 1).

Overall, our analysis has demonstrated a significant sensitivity of our forecasted estimates to the forecasting method applied, to the scenario tested and to the population targeted (e.g., EU27 average, country-specific, full sample, high skilled or medium skilled). On the one hand, the traditional trend analysis (unconditional) and the CAGR produce relatively convergent average results but tend to diverge from the projections by CEDEFOP of the 2020 employment headline target by overestimating the employability rate. On the other hand, the conditional trend model

produces results that diverge from the other two methods but converges with the employment rate forecasts.

Hence, given our assumption of an anchorage of the variability of the young graduates' employability to the variability of the labour market industry and demographic compositions (see section 3.1), it may be reasonable to consider the later method as the most likely projection.

Nevertheless, because of the remaining large variability in the predicted values across scenarios even when restraining our focus on method 3, a Monte Carlo simulation[26] has been run to attempt to account for uncertainty of the scenario-based estimates and for uncertainty of the predicted values of the EU 2020 employment headline target. Assuming a uniform distribution of the probability of occurrence of each scenario and using the estimated mean and standard deviation by scenario (as explained in section 3.2), we tested the sensitivity of our overall estimates to randomization. Results are presented in section 6.2.

6.2 Monte Carlo Simulations

As presented in section 6.1, the sensitivity of the forecasted estimates to a change in scenario motivated us to test whether this variability could be explained by the assumption of an equal probability of occurrence of each scenario. In that effort, we generated five Monte Carlo simulations for each deterministic method (with 10,000 iterations) within the estimated 95% lower and upper confidence interval bounds (presented in Table A.3). We then compared the new simulated mean and range of values with the estimated mean from the deterministic models. The different tests are presented in Table 2.

[26] The Monte Carlo simulations were computed using the Palisade Software @RISK 5.7 Industrial for Excel.

Table 2. Monte Carlo Simulation Input Values

Method 1	Nominal	Min	Max
scenario 1	53.53	34.11	72.96
scenario 2	100.00	93.64	108.23
scenario 3	90.70	90.31	90.65
scenario 4	82.18	70.66	93.69
Method 2	**Nominal**	**Min**	**Max**
scenario 1	57.52	56.68	57.42
scenario 2	98.02	97.16	97.9
scenario 3	90.70	90.31	90.65
scenario 4	78.74	78.73	78.74
Method 3	**Nominal**	**Min**	**Max**
scenario 1	53.40	33.85	72.94
scenario 2	92.44	90.3	94.57
scenario 3	90.70	90.31	90.65
scenario 4	75.56	72.75	78.37
Scenario coef. ci	0.25	0	0.4

For each of the three deterministic forecasting method, we generated 5 tests:

- Test 1: Equal coefficients to all scenarios.

$$Employability = 0.25 * scenario1 + 0.25 * scenario2 + 0.25 * scenario3 + 0.25 * scenario4$$

- Test 2: Random coefficient to scenario 1 within [0; 0.4], fixed coefficients of scenarios 3 and 4 (=0.25) and coefficient of scenario 2 defined as a function of the other three coefficients.

$$Employability = c_1 * scenario1 + (1 - \sum_{2}^{4} c_i) * scenario2 + 0.25 * scenario3 + 0.25 * scenario4$$

- Test 3: Random coefficient to scenario 2 within [0; 0.4], fixed coefficients of scenarios 3 and 4 (=0.25) and coefficient of scenario 1 defined as a function of the other three coefficients.

$$Employability = (1 - \sum_{2}^{4} c_i) * scenario1 + c_2 * scenario2 + 0.25 * scenario3 + 0.25 * scenario4$$

- Test 4: Random coefficient to scenario 3 within [0; 0.4], fixed coefficients of scenarios 1 and 4 (=0.25) and coefficient of scenario 2 defined as a function of the other three coefficients.

$$Employability = 0.25 * scenario1 + (1 - \sum_{2}^{4} c_i) * scenario2 + c_3 * scenario3 + 0.25 * scenario4$$

- Test 5: Random coefficient to scenario 4 within [0; 0.4], fixed coefficients of scenarios 1 and 3 (=0.25) and coefficient of scenario 2 defined as a function of the other three coefficients.

$$Employability = 0.25 * scenario1 + (1 - \sum_{2}^{4} c_i) * scenario2 + 0.25 * scenario3 + c_4 * scenario4$$

The results of each test for each method are summarized in Table A.4 and presented graphically in Figures A.6 to A.8.

The Monte Carlo simulation of test 1 for the first method (i.e. unconditional linear trend forecast) reveals, that assuming equal weights to all scenarios yields a normal distribution of the estimated employability around a mean value of 81.74 (compared to the 81.84% predicted with the deterministic methods), that is likely to vary within the following range of values: [81.81; 81.67]. This result confirms the validity of the assumption of an equal probability of occurrence of each scenario when using method 1 to forecast the 2020 employability rate.

With regard to the second method (i.e. CAGR), simulations of test 1 yield a normal distribution of the employability rate at a mean value of 80.95 (compared to the 81.25% predicted with the deterministic methods). The CAGR method estimates the possibility of variations within a 95% CI interval of [80.72; 81.18] which includes the 80.95% simulated randomly. Hence, once again, it seems that our assumption of an equal weight of scenarios holds also with method 2.

Moreover, test 1 on method 3 reveals that the assumption of equal weight may lead to a potential overestimation bias when method 3 is applied. Indeed, Figure A.8 shows a non-normal distribution of the simulated estimations with a quasi-equal probability of occurrence of any value within a range of values of [77.92; 78.04]. The estimated employability with the deterministic method 3 was 78.03% within a 95% CI of [71.80; 84.13]. Given the differences between the estimated and simulated values, it seems particularly relevant to test for consequences of relaxing the assumption of an equal scenario weights to see if it can explain the bias produced by method 3.

From Figure A.8 and Table A.4, we find that the only test that normalizes the distribution of the employability forecast is test 4, namely the assumption that scenario 4 may occur at a probability that differs from the one of the other three scenarios. From our measurements we find that a normal distribution of our estimated employability is more likely to occur if the probability of occurrence of scenario 4 tends towards 0.19 (which is below the other three scenarios). In that case, the employability rate is likely to be normally distributed around a mean value of 78.50% (compared to the 78.03% predicted with method 3), within a range of [78.73; 78.87].

Furthermore, in the case of method 1, tests 4 and 5 produce estimates that are sufficiently normally distributed to argue that scenarios 3 and 4 may likely occur at a different probability than scenarios 1 and 2 (namely, at a respective probability of 0.34 and 0.14).

Finally, it is worth noticing that method 2 (i.e. CAGR) is the only deterministic forecast method for which none of the tests 2 to 5 on a randomization of the scenario weights can validated (see Figure A.7). In other words, method 2 is the only method for which the assumption of equal weight to all scenarios is not questions by any randomization test.

7. DISCUSSION AND CONCLUSIONS

In section 4.2., we showed that two deterministic forecasting methods out of three estimate an overall increase between 2010 and 2020 by almost 5 percentage points[27], with significant variations across individuals with different educational attainment levels. For instance, we observed a 3 percentage points decrease for the medium educated (when considering the conditional trend model)[28]. The only educational group for which a positive increase is predicted by all three methods is the high educated (with an increase comprised between 2 and 3 percentage points). See Table 1 for details.

In view of the variability of these results, we relaxed the assumption that each scenario predicts the overall employability rate at an equal weight. We conducted Monte Carlo simulations for each method to estimate the impact of a random change of weight in one scenario at a time (section 4.3). This final adjustment revealed that in the case of method 1, the assumption of equal weight could be validated; while in the case of methods 2 and 3, scenario 4 was less likely to occur than the other three scenarios, and in the case of method 2 only, scenario 3 was more likely to occur than the other three (see Table A.4 and Figures A.6-A.8).

In turn, the Monte Carlo simulations yield a lowest possible value of 75.91% (based on method 3) and a highest possible value of 83.96%. (based on method 1) (see Table A.4). In terms of plausible percentage point changes between 2010 and 2020, this means that the benchmark target should be defined within a range of [-0.6; +7.5]. A negative benchmark target being of course excluded, we need to choose a value within the range [0; 7.5].

The choice of the actual target value within that range becomes at this stage more political than statistical. Still, one last statistical option in support of the final political decision is to look back at the overall mean value estimated by the

[27] The conditional trend model predicts a 1.5 percentage points increase.
[28] Contrarily to the conditional trend model (both when assuming a linear and an exponential trend), the CAGR and the unconditional linear model predict an increase by at least 6 percentage points of the medium educated's employability.

deterministic forecasting methods (Table 1), namely +3.79, which enables us to finally reduce the plausible range of values to **[3.79;7.5]**.

Finally, considering the full analysis presented in this report, DG EAC decided to formulate the following benchmark proposal as defined in Box 3 below (European Commission, 2011).

BOX 3. PROPOSAL ON A BENCHMARK OF EDUCATION FOR EMPLOYABILITY

Possible approach to framing a benchmark on education for employability

By 2020, there should be an increase by at least 5 percentage points in the employment rate of graduates (20-34 year olds) having left education, measured as an average of employment rates 1, 2 and 3 years after graduation.

Possible future actions to improve data availability

Such a benchmark should allow for a breakdown by specific sub-populations. There should in particular be a disaggregation of data based on ISCED levels and educational orientation which would allow, for example, distinction between the performance of upper secondary graduates as they emerge from Vocational Education and Training (VET) or from general education.

Work undertaken by EUROSTAT and the Member States could allow in time the addition of a measure linked to the analysis of the quality of the first job, based on better matching between the ISCED-measured educational attainment of people and their ISCO-measured job content.

Source: European Commission (2011).

As demonstrated above, this choice of a minimum of 5 percentage points increase is motivated by the fact that such a target would guarantee a plausible (and thereby, realistic) improvement of the employability of all educational groups (supported by all forecasting methods and controlling for uncertainty). As shown by Figure A.9, such a target would lead the majority of the MS above 75% of employability for their 20-34 year-olds graduates. The main outliers are IT, GR, LV and EE, who are expected to remain below 70% of employability. When looking at the higher educated sample, only countries below 80% by 2020 are GR and IT. For the medium educated

sample, six countries are expected to be below 70% by 2020, namely EE, IT, LV, LT, IE and GR.

Of course, such an overall target would require specific sub-targets by gender, by type of educational programme (vocational vs. mainstream), by field of education, and, in some countries, by immigration status.

Overall, “the purpose of a benchmark on Education for Employability is to enhance policy exchange on what constitutes good education policies to stimulate employability. Relevant policy steps have already been outlined in "the Framework for Youth Employment" in "Youth on the Move" and within the "Agenda for New Skills and Jobs". These would suggest that education systems shall engage in systematic monitoring of the labour market situation of young people and develop better and more responsive educational policies which reflect labour market realities, including the provision of the mix of skills or key competences that are relevant to the labour market; combating early school leaving; enhancing school-business links; providing transparent information on learning outcomes; aligning the orientation of graduates to future labour market demands; and providing guidance and counselling” (European Commission, 2011).

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ANNEXES

Table A.1 Country Performance Trends (2004-2010), by Educational Attainment Level

	All educational attainment levels							Tertiary education						
	2004	2005	2006	2007	2008	2009	2010	2004	2005	2006	2007	2008	2009	2010
EU27	75.19	75.75	78.09	79.86	80.99	77.20	76.50	81.88	82.73	84.10	85.99	86.93	83.80	82.83
AT	85.98	87.18	89.60	90.05	90.11	88.25	88.44	80.66	80.94	90.33	91.86	94.74	90.96	90.00
BE	83.75	77.74	80.00	81.40	82.47	79.45	78.86	88.33	87.17	87.46	88.47	90.79	87.81	88.18
BG	65.71	67.39	69.15	72.08	79.59	73.66	68.54	76.62	81.09	82.31	84.97	87.16	85.24	82.73
CY	82.66	77.30	80.63	82.29	85.77	81.18	78.60	82.81	87.75	82.57	85.34	87.01	82.96	80.14
CZ			82.78	87.60	87.78	84.47	81.21	81.17	88.47	87.48	91.15	88.50	89.02	87.09
DE	79.73	78.72	80.84	82.37	85.20	83.80	84.70	63.39	80.69	91.35	91.94	93.56	93.35	90.19
DK	83.03	86.18	88.60	90.71	88.72	86.84	83.13	91.00	89.14	88.73	93.54	89.75	90.36	85.39
EE	69.17	72.63	82.82	84.95	81.90	64.97	64.15	91.48	88.96	90.45	90.83	82.72	-71.21	76.69
EL	63.74	59.23	66.33	67.64	67.52	64.61	58.25	78.93	79.91	69.22	69.89	70.79	67.71	60.31
ES	77.39	77.18	82.11	84.98	79.13	70.28	66.59	79.27	82.79	83.97	87.40	85.09	76.05	74.46
FI	77.01	79.28	79.74	82.83	82.31	77.79	79.69	86.51	85.44	87.42	85.10	87.81	84.06	84.91
FR	75.57	77.07	75.38	77.45	80.77	75.16	75.58	67.90	62.75	82.16	84.58	88.48	83.10	83.37
HU	80.74	73.63	79.30	79.54	79.80	75.28	73.77	94.41	-93.45	87.65	86.88	87.36	84.72	82.76
IE	85.88	84.81	88.09	86.78	85.44	74.47	71.09	67.40	65.26	91.39	90.40	88.69	82.79	80.00
IT	64.73	62.05	66.05	65.92	65.05	60.42	57.66	86.37	85.07	69.00	69.98	70.51	66.05	64.68
LT	71.77	78.01	82.22	83.18	77.97	70.93	71.65	92.28	92.89	90.42	92.46	87.64	84.61	84.38
LU	88.58	88.71	89.88	86.50	85.16	84.67	88.14	86.01	88.43	95.80	88.27	92.92	90.36	91.27
LV	73.04	81.08	78.58	81.78	81.62	69.60	63.99	78.79	87.75	85.01	86.48	87.65	82.09	75.47
MT	92.05	92.47	90.63	93.26	94.20	93.29	93.01	93.76	95.04	94.15	96.46	95.31	97.49	97.97
NL	91.46	89.74	89.47	91.35	90.97	90.38	91.05	90.36	89.16	94.45	96.59	95.41	94.21	94.64
PL	63.75	66.77	70.85	74.36	79.04	77.97	76.16	85.23	84.68	81.59	84.40	86.97	85.68	83.72
PT	82.37	82.08	82.30	80.65	81.07	81.37	79.48	83.88	84.73	84.27	81.99	83.17	84.23	83.25
RO	73.76	72.05	74.70	79.18	84.76	77.57	71.13	-78.26	86.65	86.42	88.98	92.93	85.75	81.93
SE	80.40	79.34	83.08	84.99	85.08	81.22	82.43	90.94	90.13	88.19	89.93	90.72	89.92	89.26
SI	73.43	78.23	80.76	81.28	83.32	82.24	80.74	76.00	84.87	84.51	84.92	86.69	88.74	84.32
SK	64.99	72.80	77.54	80.99	81.33	74.41	69.46	84.06	84.80	87.88	86.36	84.34	83.50	80.59
UK	87.42	86.09	85.73	84.76	82.99	78.75	80.73	96.98	93.87	87.72	89.19	87.29	84.00	85.93
IS	90.50	92.61	91.93	93.06	89.02	84.43	83.58	92.48	91.35	94.41	91.61	88.44	87.48	86.14
CH	87.27	86.19	88.66	89.00	88.23	86.74	87.39		78.57	93.67	93.37	93.08	90.06	89.45
HR		64.05	71.28	72.94	77.81	76.84	70.17			81.33	-80.78	-85.09	-83.18	-74.83
MK			32.08	39.14	43.49	44.71	47.86			-45.82	-51.27	53.04	51.18	53.08
TR			56.16	56.31	58.45	57.54	59.62			66.06	65.97	67.80	65.99	65.40

Source: CRELL computations based upon EUROSTAT, EU-LFS annual aggregated data (2004-2010)
Note: Empty cells correspond to data either not available or not reliable due to very small sample size; negative values lack reliability due to small sample size.

Table A.1 (cont'd)

	Lower than upper secondary education							Upper secondary and post-secondary non-tertiary education						
	2004	2005	2006	2007	2008	2009	2010	2004	2005	2006	2007	2008	2009	2010
EU27	60.99	59.23	61.86	61.25	57.77	53.63	52.20	69.70	70.76	73.99	75.82	77.28	72.76	72.17
AT								50.26	54.38	89.95	89.94	89.04	87.68	88.19
BE	63.63	58.55	60.19	68.11	59.75	52.29	45.62	79.83	68.10	71.99	73.21	73.57	71.91	71.51
BG								54.13	55.38	58.84	62.51	74.07	63.73	58.42
CY								67.78	76.84	74.00	71.52	80.93	73.79	70.01
CZ	-96.47							83.60	84.53	80.87	86.11	87.58	81.74	77.37
DE			50.53	50.60	42.48	44.02	55.78	78.22	-68.22	78.18	80.25	83.58	81.57	83.65
DK	45.05	43.11						76.02	76.21	89.28	89.49	89.83	83.48	81.56
EE								74.15	77.89	-78.58	-81.66	81.91	-64.53	-48.37
EL	71.35	72.56	62.75	64.48	60.37	-61.43	-50.76	73.88	71.94	62.59	64.18	62.86	60.08	55.83
ES	58.82	60.50	80.91	79.00	60.26	55.86	43.24	74.03	73.78	77.70	81.66	74.50	63.80	60.53
FI								75.59	74.21	75.34	81.40	78.85	72.92	76.31
FR	48.30	-53.18	54.74	59.15	58.89	52.49	44.00	62.93	61.66	72.00	73.19	75.26	69.39	69.17
HU								91.17	-91.59	71.83	72.92	71.70	66.39	65.86
IE								59.69	53.67	81.99	81.24	79.21	60.82	54.63
IT			-53.94	52.38	-45.68		-51.10	72.06	57.04	63.65	62.63	60.52	55.98	52.33
LT	-75.13	-74.68						87.15	87.55	74.69	72.81	67.79	56.93	54.32
LU								76.03	62.14	86.49	87.71	80.05	79.30	86.61
LV					-57.77			63.31	68.62	73.09	77.85	77.65	59.22	54.04
T	-90.32	64.41						88.57	89.31	-87.02	89.89	96.31	89.38	-87.34
NL			60.62	62.36	64.53	62.76	-60.77	84.71	86.92	90.66	91.92	91.42	91.29	89.67
PL	79.14	77.11	-35.88					78.61	80.39	60.70	64.94	70.07	68.75	67.39
PT			79.76	78.45	73.96	76.78	74.84	65.55	62.74	80.69	79.68	81.92	79.89	77.40
RO								-69.87	72.30	64.79	70.66	77.12	69.12	61.25
SE		45.14		-62.56	-57.89	-55.86		83.82	83.75	78.44	81.03	81.60	74.56	77.30
SI								59.89	66.39	77.41	77.96	79.82	73.27	75.10
SK								72.34	75.92	71.70	77.83	79.50	67.90	60.53
UK			60.69	53.66	55.12	49.58	48.11	88.37	91.73	84.68	81.96	79.52	75.02	76.51
IS	-69.13	-55.94						85.26	84.55	89.03	94.35	89.93	81.68	81.43
CH			-94.26				-72.19		56.76	85.25	86.20	84.47	84.05	86.45
HR										65.02	-68.08	-72.66	-73.06	-66.49
K										-24.85	-30.46	-36.30	-38.04	-40.40
TR			58.14	42.55	39.03	41.07	50.68			40.38	40.64	44.13	42.91	46.68

Source: CRELL computations based upon EUROSTAT, EU-LFS annual aggregated data (2004-2010)
Note: Empty cells correspond to data either not available or not reliable due to very small sample size; negative values lack reliability due to small sample size.

Table A.2 Gender Gap (M/F) in Country Performance (2004-2010), by Educational Attainment Level

	All educational attainment levels							Tertiary education							Upper secondary and post-secondary non-tertiay education						
	2004	2005	2006	2007	2008	2009	2010	2004	2005	2006	2007	2008	2009	2010	2004	2005	2006	2007	2008	2009	2010
EU27	1.05	1.08	1.07	1.08	1.06	1.04	1.06	1.05	1.08	1.06	1.08	1.05	1.05	1.05	1.07	1.10	1.08	1.09	1.10	1.05	1.09
BE	1.01	1.02	1.02	1.03	1.03	1.01	1.00	0.96	0.98	0.99	1.00	1.01	1.03	1.00	1.13	1.17	1.18	1.15	1.20	1.06	1.15
BG	0.97	1.03	1.01	1.06	1.08	1.06	0.93	1.00	1.15	1.15	1.15	1.18	1.16	1.09	1.13	1.05	0.97	1.08	1.04	1.12	0.92
CZ			1.17	1.12	1.13	1.12	1.11			1.15	1.11	1.16	1.14	1.14			1.18	1.14	1.12	1.14	1.13
DK	1.06	1.11	1.09	1.07	1.04	1.04	1.01	1.00	1.09	1.11	1.06	1.07	1.07	1.07	1.11	1.12	1.05	1.08	1.02	1.01	0.98
DE	1.00	1.02	1.02	1.05	1.04	1.01	1.05	1.06	1.07	1.09	1.09	1.04	1.01	1.04	0.95	0.99	0.97	1.04	1.05	0.99	1.04
EE	1.43	-1.32	1.22	-1.07	1.17	1.30	1.22	0.00	0.00	1.16	0.00	1.23	0.00	1.44	1.25				1.17		
IE	1.02	1.00	1.06	1.07	1.01	0.94	0.95	0.99	0.98	1.02	1.05	1.00	0.99	0.95	1.10	-1.07	1.19	1.16	1.06	0.93	1.07
EL	1.18	1.19	1.15	1.11	1.07	1.11	1.08	1.16	1.13	1.06	1.04	1.03	1.08	1.04	1.20	1.29	1.28	1.28	1.15	1.14	1.15
ES	1.09	1.12	1.09	1.07	1.01	1.04	1.04	1.08	1.08	1.07	1.07	0.99	1.04	1.03	1.15	1.18	1.13	1.04	1.11	0.91	1.05
FR	1.02	1.08	1.11	1.08	1.01	1.03	1.03	0.99	1.03	1.04	1.05	0.99	1.02	1.01	1.08	1.18	1.20	1.09	1.05	1.07	1.12
IT	1.11	1.18	1.15	1.16	1.13	1.12	1.09	1.05	1.19	1.11	1.18	1.14	1.16	1.15	1.17	1.18	1.23	1.19	1.17	1.14	1.10
CY	1.19	1.08	1.00	1.02	0.99	1.06	0.99	1.20	1.16	1.04	1.01	1.03	1.08	1.05	1.18	0.98	-0.95	-1.34	-0.92	-1.09	-0.83
LV	1.39	1.16	1.31	1.09	1.20	1.06	1.02	1.35	1.09	1.11	1.11	1.17	1.13	1.09	1.51	-1.34	1.69	1.12	1.36	1.19	1.15
LT	1.00	1.09	1.09	1.05	1.10	0.95	0.90	0.88	-1.11	1.05	1.05	-1.01	0.99	0.98	1.24	1.18	1.27	1.15	1.60	1.07	0.99
LU	1.11	1.06	0.99	1.00	1.03	1.03	1.09	1.06	1.05	1.01	1.03	1.05	-1.01	-1.15	1.18	1.11	0.99	1.00	1.05	1.05	1.05
HU	1.07	1.11	1.06	1.09	1.11	1.04	1.00	1.08	1.10	1.05	1.08	1.12	1.10	0.99	1.10	1.21	1.14	1.20	1.18	1.07	1.09
MT	0.94	1.04	0.97	0.99	0.97	0.98	0.99	0.96	0.00	0.94	0.97	0.97	1.03	1.01	0.00				0.00		
NL	1.01	1.02	1.04	1.04	1.06	1.01	1.03	1.02	1.00	1.02	1.02	1.05	1.00	0.99	0.99	1.00	1.04	1.00	1.02	1.01	1.08
AT	0.95	1.05	1.04	1.06	1.02	1.02	1.02	1.05	1.11	1.12	1.09	1.07	1.06	1.15	0.90	1.02	1.01	1.05	1.00	1.01	0.98
PL	1.11	1.11	1.06	1.10	1.11	1.09	1.09	1.11	1.14	1.07	1.09	1.10	1.10	1.07	1.32	1.23	1.18	1.23	1.22	1.23	1.25
PT	1.03	1.02	1.08	1.06	1.09	1.08	1.06	1.05	1.01	1.06	1.07	1.03	1.01	1.00	1.02	1.11	1.10	1.07	1.20	1.19	1.10
RO	0.92	1.02	0.98	0.99	1.06	1.04	1.02	1.01	1.04	1.00	0.98	1.02	1.02	1.03	0.84	1.04	1.02	1.06	1.15	1.12	1.09
SI	1.27	1.12	1.14	1.14	1.09	1.02	1.09	1.22	-1.05	-1.12	-1.14	-1.12	-1.07	-1.09	1.52	-1.27	-1.22	-1.25	-1.11	1.10	1.26
SK	1.09	1.10	1.13	1.09	1.18	1.05	1.00	1.26	1.10	1.13	1.11	1.12	1.17	1.09	1.03	1.13	1.17	1.09	1.27	1.05	1.06
FI	1.07	1.12	1.09	1.10	1.15	1.04	1.08	1.11	1.20	1.11	1.20	1.09	1.20	1.10	1.07	1.10	1.10	1.05	1.26	0.95	1.10
SE	1.00	1.03	1.05	1.05	1.05	0.99	1.02	0.99	1.07	1.07	1.07	1.03	1.02	1.04	1.03	1.01	1.05	1.07	1.07	0.99	1.05
UK	1.05	1.05	1.03	1.07	1.04	1.01	1.09	0.98	1.00	0.97	1.02	0.99	0.96	1.01	1.16	1.13	1.10	1.11	1.10	1.08	1.17
IS	1.05	1.05	1.10	1.07	1.08	0.96	1.06	0.00	1.03		1.07	1.07	0.97	1.11	1.25			1.08	1.12	0.97	1.01
CH	0.99	1.00	1.03	1.01	1.00	0.97	1.08	1.04	1.04	1.04	1.00	1.03	1.02	1.20	0.93	0.96	1.01	1.02	0.98	0.94	1.01
HR		1.05	1.06	0.98	1.04	1.02	1.00		1.08	1.09	1.07	1.00	1.03	1.06		1.14	1.10	1.00	1.15	1.06	1.02
MK			0.85	0.96	-1.08	1.21	1.18			0.99	1.04	1.12	1.38	1.20			0.86	1.16	1.24	1.22	1.38
TR			1.31	1.25	1.27	1.28	1.31			1.15	1.14	1.15	1.18	1.18			1.85	1.53	1.61	1.66	1.79

Source: CRELL computations based upon EUROSTAT, EU-LFS annual aggregated data (2004-2010)
Note: Empty cells correspond to data either not available or not reliable due to very small sample size; negative values lack reliability due to small sample size.

Table A.3 Scenario-based forecast estimates by forecasting method and educational attainment level, EU27 average (The 95% confidence intervals of the predicted values are presented in brackets)

Estimation Method	All Educational Levels	2004	2005	2006	2007	2008	2009	2010	*2015*	*2020*
Unconditional Linear Trend model	Scenario 1: Crisis' average annual rate (2008-2009)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*64.76 [53.90;75.62]*	*53.53 [34.11;72.96]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*92.76 [87.89;97.63]*	*100.94 [93.64;108.23]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	90.70	90.30	90.04	91.77	91.76	90.64	90.84	*83.30 [83.22;83.54]*	*90.70 [90.31;90.65]*
	Scenario 4: Average annual rate (2004-2009)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*80.44 [72.48;88.40]*	*82.18 [70.66;93.69]*
	Average across scenarios	79.07	79.39	81.08	82.84	83.68	80.56	80.08	*80.32 [74.37;86.30]*	*81.84 [72.18;91.38]*
Compound Average Growth Rate	Scenario 1: Crisis' average annual rate (2008-2009)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*66.33 [66.15;66.87]*	*57.52 [56.68;57.42]]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*86.59 [86.42;87.13]*	*98.02 [97.16;97.90]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	90.70	90.30	90.04	91.77	91.76	90.64	90.84	*83.30 [83.22;83.54]*	*90.70 [90.31;90.65]*
	Scenario 4: Average annual rate (2004-2009)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*77.61 [77.61;77.62]*	*78.74 [78.73;78.74]*
	Average across scenarios	79.07	79.39	81.08	82.84	83.68	80.56	80.08	*78.46 [78.35;78.79]*	*81.25 [80.72;81.18]*
Conditional Linear Trend Model	Scenario 1: Crisis' average annual rate (2008-2009)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*64.72 [53.82;75.62]*	*53.40 [33.85;72.94]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*86.30 [84.95;87.66]*	*92.44 [90.30;94.57]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	90.70	90.30	90.04	91.77	91.76	90.64	90.84	*83.30 [83.22;83.54]*	*90.70 [90.31;90.65]*
	Scenario 4: Average annual rate (2004-2009)	75.19	75.75	78.09	79.86	80.99	77.20	76.50	*75.50 [72.68;78.32]*	*75.56 [72.75;78.37]*
	Average across scenarios	79.07	79.39	81.08	82.84	83.68	80.56	80.08	*77.46 [73.67;81.29]*	*78.03 [71.80;84.13]*
Baseline Variable for the Conditional Trend Model*	Scenario 1: Crisis' average annual rate (2008-2009)	52.75	52.92	53.45	54.08	54.14	52.85	51.56	*45.12*	*43.84*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	52.75	52.92	53.45	54.08	54.14	52.85	55.34	*55.71*	*56.09*
	Scenario 4: Average annual rate (2004-2009)	52.75	52.92	53.45	54.08	54.14	52.85	51.81	*51.98*	*51.97*

Table A.3 (cont'd)

Estimation Method	Medium Educational Attainment	2004	2005	2006	2007	2008	2009	2010	*2015*	*2020*
Unconditional Linear Trend model	Scenario 1: Crisis' average annual rate (2008-2009)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*53.93 [44.98;72.55]*	*34.80 [21.35;70.66]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*95.03 [87.67;98.50]*	*104.73 [95.78;111.99]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	88.96	89.48	89.96	90.59	92.52	89.45	88.40	*80.48 [80.36;80.87]*	*89.75 [89.13;89.67]*
	Scenario 4: Average annual rate (2004-2009)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*85.39 [67.70;87.13]*	*90.13 [67.78;86.30]*
	Average across scenarios	74.52	75.44	77.98	79.51	81.08	76.93	76.23	*78.71 [70.18;84.76]*	*79.85 [68.51;89.66]*
Compound Average Growth Rate	Scenario 1: Crisis' average annual rate (2008-2009)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*60.84 [60.61;61.55]*	*51.29 [50.19;51.17]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*82.11 [81.92;82.66]*	*93.41 [92.53;93.29]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	88.96	89.48	89.96	90.59	92.52	89.45	88.40	*80.48 [80.36;80.87]*	*89.75 [89.13;89.67]*
	Scenario 4: Average annual rate (2004-2009)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*74.30 [74.29;74.32]*	*76.49 [76.45;76.48]*
	Average across scenarios	74.52	75.44	77.98	79.51	81.08	76.93	76.23	*74.43 [74.30;74.85]*	*77.74 [77.08;77.65]*
Conditional Linear Trend Model	Scenario 1: Crisis' average annual rate (2008-2009)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*58.72 [44.89;72.55]*	*45.86 [21.05;70.66]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*70.74 [62.97;78.51]*	*71.19 [63.94;78.44]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	88.96	89.48	89.96	90.59	92.52	89.45	88.40	*80.48 [80.36;80.87]*	*89.75 [89.13;89.67]*
	Scenario 4: Average annual rate (2004-2009)	69.70	70.76	73.99	75.82	77.27	72.76	72.17	*70.67 [61.54;79.79]*	*69.70 [58.41;80.99]*
	Average across scenarios	74.52	75.44	77.98	79.51	81.08	76.93	76.23	*70.15 [62.44;77.93]*	*69.13 [58.13;79.94]*
Baseline Variable for the Conditional Trend Models*	Scenario 1: Crisis' average annual rate (2008-2009)	59.87	59.57	59.54	60.17	59.91	58.29	56.67	*48.58*	*40.49*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	59.87	59.57	59.54	60.17	59.91	58.29	60.18	*59.11*	*59.06*
	Scenario 4: Average annual rate (2004-2009)	59.87	59.57	59.54	60.17	59.91	58.29	56.73	*55.26*	*53.74*

Table A.3 (cont'd)

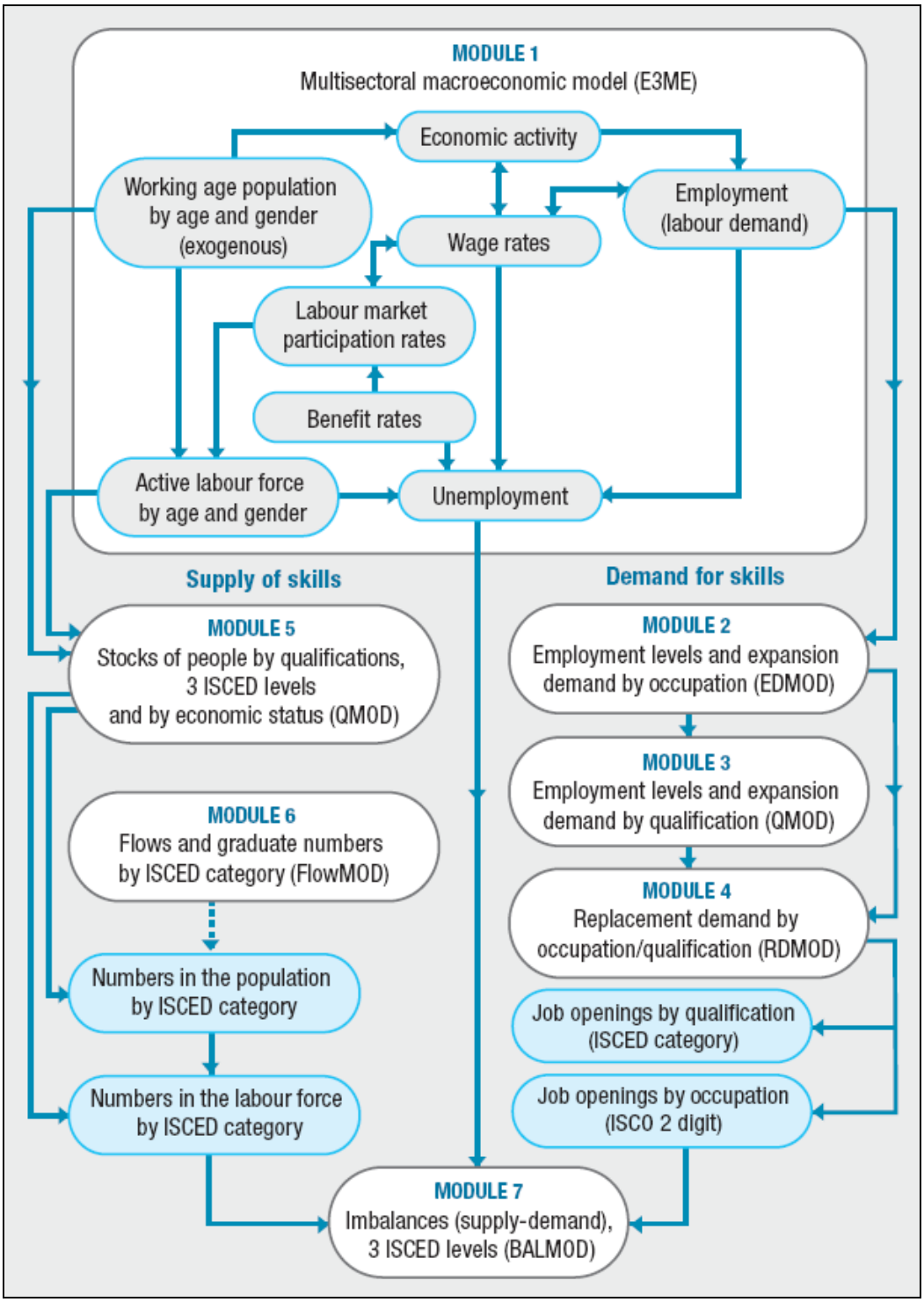
Estimation Method	High Educational Attainment	2004	2005	2006	2007	2008	2009	2010	*2015*	*2020*
Unconditional Linear Trend model	Scenario 1: Crisis' average annual rate (2008-2009)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*65.00 [64.59;79.83]*	*49.30 [48.32;75.57]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*97.17 [93.55;99.84]*	*104.28 [98.84;108.26]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	93.48	93.79	94.80	95.53	95.15	95.02	94.63	*88.42 [88.38;88.59]*	*94.40 [94.16;94.37]*
	Scenario 4: Average annual rate (2004-2009)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*90.33 [79.40;93.14]*	*93.92 [77.73;97.60]*
	Average across scenarios	84.78	85.50	86.78	88.37	88.99	86.60	85.78	*85.23 [81.48;90.35]*	*85.48 [79.76;93.95]*
Compound Average Growth Rate	Scenario 1: Crisis' average annual rate (2008-2009)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*73.40 [73.26;73.83]*	*65.04 [64.37;64.97]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*89.27 [89.20;89.47]*	*96.21 [95.89;96.17]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	93.48	93.79	94.80	95.53	95.15	95.02	94.63	*88.42 [88.38;88.59]*	*94.40 [94.16;94.37]*
	Scenario 4: Average annual rate (2004-2009)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*83.63 [83.63;83.63]*	*84.44 [84.43;84.44]*
	Average across scenarios	84.78	85.50	86.78	88.37	88.99	86.60	85.78	83.68 [83.62;83.88]	85.02 [84.71;84.99]
Conditional Linear Trend Model	Scenario 1: Crisis' average annual rate (2008-2009)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*72.17 [64.52;79.82]*	*61.82 [48.11;75.54]*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*100.28 [76.57;123.99]*	*105.75 [74.37;137.13]*
	Scenario 3: Pre-crisis best 3 performers' average value (2004-2007)	93.48	93.79	94.80	95.53	95.15	95.02	94.63	*88.42 [88.38;88.59]*	*94.40 [94.16;94.37]*
	Scenario 4: Average annual rate (2004-2009)	81.88	82.73	84.10	85.99	86.93	83.80	82.83	*84.29 [77.93;90.65]*	*84.38 [76.62;92.14]*
	Average across scenarios	84.78	85.50	86.78	88.37	88.99	86.60	85.78	*86.29 [76.85;95.76]*	*86.59 [73.32;99.80]*
Baseline Variable for the Conditional Trend Models*	Scenario 1: Crisis' average annual rate (2008-2009)	76.79	75.47	75.39	75.32	72.66	70.63	68.61	*58.49*	*48.36*
	Scenario 2: Pre-crisis' average annual rate (2004-2007)	76.79	75.47	75.39	75.32	72.66	70.63	73.73	*66.70*	*62.93*
	Scenario 4: Average annual rate (2004-2009)	76.79	75.47	75.39	75.32	72.66	70.63	68.57	*64.49*	*61.13*

Source: CRELL computations based upon EUROSTAT, EU-LFS annual aggregated data (2004-2010).
Note: (*) Forecast estimates of the employment rate indicator were computed using CEDEFOP's (2010) estimated values of the employment, by level of qualification (000s) (IER's estimates from IER's qualifications model based on CE's forecasts for sectoral demand from the E3ME model) divided by CEDEFOP's estimated working age population, by level of qualification (000s) (Based on CE estimates from the E3ME model and using EUROSTAT data). See Chart A.1 in Annex for details.

Table A.4 Summative table of the Monte Carlo simulations results, by method

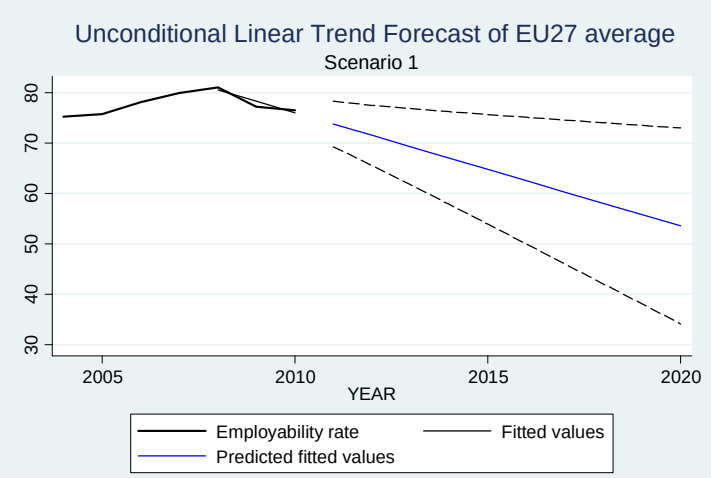
	Method 1					Method 2					Method 3				
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 1	Test 2	Test 3	Test 4	Test 5	Test 1	Test 2	Test 3	Test 4	Test 5
N	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
mean	81.74	84.09	79.43	82.34	82.68	80.95	82.99	78.91	81.3	81.86	77.98	79.94	76.03	78.1	78.8
median	81.73	84.48	80.22	82.25	82.76	80.95	82.99	78.9	81.3	81.88	78.01	80.55	77.03	78.12	78.82
sample s.	3.43	6.38	6.8	3.78	4.11	0.08	4.67	4.69	0.82	2.17	2.85	5.17	5.86	2.88	3.5
max	91.20	99.57	94.83	94.18	94.35	81.17	91.24	87.18	82.95	85.93	83.76	89.18	86.72	84.65	87.96
min	72.63	64.56	58.05	72.67	70.48	80.73	74.71	70.63	79.76	78	72.05	64.09	58.22	72.04	70.12
Q(.75)	84.27	88.93	84.72	85.03	85.59	81	87.03	82.99	81.99	83.71	80.4	84.08	80.67	80.54	81.38
Q.(.25)	79.18	79.67	74.77	79.6	79.79	80.89	78.94	74.84	80.58	79.97	75.58	76.49	72.2	75.67	76.25
skewness	-0.01	-0.27	-0.41	0.12	-0.08	-0.02	0.002	0.01	0.01	0.01	-0.01	-0.52	-0.61	-0.03	-0.02
kurtosis	-0.63	-0.47	-0.45	-0.04	-0.37	-0.48	-1.2	-1.2	-1.16	-1.19	-1.12	-0.41	-0.36	-1.1	-0.64
StErr	0.03	0.06	0.07	0.04	0.04	0.001	0.047	0.05	0.01	0.02	0.03	0.05	0.06	0.03	0.03
95%UCL	81.81	84.21	79.56	82.41	82.76	80.95	83.09	79	81.31	81.9	78.04	80.04	76.14	78.15	78.87
95%LCL	81.67	83.96	79.44	82.26	82.6	80.95	82.9	78.82	81.28	81.82	77.92	79.84	75.91	78.04	78.73

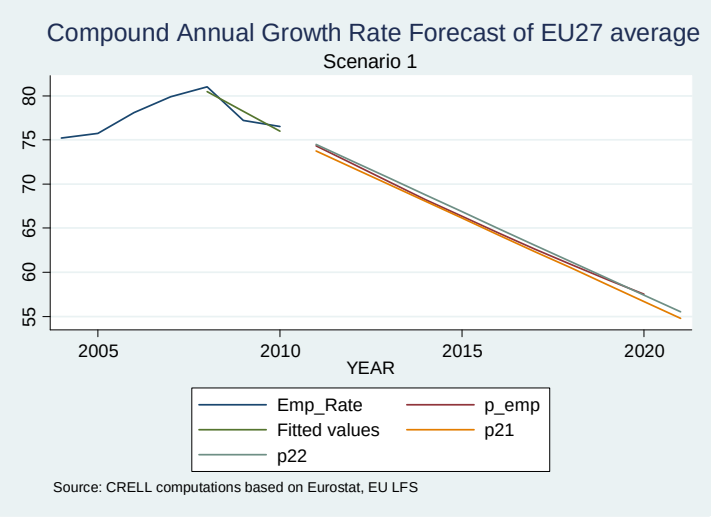
Chart A.1 CEDEFOP's Conceptual framework of modelling the demand for and supply of skills



Source: CEDEFOP (2010), p. 33.

Figure A.1 Scenario 1 Estimates by Forecasting Method: Full Sample





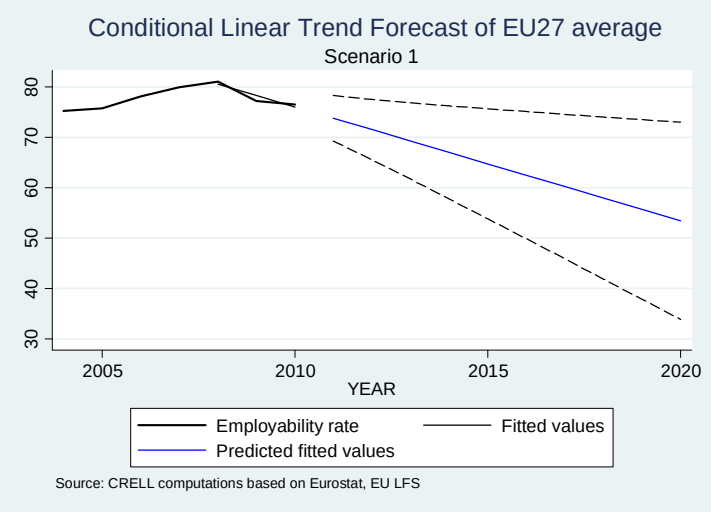
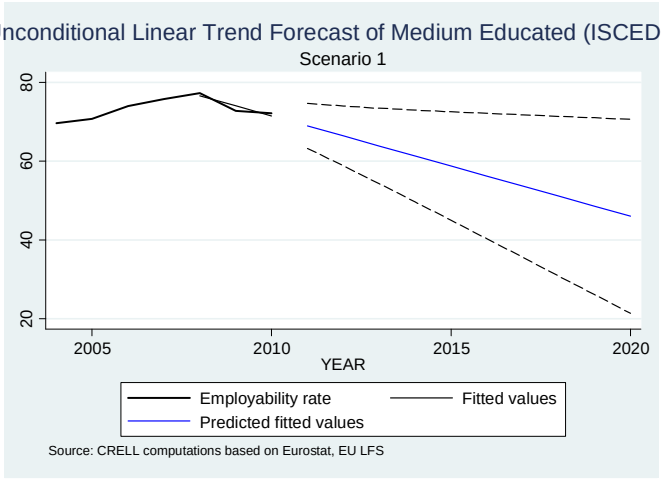
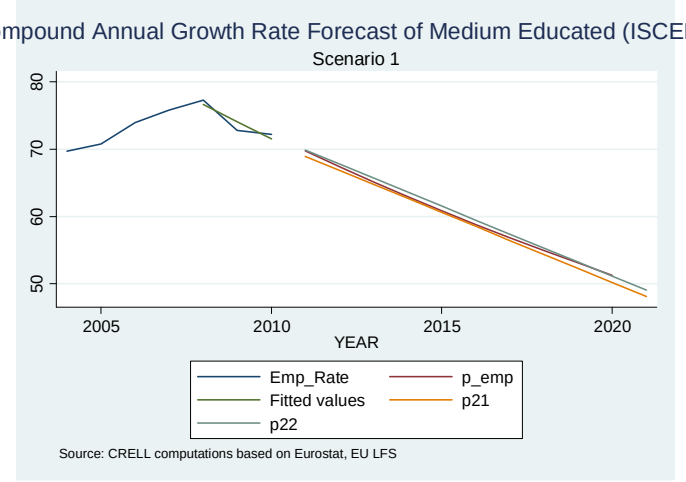


Figure A.1a Scenario 1 Estimates by Forecasting Method: Upper Secondary Education Sample





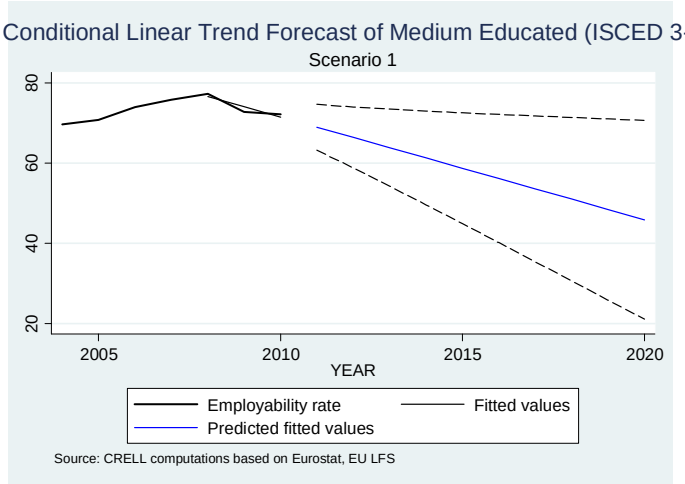
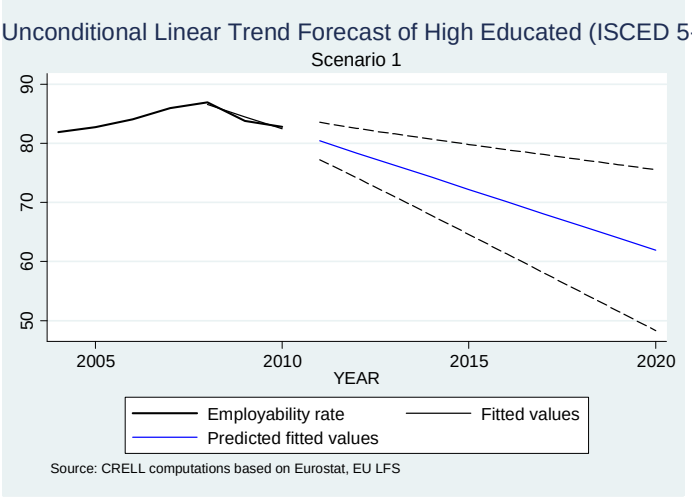
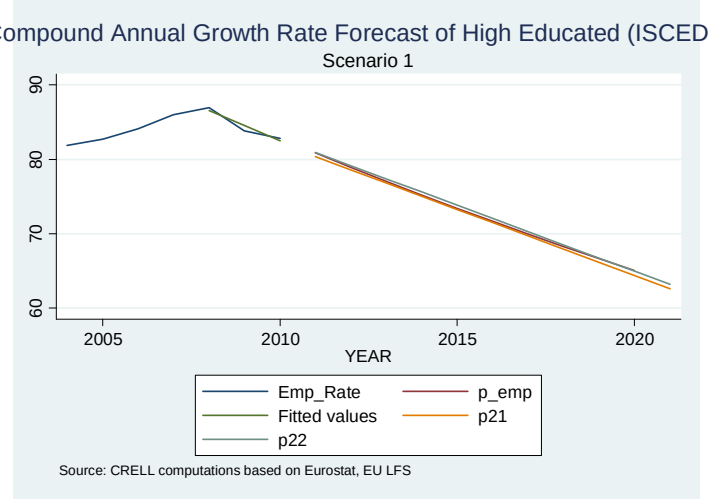


Figure A.1b Scenario 1 Estimates by Forecasting Method: Tertiary Education Sample





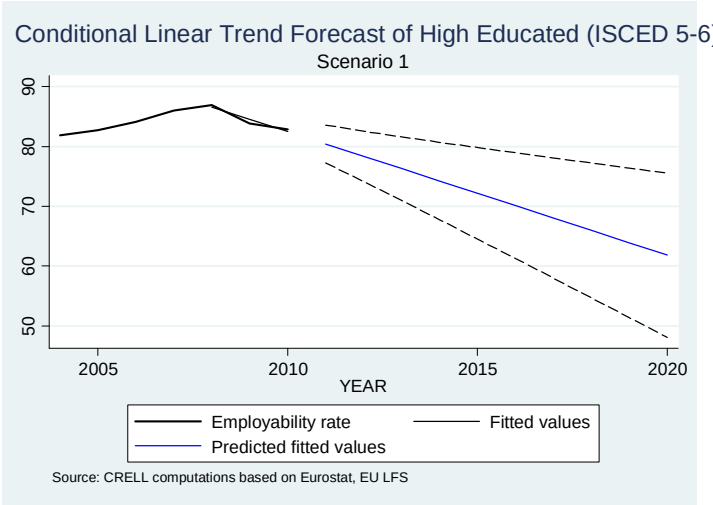
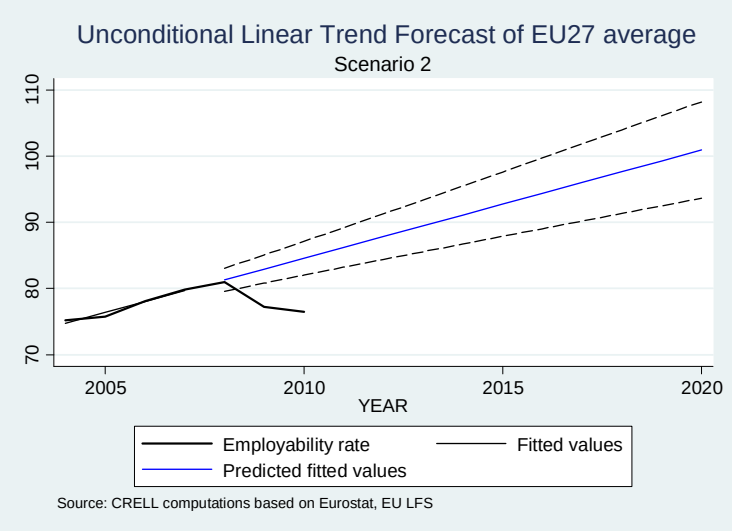
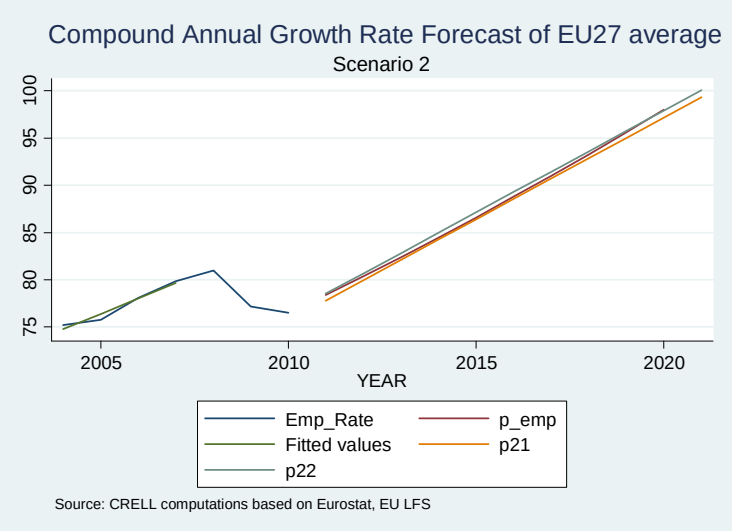


Figure A.2 Scenario 2 Estimates by Forecasting Method: Full Sample





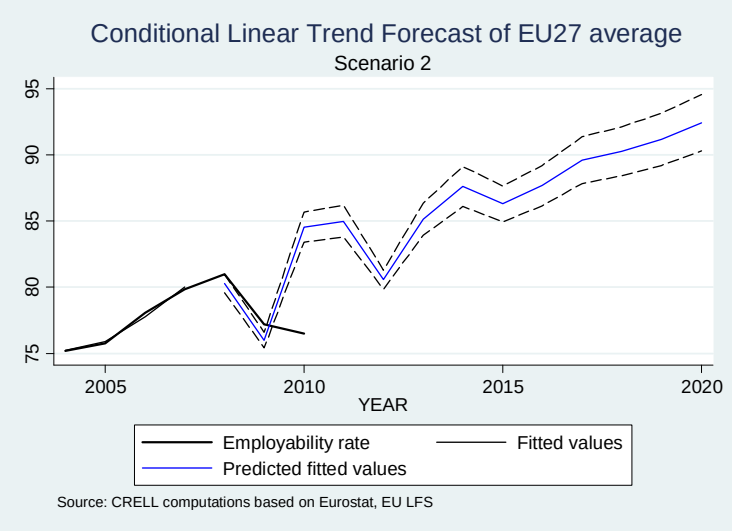
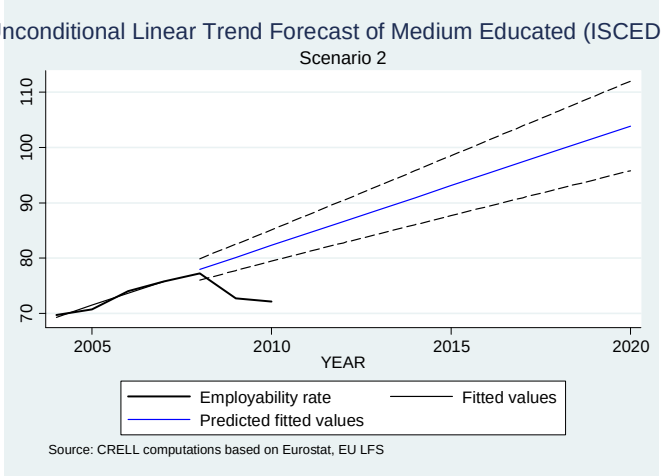
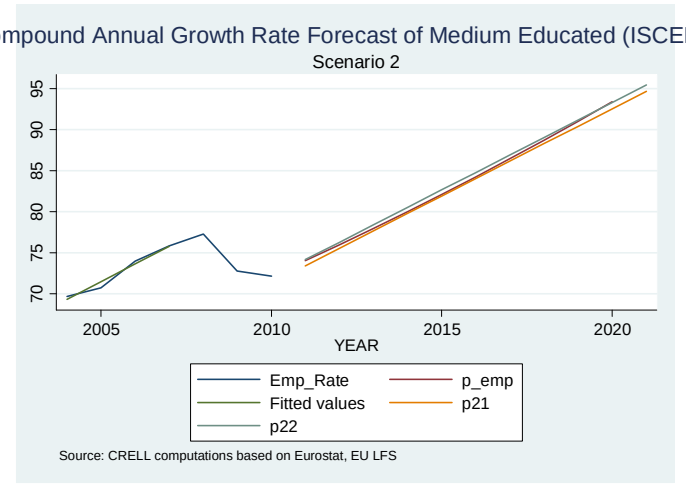


Figure A.2a Scenario 2 Estimates by Forecasting Method: Upper Secondary Education Sample





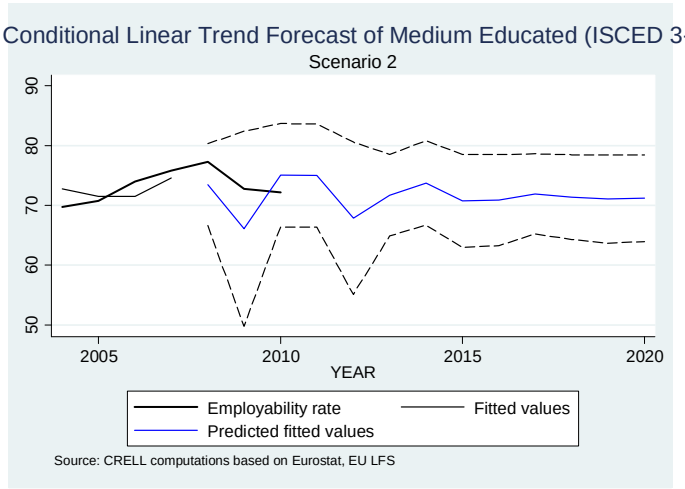
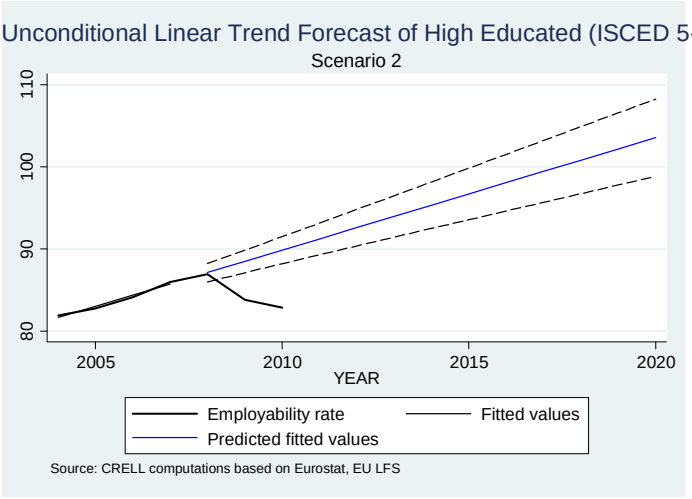
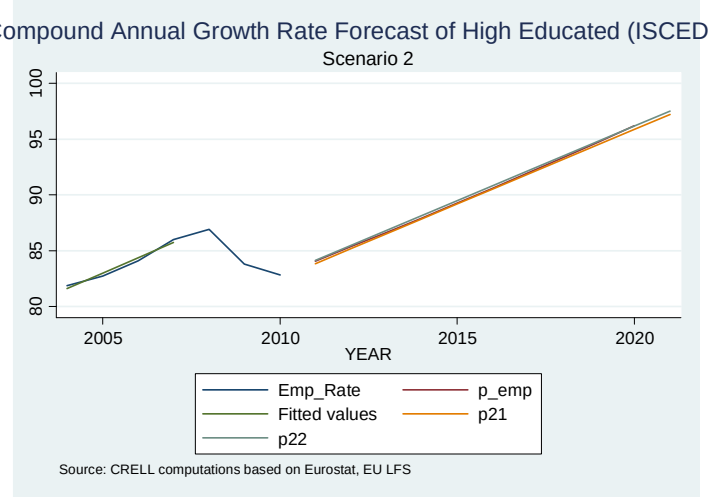


Figure A.2b Scenario 2 Estimates by Forecasting Method: Tertiary Education Sample





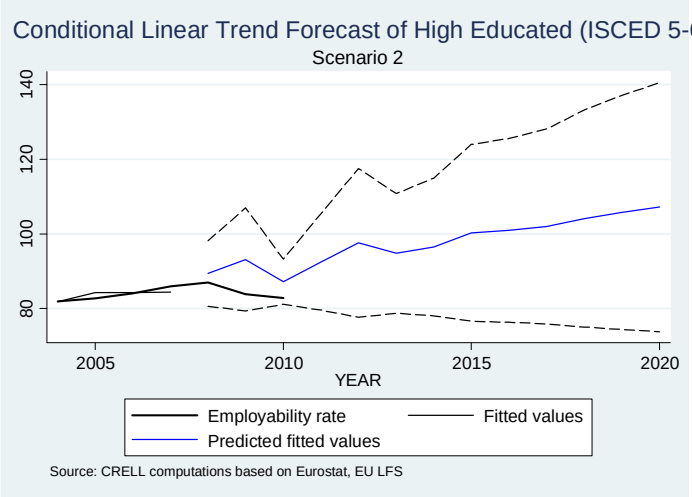
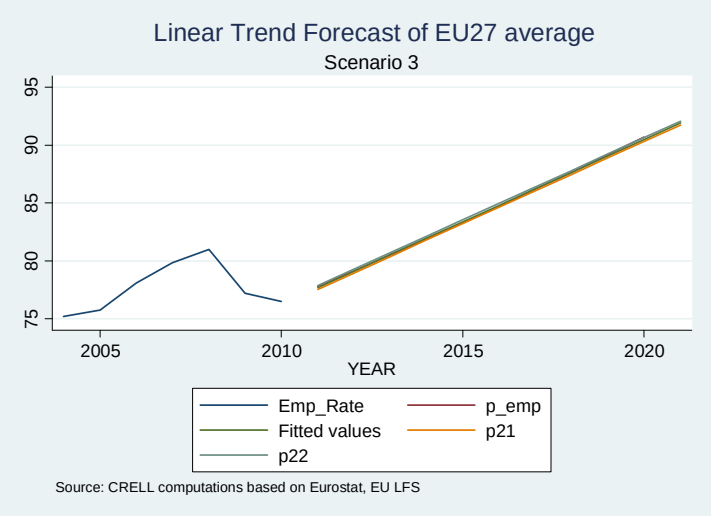
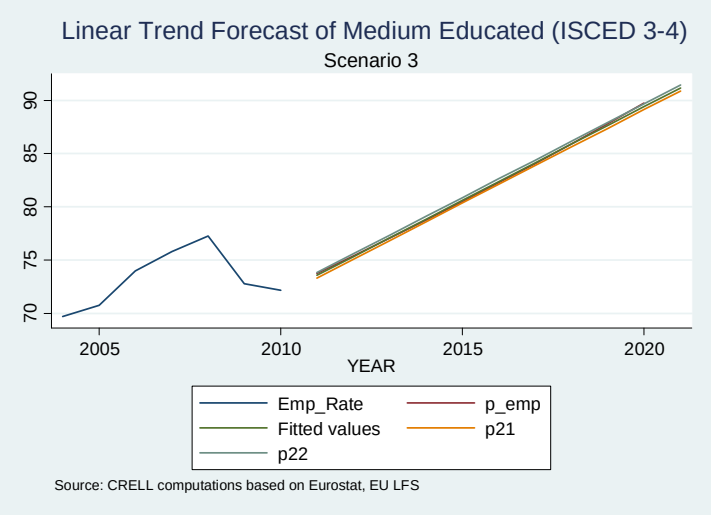


Figure A.3 Scenario 3 Estimates by Educational Attainment





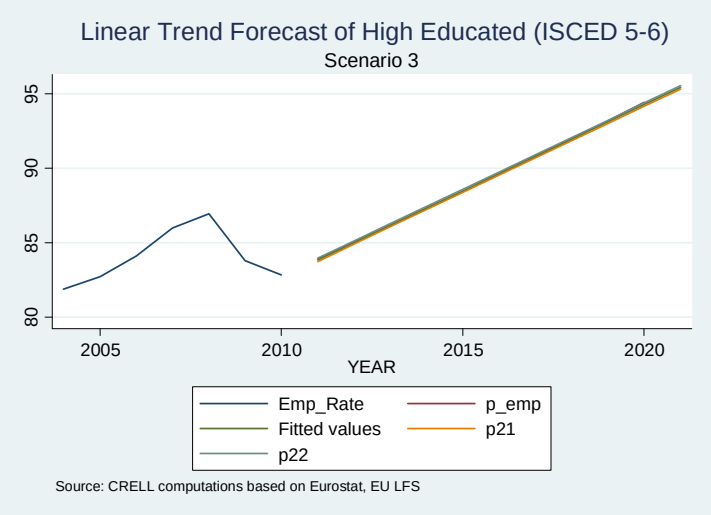
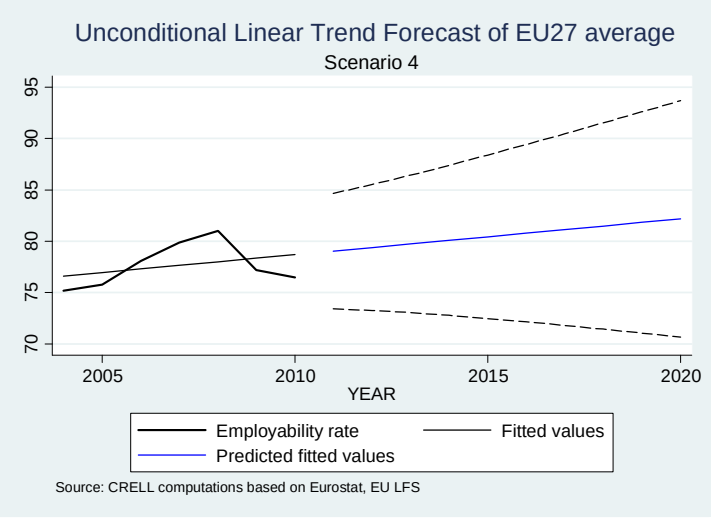
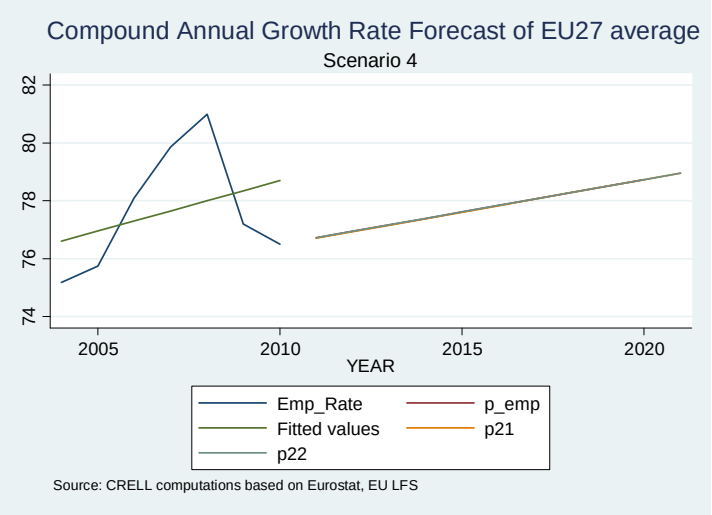


Figure A.4 Scenario 4 Estimates by Forecasting Methods: Full Sample





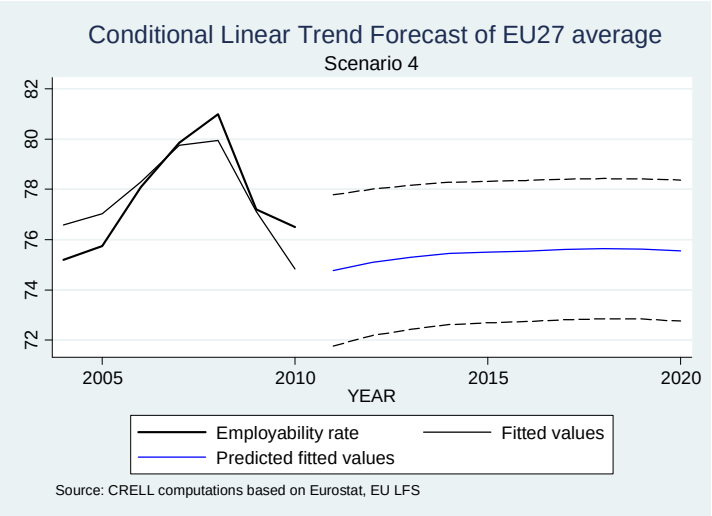
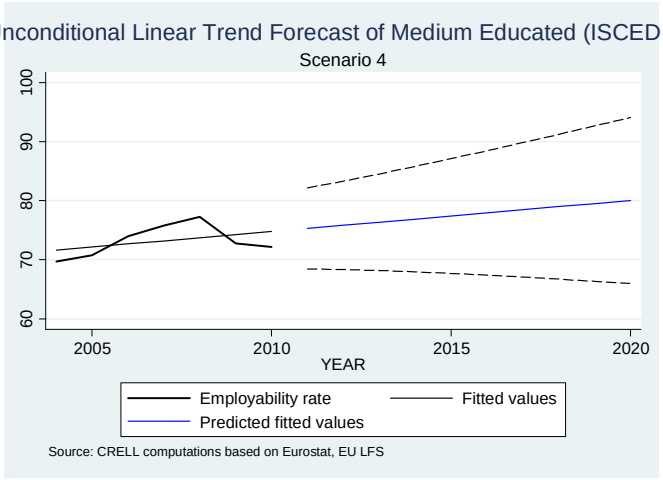
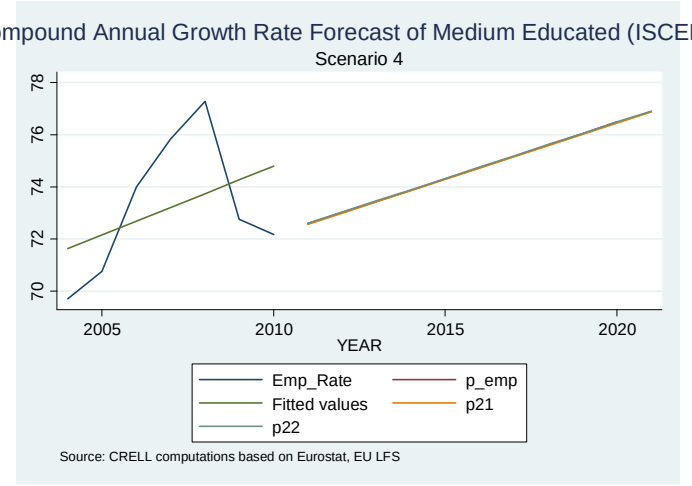


Figure A.4a Scenario 4 Estimates by Forecasting Method: Upper Secondary and Post-secondary Non-Tertiary Education Sample





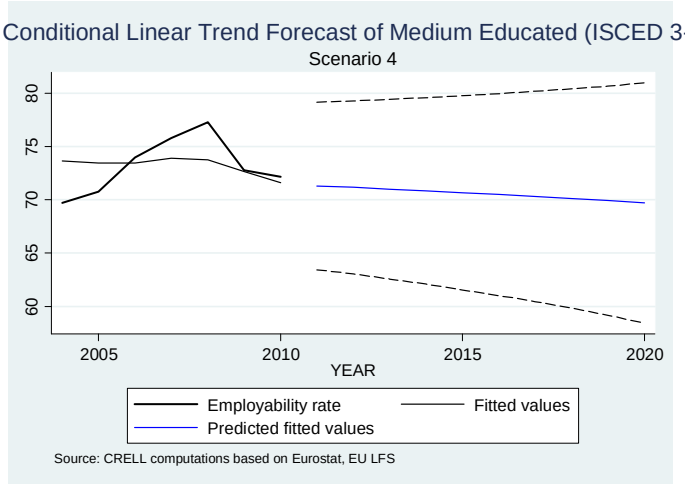
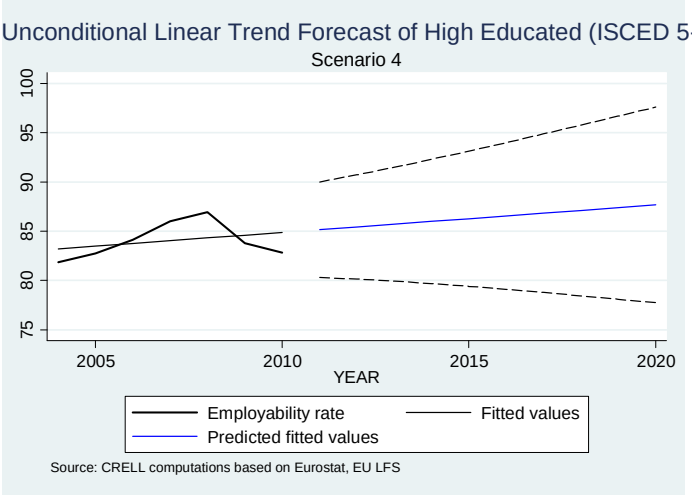
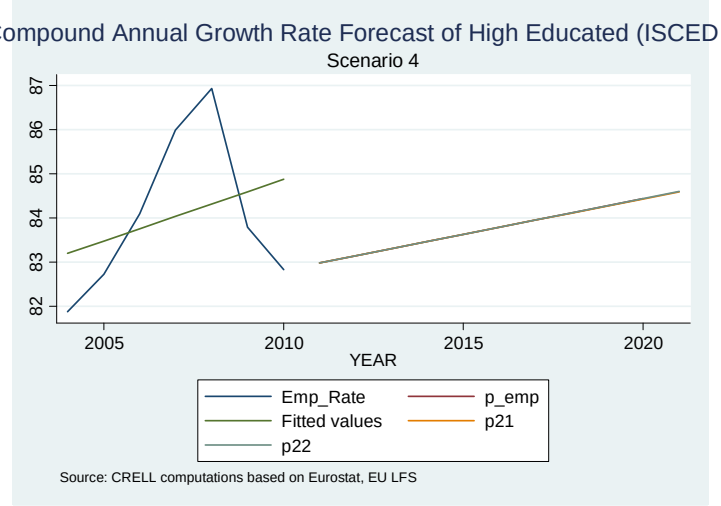


Figure A.4b Scenario 4 Estimates by Forecasting Method: Tertiary Education Sample





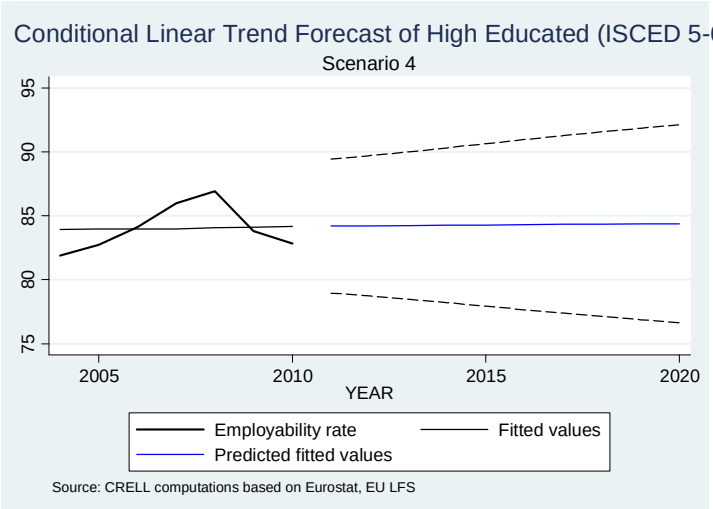
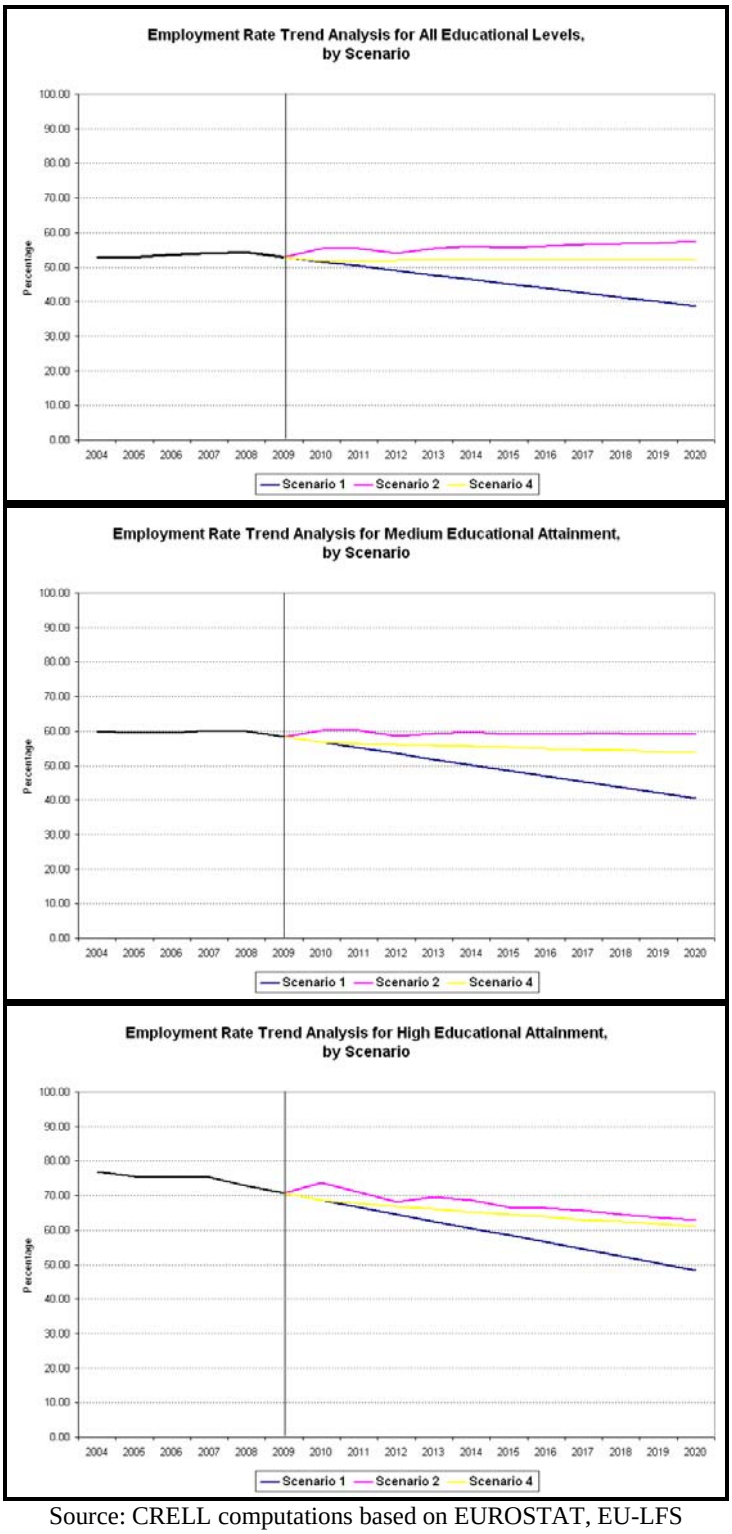


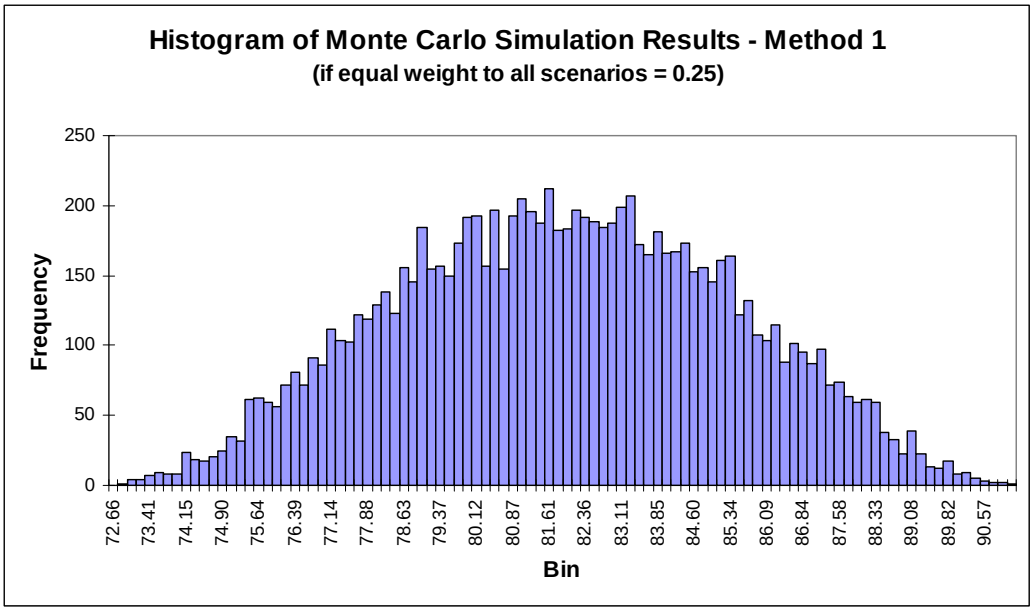
Figure A.5 Baseline indicator for the computation of the Conditional Linear and Exponential Trend Analyses, by Educational Attainment and Scenario: Employment Rate



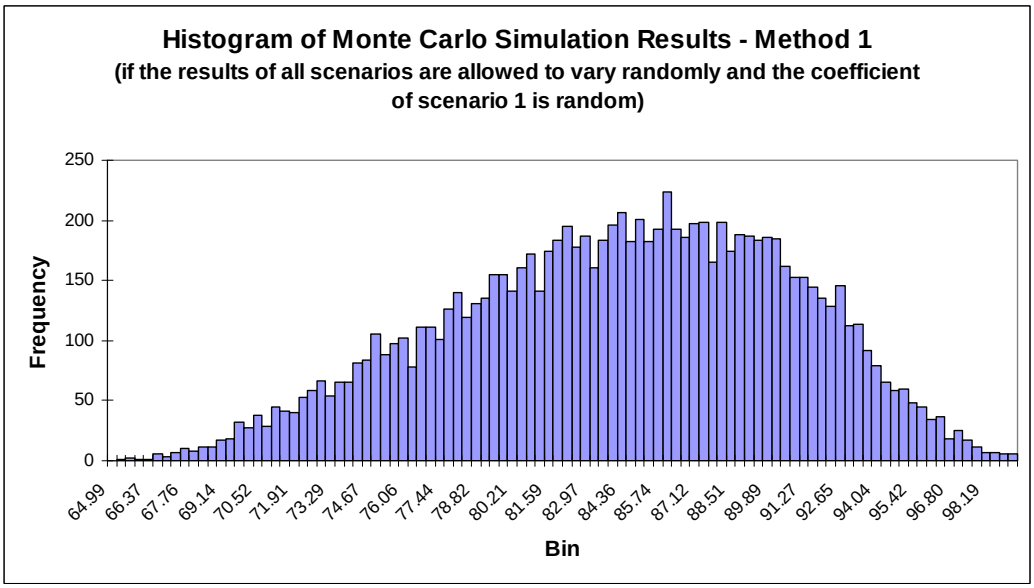
Source: CRELL computations based on EUROSTAT, EU-LFS

Figure A.6 Histograms of Monte Carlo Simulation Results – Method 1, by Test

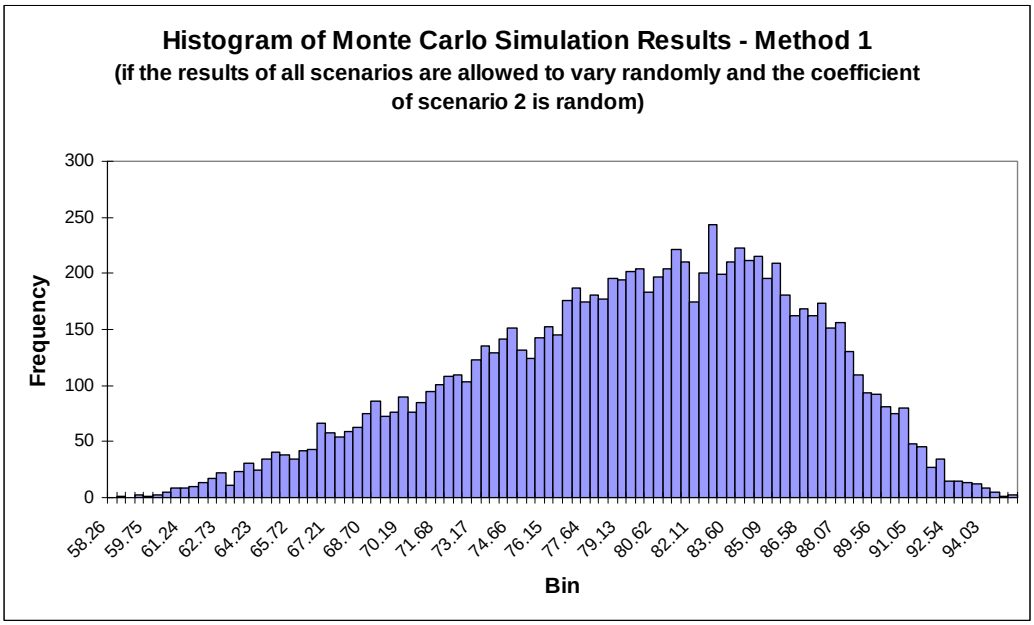
TEST 1



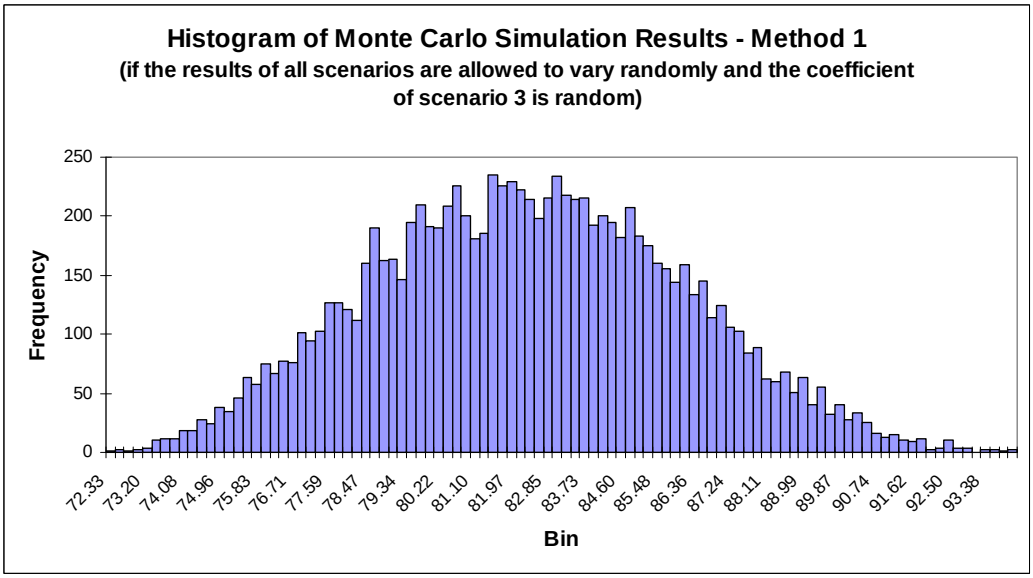
TEST 2



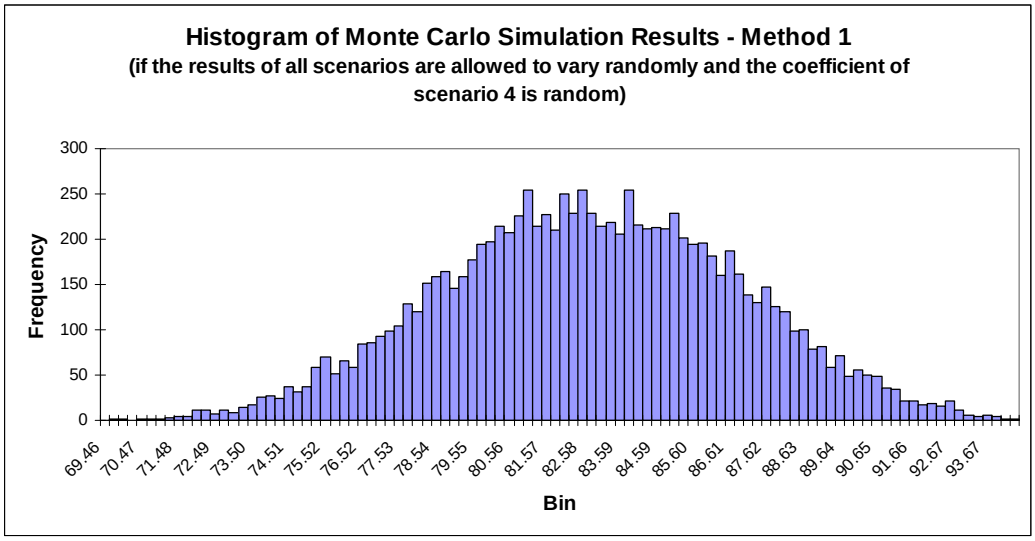
TEST 3


Histogram of Monte Carlo Simulation Results - Method 1
(if the results of all scenarios are allowed to vary randomly and the coefficient of scenario 2 is random)
Frequency
300
250
200
150
100
50
0
58.26
59.75
61.24
62.73
64.23
65.72
67.21
68.70
70.19
71.68
73.17
74.66
76.15
77.64
79.13
80.62
82.11
83.60
85.09
86.58
88.07
89.56
91.05
92.54
94.03
Bin

TEST 4


Histogram of Monte Carlo Simulation Results - Method 1
(if the results of all scenarios are allowed to vary randomly and the coefficient of scenario 3 is random)
Frequency
250
200
150
100
50
0
72.33
73.20
74.08
74.96
75.83
76.71
77.59
78.47
79.34
80.22
81.10
81.97
82.85
83.73
84.60
85.48
86.36
87.24
88.11
88.99
89.87
90.74
91.62
92.50
93.38
Bin

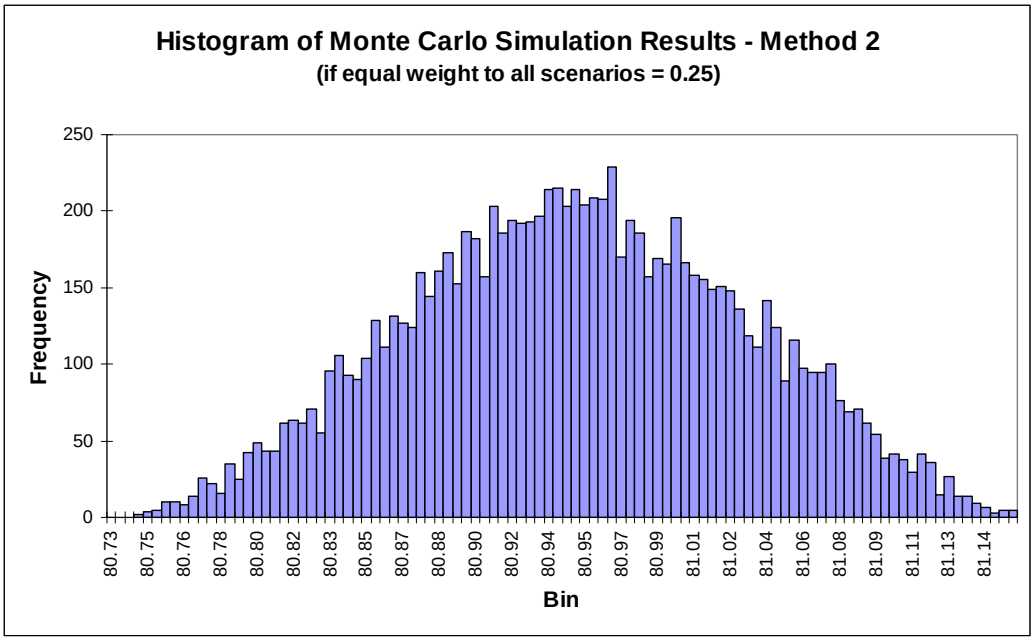
TEST 5



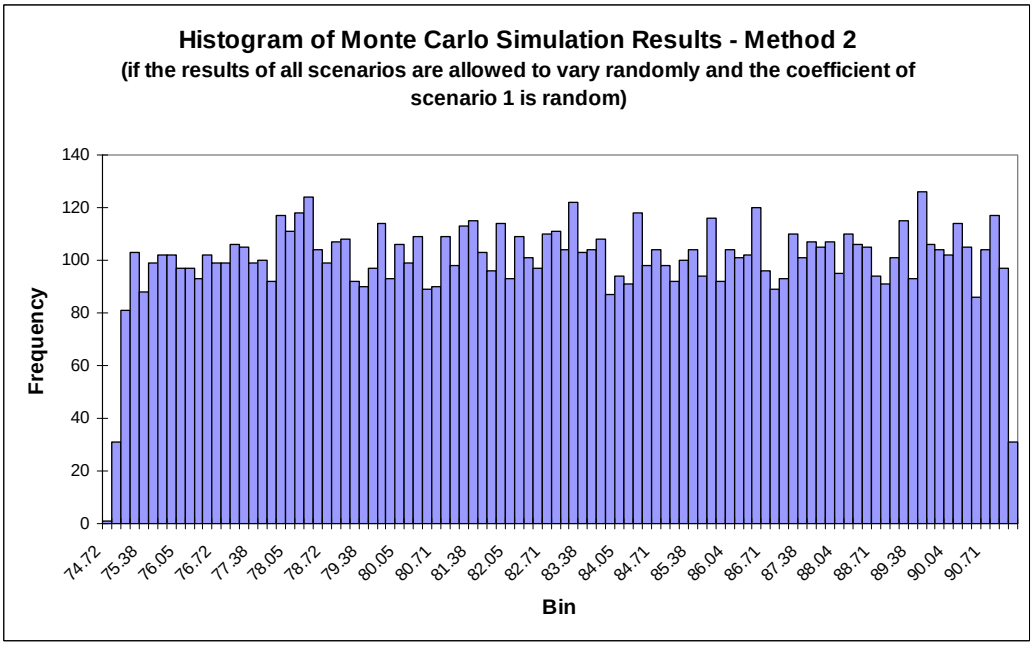
Source: CRELL computations based on results from the deterministic forecasting method 1

Figure A.7 Histograms of Monte Carlo Simulation Results – Method 2, by Test

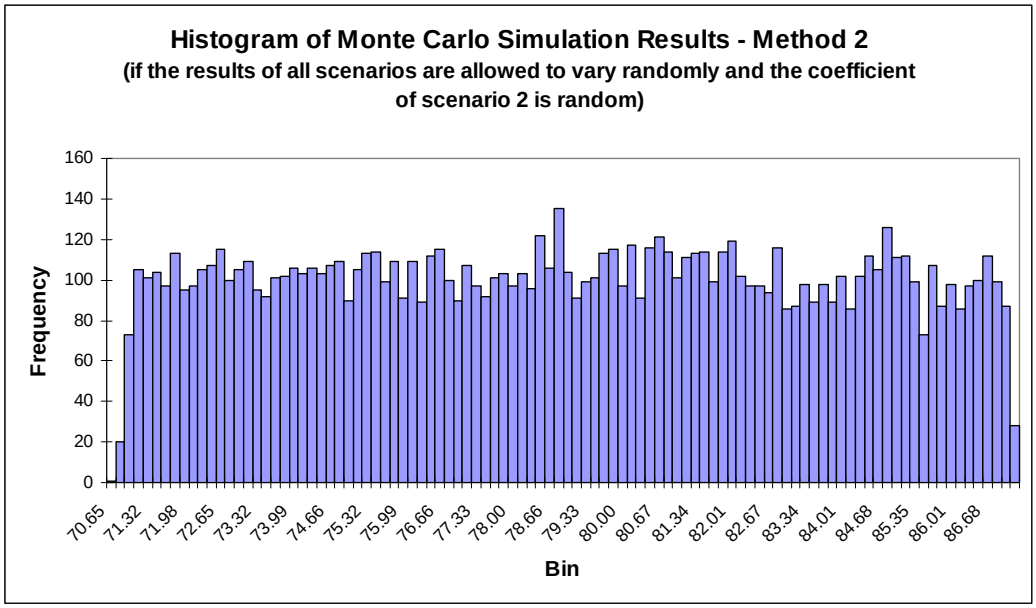
TEST 1



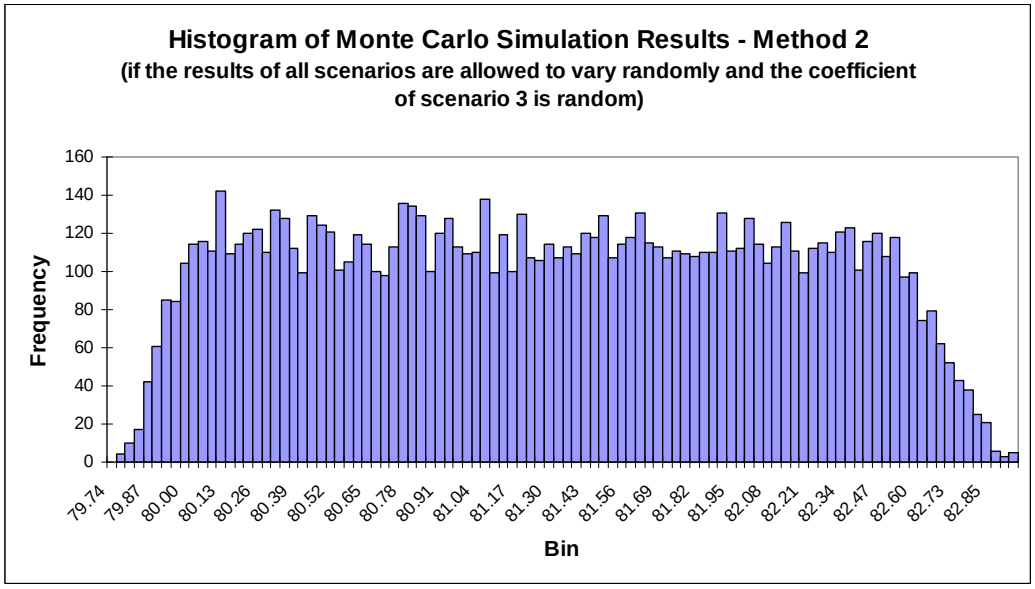
TEST 2



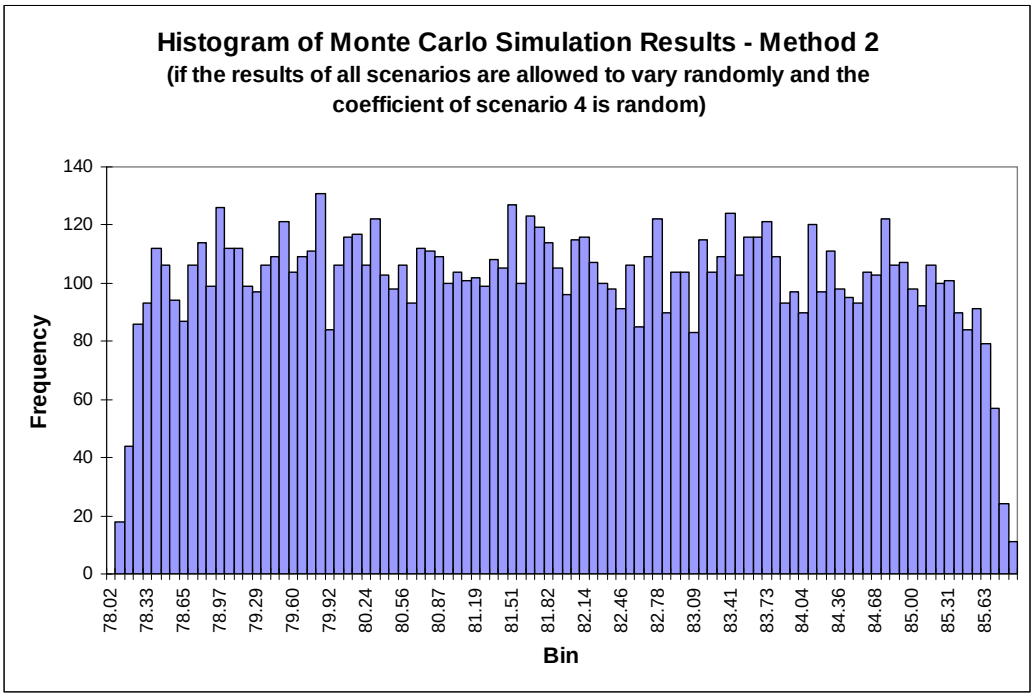
TEST 3


Histogram of Monte Carlo Simulation Results - Method 2
(if the results of all scenarios are allowed to vary randomly and the coefficient of scenario 2 is random)
Frequency
Bin
160
140
120
100
80
60
40
20
0
70.65
71.32
71.98
72.65
73.32
73.99
74.66
75.32
75.99
76.66
77.33
78.00
78.66
79.33
80.00
80.67
81.34
82.01
82.67
83.34
84.01
84.68
85.35
86.01
86.68

TEST 4


Histogram of Monte Carlo Simulation Results - Method 2
(if the results of all scenarios are allowed to vary randomly and the coefficient of scenario 3 is random)
Frequency
Bin
160
140
120
100
80
60
40
20
0
79.74
79.87
80.00
80.13
80.26
80.39
80.52
80.65
80.78
80.91
81.04
81.17
81.30
81.43
81.56
81.69
81.82
81.95
82.08
82.21
82.34
82.47
82.60
82.73
82.85

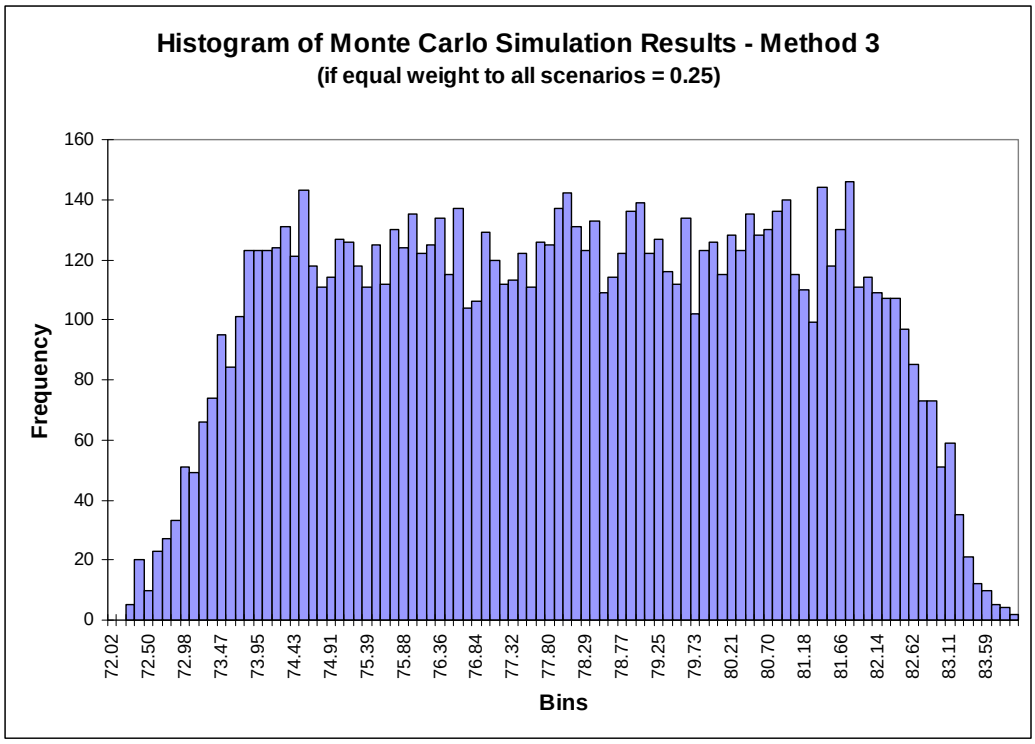
TEST 5



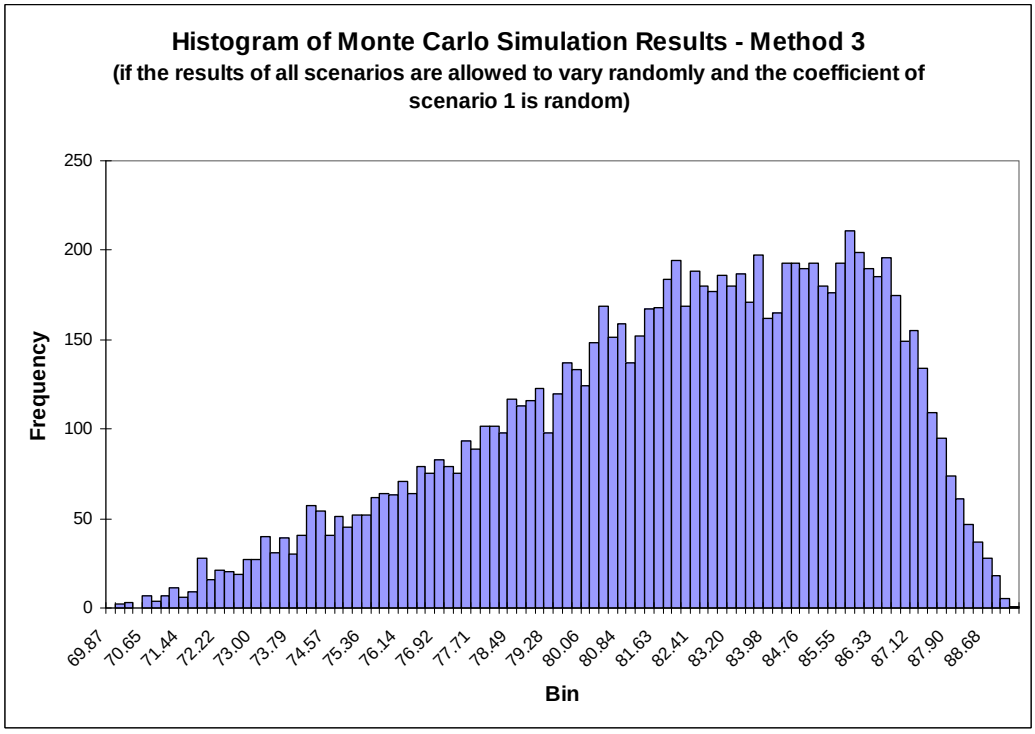
Source: CRELL computations based on results from the deterministic forecasting method 2

Figure A.8 Histograms of Monte Carlo Simulation Results – Method 3, by Test

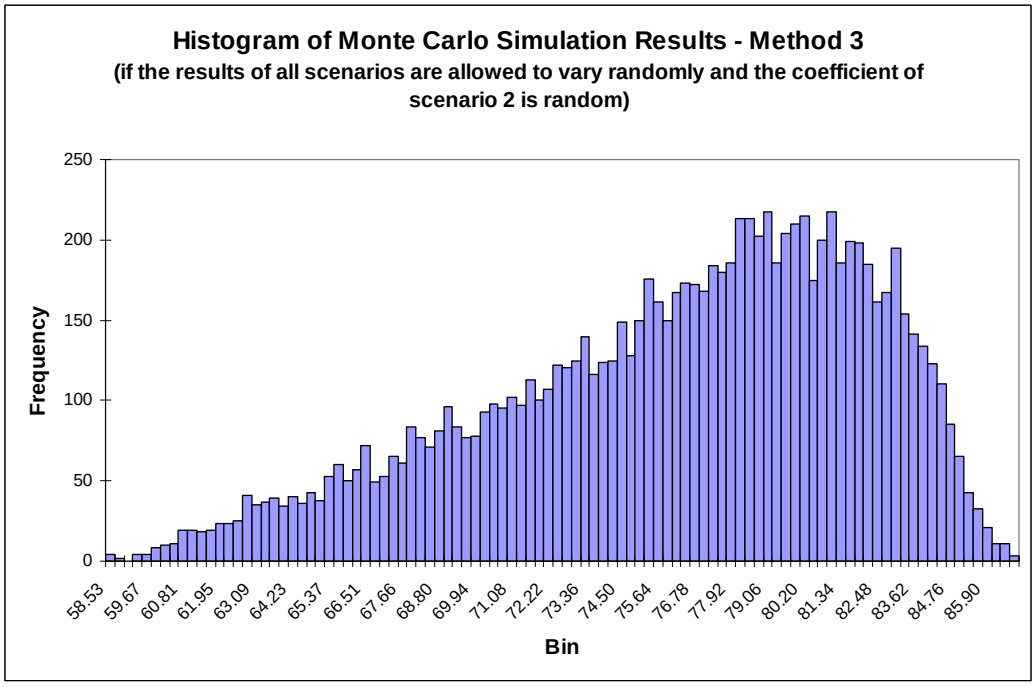
TEST 1



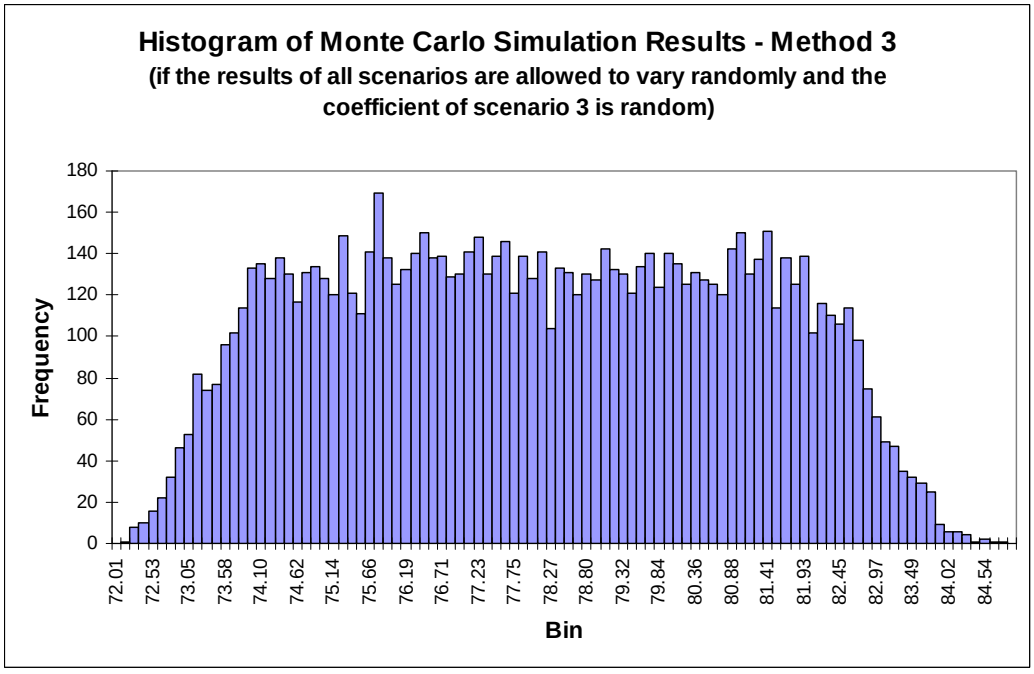
TEST 2



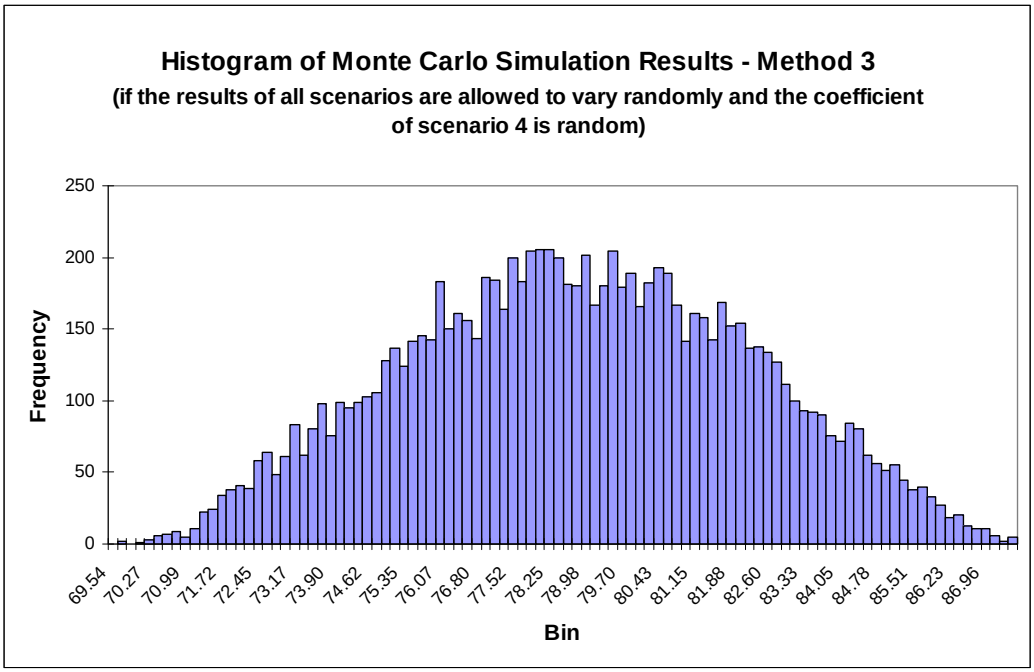
TEST 3


Histogram of Monte Carlo Simulation Results - Method 3
(if the results of all scenarios are allowed to vary randomly and the coefficient of scenario 2 is random)
Frequency
250
200
150
100
50
0
58.53
59.67
60.81
61.95
63.09
64.23
65.37
66.51
67.66
68.80
69.94
71.08
72.22
73.36
74.50
75.64
76.78
77.92
79.06
80.20
81.34
82.48
83.62
84.76
85.90
Bin

TEST 4

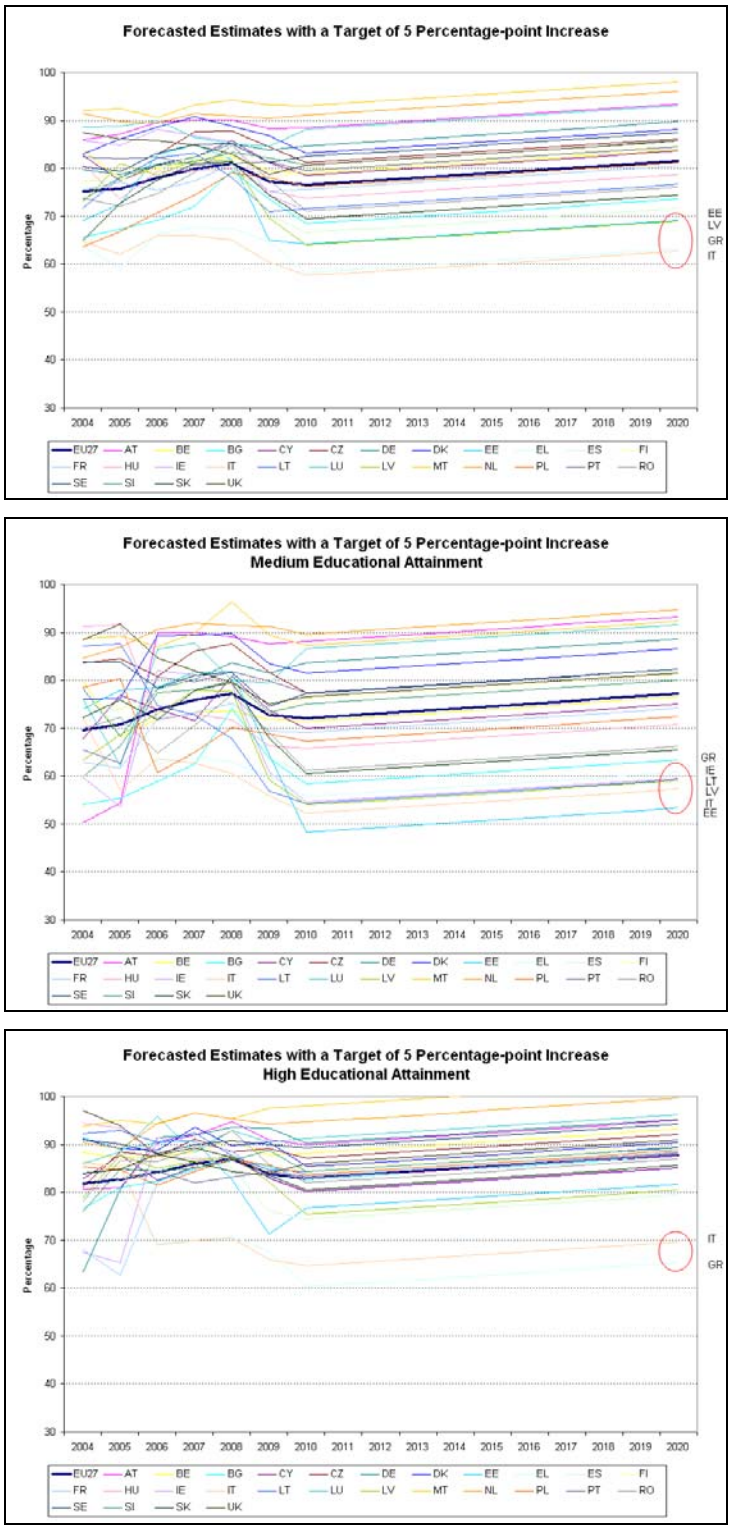

Histogram of Monte Carlo Simulation Results - Method 3
(if the results of all scenarios are allowed to vary randomly and the coefficient of scenario 3 is random)
Frequency
180
160
140
120
100
80
60
40
20
0
72.01
72.53
73.05
73.58
74.10
74.62
75.14
75.66
76.19
76.71
77.23
77.75
78.27
78.80
79.32
79.84
80.36
80.88
81.41
81.93
82.45
82.97
83.49
84.02
84.54
Bin

TEST 5



Source: CRELL computations based on results from the deterministic forecasting method 3

Figure A.9 Consequences of a 5 Percentage-points Increase Target on the Forecasts of the Education for Employability Benchmark, by educational attainment and by country



Source: CRELL computations based on EUROSTAT, EU-LFS

European Commission

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Abstract
The present report presents the methodological framework applied to define the benchmark on education for employability to be proposed to European Council in 2012. While the three first sections present the proposed indicator, the fourth section discusses the sensitivity of that indicator to a change in data source and its correlation with counterfactuals. Moreover, section 5 presents the forecasting approach applied to define the target level at the horizon 2020. Section 6 presents the results of the deterministic and stochastic forecasting models and section 7 concludes.

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