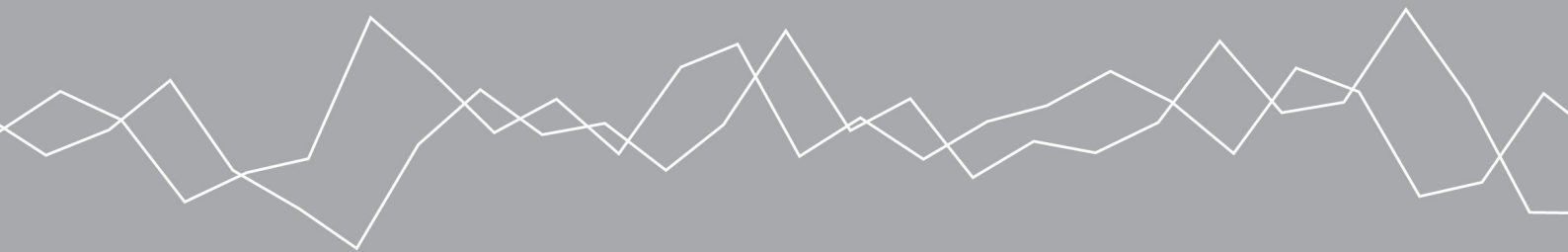


Into the Gap

Exploring gaps and mismatches



Amsterdam, June 2012
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Into the Gap

Exploring gaps and mismatches

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Summary

- The future labor market will be characterized by quantitative and qualitative mismatch. Quantitative mismatch implies that there will be fewer workers than jobs in the future, whereas qualitative mismatch implies that the skills of the workers do not match the required skills of the job. In terms of functioning of the labor market qualitative mismatches are as important as quantitative ones.
- The economic crises that most countries experienced recently, will have long run effects on employment growth. Fewer jobs will be created in the decade to come, than had been expected before the economic crisis. Policies that support the creation of jobs especially in the private sector are recommended in the coming years.
- The negative effects of the present economic crisis will not go on forever. In the more distant future the effects of demographic changes and the aging process will have a defining influence on the supply and demand for labor. As a consequence labor markets will become tighter and quantitative mismatch will rise. The ‘potential employment gap’ of 35 million workers for 2050 in the EU that was projected in the earlier study on “Bridging the gap” is still relevant.
- Qualitative mismatch in the labor market entails a waste of human resources and a loss of productivity and this will put the economy on a lower growth path than would be the case with better matches.
- There are three major sources of quantitative mismatch: business cycles, the perpetual creation and destruction of jobs in a market economy and long term divergent developments between the educational decisions of workers and changes in job requirements brought about by changes in production technology.
- Qualitative mismatches occur because of the lack of information. Workers do not know where the perfect job is and employers do not know where to find the perfect worker for his vacancies. Workers and employers will have to search and as search is costly they will usually stop before having found their perfect counterpart. This leads to imperfect matches between workers and jobs. The present match can often be improved upon and over time lots of rematching occurs.
- The lack of information creates a role for labor market intermediaries, such as public and private employment services to help in the matching and rematching process. Private and public employment services can not only play a role as a lubricant in the matching process but they also know both sides of the labor market and can help reduce the lack of information and improve the quality of matches. Rematching improves the functioning of the labor market as it often moves workers from less productive to more productive matches and to matches that are more satisfying for the worker.
- Roughly 3 out of 5 jobs are matched correctly in terms of level of education in both Europe and the US. Overqualification, whereby the worker has a higher level of education than the job requires is more prominent in the US than in the EU (23 versus 18 percent) while underqualification, with the worker having a lower educational level than required, is less prominent (16 versus 19 percent).
- Around 4 out of 5 jobs are correctly matched in terms of education field in Europe and the US. The United States has a somewhat lower level than the EU27: 19 compared to 23 percent.

- Quantitative gaps are postponed. As a result of the economic crisis levels of employment have fallen and growth paths are predicted to be much weaker than expected earlier. To assess the possible variation in the quantitative and qualitative gaps in 2020 two labor market scenarios are defined. A low growth scenario where employment is assumed to increase with no more than 0.11 and 0.23 percent per year in the EU27 and the US between now and 2020 and a high growth scenario with annual employment growth rates of 0.66 and 1.55 percent in the EU27 and the US. In both the low and the high growth scenario for the EU27 and the US employment growth is usually not high enough to outpace labor force growth in the years to 2020. There are usually more workers who are willing to work than there are jobs. Except in a few cases in the high growth scenario for the US and in West EU-Rhineland (Austria, Germany, The Netherlands).
- A surplus at the national level can coexist with shortages at some sector levels within the same country. For instance, in the EU27 the business services sector will face shortages in 2020 (even in the low growth scenario), while manufacturing will have surpluses (even in the high growth scenario) In contrast to the EU27 the US has either a shortage or surplus in the business sector depending on the high or low growth scenario. In the US the health sector will be short of labor under both scenarios. Obviously more sectors have shortages under the high than under the low employment growth rate. That is especially true for the West European-Rhineland countries and the Eastern European countries where more than half of the sectors switch to a shortage situation under high employment growth.
- There is a surplus of workers in manufacturing for all levels of education in both scenarios and in both the EU27 and the US. Business services show shortages of higher educated workers in both scenarios and in both continents. In the high growth scenario quite a number of sectors turn out shortages, especially for higher educated workers.
- In the low growth scenarios surpluses for all fields of education slightly increase in the EU27 as employment growth is limited. Only for workers with a degree in health does the surplus reduce ever so slightly compared with the present situation. Results are more varied for the United States. There are shortages for people with a degree in health and social sciences & humanities. In the high growth scenario surpluses for workers with degrees in health and social sciences & humanities benefit decline. Overall there is little change in the incidence of horizontal mismatch. In the United States the results of the high growth scenario vary much more. Labor markets get tighter in general for all fields and especially for workers with a degree in general education programs and services.
- The most important result on occupational mismatch is that there is a shortage of elementary workers in almost all regions in 2020 for both the high and the low growth scenario. Combining earlier results of upcoming shortages of higher educated workers and the shortage of elementary workers, supports the hypothesis that the middle of the labor market might get squeezed out in the future.
- A mismatch is a match that by definition can be improved upon. Vertical and horizontal mismatch will occur in various degrees in all national labor markets in the coming years. Rematching will be necessary. Policies that restore and stimulate the dynamics of the labor market would be beneficial to counter and repair future mismatches.

Executive summary

The future labor market will be characterized by *quantitative* and *qualitative* mismatch. Quantitative mismatch is the result of demographic changes. In the following decades fewer workers will be available on the labor market as large numbers of workers will retire and fewer school-leavers will enter. Over time the number of jobs will adjust to the available number of workers. Previous studies (*Mind the Gap* and *Bridging the Gap*) measured quantitative mismatch by counting the potential shortfall of the number of workers with respect to the number of jobs and arrived at a potential shortage of 35 million in the EU27 in 2050. That is an impressive number. But there is more.

The labor market matches workers and jobs. These matches are not always perfect. A qualitative mismatch occurs when the skills or competences of the worker do not correspond to what is required for the job. The job might for instance require a higher or lower educational degree or a different field of education than the one that the worker has acquired. Measuring the qualitative mismatch puts skills at the center and goes beyond the numerical difference between number of workers and jobs.

Qualitative mismatches occur quite often and this report measure its extent across a large number of countries between now and 2020. Qualitative mismatches affect everybody: employees, employers and society as a whole. If a job is filled by a worker who does not have the required skills, he might earn a lower wage than in a better match and might experience less job satisfaction. Employers suffer because a mismatched worker might be less productive. A less productive match implies higher labor costs, possibly leading to higher product prices and loss of market share in the product market. Substantial qualitative mismatch in the labor market entails a waste of human resources and a loss of productivity and this will put the economy on a lower growth path.

Sources of mismatch

Qualitative mismatches can happen for different reasons, but there are three major sources: business cycles, creative destruction of jobs in a market economy and long term divergent developments between the educational decisions of workers and changes in job requirements brought about by changes in production technology.

A first source is the business cycle. In times when unemployment is high and jobs are scarce, a highly qualified job searcher might decide to accept a job that is below his qualifications, rather than keep on searching for a job that would better suit him. If that occurs, the worker is overqualified for the job. In other times, when unemployment is low and the labor market is tight, an employer might have a hard time to find somebody who is well qualified to fill a job vacancy that has been left open for a while. The employer might then decide to offer the job to a less qualified worker. If that occurs the worker is underqualified for the job. Under- and overqualification are grouped together as vertical mismatch. Mismatch can also occur in terms of field of education, when the worker has obtained a degree in different field of education (astronomy) as the job required (financial economics). A mismatch of field of education is called

a horizontal mismatch. Horizontal mismatch can also be defined in terms of type of occupation. If a worker has a different occupation (clerical worker) than the job requires (plant operator) that is another example of horizontal mismatch. Vertical and horizontal mismatch are always the result of a compromise made by the worker or the employer. Rather than keeping on searching for a better fitting job the worker decides at some point that this job is adequate. The employer has made a similar decision that the worker applying for a vacancy is productive enough. Mismatches are not necessarily permanent matches and workers and employers will often separate and look for a better match. Mismatches lead to constant re-matching in the labor market.

A second source of mismatch is the process of creation and destruction of jobs in a market economy. Employment is in permanent turmoil in a market economy. New business ventures are started everyday while unsuccessful firms are folded. Existing firms expand production while others contract. This perpetuum mobile of creating and destroying jobs in a market economy is called creative destruction. Economic growth in a market economy is much more the result of ceaseless changes with new products appearing and old ones become redundant, then producing more of the same. As a result job opportunities open up in one part of the labor market while in another part workers are laid off. Workers laid off in old sectors will have to move to jobs in new sectors. New matches are made, while old matches are broken. There is permanent re-matching going on on the labor market and not all new matches are perfect right away.

The third source of mismatch is related to the educational choices that students make as to level and field of education. Their educational choices are not always synchronized with the (future) need for skills in the economy. New technological developments (e.g. computerization or robotization) and changing international trade patterns will change job descriptions and skill needs of employers change over time. It cannot be guaranteed that the educational decisions that students take now fit the requirements of the labor market tomorrow. Divergent developments in educational output and labor market needs will cause mismatch. For instance, it is general expected that the production processes in future labor markets will need much more higher educated workers than the education sector is turning out and that a 'war on talent' will be going on. It will not be possible to fill all jobs that need them with higher educated workers.

Business cycles, creation and destruction of jobs and the disparity between changes in education and technology will lead to an unrelenting process of matching in the labor market. Matches are often not perfect right away and mismatches will result almost unavoidably. Why is that?

Reasons for mismatch

Start with an unemployed person searching for a job. He will ask around for job openings, look at job advertisements in newspapers and job boards and check in at employment agencies. Having found a promising job opening he will do his best to get a job interview and if lucky get a job offer. Often he will have to keep on asking around, inquiring, phoning and going for more job interviews. Searching for a new job requires effort, time and patience. If at some point in this search process an employer offers him a job, he has to decide whether to accept this offer or keep on searching. He will keep on searching if he expects that there are better job openings available. He must be willing to put in the extra effort and time to keep looking for that better job. At some point the job searcher will decide that the possible benefit of finding a better job

does not outweigh the time and effort to keep searching. He will accept the job offer that is on the table and his search will come to an end. There is no certainty that the job he accepts is the best possible job. He can never be sure because he will not have seen all available job openings. The job offer he has just gotten will have to do. Of course a really lucky searcher might have stumbled by accident on the ultimate job, but he will more often end up not with the best job, but with a good enough job.

There is a similar story on the employer's side. An employer who has a vacancy will advertise this on his website and on job boards, pay for a personnel advertisement in a newspaper, enquire at employment agencies and look into his network. Job searchers will write letters of application, a selection will be made and the most promising candidates will be invited for a job interview. Job talks will be held, tests will be applied and a decision has to be taken on whether to select somebody. Again whether to select depends on balancing the costs to keep on searching and the probability of finding a better candidate than is in the present group of job applicants. There are direct cost to keep on searching such as the cost of a personnel advertisement and the cost of organizing job interviews and tests. There are indirect costs of production loss of keeping the vacancy open. At some point the employer will decide that the possible benefit of finding a better applicant does not outweigh the extra cost to keep on searching. He will offer the job to the best worker so far and his search will come to an end. There is no certainty that this worker is the best of all possible workers in the labor market.

The main villain in this story is 'lack of information'. If job searchers would have perfect information about all job openings they would go directly to the perfect job. If employers would know the characteristics of all available workers they could pick the perfect one immediately. It is the lack of information that necessitates the search process and that requires job searchers and employers with vacancies to spend time and effort to discover what is out there. It is lack of information that results in labor markets not working perfect, not being able to allocate each job searcher to the best available job. Imperfect information puts people in jobs that are at best satisfactory but not optimal. Imperfect information leads to qualitative mismatches.

The present match does not need to be the final match. An imperfect match will often motivate the worker and the employer to look for a better match. As a result there is lots of rematching going on on the labor market. There is for instance lots of job mobility with workers voluntary changing one job for another in periods when the economy is booming and employers have many vacancies. At the employers side there are on average many hires and separation during any given year. Across all countries between 13 and 33 percent of workers are hired at least once by an employer and between 13 and 27 percent of the workers separates at least once from their employer in a year. Countries with relatively flexible labor markets have larger percentages of hirings and separations then less flexible countries. As a result of all these matching and rematching dynamics less than half the jobs (around 40 percent) lasts for 10 years or more.

The lack of information creates a role for labor market intermediaries, such as public and private employment services to help in the matching and rematching process. That is a never ending process as labor demand and supply change all the time. Private and public employment services can not only play a role as a lubricant in the matching process but they also know both sides of the labor market and in this way can help reduce the lack of information and in this way improve

the quality of matches. Research shows that rematching improves the functioning of the labor market as it often moves workers from less productive to more productive matches and to matches that are more satisfying for the worker. The labor market improves over time, in the sense that bad matches are replaced by better ones.

First measurements of mismatch

In the recent human resources literature the term ‘competence’ is often used to denote the combination of knowledge, skills and behavior needed to improve the performance of a worker on a job. A perfect match in terms of competence would occur when the worker has the exact right combination of knowledge, skills and behavior to get maximum performance on a job. What is interesting about the term competence is that it stresses that the perfect match arises from a *combination* of characteristics. A perfect measure of the extent of mismatch would require knowledge of all the relevant components of competence. Sadly no data sets are available who provide such rich information to make this possible. For practical reasons measurement of mismatch has to rely on what is available in the data. What is usually available for a large set of countries and for large enough periods of time is information on the level and field of education and on occupation on both the demand and the supply side of the labor market. This explains the popularity of mismatch measurements based on education and occupation. Even though one would ideally want more sophisticated indicators to measure mismatch the information provided by the simple one-dimensional indicators based only on education or occupation is nevertheless very insightful.

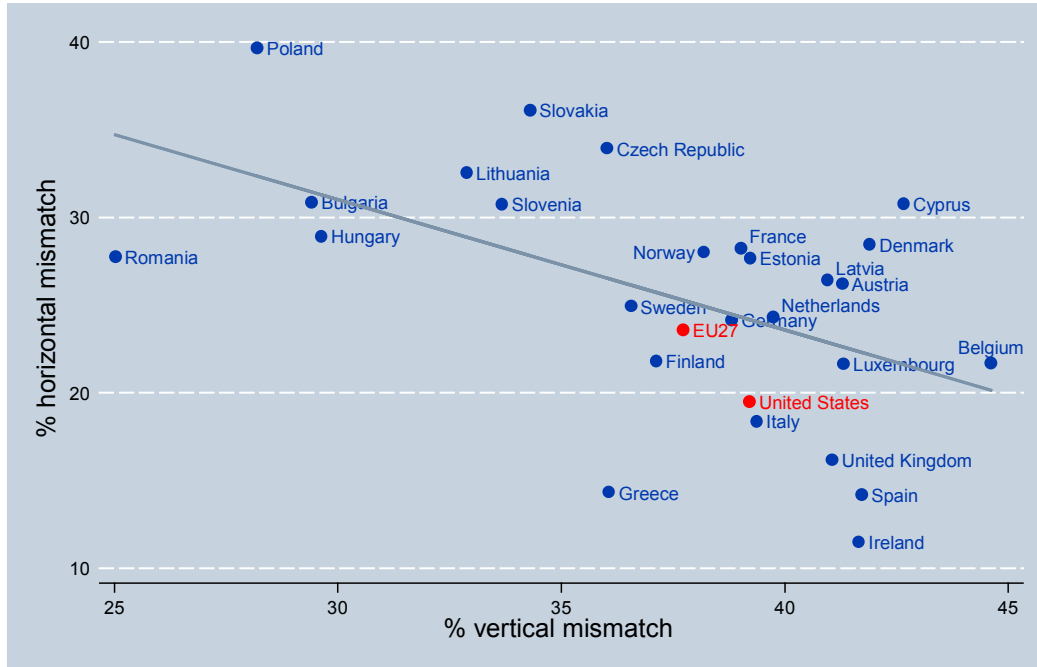
Measuring qualitative mismatch requires labor market data at a level of detail that is not available for many countries. EU countries and the US have databases that allow mismatch measurements and these are used in this study. Measurements in this report show that roughly 3 out of 5 jobs is matched correctly in terms of level of education in both Europe and the US and that there is vertical mismatch in 2 out of 5 jobs. Overqualification, implying a too high a level of education for the job, is a bit more prominent in the US than in the EU (23 versus 18 percent). Underqualification and hence a too low level of education, is less prominent (16 versus 19 percent). Looking across countries it is remarkable that Eastern European labor markets have less vertical mismatch (over- plus underqualification) than other countries in the EU.

Measurements of horizontal mismatch, implying a substantial difference in field of study between what the worker has and the job requires, occurs only in 1 out of 5 jobs. Or to put it differently: roughly 4 out of 5 jobs are correctly matched in terms of education field in Europe and the US. The United States has a lower level than the EU27: 19 compared to 23 percent. Anglosaxon countries (Ireland, UK, US) and Mediterranean countries (Spain, Greece and Italy) are doing rather well in terms of low horizontal mismatch.

Combining horizontal and vertical mismatch across countries shows that countries with higher horizontal mismatch often have lower vertical mismatch and vice versa. Eastern European countries are more likely to have relatively high levels of horizontal mismatch and low levels of vertical. The opposite holds for Mediterranean and Anglosaxon countries. This result suggests that there might exist a trade off between the two types of mismatches. Countries that have good results in matching the level of education and hence do well in terms of vertical mismatch

seem to fail in matching the educational field and do bad on horizontal mismatch. And vice versa.

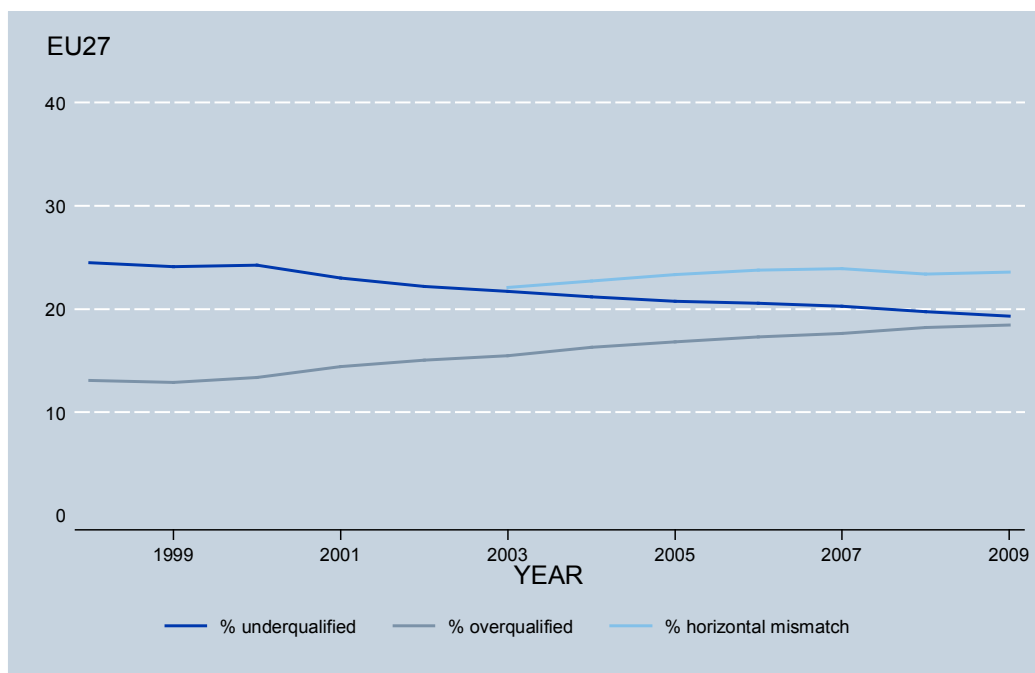
When horizontal mismatch is high, vertical mismatch is low and vice versa



Source: SEO calculations, based on Eurostat & SIPP

A striking result for the EU is that over time underqualification has dropped some five percentage points over the last decade, whereas overqualification has risen in a roughly similar manner. Digging deeper into the data it becomes clear that this overall EU result is influenced by the Mediterranean experience. It does not happen in the Anglosaxon countries and Western Rhineland countries (Austria, Germany, The Netherlands)

EU27: Underqualification has dropped while overqualification has risen



Source: SEO calculations, based on Eurostat & SIPP.

These different patterns for groups of countries suggest the following explanation for increasing overqualification over time. Unemployment in general and youth unemployment in particular has been constantly high in Southern European countries during the last decade. In any case higher than in the Northern European countries. When young unemployed job searchers after searching for a long time do find a job in a bad labor market they often have to accept lower level jobs that are clearly below their educational qualification. As (youth) unemployment remains high for a long time more young workers are forced into overqualification and the labor market will show increasing levels of overqualification. Countries with consistently lower levels of (youth) unemployment such as the Western Europe – Rhineland countries do not exhibit increasing overqualification. If the labor market improves young workers in overqualified jobs will encounter better job opportunities and leave the jobs in which they are overqualified. If however the labor market does not recover in the future young workers get stuck into low level jobs and do not get a chance to make productive use of their education.

The labor market in 2020: a high and low growth scenario

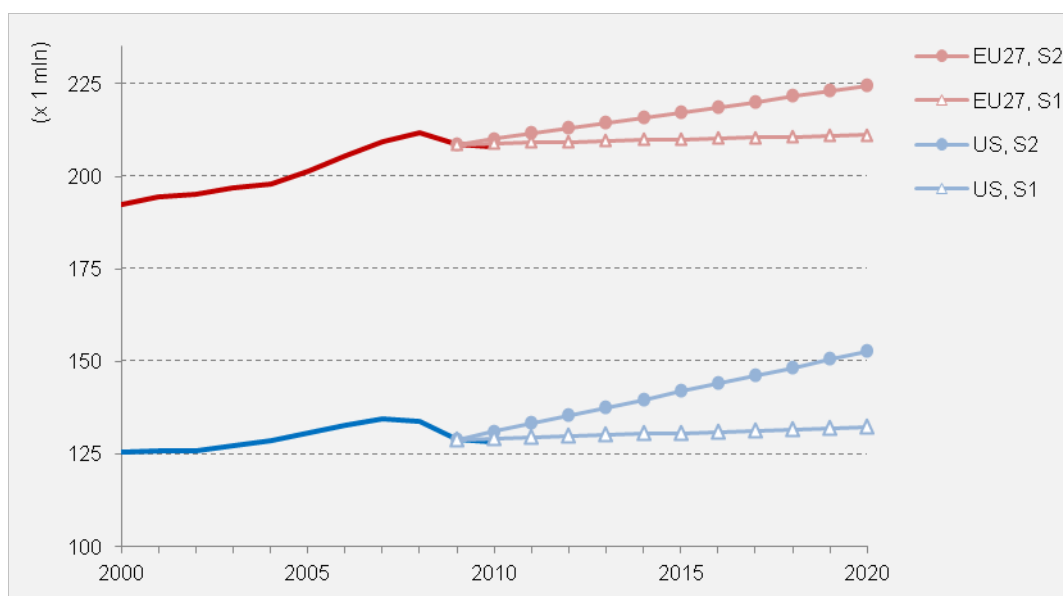
Between now and 2020 the skills that employers demand for the production of goods and services will change. On the supply side of the labor market retiring workers will leave their jobs taking their experience and skills with them. Young workers will enter the labor market with new skills acquired in school. It is to be expected that the skills demanded by firms and supplied by workers will not always be equal and qualitative mismatches will occur.

Qualitative mismatch can be measured using the Labor Market Surplus indicator (LMS). This is the ratio of labor supply over labor demand for specific corners of the labor market. It is calculated in this report for different parts of the labor market defined by sector, educational level, educational field and occupation. When supply in a specific sector of the labor market - for

instance of higher educated technicians in the industry in the US - is higher than the demand for those skills in that sector, the LMS will show a value higher than 1 implying that there is excess supply of that specific skill in that specific sector. When supply falls short of demand, the LMS has a value lower than 1, indicating that there is a supply shortage. Mismatch occurs for values different from one. A larger deviation from one is an indication of more extensive mismatch.

To capture some of the unavoidable uncertainty when projecting labor market developments until 2020, a low and a high growth scenario is presented. Combining expert predictions from Cedefop in Europe and the Bureau of Labor Statistics in the US with extrapolations of employment growth rates in the last decades in the different countries a low and a high growth scenario is specified. In the low growth scenario employment in the EU27 countries is assumed to grow at an annual rate of 0.11 percent in the next decade. The low employment growth for the US is assumed to be 0.23 percent per year.

Different employment growth paths in the aftermath of the recession: low growth scenario 1 (S1) versus high growth scenario 2 (S2)



Employed population 20-64; solid lines are realizations; dotted lines are projections

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Under the low growth scenario some clusters of countries even exhibit negative employment growth rates. The high growth scenario project a 0.66 percent annual employment growth rate for the EU and a 1.55 percent employment growth rate for the US. Under the high growth scenario all countries experience positive employment growth. The basic difference between these two scenarios is the assumption in the low growth scenario that the recent economic crisis will have a long drawn negative or substantial mitigating effect on employment prospects. The high growth scenario is less pessimistic and assumes that some of the employment loss of the crisis years will be made up for in the coming years.

Low and high employment growth rate scenario

			Scenario 1: Low employment growth	Scenario 2: High employment growth
ANG	Anglo-Saxon	UK, Ireland	0.36	0.58
SCA	Scandinavian	Denmark, Finland, Sweden, Norway	0.41	0.56
WRH	West EU-Rhineland	Austria, Germany, Netherlands	-0.04	0.64
WFR	West EU-Francophone	Belgium, France, Luxembourg	0.10	0.97
MED	Mediterranean	Spain, Greece, Italy, Portugal	0.24	1.04
EAS	Eastern Europe	Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovenia, Slovakia, Bulgaria, Romania	-0.11	0.15
EU27			0.11	0.66
US			0.23	1.55

Average annual employment growth 2009-2020, percentages.

Source: Scenario 1, Cedefop (2010) and BLS (2012); Scenario 2, Eurostat (2012) and OECD (2012)

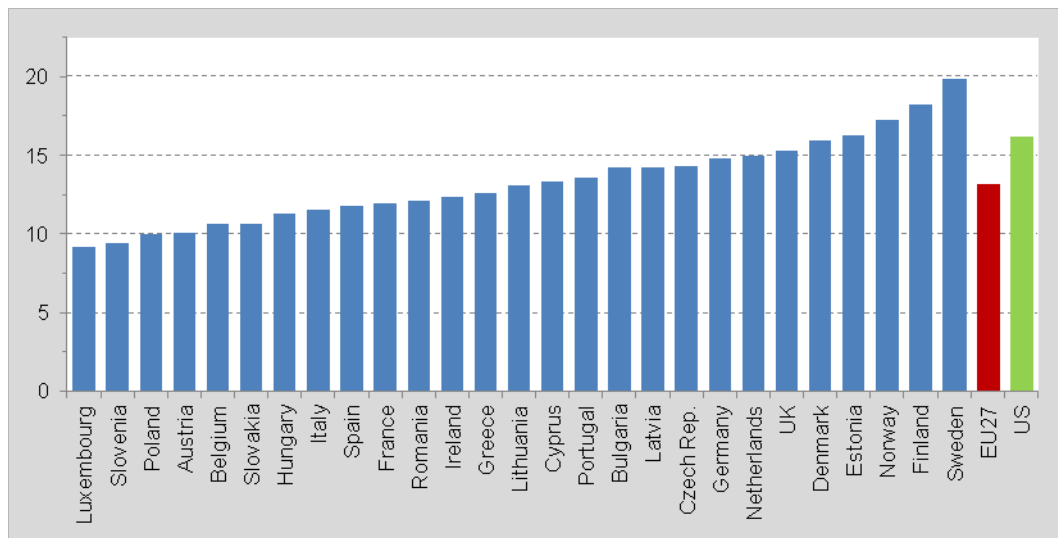
Note: The clustering of countries is copied from the he Ciett publication 'Adapting to change' (see www.ciett.org).

Scenario calculations start in the year 2009. While writing the report this was the most recent year for which consistent data were available for the EU countries and the US. By the time of publication 2010 data will be available, but this information will have come too late. It is illuminating to note some important differences between the sector make up of the EU27 and the US as this has an influence on the scenario outcomes. The EU27 has a larger *manufacturing* sector than the US (17 versus 11 percent) and its *agricultural* sector is five times as large as in the US (5 versus 1 percent). *Health* and *education* on the other hand are larger sectors in the US than in the EU27.

Interesting differences among European countries are that Eastern European countries have relatively more workers in *agriculture*, *manufacturing* and *utilities* whereas Western European countries have relatively many people in *financial* and *business* service sectors. Luxembourg is a special case with 13 percent employed in *financial services*.

Important for the scenario projections is the share of workers aged 55 and older as they can be expected to retire in the decade to come. A high share implies that their jobs will become available and the employer has to decide whether he wants to fill these slots again.

Northern European countries and the US have a large share of workers aged 55 and older



AOR: share of employed workforce aged 55-64 by country, %-points, 2009.
 Source: Eurostat (2010) and CPS (2010).

It turns out that the US has a larger share of workers aged 55 and older than the EU27 and then most of the individual European countries. In the US 16 percent of the workers is 55 years or older. The EU27 average is 13 percent. Within Europe differences are rather large. Luxembourg has the lowest share with only 9 percent. Sweden has the highest with 20 percent. In Sweden one out of five workers will leave the labor force in the next decade. In the other countries where the share of workers aged 55 and older is 15 percent or higher (Netherlands, UK, Denmark, Estonia, Finland, Norway, US) one out of six to seven workers will retire.

Employment gap predictions revisited

To provide background for the measurements of quantitative mismatch, first new predictions are presented for the difference in total numbers supplied and demanded (quantitative mismatch), expected in 2020. Predictions of qualitative mismatch discussed further on are colored by whether there are large numerical surpluses or shortages in the labor market. This new predictions take into account the impact of the severe, long drawn recession that hit the world economy starting in 2008.

Will there be enough workers to fill all jobs in 2020? In both scenarios employment growth is usually not high enough to outpace labor force growth in the years to come. There are usually more workers who are willing to work than there are jobs. Surpluses (more workers than jobs) will be dominant. Except in a few cases, such as in the high employment growth scenario for the US and in the health and business service sector in West EU-Rhineland, when labor supply falls short and shortages develop. In the low scenario case in 2020 the percentage surplus does not change very much compared to what it already was in 2009 and will be around 8.8 percent for the EU27 (20.4 million surplus out of a 231,5 million labor force). The percentage surplus goes up to 11.3% for the US (16.9 out of 149.1 million). In the higher growth scenario the surplus turns into a small shortage in the US (of 3.6 jobs) and in the West EU-Rhineland countries (0.6 million), but not in the EU overall where the surplus reduces to 7.1 million. That is a percentage surplus of only 3.1 percent. This is rather small and is lower than the usual level of frictional unemployment

that is always present in a dynamic labor market. A labor market with such a small surplus can still be qualified as a tight labor market.

What this new predictions make clear is that the expectations that were held before the recent crisis about the early appearance of labor market shortages were premature. The crisis has changed the fortunes of the world economy. In its aftermath the slowdown of the economy is such that surpluses will occur more often than shortages. The demographic picture is still that population growth will keep on slowing down and turn negative in the future. As soon as employment growth picks up again in the next decades surpluses are bound to happen. The results of the high growth scenario already steer in the direction of a tight labor market.

Surplus and shortage at the sector level

A surplus at the national level can coexist with shortages at some sector levels within the same country. As is well known almost all countries experience a structural shift from primary sectors such as agriculture and industry to service sectors. In many countries business services face shortages, whereas in manufacturing labor is abundant. In the EU27 the move from primary production to services is illustrated by declining shares of agriculture (minus 1.1 %-points) and manufacturing (minus 1.6 %-points). At the same time the employment share of business services (+1.8 %-points) and trade & repair (+0.7 %-points) increases. In the United States the sectoral shift is even more apparent. The share of manufacturing declines by 2 percentage points, while the shares of business services (0.8 %-points), health (2.4 %-points) and education (1.6 %-points) all increase.

Across sectors shortages and surpluses coexist. For instance, in the EU27 the business services sector will face shortages in 2020 (even under the low growth scenario), while manufacturing will have surpluses (even in the high growth scenario). More sectors show shortages under the high than under the low growth scenario. The coexistence of shortages and surpluses is also seen in the US: the health sector will be short of labor while the manufacturing sector and trade & repair sector has a surplus. In contrast to the EU27 the US has either a shortage or surplus in the business sector depending on the high or low growth scenario. Obviously more sectors have shortages under the high growth scenario than under the low growth scenario. That is especially true for the West European-Rhineland countries and the Eastern European countries where more than half of the sectors switch to a shortage situation under high employment growth.

Vertical mismatch

To measure the extent of possible mismatch in terms of education and occupation this report relies on the Labor Market Surplus indicator (LMS). A LMS value higher than 1 indicates that there will be a surplus of workers for the given educational level, educational field of occupation. For a LMS value lower than one there will be a shortage. When interpreting the value of the LMS indicator it should be kept in mind that there is always unemployment in real life labor markets. The level of unemployment fluctuates with the cycle but underneath it all there is a structural unavoidable minimal level of unemployment. This structural level of unemployment carries different names such as the frictional level of unemployment, the natural rate of unemployment or the NAIRU. The latter refers to the “Non Accelerating Inflationary Rate of Unemployment” implying that if the unemployment rate goes below that, inflationary wage and price inflation can

be expected. This structural level of unemployment varies over time and between countries and depends heavily on the way the institutions of the labor market are specified (e.g. an ample unemployment benefit provision will increase the structural level of unemployment). Assuming for simplicity that the structural level is at least 6% then a LMS equal or less than 1.06 would point to a tight labor market.

Either there will be more workers with a given level of education on the labor market in 2020 than employers need, in which case a surplus of workers with this educational level will arise (and the LMS indicator for these workers will be greater than 1). Or there will be fewer workers with a given level of education than there is demand for and then there will be a shortage of workers with that educational level (and their LMS indicator will be smaller than 1).

In 2009 the EU27 runs surpluses on all levels of education with all LMS-values above 1. Lower educated labor is most abundant (an LMS of 1.15) while the surplus for higher educated workers is the smallest (1.05). The same conclusion holds for the United States in 2009. Again there are surpluses at all levels of education; the largest surplus is among lower educated workers (LMS of 1.22) and the smallest among higher educated (1.05).

Different outcomes of LMS indicator in both scenario's, for EU27 and US

	2009	Scenario 1 (low)	Scenario 2 (high)
EU27			
Low	1.15	1.13	1.07
Medium	1.09	1.15	1.08
High	1.05	1.02	0.96
United States			
Low	1.22	1.65	1.43
Medium	1.11	1.23	1.06
High	1.05	0.99	0.86

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

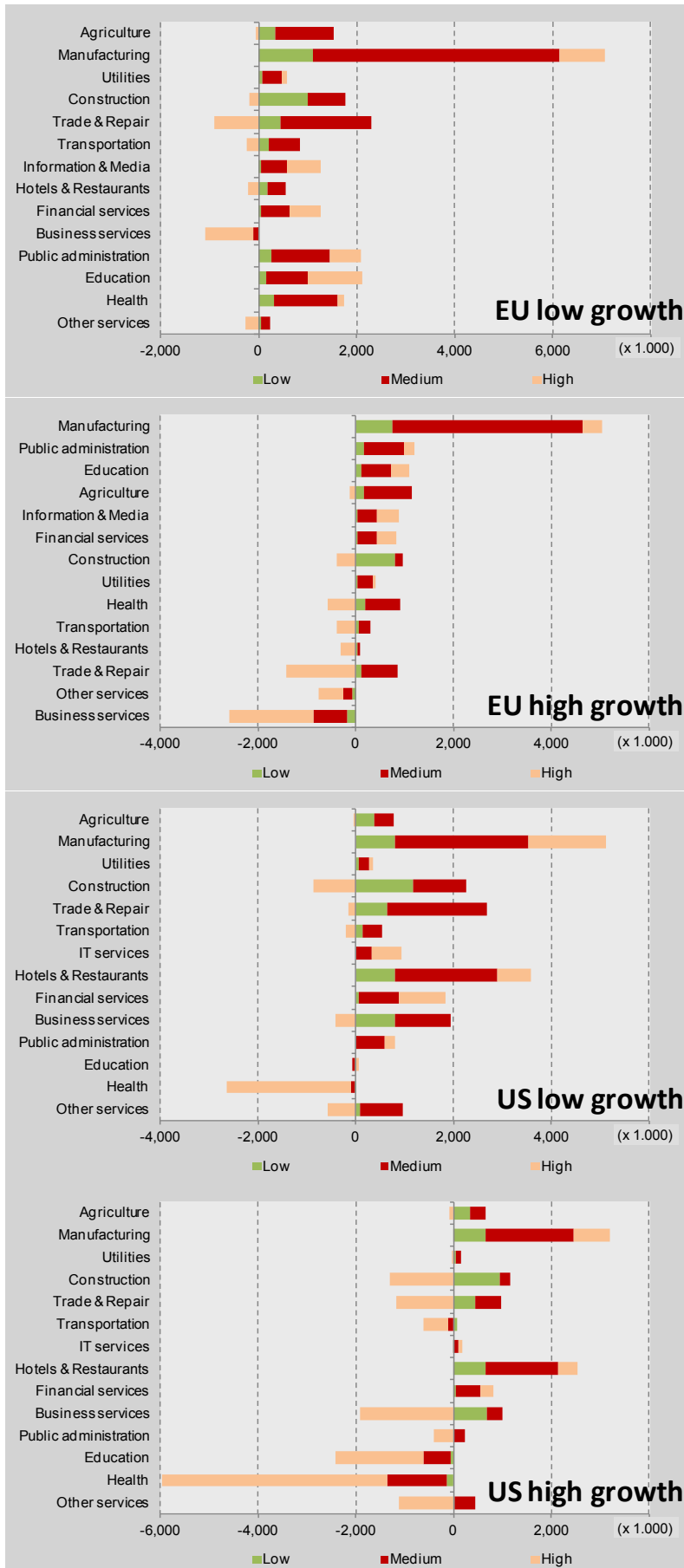
In both scenarios past developments of increased demand for higher educated workers are projected to continue in the future. The increased demand for higher educated workers is clearly reflected in the outcome for 2020 in both the EU27 and the US. Surpluses for higher educated persons decline in both scenarios. The surplus for higher educated workers changes into a shortage in the high growth scenario in the EU27. In the US even the low growth scenario leads to a high education shortage in 2020.

For the different levels of education the LMS patterns are different between the EU27 and US and between scenarios. In the EU27 the surplus of medium educated workers increases (from 1.09 to 1.15) between 2009 and 2020 whilst that of lower educated decreases (from 1.15 to 1.13) in the low growth scenario. In the US the surplus of the lower educated workers increases substantially in the low growth scenario (from 1.22 to 1.65). It remains high (and is in any case always higher than in the EU27) even in the high growth scenario. The 2009 surplus of high educated workers turns into a shortage in both scenarios in the US and in the high growth scenario in the EU. Using a LMS value of less than 1.06 rather than 1.0 as the dividing line for a

shortage, then there will also be a shortage of high educated labor in the EU even in the low growth scenario.

It is also possible to project shortages and surpluses per sector and per educational level in number of workers in 2020 for the low and high growth scenarios. As can be seen in the figure below there is a surplus of workers in manufacturing for all levels of education in both scenarios and in both the EU27 and the US. Business services show shortages of higher educated workers in both scenarios and in both continents. In the high growth scenario quite a number of sectors turn out shortages, especially for higher educated workers and often also for medium educated workers.

Even within industries shortages and surpluses coexist



Horizontal mismatch by level of education

Horizontal mismatch by field of education will occur in 2020 when there are more workers with a given field of education than there are jobs requiring that field. For instance there might be more workers with a degree in social science than employers need in the future. In that case there will be a surplus of workers with a social science degree and the LMS will be higher than one for workers having studied in the social sciences field. For other fields of education the reverse could be true. For instance there might be less workers with a degree in engineering than are needed in the future. In that case there will be a shortage and the LMS will be smaller than one for workers having studied engineering.

There is a surplus for all fields of education in 2009. In the EU27 this is highest for those with general education. Among the other fields of education the LMS is either 1.07 or 1.08. The US tells a different story. Labor is especially abundant among those with a degree in social sciences & humanities and engineering, science and agriculture.

Horizontal mismatch more stable in the EU27 than in the US

	2009	2020 - Scenario 1	2020 - Scenario 2
EU27			
General	1.13	1.13	1.07
Education, Humanities & Social	1.07	1.07	1.01
Science, Engineering & Agricultural	1.08	1.10	1.03
Health & welfare	1.07	1.06	1.00
Services	1.08	1.11	1.04
United States			
General	1.03	1.30	1.12
Education, Humanities & Social	1.21	0.99	0.86
Science, Engineering & Agricultural	1.16	1.09	0.94
Health & welfare	1.08	0.91	0.79
Services	1.00	1.18	1.03

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

In the low growth scenarios surpluses slightly increase in the EU27 as employment growth is limited. Only for those workers with a degree in health does the value of the LMS drop ever so slightly (from 1.07 to 1.06). The LMS now ranges between 1.06 (for health) and 1.13 (for general educated). In 2009 the LMS ranged between 1.07 and 1.13. Hence the incidence of horizontal mismatch does not change a lot. Results are more varied for the United States. There are shortages for people with a degree in health and social sciences & humanities. For the general educated and people with a degree in services (such as hospitality, beauty and transport services) the LMS increases. In 2009 the LMS-range was between 1.09 and 1.21; in the low growth scenario it ranges between 0.91 (for health) and 1.30 (for general educated) in 2020. This wider range indicates a small increase in potential horizontal mismatch.

In the high growth scenario the LMS declines in the EU27 for all fields of education because of higher employment growth. Especially workers with degrees in health and social sciences & humanities benefit. Their LMS is close to 1. Still, the range of LMS values for the various fields remains relatively narrow. There is little change in the incidence of horizontal mismatch. In the

United States the results of the high growth scenario vary much more. The LMS increases for workers with a degree in general education programs and services. For all the other fields the LMS declines considerably. This is mainly related to level of education. It is mostly the higher educated workers who hold these degrees and demand for higher educated workers increases.

Horizontal mismatch by type of occupation

Horizontal mismatch by type of occupation will happen in 2020 when there are more workers with a given type of occupation than there are jobs requiring that occupation. For instance there might be more workers with a clerical occupation than there is demand for that particular type of occupation in the future. In that case there will be a surplus of clerical workers and the LMS for clerical occupations will be higher than one. The reverse can be true for other types of occupation. Professionals could be in short supply in the future when there are fewer workers with a professional occupation than there are jobs for them. In that case the LMS for professional occupations will be less than one in 2020.

The most important result on occupational mismatch is that there is a shortage of elementary workers in almost all regions in 2020 for both scenarios. The LMS is above 1 only for the United States in the low growth scenario. But note that in the US not only the lower educated workers work in an elementary occupation. About half of the workers employed in elementary job have a medium level of education. All economies in Europe and the United States are moving more and more towards a service economy. Especially in terms of employment. This implies that employment falls in primary sectors: agriculture, manufacturing and utilities. In most regions employment in health care and business services will grow substantially. Employment growth in other sectors differs across (clusters of) countries. Combining earlier results of upcoming shortages of higher educated workers and the shortage of elementary workers, supports the hypothesis that in the middle of the labor market might get squeezed out in the future.

Shortages mostly for elementary occupations in the EU and the US

	2009	2020 - Scenario 1	2020 - Scenario 2
EU27			
Professionals	1.07	1.11	1.05
Clerical & Service	1.10	1.11	1.05
Agri, Craft & Plant	1.11	1.16	1.09
Elementary	1.12	0.91	0.85
United States			
Professionals	1.08	1.06	0.91
Clerical & Service	1.08	1.13	0.98
Agri, Craft & Plant	1.13	1.24	1.07
Elementary	1.13	1.14	0.99

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

There is much discussion among labor market researchers and in the popular press about the ‘squeezed middle’. What seems to be going on is that there is a relative increase in the demand for occupations in the top and the bottom of the labor market, while occupations in the middle part are somehow squeezed out. Assigning professional occupations to the top of the labor market, elementary occupations to the bottom and the clerical and service occupations and the

agricultural, craft and plant operators to the middle, then the results point in the direction of the hypothesis of the squeezed middle. There is a tendency toward shortages and tight labor markets for elementary workers and professionals, whereas the agricultural, craft and plant operators show a surplus. The results for clerical and service workers are a bit mixed.

1 Into the gap

The labor market is a market of matches between workers and jobs. These matches are hardly ever perfect because the characteristics of the worker do not always correspond to the required competences for the job. The job might require a lower educational degree than the one that the worker brings. Or the job might ask for a different field of education, like a financial degree rather than a degree in mathematics. Education is only one of an array of competences needed to be productive on a job. Social and management skills, problem solving skills, manual dexterity can all be part of the competence fields that the employer is asking for. A worker will usually have many of these competences or skills. Sometimes skills that the worker has might compensate for the ones he is missing. A worker with good learning abilities can make up quickly for some of the skills lacking at the start of the job, with the help of on-the-job training. But even then the match will not be perfect. There will almost always exist a difference or mismatch between what the worker has to offer and what the job demands. Imperfect matches or qualitative mismatch will be the unavoidable result of the way workers are linked to jobs in the labor market. Labor markets where there is a perfect quantitative match with exactly the same number of workers as jobs (a situation, by the way, which never occurs) can still have lots of qualitative mismatch. In a labor market with hundred construction workers and a hundred job openings for intensive care nurses, there is a perfect quantitative match and a hundred percent qualitative mismatch. A hundred percent qualitative mismatch is in some sense just as bad as a hundred percent quantitative mismatch. There is hardly any difference between a market with a hundred construction workers looking for jobs but zero job openings or the same market with hundred job openings for intensive care nurses. Quantitative mismatches are just as bad for the economy as qualitative labor market shortages or surpluses.

Looking into the Gap

Previous studies (*Mind the Gap* and *Bridging the Gap*) provided estimates of the potential future employment gaps in quantitative terms. These estimates give an indication of the potential quantitative shortage of workers in the future due to demographic changes. These estimates are at the same time informative and impressive. Yet they do not reveal all the elements of the future labour markets. The 'potential employment gap' of 35 million in the EU27 in 2050 is an estimate of the potential quantitative mismatch, of how much slower supply of labor might developed due to aging compared with the development of the demand for labor. This number conceals possible quantitative mismatches that might occur at the same time. It is very well possible that there will be qualitative on top of quantitative mismatch. In the future there might be lots of vacancies for highly educated IT workers in the commercial service sector but not enough IT workers to fill these job openings. At the same time and in another part of the labor market medium skilled technical workers might be laid off in manufacturing. Maybe some laid off technical workers will be hired for the IT vacancies, but the fit will not be perfect. Also some of the IT vacancies will remain open and some of the unemployed technical workers will stay unemployed. Under these circumstances the future labor market will be one where there are not only imperfect matches, but also employers with vacancies searching for workers that will fit their job requirements and jobless workers trying to find a job that matches their skills. The future labor market will be characterised simultaneously by quantitative and qualitative mismatch. The

first caused by demographic developments, the latter because of shifting employment patterns due to technological changes and globalization. This labor market is a far cry from the perfect labor market where the *right person is in the right place at the right time*.

A situation whereby the skills or competences of the worker do not match with what is required for the job is called skill mismatch. A skill mismatch is a *qualitative* mismatch because the qualifications of the worker do not completely match up with those that the employer is looking for. It differs from a *quantitative* mismatch where the focus is only on the difference between the total number of jobs and the number of workers. Quantitative mismatch only refers to a numerical difference between the total quantity of labor supplied and demanded. Measuring the qualitative mismatch puts skills and competences at the center and goes beyond the sheer numerical difference between total demand and supply in the labor market. Qualitative mismatch plays at a deeper level where differences in characteristics demanded and supplied count. For instance when there are more vacancies for higher educated workers than there are higher educated job searchers. Crucial for the measurement of qualitative mismatch is the imbalance between the characteristics of labor supply and the requirements of labor demand. There is qualitative mismatch when there are at the same time job searchers with a given level or field of education on the supply side and employers with jobs requiring a different level or field on the demand side. Qualitative mismatch occurs when the fit between supply and demand is wrong. Qualitative mismatch puts a measure on how big this misfit is. Qualitative mismatches occur quite often and this report aims to shed light on the extent of qualitative mismatch in different countries and on changes over time (to 2020).

This report complements the previous studies in which the quantitative gap was measured by looking into the qualitative characteristics of the gap. The focus of this report is the explanation and the measurement of present and future qualitative mismatches in the labor market of European countries and the US. It will in the final chapter (chapter 5) build on two scenarios for possible future developments in the characteristics of demand and supply in the labor market of Europe and the US¹. It will project the skills that will be demanded by the employers and supplied by the workers. By detailing the qualitative differences between skill demand and supply in the future, this report is really *looking into the gap*.

Judging skill mismatches

Qualitative mismatches can happen for different reasons. In times when unemployment is high and jobs are scarce, a highly qualified job searcher might decide to accept a job that is below his qualifications, rather than keep on searching for a job that would better suit him. If that occurs, the worker is overqualified for the job. In other times, when unemployment is low and the labor market is tight, an employer might have a hard time to find somebody who is well qualified to fill a job vacancy that has been left open for a while. The employer might then decide to offer the job to a less qualified worker. If that occurs the worker is underqualified for the job. Good and bad times follow one after the other. A period of economic boom is followed by a recession and low unemployment changes into high unemployment until the wheel of economic fortune turns over once more. During the economic cycle periods with lots of overqualification are followed by periods with lots of underqualification. At any point in time, there will always be job matches

¹ Due to data constraints it is not possible to make comparable projections for other important countries like Australia and Japan. But the information that is available on those countries will be presented.

whereby the worker is overqualified as his match has originated in times of high unemployment, and there will be job matches with an underqualified worker having found this job in times of low unemployment. Of course there will also be lots of matches where the qualifications of worker and job are well aligned.

Labor markets are dynamic markets and imperfect matches can be undone and new, better matches can be made. A worker who is not happy in his job can look for another job while working and change job if a better opportunity comes along. An employer who is not satisfied with the worker can refuse tenure at the end of the probation period or contract. Over time, if the labor market would be let alone, labor mobility and firing and hiring decisions would improve the quality of the matches, resulting in less qualitative mismatch in a labor market.

But it never happens that the labor market is left alone. Labor markets move with the never ending economic cycle. In good, expansionary times employment and the number of job openings grows and more workers start looking for jobs. In bad, contractionary times employment goes down, unemployment goes up and vacancies go down. The economy is not only influenced by the cycle. It is also constantly bombarded by technological development, changes in consumer preferences and by changes in the pattern of international competition. The result is an economy with jobs being destroyed in one sector or occupation and created in another. Because of the economic cycle and the constant process of creation and destruction of jobs, existing matches are dissolved and new imperfect matches are made everyday. The labor market is never left alone long enough to reach perfection. Also adjustments to imbalances take a longer time in the labor market than in other markets. One of the reasons for this is that wages do not adjust immediately and automatically when there are shortages or surpluses in the labour market.

Mismatches affect everybody: employees, employers and society as a whole. If a job is filled by a worker who does not have the required skills, he might earn a lower wage than in a better match and might experience less job satisfaction. Employers suffer because a qualitative mismatch might be less productive. A less productive match implies higher labor costs, possibly leading to higher product prices and loss of market share in the product market. If qualitative mismatch is substantial in a labor market this entails a waste of human resources and a loss of productivity and this will put the economy on a lower growth path than would be the case with better matches. Lower growth translates over time into lower average incomes and less economic welfare. At the same time, one should keep in mind that when a worker or an employer decides to accept a less than perfect job match, the imperfect match is chosen rather than staying unemployed longer or rather than keeping the vacancy open. The decision is one where the worker and the employer is choosing between two 'bads': an imperfect match versus longer unemployment or an unfulfilled vacancy. If this choice is made in a rational way one could conclude that the worker and the employer prefer the imperfection of the match rather than staying unemployment and keeping the vacancy open.

Defining qualitative mismatch

It is hard to measure the extent of qualitative mismatch in a labor market at a certain point in time because mismatch can occur in many dimensions. A job requiring management skills that is occupied by a follower rather than a leader is a mismatch. The same is true for a taxi cab driver

having an academic degree in philosophy. It is impossible to measure mismatch in all dimensions. Quite a number of competences cannot be measured. Try for instance to measure the social skills of a worker, and even if you manage to measure these, how do you formulate the required level for a job? Should the job applicant score at least an eight out of ten on the ladder for social skills? Some competences can be readily measured: the level or field of education for instance. These easy to measure dimensions are often used to get a grip on the level of mismatch in a labor market.

In practical terms qualitative mismatch refers to the situation where a characteristic of the worker does not completely meet a requirement of a job. As there are many worker characteristics and many job requirements, there are many possible approaches to measure qualitative mismatch. Cedefop (2010b) provides an overview of many different definitions of qualitative mismatch, which is reproduced in Table 1.

Table 1 A collection of qualitative mismatch indicators

Type	Explanation
Overqualification	To hold a higher qualification than the current job requires.
Underqualification	To hold a lower qualification than the current job requires.
Vertical mismatch	The level of education or skills is less or more than the required level of education or skills.
Horizontal mismatch	The field of education or type of skills is inappropriate for the current job.
Overeducation	To have completed more years of education than the current job requires.
Undereducation	To have completed fewer years of education than the current job requires.
Overskilling	To be unable to fully use one's skills and abilities in the current job.
Underskilling	To lack the skills and abilities necessary to perform the current job to acceptable standards.
Skill shortage	Demand for a particular type of skill exceeds the supply of available people with that skill.
Skill surplus	The supply of people with a particular skill exceeds the demand for it.
Skill gap	The level of skills of the person employed is less than that required to perform the job adequately or the type of skill does not match the requirements of the job.
Economic skills obsolescence	Skills previously used in a job are no longer required or are less important.
Physical skills obsolescence	Physical or mental skills and abilities deteriorate due to atrophy or wear and tear.

Measuring qualitative mismatch started with the term 'overeducation' back in 1976 in Richard Freeman's seminal work on *The Overeducated American*. This made measuring mismatch in terms of education popular until this day. In later years qualitative mismatch was redefined in broader terms of qualification and skills instead of just years of education. More recently mismatch is stretched even wider in terms of discrepancies between acquired and required levels of proficiency, whereby proficiency is defined as the set of personal characteristics.

Qualitative mismatch now and in the future

From the set of qualitative mismatch indicators in Table 1 three indicators based on education will be chosen for this report: overqualification and underqualification (which are both elements of vertical mismatch) and horizontal mismatch. If the level of education of the worker is higher than required for the job, the worker is defined as being overqualified. If he has an educational degree

that is lower than required, the worker is defined as being underqualified. Over- and underqualification are two sides of the same coin: vertical mismatch. If the worker has an education in a different field than is required for the job (a medical doctor doing financial consultancy), this is called a horizontal mismatch. Chapter two deals with measuring the levels of vertical and horizontal educational mismatch for the EU27 countries and the US.

Chapter three explains why mismatch will occur in the labor market. Mismatches would not occur if a worker has perfect knowledge of all the requirements of all the jobs that are available in the labor market, and if the employer would know all the characteristics of all the workers. In this unrealistic setting of perfect information workers and jobs would be perfectly matched. Qualitative mismatch is the unavoidable consequence of imperfect information. A job searcher knows that there are job openings out there and will start approaching employers with vacancies and try to locate the perfect job for his characteristics. Searching for a job takes time and effort and the worker will often stop searching and accept a good enough job before his number one job has been found. Similarly an employer with a job opening will put out job advertisements and arrange for job interviews to select the best possible worker for his job opening. Selecting a worker takes time and effort and the employer will usually stop and hire a good enough worker before he has found the ultimate best one. Imperfect matches are inevitable in labor markets where information is lacking and search is costly.

The never ending changes in the labor market raises the question what the levels of mismatch will be in the future. Chapters 4 and 5 set out to answer those questions by building two probable scenarios for 2020. In chapter 4 the groundwork is laid for the scenario analysis in chapter 5. A crucial variable that is used to measure qualitative mismatch is *the labor market surplus indicator*. The labor market surplus indicator is simply the ratio of supply over demand. If there is more supply than demand (more workers than jobs) the indicator is larger than one. By specifying the supply of a certain skill with the demand for that skill, the extent of mismatch for that skill can be measured. For instance, supply is measured as the number of workers with a high level education offering their services in the business service sector in the EU in 2020. Labor demand is measured as the number of higher educated workers that the employers in the business service sector in the EU need in that year. If the supply of higher educated workers in the business sector in the EU is smaller than the number of jobs asking for higher educated workers, then the labor market surplus indicator is smaller than one in that particular case. The message is then that there will be not enough higher educated workers in the EU business sector in 2020. Chapter 5 will measure the labor market surplus indicator for Europe and the US in 2020. The labor market surplus indicator will cover all the different sectors and measure mismatches in terms of level and field of education and type of occupation.

2 Mismatch of workers and jobs

Qualitative mismatch can be defined in different ways. Section 2.1 explains the three qualitative mismatch indicators that will be used in this report: overqualification, underqualification and horizontal mismatch. With these indicators international comparisons can be made and time paths can be analysed. Overqualification and underqualification derive from comparing the *level* of education of the worker with the level required by the job, leading to an indicator for over- and underqualification. Horizontal mismatch derives from comparing the *field* of education that the worker has with the field required by the job.

Under- and overqualification and horizontal mismatch are always the result of a compromise made by the worker or the employer. Rather than keeping on searching for a better fitting job the worker has decided at some point that this job is good enough. The employer has made a similar decision. It could be that the job or the worker has many other interesting characteristics that compensated for the gap in type or qualification. It could be that the worker and/or the employer have agreed to the match at the bottom of a recession, hoping to move on to a better fitting job or a better skilled worker when the labor market recovers. Still, measuring the level of vertical or horizontal mismatch in the labor market is interesting because it gives an indication of the possible magnitude of the adjustment that the labor market will have to make in order to reach a perfect match for all workers and all jobs. In this sense the measurement of qualitative mismatch is comparable to measuring the size of the quantitative gap between labor supply and demand. The size of the quantitative gap is an indication of the magnitude of adjustment needed to equalize supply and demand in numerical terms.

Section 2.2 will present evidence on mismatch in terms of over- and underqualification for different national labor markets in 2009.² Section 2.3 documents mismatch in terms of horizontal mismatch. The focus of section 2.4 is on changes in mismatch levels over time.

2.1 A gallery of mismatches

There are many dimensions on which the characteristics of the worker can be matched with the requirements of a job. There is of course the level and the field of education that the job requires and that the worker has acquired at school or by training. But level and field of education are only two dimensions or rather approximations of the many different cognitive skills that might be required for a job. Besides cognitive skills a job also demands non-cognitive and ‘soft’ skills such as interpersonal skills, persistence and communication skills. These skills cannot always be objectively measured.

In the recent human resources literature the term ‘competence’ is often used to denote the combination of knowledge, skills and behaviour needed to improve the performance of a worker on a job. A perfect match in terms of competence would occur when the worker has the exact

² This is the most recent year for which, in the beginning of 2012, data are available for all EU countries and the US.

right combination of knowledge, skills and behaviour to get maximum performance on a job. What is interesting about the term competence is that it stresses that the perfect match arises from a *combination* of characteristics. A worker has many characteristics. Some of these will weaken and others will strengthen his performance on-the-job. Sometimes strong characteristics will compensate for weak ones, but not always. Also workers will grow into the job, over time. Or the specific requirements of the job will over time be adjusted to the competences held by the worker. These are crucial considerations to keep in mind when (in the rest of this chapter) one-dimensional indicators will be introduced to gauge the size of mismatch in a labor markets. The one-dimensional indicators are introduced because they are simple, straightforward and easy to measure.

The main reason why qualitative mismatch indicators defined in terms of education are still popular today is that information on level and field of education acquired by the worker and required by the job is the only one readily available for a large set of countries and for large enough periods of time. The information on education is based on international comparable definitions and is measured consistently over time.

Restricting the measurement of qualitative mismatch to formal education does not imply that competences or skills required for the job can not be acquired through formal and informal training while working and by learning-on-the-job. Unfortunately, the educational field and level acquired through formal and informal training while working and through learning-by-doing are not well measured. Some national statistical agencies have made a valiant attempt of measuring and labelling the results of training while working but these are hardly ever comparable across countries. Formal education acquired in school before entering the labor market is the only relevant variable (defined consistently over countries and over time) that can be used to measure qualitative mismatch.

2.2 Vertical mismatch: over- and underqualification

If a mechanical engineer with a university degree works in a garage as a car mechanic he is clearly working beneath his educational level. This is defined as overqualification. If a business economist with a higher vocational degree has a job that requires an academic degree, he is working above his education level and this will be labelled as underqualification. Over- and underqualification occurs when the level of education of the worker is higher or lower than the level required for the job. They are both instances of vertical mismatch.

Vertical mismatch is measured in this report by contrasting the skill level that belongs to a job with the skill level that belongs to the educational qualification of the worker. The best way to explain the measurement method is by looking at Table 2. Each job corresponds with an occupational group. The left-hand side of Table 2 has occupational groups classified using the International Standard Classification of Occupation (ISCO) developed by the International Labor Organization (ILO). Each worker has a level of education. The right hand side of Table 2 has educational levels measured using the International Standard Classification of Education (ISCED), developed by UNESCO. Both classification systems are described in more detail in Appendix A.

In the middle column of Table 2 a skill level is assigned to the occupational groups and to the educational levels. This assignment follows as close as possible the ILO recommendations.³ Occupational groups are assigned to skill levels 1 (lowest) to 4 (highest).⁴ These are the skill levels required for the job. At the same time and in a similar way educational levels are translated into these same skill levels. These are the skill levels acquired by the worker.

The definition of vertical mismatch now becomes obvious. There is no vertical mismatch if the job has the same skill level as the educational qualification of the worker. For instance jobs that require technicians and associate professionals show no vertical mismatch if the worker has an educational degree at the level of the first stage of tertiary education. In that case occupational group and educational level correspond to the same skill level 3. There will be overqualification if the worker on that job has an educational degree corresponding to skill level 4 and underqualification if he has an educational level corresponding to skill level 1 or 2.

Table 2 How required skill level is matched to highest completed educational degree

ISCO major occupational Group	ISCO skill level	ISCED education level
2 Professionals	4	6 Second stage of tertiary education
		5a First stage of tertiary education, 1st degree
3 Technicians and Associate Professionals	3	5b First stage of tertiary education
4 Clerical Support Workers	2	4 Post-secondary, non-tertiary education
5 Services and Sales Workers		3 Upper secondary level of education
6 Skilled Agricultural Workers		2 Lower secondary level of education
7 Craft and Related Trades Workers		
8 Plant and Machine Operators		
9 Elementary Occupations	1	1 Primary level of education

Source: ILO (2007) Meeting of Experts on Labour Statistics – Report

Armed with this measurement method it is now possible to establish how extensive vertical mismatch is in different countries and how much over- and underqualification occurs.

Figure 1 has the share of workers in various countries in 2009 that are under- or overqualified. The figure is organised in increasing order of vertical mismatch. Vertical mismatch is smallest in Romania and highest in Belgium. On average more than 60 percent of the workers and jobs in the US and the EU27 are well matched. Overqualification is a bit more prominent in the US than in the EU (23 versus 18 percent) while underqualification is less prominent (16 versus 19 percent).

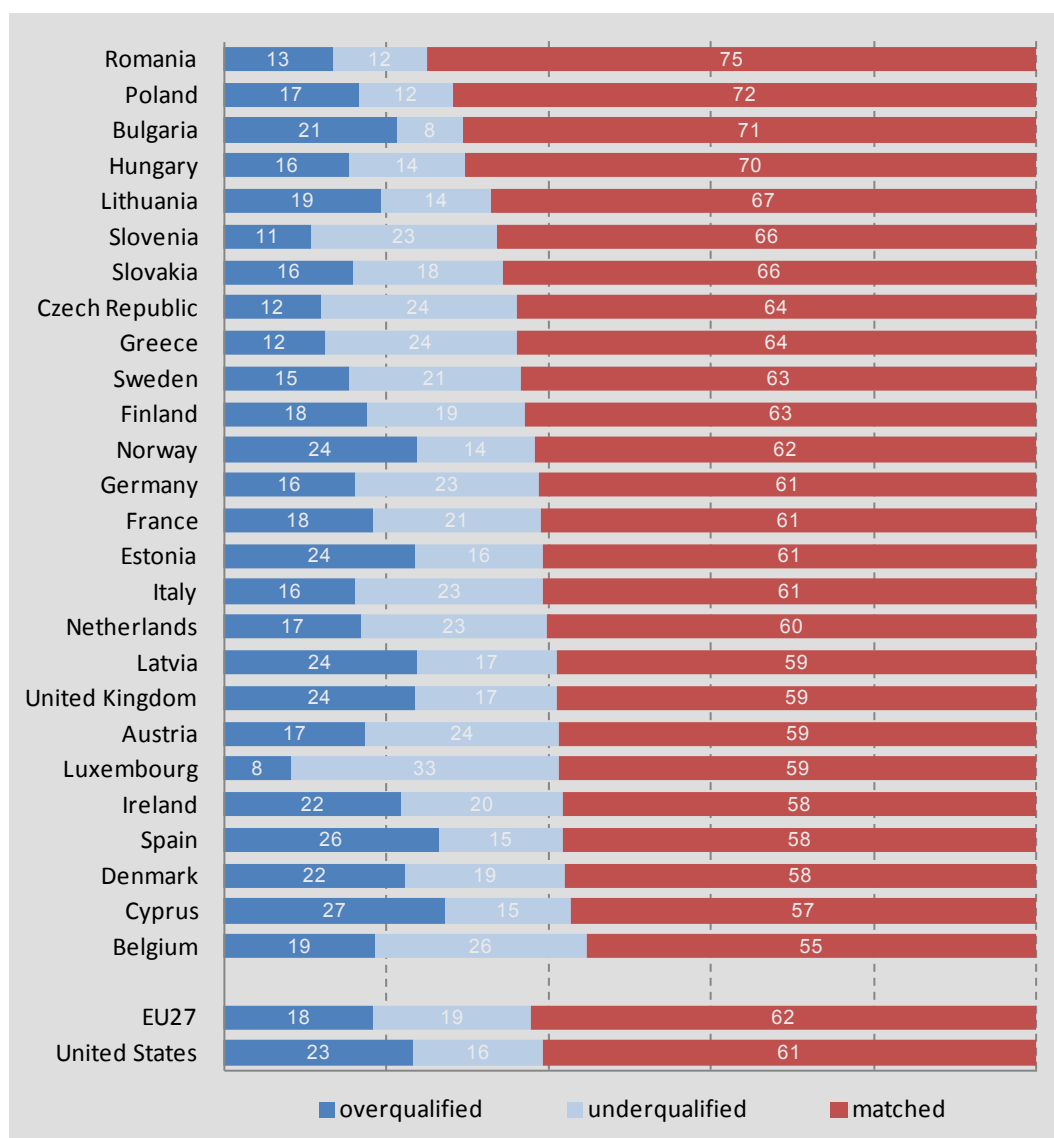
Looking across countries it is remarkably that Eastern European labor markets have more good matches than the other countries of the EU. In those Eastern European countries roughly two thirds of the workers have a job at the skill level that fits their educational qualification. A possible explanation may be that this is still the result of their communist past with lots of

³ See ILO (2007), Meeting of Experts on Labour Statistics – Report.

⁴ Military occupations are left out of the analysis, managers are assigned to either skill level 2 or skill level 4 based on their detailed occupation code.

economic planning of industrial development and investment in education that conforms with those plans. This is just a hypothesis and the data do not allow to test its validity.

Figure 1 Vertical mismatch, per country (2009)



Source: SEO calculations, based on Eurostat & SIPP

2.3 Horizontal mismatch

A different type of mismatch occurs when the worker has a field of education that is not the same as the field asked for in the job. As an extreme example, think of having many vacancies for nurses and having only unemployed construction workers. If differences are not too extensive, additional training can bridge the mismatch.

Research on horizontal mismatch is scarce, for two reasons. Not many datasets allow for the measurement of horizontal mismatch. And the definition of a horizontal mismatch is a balancing act. While measuring horizontal mismatch one can err in two directions. One can either define

the field of education very narrowly and in that case the field of education of the worker will very often not correspond with the field asked for in the job. Take for instance a political scientist being responsible for the stock exchange pages of a financial newspaper. If one would narrowly define the field of education of the worker (political science), that would not map with a narrowly defined field of the field of education required (financial economics). In that case one would err in the direction of measuring too high a level of horizontal mismatch. On the other hand one can also define the field of education in such a general and broad way (all human and social sciences) that it will almost always cover the field asked for in the job. In that case one would err in the direction of underestimating the level of horizontal mismatch. This report has tried to find a balance between erring in either direction. If the measurement in this report still errs, it is in the direction of underestimating the level of horizontal mismatch. For example: a worker with a qualification in science is regarded as a perfect match for science job types, but also as a sufficient match for engineering jobs. A political scientist educated in the field ‘social sciences, law & economics’ is considered a perfect match in an economic research job and in a legal job at a multinational business. Also a law school graduate with the same broad field of study ‘social sciences, law & economics’ would be considered a good horizontal match in the same job types. Even ending up as a teacher would not count as a horizontal mismatch. Should he be working in a cultural occupation, then that would count as a horizontal mismatch.

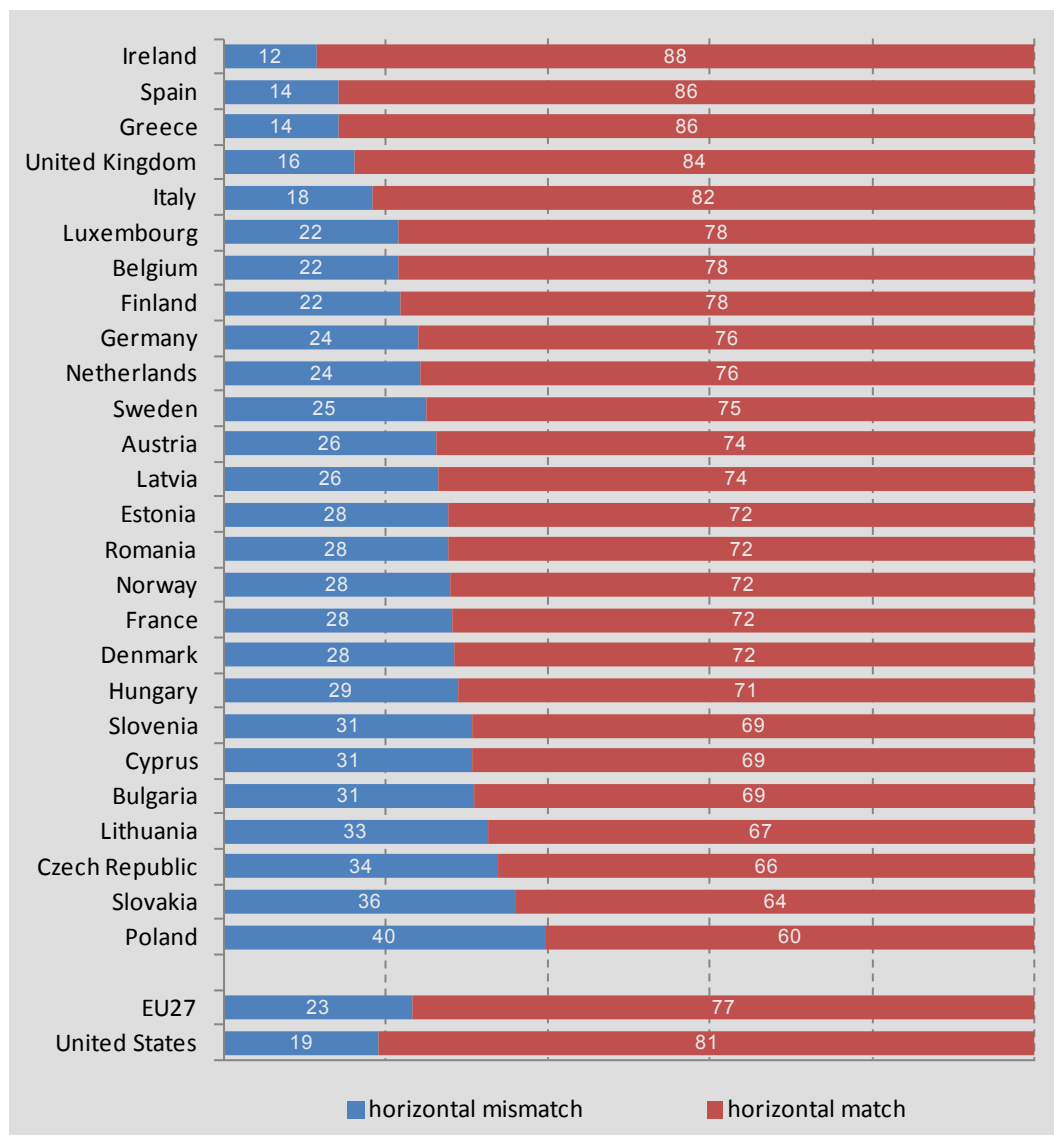
To measure horizontal mismatch all types of education were classified into ten broad fields of study such as for instance ‘humanities’, ‘engineering’ and ‘health’. All educational fields and job categories were made comparable between the EU countries and the US. Jobs were also clustered. Eleven broad job categories are distinguished such as for instance ‘engineering’, ‘production’ and ‘health’. Next it was established empirically how frequent each of the fields of study is observed in each of the job categories. Obviously the educational field ‘health’ is observed very often in the job category ‘health’. The same is true for the educational field ‘engineering’ which is most often seen in the job category characterised as ‘engineering’. But engineering graduates (at all educational levels) are also frequently observed in the job categories ‘science’ and ‘production’. If certain combinations of educational field and job categories occur with relatively high frequency, and at the same time made intuitive sense, they are classified as a proper horizontal match. Other combinations that do not occur very frequent such as workers with an agricultural degree working in a cultural type of job are classified as a horizontal mismatch⁵⁶.

How well do countries succeed in matching the educational fields acquired by the workers with the field of education most often required on-the-job? Figure 2 shows the level of horizontal mismatch in increasing order. Ireland has the lowest level of horizontal mismatch, Poland has the highest. The United States has a lower level than the EU27: 19 compared to 23 percent. In the figure Anglosaxon countries (Ireland, UK, US) and Mediterranean countries (Spain, Greece and Italy) are doing rather well in terms of small horizontal mismatch. In complete contrast with the previous figure where they had the lowest levels of vertical mismatch, Eastern European countries have the highest levels of horizontal mismatch.

⁵ See Appendix A.4 for a detailed description of the classification and measurement procedure .

⁶ Managers were left out of the analysis as they can come from all fields of education.

Figure 2 Horizontal mismatch, per country (2009)

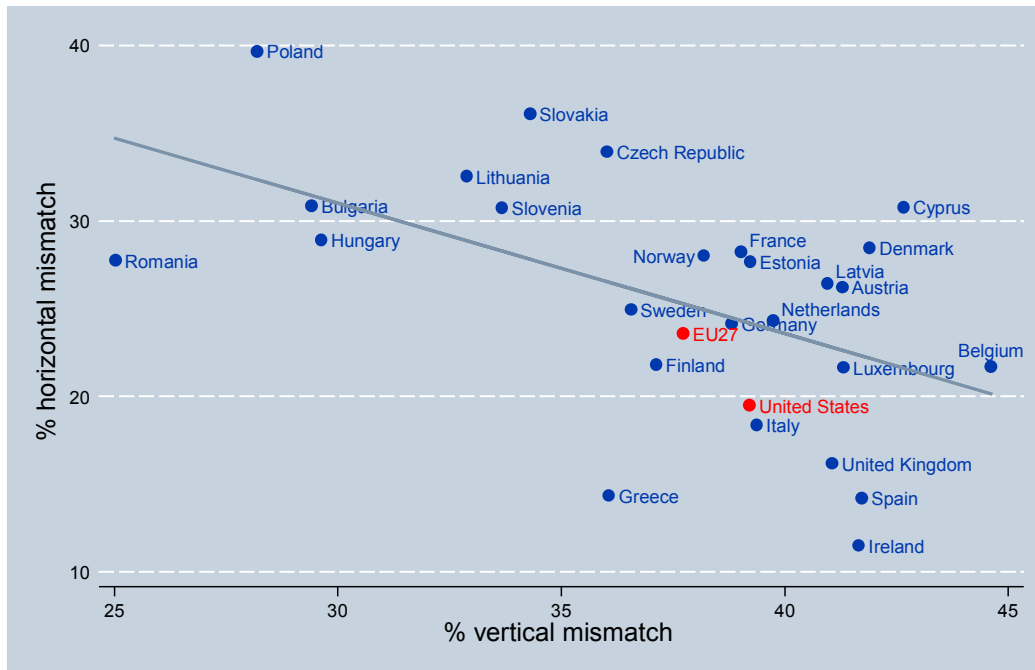


Source: SEO calculations, based on Eurostat & SIPP

Could it be that there is a negative correlation between horizontal and vertical mismatch across countries? Figure 3 throws some light on this question, suggesting that countries with higher horizontal mismatch often have lower vertical mismatch and vice versa.

Two clusters of countries can be seen at the top left and bottom right corner of Figure 3. There is a cluster of Eastern European countries in the upper left corner and a cluster of Mediterranean and Anglosaxon countries at the bottom right corner. This would suggest that Eastern European countries are good in matching jobs to employees with the right educational level, but are less successful in matching jobs to workers with the right field of education. The opposite holds for the Mediterranean and Anglosaxon countries.

Figure 3 When horizontal mismatch is high, vertical mismatch is low and vice versa



Source: SEO calculations, based on Eurostat & SIPP

In both cases, available human resources are not optimally matched. To improve job matching Eastern Europe must ponder the question why so many people are working in jobs that would ideally be filled by workers with different field of education. While the Mediterranean and Anglosaxon countries must wonder why so many people are working in jobs that would better be filled by workers with a higher or lower level. It is hard to tell whether one situation is worse than the other. A mismatch is bad for an employer because the imperfectly matched worker might have a lower productivity than a perfectly matched worker. It is hard to tell without looking into the details of the match whether vertical mismatch causes more productivity loss than horizontal mismatch. A mismatch is bad for the worker when it gives him less job satisfaction than a perfectly matched job. What can be however is that the larger the difference in productivity or job satisfaction between an imperfect and a perfect match, the larger the incentive for both the employer and the worker to look for a better match.

2.4 Mismatch over time in Europe

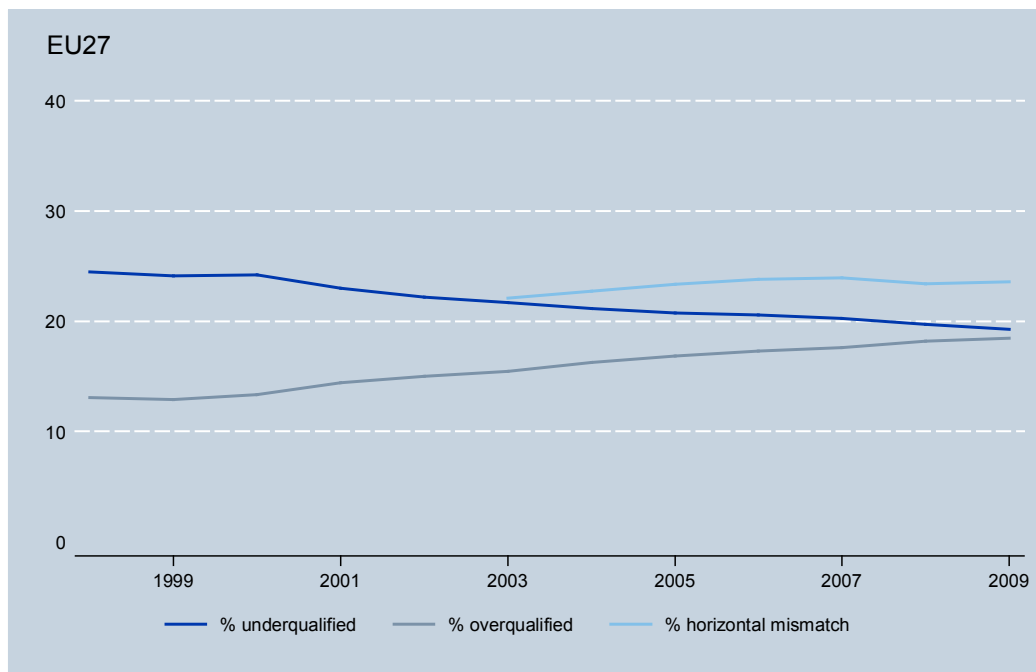
For most European countries, detailed yearly information on over- and underqualification is available starting in 1999 and for horizontal mismatch from 2003 onwards⁷. Unfortunately, a similar time series is not available for the US. Figure 4 plots the timepath of under- and overqualification and of horizontal mismatch. A striking result is that over time underqualification has dropped some five percentage points over the last decade, whereas overqualification has risen in a roughly similar manner⁸. A possible explanation could be the

⁷ Information can be obtained on request by the authors.

⁸ EU time series are corrected for missing information for certain years in some countries.

upskilling of the labor force whereby the level of education of workers rises faster than the level required for most jobs. This is an intriguing result that will be revisited in Chapter 5 where future scenarios are discussed.

Figure 4 EU27: Underqualification has dropped while overqualification has risen



Source: SEO calculations, based on Eurostat & SIPP.

Even though the average European trend is clear, there are important differences between the different areas of Europe. To expand on internal European differences the EU countries are subdivided according to geographic location and kind of social and economic institutions. An important characteristic of Anglosaxon countries is that their economy is mostly market driven. In Scandinavian countries and in Western European Rhineland social dialogue and social consensus are crucial. Western European Francophone and Mediterranean countries rely more on legal institutions. The main overlapping characteristic of Eastern European countries is the recent change of their economic system from a planned economy to an emerging market economy. Table 3 summarises the classification.

Table 3 Clustering of EU countries, based on location and institutional framework⁹

cluster name	market regulation	Countries
Anglosaxon	market driven	UK, Ireland
Scandinavia	social dialogue	Denmark, Finland, Sweden, Norway
West EU-Rhineland	social dialogue	Austria, Germany, Netherlands
West EU-Francophone	legislation driven	Belgium, France, Luxemburg
Mediterranean	legislation driven	Spain, Greece, Italy, Portugal
Eastern Europe	emerging markets	Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Slovenia, Slovakia, Bulgaria, Romania

Analyzing the trend in vertical and horizontal mismatch indicators for each of these clusters reveals the following:

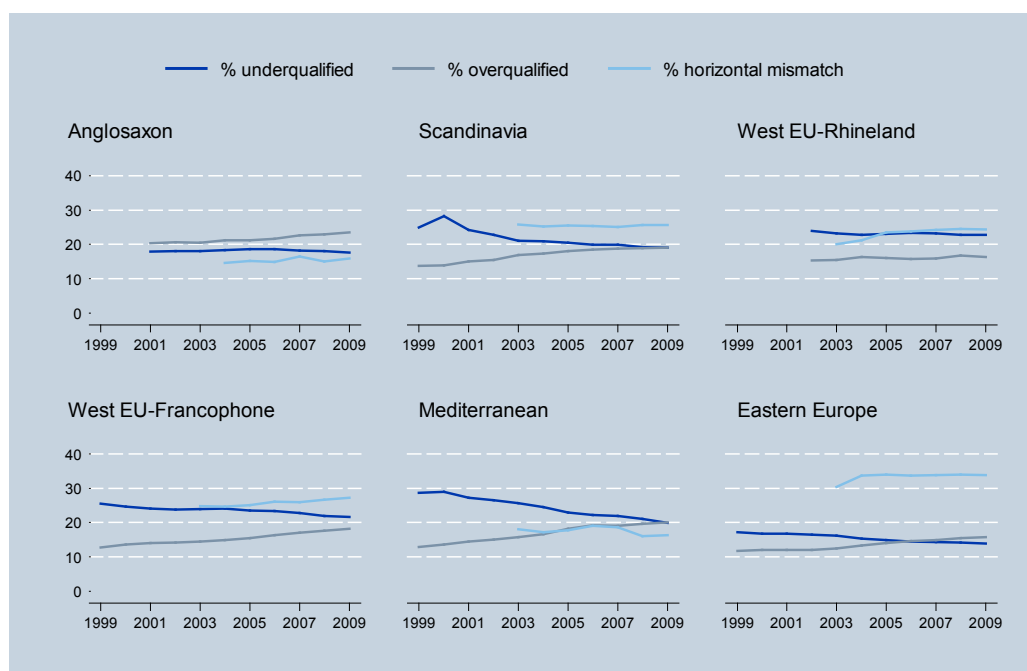
- the overall EU trend of rising overqualification and declining underqualification is not seen in Western Europe-Rhineland, and shows up only recently in the Anglosaxon countries;
- the trend of rising overqualification and declining underqualification is especially strong in Mediterranean countries: in the past decade underqualification dropped 10 percentage points and overqualification rose 8 percentage points;
- Scandinavian and Eastern European countries show weak patterns of rising overqualification and declining underqualification;
- In all clusters horizontal mismatch remains stable over time.

The average picture for the EU in Figure 4 is strongly influenced by the Mediterranean experience which is only weakly followed in Scandinavian and Eastern European countries and hardly or even not at all in the Anglosaxon countries and Western Rhineland¹⁰. These different patterns for groups of countries suggest the following explanation for increasing overqualification over time. Unemployment in general and youth unemployment in particular has been constantly high in Southern European countries during the last decade. In any case higher than in the Northern European countries. When young unemployed job searchers after searching for a long time do find a job in a bad labor market they often have to accept lower level jobs that are clearly below their educational qualification. As (youth) unemployment remains high for a long time more and more young workers are forced into overqualification and the labour market will show increasing levels of overqualification. Countries with consistently lower levels of (youth) unemployment such as the Western Europe – Rhineland countries do not exhibit increasing overqualification. If the labor market improves young workers in overqualified jobs will encounter better job opportunities and leave the jobs in which they are overqualified. If however the labor market does not recover in the future young workers get stuck into low level job and do not get a chance to make productive use of their education.

⁹ The clustering of countries is copied from the one used in the Ciett publication ‘Adapting to change’ (see www.ciett.org). For some countries the clustering is more arbitrary than for others: for example Belgium has also many aspects of social dialogue.

¹⁰ Mismatch not only differs between countries, or group of countries but as chapter 5 will make clear, even within the same country mismatch can differ across sectors.

Figure 5 Underqualification, overqualification & horizontal mismatch, by cluster



Source: SEO calculations, based on Eurostat & SIPP.

2.5 Lessons learned

Many measures of qualitative mismatches are possible. Overqualification, underqualification and horizontal mismatch are used most often. Overqualification implies that the level of education that the worker brings to the job is higher than required. The reverse is true for underqualification. Horizontal mismatch occurs when the field of education in no way covers the field asked for in the job. The main reason why qualitative mismatch indicators defined in terms of education are most popular is that information on level and field of education acquired by the worker and required by the job is the only one readily available for a large set of countries and for large enough periods of time. The information on education is based on international comparable definitions and is measured consistently over time. It is interesting to compare differences in over and underqualification and horizontal mismatch across countries as it gives an indication at least in the dimension of education of the possible magnitude of the adjustment that the national labor market will have to make in order to reach a perfect match for all workers and all jobs.

Levels of vertical and horizontal educational mismatch are measured for the EU27 countries and the US. It is found that there is an average 38 percent vertical mismatch in the European countries. Of the total number of matches on the European labor markets around 18 percent consists of matches where the worker has a higher educational degree than the job requires (overqualification) and in around 19 percent of the cases the worker has a lower degree (underqualification). The percentages for the US labor market are 23 percent of the matches with overqualification and 16 percent with underqualification. This adds up to 39 percent vertical mismatch. Or to look at the results from the other angle: roughly 3 out of 5 jobs is matched correctly in terms of level of education in both Europe and the US.

In around 23 percent of the matches in the European labor market workers have an educational field that is clearly different from the educational field required by the job (horizontal mismatch). In the US horizontal mismatch holds for 19 percent of the jobs. To put it differently: roughly 4 out of 5 jobs are correctly matched in terms of education field in Europe and the US. In the last decade the percentage underqualification has declined whereas the percentage overqualification has increased, on average for Europe. Total vertical mismatch stayed roughly the same over time, but the composition changed. Horizontal mismatch has more or less stayed at the same level over time. Two lessons can be learned from the empirical results in chapter two. First that qualitative mismatch is sizeable and second that the level of vertical mismatch changes over time.

A striking result is that over time underqualification has dropped some five percentage points over the last decade in Europe, whereas overqualification has risen in a roughly similar manner. A possible explanation could be the upskilling of the labor force whereby the level of education of workers rises faster than the level required for most jobs. Even though the average European trend is clear, there are important differences within Europe. Digging deeper it is found that the trend of rising overqualification and declining underqualification is especially strong in Southern European countries and less so in Northern countries. This suggests another explanation. Long periods of unemployment especially for young people will force them into accepting jobs that are below their qualifications. Rising levels of overqualification could be the result of more and more young people getting stuck into such a situation. Normally when the economy turns around and starts growing again, the labor market will improve and new job openings will become more abundant giving workers in overqualified jobs an opportunity to change to a new job that better fits their qualification. After a long enough period of growth, overqualification should reduce. If the economy does not grow, overqualification will not go down and only increase over time. The Southern European countries have experienced much worse labor markets for much longer times than the Northern European countries in the last decade.

An important qualifier of the empirical results in this chapter is that our measurements are at the level of a country or a group of countries. Average results for the national labour markets might hide totally different situations in the underlying regional or sectoral labor markets. Even if overeducation is on the increase on average at the national level, it might still be hard for an employer to find a higher educated worker in his local labor market.

3 Causes and consequences of qualitative mismatch¹¹

Measuring the amount of under- or overqualification as was done in the previous chapter, is just one way to get an impression of how much mismatch there is in the labor market. Perfectly matching the ‘right person’ with the ‘right job’ in the labor market is a taxing standard. If a worker would know all the jobs there are in labor market he would go directly to the one that is best for him. If the employer would know all the workers that are available for his vacancy he would pick the best one at a drop of the hat. But perfect information is never to be had. Workers and employers have to put in time and effort to find the best job. Matches will come about that are not perfect. Workers and employers will make compromises. This will motivate some workers to move jobs and employers to change workers. The lack of information creates a role for labour market intermediaries, such as public and private employment services to help in the matching process. The labor market might get better over time, in the sense that bad matches are replaced by better ones. That is a never ending process as labor demand and supply change all the time.

This chapter will discuss the consequences of this unavoidable imperfection for the functioning of the labor market and explain how workers and employers deal with it. The next chapters will present scenarios for future labor markets in which imperfect matches play a central role.

3.1 Paradise lost

Start with an unemployed person searching for a job. He will usually ask his friends and relatives whether they know about job openings, he will look at job advertisements in newspapers and at jobboards and maybe go to local employment agencies to check for information on job openings. Having found a promising job opening he will hand in his cv to the employer and if lucky get invited for a job interview and if even more lucky get a job offer. Often he will have to keep on asking around, inquiring, phoning and going for more job interviews. Searching for a new job requires effort, time and patience.

If at some point in this search process an employer offers him a job, he has to decide whether to accept this offer or keep on searching. He will keep on searching if he expects that there are better job openings available out there in the labor market that he has not seen yet. Also he must be willing to put in the extra effort and time to keep looking for that better job. At some point he will accept the job offer that is on the table and his search will come to an end.

What is important to realise is that there is no certainty that the job he accepts is the best possible job that is available for him on the labor market. He can never be sure because he will not have seen or inquired about all available job openings. At some point the job searcher will decide that

¹¹ This chapter is to a large extent based on the forthcoming publication “Qualitative Mismatches” written by Michael Sattinger to be published by Now Publishers Inc in Boston/Delft. Publication is expected in the second half of 2012. In the period 2011-2012 Michael Sattinger is visiting professor at the Randstad chair on the *Labour Market for Flexible Work and Private Employment Services*.

the possible benefit of finding a better job does not outweigh any longer the extra time and effort to keep searching. The job offer he has just gotten will have to do. Of course a really lucky searcher might have stumbled by accident on the ultimate job, but he will more often end up not with the best job, but with a good enough job. Similar results whereby the searcher is satisfied with good enough rather than the ultimate best, happen in all markets where search is essential. Obvious examples are finding a house or a place to eat in a strange city. It also happens in other parts of life: think about finding a partner¹².

Contrast this more or less unsatisfactory result of not having found the number one best job with the obviously unrealistic situation whereby the job searcher would without any cost or effort know about all the available job openings and would have enough detailed information so that he can without any hesitation pick the top one. In that case the labor market would always be working perfect. It is unrealistic to expect such a perfect result to be achieved in the real labor market. In a real labor market information about job openings is not freely available. It is possible to get more information about job openings by putting in effort and time, but it is not realistic to keep on going until information about all openings is known. A searcher does not have the time or the stamina. By the time he has contacted all job openings some might already have disappeared and new ones might have come about.

Neither is it worth the effort economically speaking. At some time in the search process the point is reached that it is not 'worth' it to keep on searching. The cost is larger than the expected benefit of searching for yet another job opening.

Inescapable imperfect information

The main villain in this story is 'lack of information'. It is the lack of information that necessitates the search process and that requires the searcher to spend time and effort to discover what is out there. It is lack of information that results in labor markets not working perfect, not being able to allocate each job searcher to the best available job. Imperfect information puts people in jobs that are at best satisfactory but not optimal. Imperfect information is an existential characteristic of the labor market (as it is of many aspects of life). The information problem in the labor market is even greater than has been suggested so far. Going to a job interview and talking to the employer provides more and better information on-the-job and its characteristics than what is clear from reading the text of the job advertisement. But to find out what a job is really like, one has to experience the job, one has to actually work on-the-job. Only then will it be possible to know what a job entails, what is hard or easy about it, what the work environment feels like, who the other employees are and what kind of person your boss is. A job can be worse but also better than expected when the worker accepted the job offer. The worker can be better or worse than the employer expected at the start. There is information about a job and a worker that can only be revealed through experience. Searching for the right person or the right job is not enough; only also has to experience the job before one really knows what the match is like.

In markets where there is imperfect information there is an incentive for intermediaries to help providing information. Housing markets have real estate agents, financial markets have financial

¹² Dale T. Mortensen (1988), Matching: Finding a Partner for Life or Otherwise, *The American Journal of Sociology*, vol. 94 (supplement), pp. 215-240.

intermediaries and labor markets have newspapers with personnel advertisements, jobboards and private and public employment agencies. As internet websites have become popular job openings are much more accessible and more searchable than the advertisements in a newspaper. Articles have been written about ‘wiring the labor market’¹³ and the positive effects of websites on the search effort of job searcher. All that is true. But that still does not mean that the internet has created perfect information. There is only so much that can be written about a job opening on a website. To really know what the characteristics of a job are, one still has to go to a job interview, talk with the employer and ask whether certain wishes you have (salary, part time work, travel costs) can be granted. While the internet probably gives you better information on job openings it does not necessary reduce search effort. Neither does it diminish the need to experience the job to know what it is really like.

Public and private employment services are essential intermediaries between workers and jobs. They have information on both sides of the labor markets. They know about employers, their business and their vacancies and they know about workers and job searchers and their characteristics. They can obviously play an important role in reducing information imperfection and search cost in the labor market. In a large number of European countries public and private employment services cooperate and work together in matching demand and supply in the labor market¹⁴.

Meanwhile on the employer’s side

There is a similar story about information imperfection on the employer’s side. Start with an employer who has a vacancy and is looking for a worker to fill that vacancy. The employer will advertise the vacancy on his website and jobboards, pay for a personnel advertisement in a newspaper or trade journal, enquire at public employment services and hire private employment agencies, ask his relations and look into his network. Job searchers will write letters of application. He or his personnel manager will make a selection from these letters and invite the most promising candidates for a job interview. Job talks will be held, tests will be applied and a decision has to be taken on whether to select somebody and if so who to select. Again whether to select depends on balancing the costs to keep on searching for a more ideal worker than is in the present group of job applicants and the probability that one will find a better candidate. There are direct cost to keep on searching such as the cost of a personnel advertisement and the cost of organizing job interviews and tests. There are indirect costs of production loss of keeping the vacancy open.

If an employer with a job vacancy would have perfect information about the right person for his job opening he would phone him the same evening and make him an offer she could not refuse. In the real labor market the employer, like the job searcher, has imperfect information. Searching for the ideal worker to fulfil the vacancy is a time consuming costly process and it will usually stop before the ideal worker is found. It will stop when a good enough person has been found. It will stop when the extra costs of looking further is not worth the expected benefits of finding a much better job applicant. In the real labor market there is an inevitable lack of information on

¹³ David H. Autor (2001), Wiring the Labor Market, *Journal of Economic Perspectives*, 15(1), p. 25-40.

¹⁴ Eurociett provides up to date information on cooperation between public and private employment services in many European countries.

where the ideal job candidate is to be found and the employer will be happy with somebody who is maybe not perfect but will do. Again the labor market is not functioning in a perfect way. Except for a very lucky coincidence an employer will not hire the ultimate best worker for the vacancy.

Also, an employer will only know for sure whether a worker really fits the job, once he has hired him and has experienced how he is performing on-the-job, how he is dealing with the specific demands of the job, how he is dealing with the team that surrounds him, how satisfied and productive he is on-the-job. He might turn out better than expected, though, he might also be a disappointment.

Imperfection means mismatch

In the real labor market with imperfect information and with non negligible search cost a job searcher will accept a good enough job before he has found the best possible job and an employer will hire a good enough worker before he has met the best possible worker. The result is obviously a match that is not perfect. There is most likely a better worker for this vacancy and a better job for this job searcher out there in the labor market. Imperfect matches have at least three important consequences.

First, compare an imperfect match whereby a 'good enough worker' occupies a 'good enough job' with a perfect match whereby the 'right worker is on the 'right job'. From the point of view of the employer, the perfectly right worker is the most productive worker on that job. In any case more productive than the good enough worker. From the point of view of the worker the perfect job will give him the highest job satisfaction. In any case more satisfaction than this good enough job. In the imperfect labor market full of imperfect matches the productivity loss per match adds up to a total productivity loss for society. The loss of job satisfaction per match adds up to a loss of welfare for the working population.

It is interesting to compare this unsatisfactory result in terms of productivity loss and welfare loss in real world labor markets with Adam Smith's conjecture of the working of the invisible hand in a market economy. He speculated that in a market whereby each participant would take decisions so as to maximise his own personal welfare, there would be an invisible hand that would be working in such a way that this would lead to the highest possible social welfare. The invisible hand does not work in a market with imperfect information. A job searcher stops searching when his personal costs of searching no longer compensate for the possible benefit of finding an even better job. An employer with a vacancy also stops searching when the cost to his business of searching for an even better worker outweighs the possible benefit. Both the job searcher and the employer take a rational decision that maximise their own welfare or profit. Yet the invisible hand does not work. The outcome of their private decision is that society is less productive and social welfare is lower than it could be. The invisible hand does not work in markets with imperfect information. In economics it is said that imperfect information makes it impossible to reach the first best situation. What is possible is a second best outcome. It is hard to tell how far apart the first and second best situation are in terms of productivity and welfare loss. What is important to realise is that better information about workers and job openings and job-to-job mobility can bring second closer to first best. Labor market intermediaries such as public and private employment service can help in closing this gap.

Second, when using the terms ‘good enough job’ and ‘good enough worker’ what is meant is that a compromise is made. A worker with a higher education in Old Greek is looking for a job that fits the level and field of his education. After searching a long time he accepts a job as a teacher that does not require higher education or he accepts a job in an insurance firm that does require an academic degree but not necessarily in Old Greek. Similarly on the employer’s side not being able to find the perfect worker, the employer might hire somebody that is over- or underqualified or who does not really have the right field of education. In this way qualitative mismatches come about. In the previous chapter the number of qualitative mismatches in terms of over- and underqualification and in terms of horizontal mismatch was measured for a large number of countries. Given the certainty of mismatches occurring in a labor market with inevitable imperfect information it is not really surprising that there is a large number of imperfect matches. Even those matches whereby the level of education that is required for the job is equal to the level that the worker has acquired, might not be perfect matches. There are many dimensions in any match and even if the match is right in the educational level, it still can be off in another dimension. And even if the match is right in measurable variables (such as education level or type) there still are hard to measure or unmeasurable requirements (such as problem solving skills and social skills) that might also be crucial for a perfect match.

Table 4 Less than half the jobs last 10 years and more

	Percentage distribution of job duration				Average years of tenure
	< 1 year	1 to < 3 years	3 to < 10 years	10 years and over	
Australia	20	24	33	23	n.a.
Austria	14	11	33	42	11.2
Belgium	11	13	30	46	12.2
Canada	18	20	31	31	n.a.
Czech Republic	11	12	36	42	10.3
Denmark	19	19	34	28	8.3
Finland	18	13	30	40	11.0
France	13	10	32	44	11.8
Germany	14	13	29	44	11.4
Hungary	13	13	36	38	9.8
Iceland	18	14	37	31	8.8
Ireland	11	12	40	37	10.6
Italy	10	10	31	48	12.7
Luxembourg	11	14	33	42	11.1
Mexico	21	14	32	33	n.a.
Netherlands	10	14	35	41	11.1
Norway	14	18	33	35	9.8
Poland	14	14	31	41	10.9
Portugal	12	12	28	48	13.1
Spain	16	12	34	39	10.6
Switzerland	16	15	34	35	9.7
United Kingdom	14	15	39	32	9.3
United States*	19			35	
Average	14	14	33	38	10.0

Source: OECD labour market data. Calculations by SEO. Data are for 2010. Australian data are for 2009.

* These numbers are taken from H.S. Farber (1999), *Mobility and Stability: The Dynamics of Job Change in the Labor Markets*, *Handbook of Labor Economics*, vol 3B, chapter 37. North Holland Amsterdam

Third, the present match is no longer the match for life. Table 4 shows that most workers have a job that has lasted less than 10 years. Average job duration is 10 years. There are however substantial cross country differences. Job duration of 10 years and more occur less often in flexible labor markets such as in Australia, Denmark, Iceland, and the United Kingdom. Labor market with a lot of older workers such as Belgium, Germany, France and the Netherlands tend to have a higher percentage of workers in the over 10 years category. Italy and Portugal have the highest percentage of workers with long job durations. As was argued earlier a worker will only know what a job is really like after experiencing being on-the-job. An employer will only know what a worker is really like if he has been on-the-job. If the experience is disappointing the match can be undone. It is always possible for a worker to move on and find another job if he is not really happy with this job or if a better opportunity presents itself at another firm. Similarly an employer can fire his worker if he is not really satisfied with his performance. Usually when a new worker is hired he does not get a permanent contract right away. He gets a temporary contract or a string of temporary contracts before a tenure decision is taken. In this way a trial period is build in to allow for experiencing with a new worker performing on-the-job. So matches or not for ever and workers can move on to another job and employers can lay off underperforming workers and hire somebody else.

Table 5 Worker flows, by country

	Hirings	Seperations
Austria	13,6	13,4
Belgium	16,6	16,6
Czech Republic	14,9	14,6
Denmark	24,9	25,1
Finland	23,6	22,7
France	18,7	18,0
Germany	16,7	17,3
Greece	13,9	12,5
Hungary	15,2	13,4
Ireland	22,1	19,5
Italy	15,3	13,2
Netherlands*	13,8	10,0
Norway	16,5	17,9
Poland	21,6	21,3
Portugal	17,3	16,4
Slovakia	16,8	15,5
Slovenia	15,1	14,3
Spain	25,2	21,5
Sweden	18,3	17,8
Switzerland	17,5	17,1
Turkey	32,5	27,2
United Kingdom	22,4	22,9
United States	24,6	25,1

Source: OECD (2009), table 8, p. 26

* These numbers are taken from P. Gautier e.a. (1999), Separations at the Firm Level, in *The Creation and Analysis of Employer-Employee Matched Data*, Haltiwanger e. a. (eds.) North Holland: Amsterdam.

Table 5 is reproduced from a recent OECD (2009) study¹⁵ makes clear that worker hirings (reflecting movements of workers into jobs) and worker separations (reflecting movement of workers out of jobs) can be very substantial in some countries. Across all countries between 13 and 33 percent of workers are hired at least once by an employer and between 13 and 27 of the workers separates at least once from their employer in a year. Countries with a large informal sector (Turkey) or with large shares of temporary workers (Finland, Poland, Spain) or relatively flexible labour markets (Denmark, Ireland, UK and US) have larger percentages of hirings and separations than other countries (such as Austria, Czech Republic and Greece).

The million dollar question now is whether job mobility decisions by workers and turnover decisions by employers change imperfect matches into perfect matches or at least into less imperfect matches? There is some empirical evidence that voluntary job mobility¹⁶ takes a worker from a job in which he is less paid to job that pays better (maybe because he is more productive on this new job). Or it takes him from a job in which he is unhappy to a job that makes him more satisfied. There is other empirical work suggesting that job creation and job destruction and job mobility is an important determinant of growth of labor productivity in an economy as

¹⁵ Andrea Bassanini & Pascal Marianna (2009), Looking Inside the Perpetual-Motion Machine: Job and Worker Flows in OECD Countries, OECD Social, Employment and Migration Working Papers No. 95, OECD:Paris.

¹⁶ Voluntary job mobility means that a worker chooses freely to change jobs. Inivoluntary job mobility occurs when a worker has to change jobs because he has been laid off or expects to be laid off.

workers in general move from a less productive job to a more productive job. Labour productivity increases in an economy due to the growth of productivity within firms and due to job mobility between firms. Labour productivity growth through job mobility comes about because workers move from less productive destroyed jobs to more productive newly created jobs and move from non-growing less productive firms to growing more productive firms. It is found in some studies that labour productivity growth due to job mobility is as large or even larger than productivity growth within firms¹⁷. In this sense one could say that the labor market is always correcting itself, moving to better matches.

However, one should not exaggerate this finding too much because the labor market is changing all the time. At any moment of time jobs are destroyed in this part of the labor market while at the same time jobs are created in another part. The labor market does not stop after it has changed. It does not wait until everybody has found the perfect match after much trial and error until it changes again. It just changes all the time.

A more subtle change which works over time to make the match better occurs on the job. If a worker is not a perfect match for the job but is in another way profitable for the firm, the employer might change the job description to tailor the job better on the qualifications of the worker. Or the worker can follow training that makes him better qualified for the job. Job descriptions can be changed and workers can acquire new qualifications.

3.2 Matching never stops

There are two mechanisms which explain why the labor market in a capitalist economy changes all the time: the business cycle and creative destruction. Experience has taught us that economic periods of expansion are followed by periods of contraction which eventually turn into expansionary periods again. Good times are followed by bad times and these are followed by good times. This repetition is called the business cycle. Apart from the sequence of going up and down, there is no system in the cycle. It certainly does not follow the biblical sequence of seven fat years followed by seven lean years. The precise length of periods of contraction or expansion is (almost) impossible to predict. Turning points where an expansion changes into a contraction or vice versa are impossible to pinpoint in the future. Cycles are caused by expansion and contraction in expenditure: consumption, investment, exports and imports, government expenditure. As expenditure expands so does production. More production means more workers are needed. As expenditure decreases, the economy contracts and production and employment goes down. During an expansion employment grows, more people start looking for a job, unemployment decreases and the number of vacancies grows larger. In an expansionary period a job searcher can find a job more easily than in periods of contraction. In periods of contraction employers with vacancies have more people applying for a job than in expansionary periods. During an expansion many more people voluntarily change jobs than during a contraction. There are just more job opportunities during an expansion. Over time the business cycle constantly breaks up matches and creates opportunities for new matches.

¹⁷ See Andrea Bassanini & Pascal Marianna (2009) for a brief review of the empirical literature, p. 44

In good times searching is easier for job searchers than for employers with a vacancy, mainly because there are fewer unemployed competing for more vacancies. As was explained earlier the matches that will arise will be compromises between what the worker desires and the employer requires. In an expansionary period while bargaining about job conditions, a worker will be able to get more of his desires fulfilled and the employer will have to give in more on his requirements. During a period of contraction the bargaining position of the employer gets stronger and he will be able to impose more of his requirements. In terms of the previous chapter matches with underqualification have a larger change to occur during an expansion, whereas matches with overqualification have a higher probability during a recession.

The second mechanism is what is called the process of creative destruction. In a capitalist economy there will always be existing jobs destroyed in one part of the labor market, while at the same time new jobs will be created in other parts of the economy. A contemporaneous example of creative destruction is the effect of the internet and of digitalisation of music, pictures, movies, television programs, texts etc. Internet business is replacing brick and mortar business. In the US Amazon keeps growing and Borders, a huge national chain of bookshops, went broke. Movies are downloaded or watched on demand, changing employment in the film distribution sector and making video and DVD rental shops go broke. During any given year job creation and destruction occurs in substantial numbers. Workers losing their job in parts of the economy where jobs are destroyed have to search for jobs in those parts where jobs are created. Matches are broken because of destruction and new matches are formed because of creation.

There are many reasons for job creation and destruction. Important are innovation and technological change and the introduction of new, better or cheaper products, globalization and the loss or gain of market share on the international markets and changes in consumer preferences (for instance changes in preferences for biological and green products). Job creation and destruction never stops and hence there will always be existing matches disappearing and potential matches appearing.

3.3 Changes like a glacier

The labor market is a very dynamic labor market with matches being created and broken everyday under the influence of the ever changing economic cycle and the constant destruction and creation of new jobs. There are however also changes in the labor market that operate at a much smaller frequency. Changes that move at glacier speed rather than fast tumbling over like a mountain river cascading downwards. Still taking enough time the effects of a moving glacier are very noticeable in the landscape. The same is true with the long run effect of these slower moving changes in the labor market. The best known slow movement in the labor market is called the Tinbergen race or the race between technology and education. Calling it a race is a misnomer as its effects are only made clear by comparing labor market results over decades.

Tinbergen was interested in explaining the difference in earnings between a higher educated and a lower educated worker. This earnings difference is a reflection of the reward that a person gets when he has invested in an education and enters the labor market with a higher educational

degree. The earning difference tells us what the (labor market) return is that a person gets from his investment in an education.

Like all returns this educational return will depend on demand and supply. Supply consists of the number of people that enter the labor market with a higher educational degree. Demand comes from businesses and other labor organisations and depends on the number of higher educated persons they need in the production of goods and services. The demand for higher educated workers depends on the technology of production. In less advanced economies, such as predominantly agricultural economies, there is hardly any demand for higher educated workers. As an economy advances through time and through higher stages of development, demand for higher educated workers increases. In a knowledge economy such as most Western European and North American economies, the demand for higher educated persons is substantial.

What is known empirically is that there exists this clear long term trend whereby demand for higher educated workers increases over time. There are two reasons for this structural increase. First the demand for higher educated workers correlates with more capital intensive production. As an economy uses more physical capital goods in the production process and invest in production plants, infrastructure, machines, computers and network, it will require an increasing number of higher educated people. It turns out empirically that physical capital is often a substitute for lower educated workers (the famous example of the coffee machine substituting for the canteen personnel that made coffee). At the same time physical capital and human capital (that is workers who have invested in education) are complements. Over time more physical capital goes together with more human capital. As advanced economies use more physical capital, they also need more human capital.

There is more. It is found in other empirical studies that technological changes over time are 'skill biased'. This means that new technological production methods require relatively more skilled people (educated people) than previous production methods. Each new round of new technological changes in production requires relatively more higher educated workers than previous rounds. The mainframe computers that started to be installed widely in the sixties and the seventies needed relatively more higher educated people than the technological advances that automated production in the sixties. The PC that appeared on every desk in the eighties and the nineties needed relatively more higher educated people than the mainframes. The technological changes brought about by ICT increases demand for more higher educated workers even further. This disproportional increase in the demand of higher educated people with each new round of technological change is called 'skill biased technological change'.

Supply of educated people increases as more youngsters get a higher education degree. Demand for higher educated workers comes from technological change. The difference between the earnings of higher versus lower educated people and hence the return on education depends on whether more people with a higher education degree flow into the labor market than there is a demand for them because of technological change. That is why Tinbergen called the determination of the return on education the outcome of a race between education and technology.

If higher educated workers flow out of the educational system in larger numbers than technological developments demands them, the return on education will go down. In the seventies and the eighties the first large generation baby boomers (who were then in their twenties) entered the labor market. Educational policies in those years had stimulated large numbers of the baby boom generation to get a higher education degree. In the eighties the supply of higher educated workers was much higher than the demand and the return to schooling dropped. That is when Freeman wrote his book on 'the overeducated American'. Since then times have changed. The supply of higher educated workers still increases over time, but at a much smaller rate than in the sixties and the seventies when large generations of baby boomers entered the labor market. The demographics are completely different and the growth of the share of people in higher education does not increase that fast any more. In the meantime the demand for higher educated workers has not stopped increasing and in the nineties the demand due to technological change was higher than the supply coming out of the educational system and the return on education started increasing. It is often predicted that returns will keep on increasing in the future as technological developments will win the Tinbergen race over the supply of higher education.

3.4 Implications

Mismatch is unavoidable in a real labor market. But levels of mismatch can change over time. It is interesting to measure the level of mismatch as it changes over time. Even if one has to use imperfect measures such as over- or underqualification or horizontal mismatch. If the level of mismatch increases so does the social cost of mismatch in terms of productivity loss and loss of welfare. It is also interesting to measure what possible mismatch might be in labor markets in the future.

4 Workers and jobs

The starting point of the projections in the next chapter is 2009. The projections are for 2020. The skills needed in ten years time will depend on where the jobs will be at that time. It is wise to look at the sectoral composition of employment across countries in this starting year as it will help to better understand the outcome of the projections. The distribution of jobs over sectors changes only gradually over time. The present structure will still be partly visible in the skill distribution at the end of the decade. Section 4.1 documents the distribution of employment over sectors in 2009. The sector composition of employment not only affects where the jobs will be, but also what specific skills will be needed. The workforce in the agricultural sector needs different skills than the health sector. A contraction of the agricultural sector and an expansion of the health sector will change the demand for skills in the economy. Section 4.1 also provides information on the levels and fields of education of the workers in 2009 and on their occupations.¹⁸

What is easy to predict is that workers aged 55 and older who have jobs in 2009 will leave the labor force between now and 2020. The larger the number of workers aged 55 and older now the larger their outflow will be in the next ten years and the larger will be the need to replace them with younger workers. Not only is the number of workers aged 55 and older important but also their level and field of education and their occupation. In that way it will be possible to project more specifically what skills they will leave behind when they retire. A description of the older labor force in the different countries specifying education and occupation can be found in section 4.2.

4.1 Job and worker characteristics

The employed workforce¹⁹ differs across countries: people work in different jobs; they have acquired different levels and fields of education and have different occupations. The distribution of workers over sectors in each country can be seen in Table 6. The largest sectors are highlighted for each country.

- With few exceptions the *manufacturing* and *trade & repair* sectors employ the largest share of workers in each country. The relative size of the *manufacturing* sector differs largely: it can be as small as 7 percent (Luxembourg) and 11 percent (Netherlands, UK, US) and as large as 26 percent (Czech Republic and Slovenia). The relative size of the *trade & repair* sector does not differ that much across countries. It is around 14 percent on average in the EU27.
- In a number of countries *construction*, *business services*, *education* and *health* are found to be among the larger sectors. As countries grow richer over time the employment structure changes gradually from an agricultural economy to an industrial economy and then to a service economy. Richer countries with an increasingly older population will also see their health sector (care and cure) growing in importance. In some of the richer countries the health

¹⁸ A detailed explanation of the classifications of industrial sectors, education and occupation used in this chapter can be found in Appendix A.

¹⁹ The definition of 'employed workforce' in this chapter is restricted to people aged 20 to 65 who are in employment. Thus, characteristics of the unemployed or people aged 15-19 are not included.

sector is already the largest sector (Germany, Denmark, Finland, Netherlands, Sweden, UK, Norway) in terms of employment.

- Noteworthy differences between the EU27 and the US are:
 - The EU27 has a larger *manufacturing* sector than the US (17 versus 11 percent)
 - In the EU27 the *agricultural* sector is five times as large as in the US (5 versus 1 percent)
 - *Health* and *education* are larger in the US.
- Interesting differences among European countries are:
 - Eastern European countries have relatively more workers in *agriculture*, *manufacturing* and *utilities*;
 - Western European countries have relatively many people in *financial* and *business* service sectors. Luxembourg is a special case with 13 percent employed in *financial services*;

Table 6 Manufacturing and Trades & repair usually have the largest share of employment

	Agriculture	Manufacturing	Utilities	Construction	Trade & repair	Transportation	Information & Media	Hotels & restaurants	Financial services	Business services	Public administration	Education	Health	Other services
Austria	5	15	1	8	16	5	3	6	4	10	7	7	10	4
Belgium	1	15	1	7	13	6	3	3	4	9	10	9	13	5
Bulgaria	7	23	2	10	16	6	2	5	2	5	7	6	5	3
Cyprus	3	9	1	12	19	4	2	7	5	9	8	7	4	9
Czech Republic	3	26	2	10	13	7	3	4	2	7	7	6	7	4
Denmark	2	13	1	6	13	5	4	2	4	9	7	9	19	4
Estonia	4	20	2	10	14	9	2	3	2	7	6	10	6	4
Finland	4	16	1	7	12	6	4	3	2	11	5	7	16	5
France	3	14	1	7	13	5	3	3	3	10	10	7	13	6
Germany	1	21	1	7	13	5	3	4	4	11	8	6	12	5
Greece	11	12	1	8	18	5	2	7	3	7	9	7	5	5
Hungary	5	21	2	8	15	7	2	4	3	7	8	8	6	4
Ireland	4	12	1	8	14	5	4	6	5	9	6	8	12	5
Italy	4	20	1	9	15	5	2	5	3	10	6	7	7	7
Latvia	8	14	3	8	17	9	2	3	2	7	7	9	5	5
Lithuania	9	16	2	9	18	6	2	2	2	7	6	10	6	4
Luxembourg	1	7	1	6	10	5	3	3	13	10	12	9	10	10
Netherlands	2	11	1	6	13	5	4	3	3	12	8	8	18	4
Norway	3	12	1	7	13	6	4	2	2	10	6	9	21	4
Poland	13	21	2	8	15	6	2	2	2	6	7	8	6	3
Portugal	7	18	1	11	15	4	2	6	2	7	7	8	7	6
Romania	25	21	2	8	13	5	1	2	1	4	6	4	5	2
Slovakia	4	24	3	11	13	6	2	4	2	6	8	7	6	3
Slovenia	7	26	2	7	13	6	3	4	3	7	6	8	6	3
Spain	4	14	1	10	16	5	3	7	2	10	7	6	7	8
Sweden	2	13	1	7	12	5	4	3	2	13	6	11	16	5
United Kingdom	1	11	1	8	13	5	4	4	5	12	7	11	13	5
EU27	5	17	2	8	14	5	3	4	3	10	7	7	10	5
United States	1	11	1	7	15	5	4	6	5	11	5	10	13	5

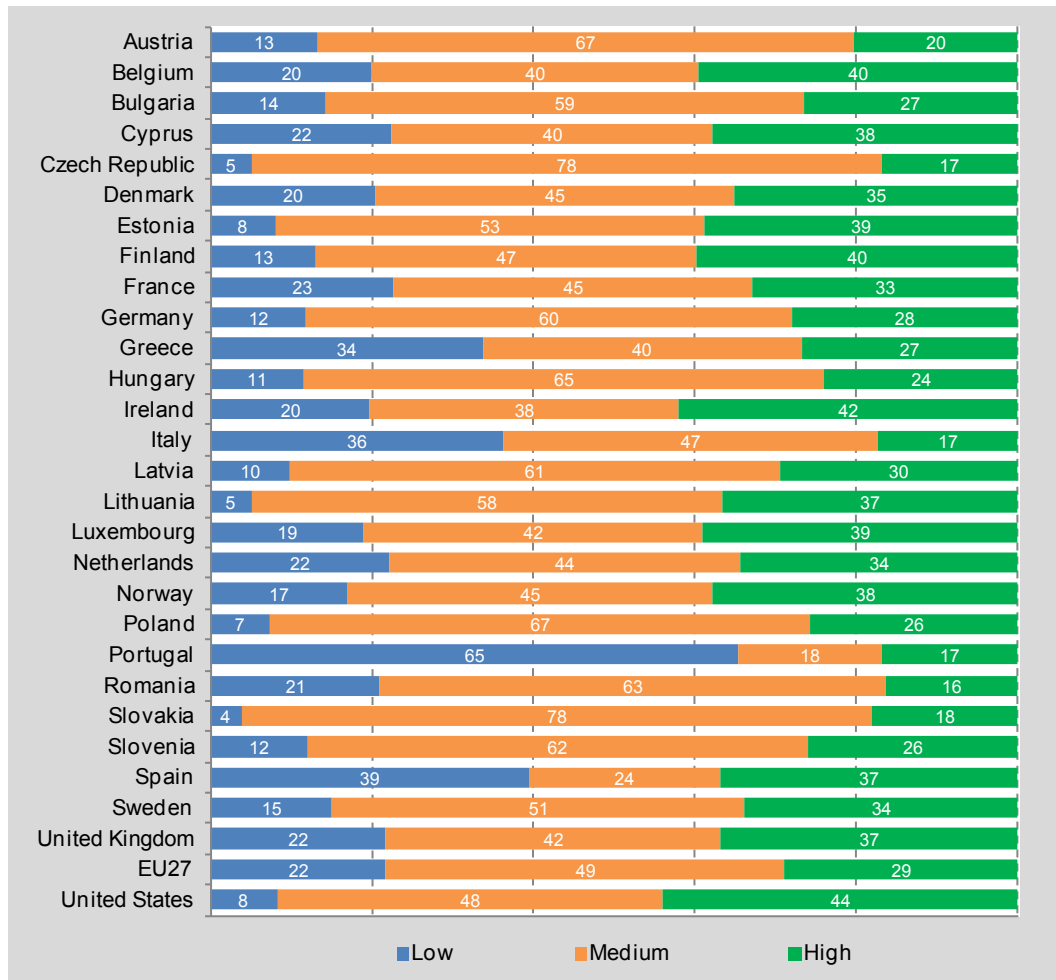
Percentage distribution of employed workforce over sectors by country, 2009. Three largest sectors per country highlighted.

Source: Eurostat (2010) and CPS (2010).

Level of education

Figure 6 presents the percentage distribution of higher, medium and lower level of education of the employed work force per country. When comparing across countries is has to be kept in mind that the education system is different for different countries. For instance, the quality of academic education may vary a lot among the universities in a country and among the countries.

Figure 6 Workers education high in the US, medium in East and low in South Europe



Percentage distribution of employed workforce by country and level of education, 2009.

Source: Eurostat (2010) and CPS (2010).

Nevertheless, the following is interesting in Figure 6:

- Relatively more US workers have a higher education degree than EU27 workers: 44 percent has completed tertiary education compared to only 29 percent in the EU27.
- Even among neighbouring countries with similar economic background, educational differences can be substantial. For instance only 28 percent of the German workers has completed tertiary education whereas 34 and 37 percent have done so in the Netherlands and United Kingdom. This difference can possibly and to a large extent be explained by the dual learning system in Germany whereby higher vocational skills are often acquired in company workflow training courses and through work experience. Eastern European countries have a rather large share of medium educated workers. In Slovakia and the Czech Republic three

quarters of the workers has a medium education. As was made clear in Table 6 Eastern European countries still have sizeable manufacturing sectors and the educational make up of the workers might be related to that.

- Portugal is clearly exceptional with two thirds of its working labor force having only lower education. Historians point to the relatively late democratization of the Portuguese education system. Until the 1980s education was not affordable for a large part of the population. Also Spain, Italy and Greece have a relatively large section of lower educated only workers, but not as much as Portugal.

Field of education Figure 7 shows the distribution of the employed workforce by field of education, for those who have at least a medium level of education.²⁰ The fields of education are clustered into five groups:

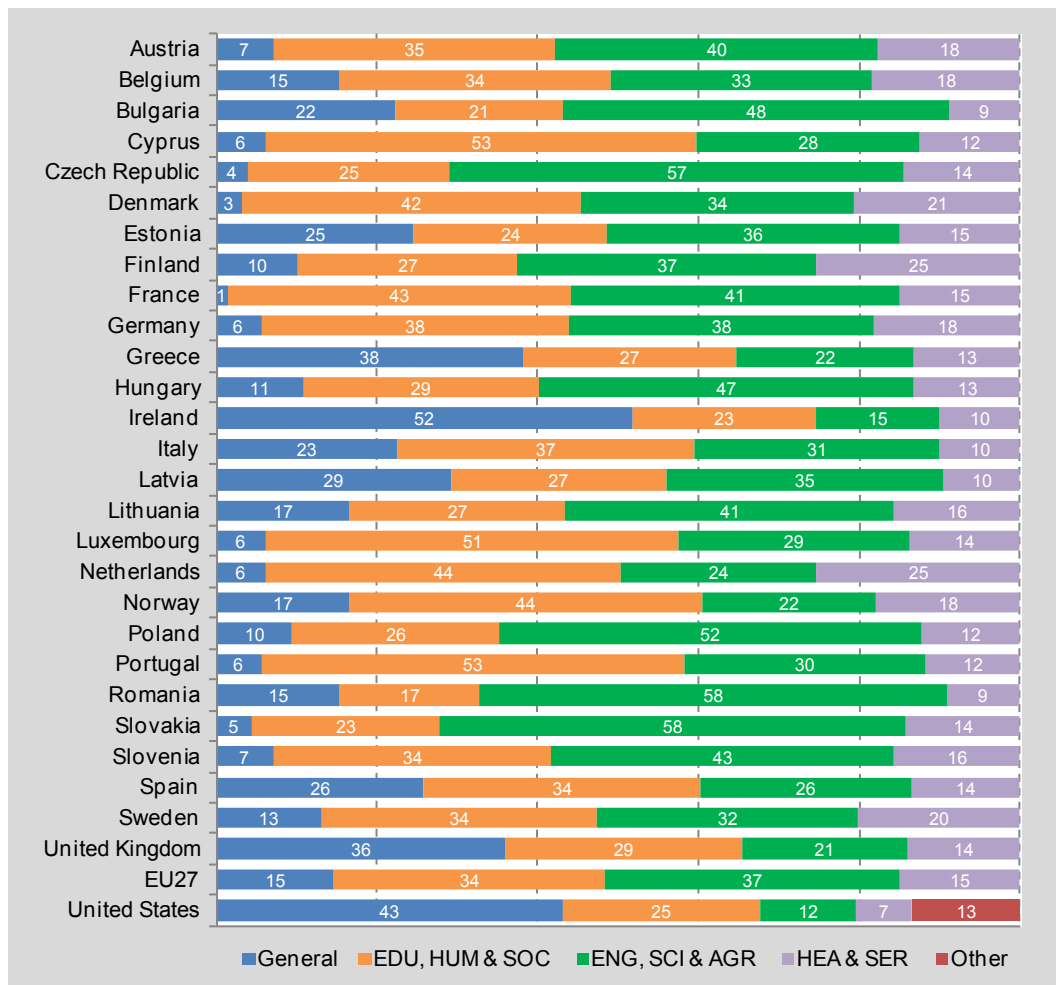
- general programs,
- education, humanities & arts and social sciences, business, economics & law,
- engineering & construction, science and agriculture,
- health & welfare and services,
- other (unclassified).

There are large differences in the shares of educational fields among countries. Partly these are due to classification differences across countries.

- In many countries, vocational programs are classified into a distinct field of education. In the Anglosaxon and some other countries vocational programs are all labeled general. This explains the rather large share of *general programs* in those countries.
- The share of the cluster *engineering & construction, science and agriculture* is much smaller in the US than in the EU27 (12% versus 37%). This may be partly explained by the smaller manufacturing sector in the US (see Table 6), but probably the larger *general programs* in US also produce engineers and scientists.
- Eastern European countries have many workers with a degree in engineering and other science and technology fields. Again this might be related to the relatively large manufacturing sector in these countries.
- Countries with relatively large health sectors (see Table 6) often have a relatively large share of workers with a degree in health. Finland, Netherland and Denmark are obvious examples.

²⁰ For the lowest level of education (primary education) no distinction can be made as everybody is grouped into 'general programs'.

Figure 7 Fields of education differ widely across countries²¹



Percentage distribution of employed workforce (with at least secondary education) by country and by field of education, 2009.

Source: Eurostat (2010) and CPS-SIPP (2009).

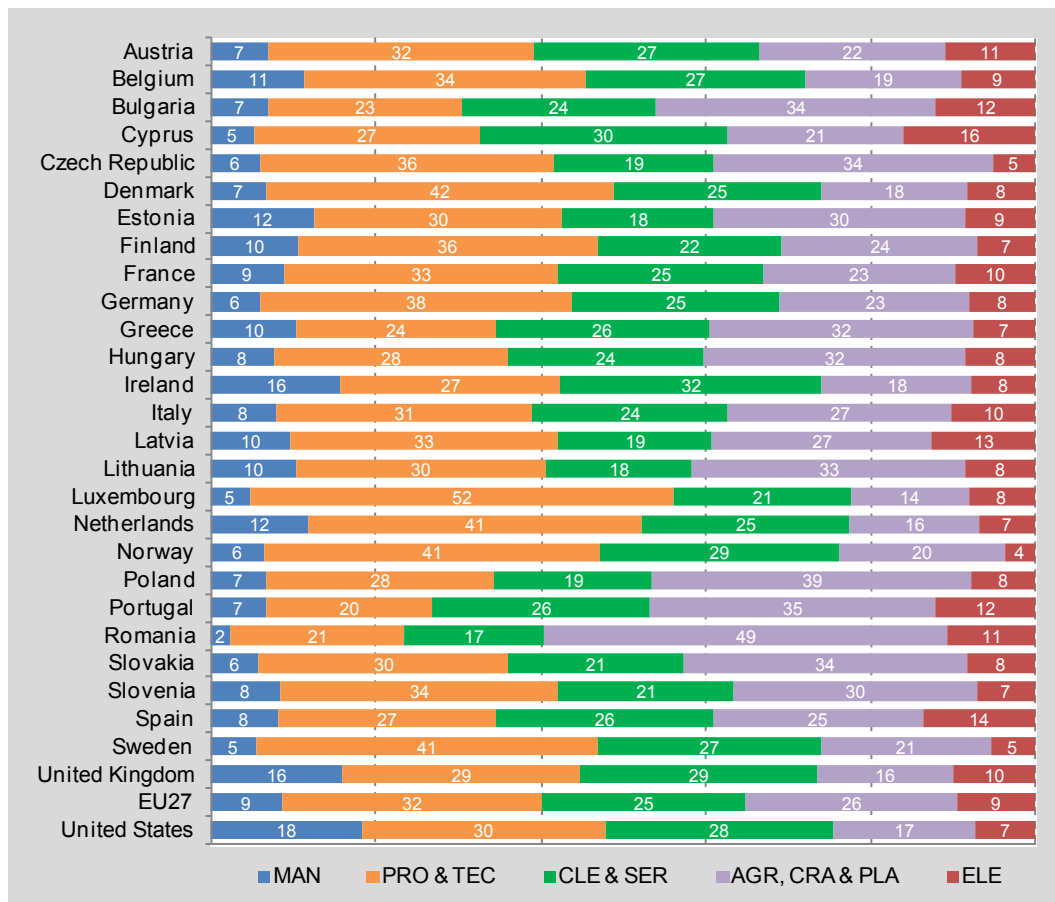
Occupation

Figure 8 has the distribution of employed workforce over types of occupation. The occupations are grouped into five clusters:

- managers & legislators,
- (associate) professionals & technicians,
- clerical and service & sales workers,
- agriculture, craft trades and plant & machine operators,
- elementary occupations.

²¹ In the US a large number of studies is classified as ‘other’. This category does not exist in the European labor force surveys. In the survey of the US Census Bureau, respondents self-report their field of education and have the option to check ‘other’ if they feel that the listed fields do not adequately describe their educational program.

Figure 8 Occupational make-up differs substantially across countries



Percentage distribution of employed workforce by country and by occupation, 2009.

Source: Eurostat (2010) and CPS (2010).

- The share of *managers* is twice as large in the US as in the EU27 (18 versus 9 percent). This seems to be an Anglosaxon feature. The UK and Ireland also have a rather large share of managers.
- The share of *agriculture, craft trades and plant & machine operators* is larger in Europe than the US (26 versus 17 percent). Again the larger manufacturing sector in Europe and especially in Eastern Europe might be a possible explanation for this (see Table 6).
- Western and Nordic countries have a larger share of *clerical and service & sales workers* than the Eastern European countries.

4.2 Characteristics of workers aged 55 and older

Many advanced economies have an aging population and a large number of workers aged 55 and older in the labor force. These workers aged 55 and older will leave the labor force in the next decade and raise the need to replace them. Labor demand originated in the replacement of retiring older workers is called ‘replacement demand’.

A relevant question for the scenario projections in the next chapter is how many workers aged 55 and older will retire in the next decade. The answer can be captured in a statistic called the

‘aging-outflow-rate’ (AOR). The aging outflow rate defined as the share of workers aged 55 or older at this moment. The workers in that age group will be the ones that will retire from the labor market in the next ten years. Many workers withdraw from the labor market well before the official age of retirement. In many countries the official retirement age is 65 but the effective retirement age is often three to four years earlier²². The effective retirement age is the average age at which persons over 40 years and older have left the labor force.

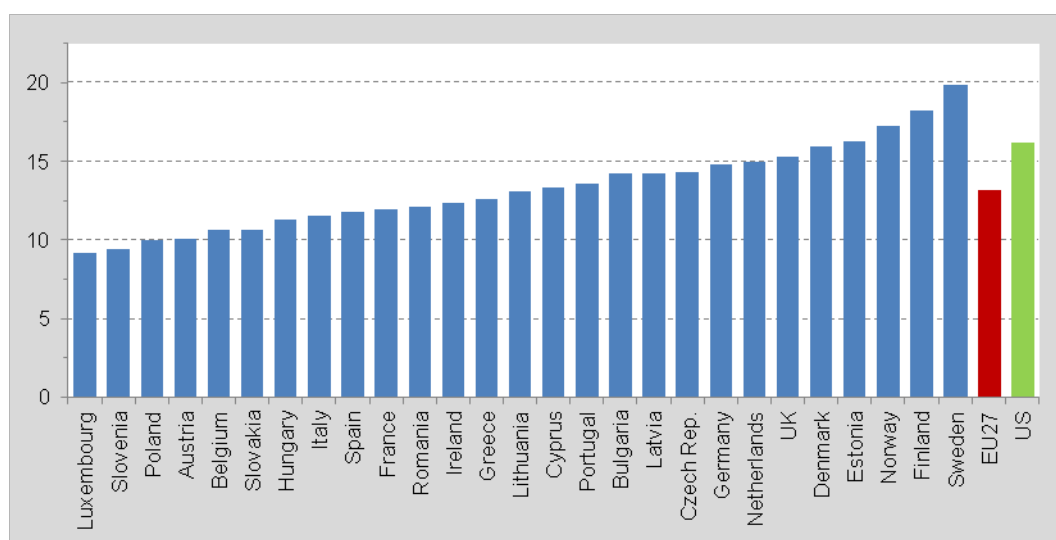
The number of worker in that age group and hence the AOR differs across countries. Also the make up of this group in terms of educational level and field and occupation is different from one country to the next. These national differences in outflow rates by education and occupation will show up again in the projections for 2020 in the next chapter.

Share of workers aged 55-64

The share of workers aged 55 and older is presented in Figure 9.

- The US has a larger share of workers aged 55 and older than the EU27 and then most of the individual European countries. In the US 16 percent of the workers is 55 years or older. The EU27 average is 13 percent.
- Within Europe differences are rather large. Luxembourg has the lowest share with only 9 percent. Sweden has the highest with 20 percent.
- A high share of workers aged 55 and older implies a high aging outflow rate (AOR) in the years to come. In Sweden one out of five workers will leave the labor force. In the other countries where the share of workers aged 55 and older is 15 percent or higher (Netherlands, UK, Denmark, Estonia, Finland, Norway, US) one out of six to seven workers will retire.
- How many workers will leave in any given year in the future does not only depend on the age structure and on demographics but also on country policies with regard to (early) retirement.

Figure 9 Northern European countries and the US have a large share of workers aged 55 and older



AOR: share of employed workforce aged 55-64 by country, %-points, 2009.

Source: Eurostat (2010) and CPS (2010).

²² OECD (2006), *Live Longer, Work Longer*, Figure 2.4, p. 32

The percentage workers aged 55 and older in 2010 for Australia is 14% and 19% for Japan. These percentages are not shown in the figure and were calculated from the online OECD Employment database

Workers aged 55-64 per sector

Table 7 presents the share of workers aged 55 and older per sector across countries.

- It is immediately obvious that *agriculture* is the sector with the largest percentage of workers aged 55 and older. One out of five to one out of four works will retire from that sector. The AOR will be highest in this sector in almost every country.
- Next in line are the public sectors and semi-public sectors (or what used to be semi-public sectors). *Public administration, health, education* and *utilities* also have a relatively 'old' workforce in many countries.
- Sectors with a relatively young workforce are *information & media, hotels & restaurants*, and (in most countries) *financial services*.

Table 7 Agriculture and (semi-) public sectors have the largest share of workers aged 55-64

	Agriculture	Manufacturing	Utilities	Construction	Trade & repair	Transportation	Information & Media	Hotels & restaurants	Financial services	Business services	Public administration	Education	Health	Other services
Austria	22	8	11	9	9	10	5	9	8	9	11	14	9	12
Belgium	20	9	11	8	10	12	7	10	11	10	13	11	10	13
Bulgaria	23	13	21	13	9	12	9	10	7	18	14	21	24	17
Cyprus	35	20	14	14	13	14	7	14	6	11	11	13	20	6
Czech Republic	22	14	18	14	11	16	8	10	8	18	16	18	16	15
Denmark	20	15	19	16	13	18	11	9	15	15	19	19	17	20
Estonia	18	17	18	12	12	16	8	9	5	16	18	25	30	15
Finland	26	17	20	18	15	18	13	12	17	21	21	20	21	18
France	21	10	9	9	9	9	8	9	13	12	15	14	13	17
Germany	24	14	15	13	13	15	10	12	14	14	19	20	14	19
Greece	27	11	14	12	10	14	5	10	7	10	11	11	11	12
Hungary	17	11	14	10	9	10	7	9	9	14	11	15	12	13
Ireland	29	9	17	11	10	17	6	8	6	12	13	15	16	13
Italy	18	9	11	10	10	13	6	9	10	10	15	22	14	11
Latvia	17	16	21	9	10	16	5	6	7	18	11	20	22	16
Lithuania	20	10	23	12	7	13	8	8	5	13	12	19	21	12
Luxembourg	13	9	14	10	9	7	9	10	6	7	10	12	6	14
Netherlands	22	15	19	14	13	16	9	10	11	13	16	23	15	15
Norway	26	17	21	13	14	20	11	6	17	18	22	24	17	16
Poland	16	8	14	10	7	10	4	7	5	15	9	10	10	15
Portugal	38	10	16	10	11	14	4	13	9	10	13	11	13	20
Romania	25	8	12	8	4	9	4	5	5	9	8	14	13	9
Slovakia	19	9	16	11	7	12	4	7	6	13	12	17	14	9
Slovenia	28	7	14	10	6	9	6	7	7	9	9	9	8	13
Spain	20	13	12	11	11	12	3	9	12	9	13	16	14	12
Sweden	29	20	24	19	14	22	11	8	17	19	26	25	22	22
United Kingdom	25	16	15	16	15	19	9	10	8	16	13	18	16	16
EU27	22	12	14	12	11	14	8	10	10	13	15	17	15	15
United States	24	16	17	13	15	18	12	8	15	17	20	20	17	18

AOR: percentage share of workers aged 55-64 in the employed workforce per sector and per country, 2009. Three largest sectors per country are highlighted.

Source: Eurostat (2010) and CPS (2010).

Outflow rates by level of education

Table 8 makes clear that in the US 18% of the high educated workers is 55 or older. For American workers with low or medium education the percentage workers aged 55 and older is only 15 to 16%. In the EU27 the percentage is higher for low education and lower for high education than in the US. In Europe the younger generations are on average higher educated than the older generations²³. The US has relatively more higher educated workers aged 55 and older. A possible explanation could be that participation in higher education increased earlier in the US than in Europe. Large differences exist between European countries and it is hard to distill a pattern.

²³ This process of increasing education level over time is called 'upskilling of the population'.

Table 8 Percentage of workers aged 55 and older, per level of education

	Low (primary)	Medium (secondary)	High (tertiary)	Total
Austria	16	8	12	10
Belgium	17	9	9	11
Bulgaria	20	12	15	14
Cyprus	28	10	8	13
Czech Rep.	23	14	14	14
Denmark	20	15	15	16
Estonia	20	15	17	16
Finland	37	14	17	18
France	19	10	9	12
Germany	15	14	17	15
Greece	22	7	10	13
Hungary	15	10	12	11
Ireland	27	10	8	13
Italy	15	9	13	12
Latvia	18	14	14	14
Lithuania	18	14	11	13
Luxembourg	10	8	10	9
Netherlands	20	13	15	15
Norway	16	19	16	17
Poland	21	9	9	10
Portugal	17	5	7	14
Romania	26	9	8	12
Slovakia	22	10	12	11
Slovenia	15	8	10	9
Spain	18	8	8	12
Sweden	36	16	18	20
United Kingdom	21	15	12	15
EU27	19	11	12	13
United States	16	15	18	16

AOR: percentage share of workers aged 55-64 per level of education and per country, 2009.

Source: Eurostat (2010) and CPS (2010).

Table 9 looks at the educational level of the workers aged 55 and older in the sectors *public administration, education and health*. The numbers in the table are the AOR per educational level for the given sector. The columns labeled ‘medium’ and ‘high’ gives the share of workers aged 55 and older in the group workers with medium or high education in that sector. The column ‘overall’ gives the share of workers aged 55 and older in that sector (this number is the same as in Table 7). It is hard to pinpoint general trends, yet some interesting facts can be established.

Table 9 Focus on public administration, education and health sector

	Public administration			Education			Health		
	Medium	High	Overall	Medium	High	Overall	Medium	High	Overall
Austria	10	12	11	9	16	14	7	12	9
Belgium	13	11	13	12	10	11	8	10	10
Bulgaria	13	12	14	15	20	21	26	21	24
Cyprus	13	9	11	9	12	13	14	15	20
Czech Republic	15	15	16	17	18	18	15	17	16
Denmark	22	15	19	17	18	19	14	16	17
Estonia	20	17	18	37	20	25	37	23	30
Finland	13	23	21	15	20	20	20	16	21
France	13	12	15	18	11	14	10	14	13
Germany	19	19	19	10	25	20	14	15	14
Greece	10	9	11	10	10	11	7	12	11
Hungary	11	10	11	16	13	15	10	14	12
Ireland	13	9	13	16	13	15	15	11	16
Italy	14	16	15	20	23	22	9	16	14
Latvia	12	9	11	23	16	20	23	18	22
Lithuania	14	10	12	21	17	19	27	15	21
Luxembourg	8	11	10	16	12	12	5	7	6
Netherlands	16	15	16	16	24	23	12	15	15
Norway	32	15	22	23	25	24	22	13	17
Poland	10	7	9	13	8	10	9	10	10
Portugal	7	6	13	7	10	11	6	10	13
Romania	7	7	8	13	13	14	12	11	13
Slovakia	12	11	12	18	15	17	11	19	14
Slovenia	7	11	9	6	10	9	5	13	8
Spain	11	10	13	11	15	16	14	10	14
Sweden	31	21	26	19	25	25	15	23	22
United Kingdom	11	11	13	17	18	18	18	13	16
EU27	14	13	15	16	17	17	13	14	15
United States	19	21	20	21	20	20	17	18	17

AOR: percentage share of workers aged 55-64 in the employed workforce, overall and for medium and high education, per country, 2009. AOR's of 20 or above are highlighted.

Source: Eurostat (2010) and CPS (2010).

- **Public administration:** Denmark, Finland, Sweden, Norway and the US have a high overall AOR in this sector. In Denmark and Norway this is particularly true for the medium educated, whereas in Finland and in the US the challenge is among the higher educated. Sweden has a high outflow rate of both medium and high educated workers aged 55 and older
- **Education:** In Italy, Norway and the United States the aging outflow rate is high for all levels of education. Estonia, Lithuania and Latvia have a high AOR for medium education. Germany, the Netherlands and Sweden for high education.
- **Health:** The Nordic countries (Finland, Norway, Estonia, Latvia, Lithuania) all have sizable AOR's, mostly among the medium educated. The health sector is sizeable and has many workers aged 55 and older in Finland and Norway. In Germany the health sector is also sizeable but with relatively more younger workers.

Outflow rates by field of education

Table 10 presents the outflow rate of workers aged 55 and older by field of education. The three highest outflow rates per countries are highlighted. The share is often high in *education, engineering, agriculture* and *health*. Workers with a degree in *social science, science* and *services* or with a *general* education background are often of a younger age.

Table 10 Highest aging-outflow among workers with education and agriculture background

	General	Education	Humanities	Social	Science	Engineering	Agriculture	Health	Services	Other	Overall
Austria	6	12	12	8	10	10	17	9	6	n/a	9
Belgium	12	9	10	8	7	9	7	10	6	n/a	9
Bulgaria	11	19	13	11	16	14	16	21	9	n/a	13
Cyprus	6	8	15	9	6	8	34	13	3	n/a	9
Czech Republic	10	15	17	11	14	16	16	14	9	n/a	14
Denmark	5	19	13	14	6	18	15	17	16	n/a	15
Estonia	13	24	17	14	12	19	15	20	12	n/a	16
Finland	6	16	14	19	11	17	19	16	14	n/a	16
France	11	16	13	8	10	10	13	12	7	n/a	10
Germany	6	23	16	15	13	16	17	12	14	n/a	15
Greece	8	7	8	8	8	9	9	10	4	n/a	8
Hungary	10	11	8	11	5	12	12	10	8	n/a	11
Ireland	10	11	10	7	6	8	10	11	6	n/a	9
Italy	10	18	16	7	10	11	8	16	5	n/a	10
Latvia	12	15	16	11	17	16	20	19	7	n/a	14
Lithuania	12	15	13	10	10	13	16	18	14	n/a	13
Luxembourg	15	9	14	7	12	9	6	7	5	n/a	9
Netherlands	14	21	15	11	10	16	12	13	11	n/a	13
Norway	20	24	17	20	9	13	19	17	10	n/a	18
Poland	7	6	9	7	9	11	12	9	6	n/a	9
Portugal	8	8	5	6	3	9	9	9	3	n/a	6
Romania	7	16	9	6	7	9	10	11	9	n/a	9
Slovakia	6	13	11	9	11	11	11	12	7	n/a	10
Slovenia	6	8	17	7	14	10	7	8	8	n/a	9
Spain	8	13	9	6	7	8	7	10	6	n/a	8
Sweden	13	25	11	20	12	16	13	18	16	n/a	17
United Kingdom	17	20	11	10	9	16	11	12	9	n/a	14
EU27	11	17	12	10	9	13	13	12	10	n/a	12
United States	14	26	21	17	13	17	21	17	16	17	16

AOR: percentage share of workers aged 55-64 as part of the employed workforce per field of education (with at least ISCED 3 level or higher) and per country, 2009. Three largest fields per country are highlighted.

Source: Eurostat (2010) and CPS (2010).

Outflow rates by occupation

Table 11 reveals a consistent pattern across countries.

- The highest outflow rate of workers aged 55 and older is among workers in the agricultural occupations. As was already obvious in Table 7 the agricultural sector has a large share of workers aged 55 and older.
- Other occupations with a high aging outflow rate are *managers & legislators* and *elementary occupations*. Possible explanations are that:

- To be a manager one needs to have work experience. Hence managers will quite often tend to be older workers;
- As Table 8 showed, older generations had less education when entering the labor market compared to younger generations. Consequently a relatively large share will remain in elementary occupations requiring less education.

Table 11 Relatively more workers aged 55 and older among managers, and agricultural and elementary occupations

	Military	Managers	Professionals	Technicians	Clerks	Services	Agriculture	Craft	Plant	Elementary	Overall
Austria	9	14	12	8	8	7	21	8	12	13	10
Belgium	4	14	10	11	11	9	18	8	9	11	11
Bulgaria	1	14	17	14	14	12	25	12	12	17	14
Cyprus	0	21	11	10	6	10	40	18	14	19	13
Czech Republic	2	17	15	13	12	12	17	15	15	23	14
Denmark	6	18	17	15	17	13	19	15	18	18	16
Estonia	0	14	18	13	16	15	24	15	16	28	16
Finland	2	23	17	17	18	16	27	17	17	23	18
France	2	16	15	10	11	9	19	10	9	16	12
Germany	3	18	18	14	15	12	21	12	15	18	15
Greece	1	19	12	7	8	7	28	13	12	10	13
Hungary	3	16	12	10	10	9	13	11	10	15	11
Ireland	4	17	11	11	11	10	18	11	15	17	12
Italy	3	19	18	11	9	7	21	10	9	13	12
Latvia	0	13	13	11	17	13	23	14	14	18	14
Lithuania	0	13	14	11	11	10	21	11	14	20	13
Luxembourg	0	21	10	9	8	7	13	8	5	9	9
Netherlands	2	18	16	13	15	12	16	15	17	17	15
Norway	0	21	19	16	20	16	27	14	18	22	17
Poland	1	14	9	9	6	8	15	8	9	13	10
Portugal	4	20	9	10	8	11	37	10	13	17	14
Romania	2	11	9	10	7	5	26	8	8	13	12
Slovakia	2	16	13	9	8	7	17	11	10	16	11
Slovenia	0	15	10	7	6	5	32	9	6	13	9
Spain	3	18	11	10	9	9	22	13	12	12	12
Sweden	6	23	21	20	22	16	31	18	21	21	20
United Kingdom	2	15	15	12	16	13	21	17	20	18	15
EU27	2	17	15	12	12	10	22	12	13	16	13
United States	0	18	17	16	16	13	24	13	18	14	16

AOR: percentage share of workers aged 55-64 as part of the employed workforce, by type of occupation and by country, 2009. Three types of occupation with highest AOR per country highlighted.

Source: Eurostat (2010) and CPS (2010).

4.3 Past, present and future

The characteristics of workers and jobs presented in this chapter are determined by what happened in the past. A large number of countries moved beyond what used to be their industrial and manufacturing base. Their sectoral employment is now dominated by service sectors. In a handful of advanced countries the health sector is growing fast. The history as Communist

countries might explain why Eastern European countries still have a relatively large manufacturing sector. The educational composition of the work force shown in this chapter is influenced by past educational policies in each country.

The sectoral composition of the work force clearly has a big influence on the skill composition looked for in the work force. In the next chapter the projections will document how different sectors will grow or shrink and with these movements the demand for different skills will increase or decrease. These demand changes will then be confronted with the skills available on the supply side of the labor market. What workers bring to the labor market in terms of skills will depend on the level and fields of education they have acquired in school and through experience.

Demography is another strong determinant of the future of work and workers coming from the past. The number of workers of 55 and older will have a large influence on the (replacement) demand for labor in the next decade. The share of workers aged 55 and older and their educational and occupational characteristics differs strongly between countries. These differences are a reflection of past employment patterns and national policies regarding education, population and immigration. What has been happening in the past decade largely explains the characteristics of workers and jobs now. This is the starting point for the changes in the next ten years. It is the starting point for the projections in the next chapter.

The next chapter will model a low and a high growth scenario for the EU27 countries and for the US. Each scenario starts from the employment situation and the educational and occupational make up of the employed population in 2009 and projects a possible future for 2020. In this sense the present situation determines the future. Also the results for 2020 in the next chapter will be compared to the present situation. This chapter also details what the educational and occupational characteristics are of workers 55 and older in the different countries in 2009. These workers will be leaving the labour force in the next ten years and while doing that they will have an influence on the demand for replacement between now and 2020. The replacement demand is an essential part of each of the scenarios in the next chapter.

Japan²⁴

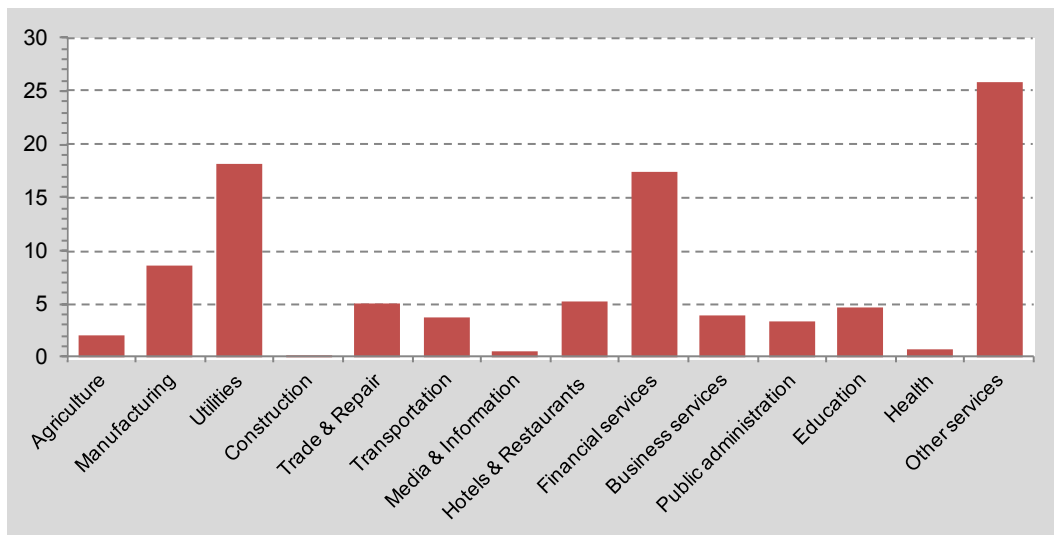
Japanese population 20-64 in and out of employment

- In 2009 56 million people were in employment in Japan. About 3 million people were unemployed.
- The total size of the population aged 20-64 is 75.6 million, 16 million people did not participate in the labor market

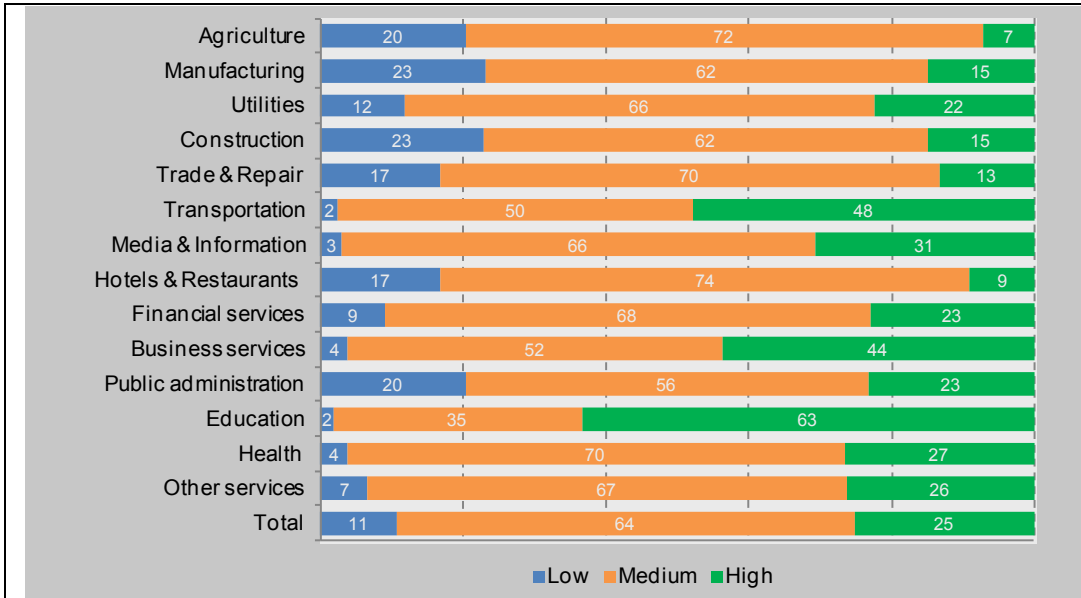
²⁴ The analysis in the textbox on Japan is based on customized tables obtained from the Japanese Statistical Bureau. The numbers are from the 2007 Employment Survey. This is, the most recent survey including detailed data on the level of education. The Japanese data are not completely comparable to those for the other countries. In particular the sector 'other services' is very hard to compare, because it contains the large share of the Japanese sector 'compound' which does not exist in EU or US. Using the OECD Labor Force Survey aggregate results for the year 2009 are available. These are combined with the custom made data from Japan.

	Total (x 1000)	percentage
2009		
Employed	56,320	
<i>of which:</i>		
- low skilled		11%
- medium skilled		64%
- high skilled		25%
Unemployed	3,140	
<i>unemployment rate</i>		5.6%
Labor force	59,460	
Not in the Labor Force	16,090	
POPULATION	75,550	

- The employment distribution over sectors in Japan stands out from that in other countries. In particular the large shares of employment in utilities, financial services and other services are high. Note that the sector 'other services' is made up most of what in the Japanese classification system is called 'compound services'. This includes many different services, mostly cooperative associations. See also: <http://www.stat.go.jp/english/index/seido/sangyo/san07-3a.htm#g>

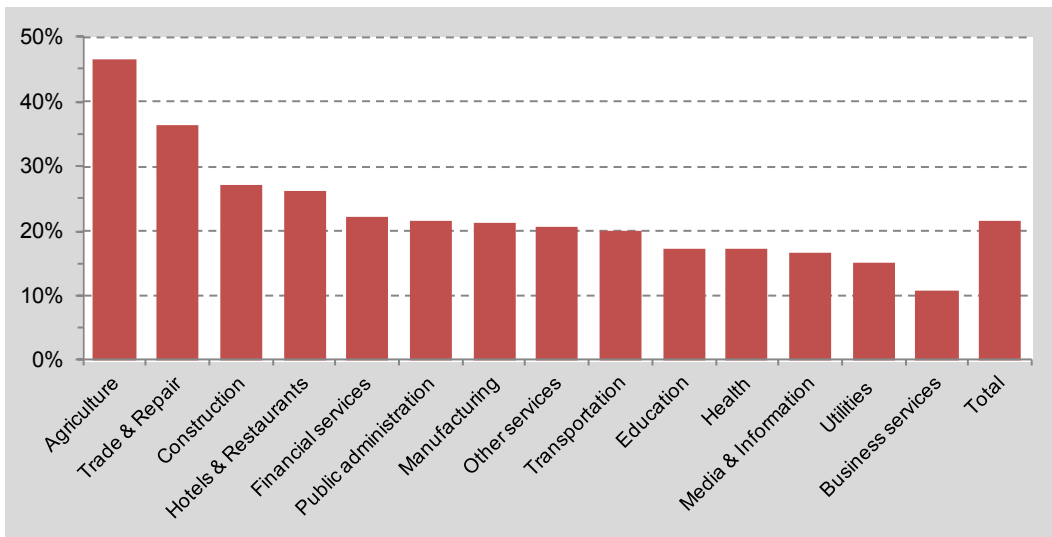


- The figure below presents the percentage distribution of the level of education in the various sectors. Level of education is defined as:
 - Low educated = junior highschool or lower
 - Medium educated = senior highschool, vocational studies or junior college
 - High educated = college, university or graduate school
- As in other countries the Japanese primary sectors (agriculture, manufacturing and construction) have relatively more workers low and medium education and the service sectors have relatively more higher educated. The sector education is completely dominated by higher educated people. Also noteworthy is the relatively high share of high educated people in transportation



Ageing

- The percentage workers 55 and older in Japan is about 21 percent overall
- This percentage is highest in agriculture and trade & repair. Business services is a relatively young sector.



Sources:

NSTAC, Statistical Bureau Japan (2007). Data made available on request.
 OECD (2012). Labor Force Survey (LFS) by sex and age. Available online via OECD.Stat (retrieved January 27th 2012).

5 Labor market frictions in 2020

Between now and 2020 the skills that employers demand for the production of goods and services will change. On the supply side of the labor market retiring workers will leave their jobs taking their experience and skills with them. Young workers will enter the labor market with new skills acquired in school. It is to be expected that the skills demanded by firms and supplied by workers in the labor market between now and 2020 will not always be equal and mismatches will occur. A mismatch implies that the job requires a different skill than the worker brings with him. Workers can have a different educational level, a different field of education, a curriculum in another occupation or in another sector than the one the employer is looking for. The occurrence and extent of such *qualitative mismatch* across countries and across sectors within countries is central to this chapter. Employers in sectors which face a potentially large number of mismatches will have the hardest time to attract the right person, and workers will have a tough time finding the right job.

The extent of the mismatch differs between countries as each country has a different sector composition of employment and their labor force has different characteristics. Occurrence and extent of possible mismatch will also depend on how much economic growth can be expected in the next decade. Slow and fast economic growth have different implications for employment growth and thereby for the skills that will be in demand in the near future. In this chapter two scenarios, one with slow and another with fast employment growth will be presented to give an impression of how sensitive mismatch is to economic conditions. This gives some handle on the uncertainty of the projection results.

The projections in this chapter are qualitatively different from the projections of the earlier SEO/Randstad publications *Mind the Gap* and *Bridging the Gap*. These publications concentrated on *quantitative mismatch*, on the sheer difference in numbers supplied and demanded. The central question was: will there be enough workers? This report moves into the gap: are the workers rightly skilled for the available jobs? Even if enough workers are available for the number of jobs, it is still possible that they bring skills to the labor market which are different from the skills that are needed.

Labor Market Surplus indicator

To measure the possible extent of the qualitative mismatch in the 2020 labor market the Labor Market Surplus indicator (LMS) will be used. This is the ratio of labor supply over labor demand for specific corners of the labor market. It will be calculated for different parts of the labor market defined by sector, educational level, educational field and occupation. This indicator gives the size of potential frictions between labor demand and labor supply. When supply in a specific sector of the labor market - for instance of higher educated technicians in the industry in the US - is higher than the demand for those skills in that sector, the LMS will show a value higher than 1 implying that there will be excess supply of that specific skill in that specific sector. When supply falls short of demand, the LMS has a value lower than 1, indicating that there is a supply shortage. Values different from 1 always signal mismatch. A larger deviation from one is an indication of more extensive mismatch.

The labor market surplus indicator is a flexible instrument that can be calculated at different levels of specificity. It can be calculated to compare labor supply and demand at the level of each industry in each country, which would be a low level of specificity. But it can be also be calculated to compare supply and demand for higher educated technical workers for each industry, which would be a higher level of specificity. The higher the level of specificity the closer the labor market surplus indicator gets to capture the extent of specific qualitative mismatch in the labor market. The labor market surplus indicator will be calculated for different levels of specificity in this chapter.

Quantitative gaps revisited

To capture some of the unavoidable uncertainty when projecting labor market developments until 2020, two different scenarios are presented. There will be a low and high employment growth scenario. Section 5.1 introduces and details these two scenarios. The effects of the recent economic recessions will be taken into account in both scenarios. To start the analysis, section 5.2 presents first the quantitative results for each scenario. This section does not go into skill mismatch yet, but gives new predictions of total numbers supplied and demanded in 2020, taking into account the impact of the severe, long drawn recession that hit the world economy starting in 2008. This recession has a substantial impact on the 'potential employment gap' in the coming years. Taking into account the effect of this world wide crisis section 5.2 presents results that are smaller than predicted in the previous Gap-studies. However, demographic changes are unavoidable and employment gaps will resurface in later decades.

Qualitative mismatch

The concept of qualitative mismatch was explained in chapters 2 and 3. It contrasts the set of competences (in terms of level or field of education and functional curriculum) of the worker with job requirements. For instance, a university graduate in economics conducting clerical work in the manufacturing sector is a mismatch. If future employment requirements and labor force characteristics diverge further, the degree of mismatch will increase. Chapter 4 illustrated that across countries the skills of the workers varied considerable along level and field of occupation and type of occupation. Also the sector composition of employment differed considerably with some countries having larger industrial sectors than others and other countries being more into service sectors. Different sector composition implies different skill demands. Additionally, the skill composition of workers 55 and older also differs substantially across countries. These workers will exit the labor market in the next years, creating job vacancies as they leave. Mismatch, be it in different mixes, exists in all national labor markets today. Mismatches are also unavoidable given the dynamics of the economy and the labor market. The objective of this chapter is to give a reliable impression of how much qualitative mismatch could occur in the future labor market.

Section 5.3 starts with a prognosis of the labor market surplus indicator for each sector in the economy. In this case the labor market surplus indicator is used at a low level of specificity. This is nevertheless an useful application of the LMS indicator as it gives a good sense of which sector will probably show surpluses and shortages in the near future. By digging deeper on sector level it provides additional information that was not available in the previous Gap-studies that remained at the national level. A general conclusion of the analysis in section 5.3 is that possible shortages

will develop in the service sector and more specifically in business services while surpluses will arise in manufacturing.

Sections 5.4 to 5.6 calculate the labor market surplus indicator at a deeper level of specificity than 5.2. These sections forecast LMS indicators per sector over level and field of education and type of occupation. Section 5.4 goes into supply and demand per sector for different *levels* of education. In this case the LMS indicator comparing the expected number of workers with the expected number of jobs for each level of education and for each sector in 2020 can be seen as another way of measuring vertical mismatch introduced in chapter 2. Section 5.5 uses the LMS indicator to measure differences between the *fields* of education of future workers and jobs. Section 5.6 details the differences between *occupation types* supplied and demanded per sector. In these two last sections the LMS calculations show the extent of horizontal mismatch in future labor markets.

5.1 The aftermath of the recent recession

The financial crisis that started in 2008 and the Euro credit crisis that followed it, delivered a major blow to economies and labor markets on both sides of the Atlantic and in most parts of the world economy. Economic growth and employment rates fell dramatically and the recovery is anything but robust. At the moment it is uncertain how smooth the path to recovery will be, and how long that road will be. To capture the uncertainty of the next years, this chapter builds on two different scenarios, one being based on expert expectations, the other building on historical extrapolation.

Expert forecasts

The expectations of experts at Cedefop for Europe and at the Bureau of Labor Statistics (BLS) for the United States are the first source.²⁵ In the midst of the recession Cedefop (2010) published detailed projections on skill demand and supply. The BLS (2012) provides a more recent prediction for the US economy. The first column in Table 12 presents average rates of annual employment growth to be expected in the various (clusters of) countries according to these experts²⁶. Expectations for Europe (0.11 percent for the EU27) are less optimistic than those for the United States (1.55 percent). The BLS expects that the US economy will quickly recover from the current recession and employment will catch up again with the pre-crisis growth path. In the case of Europe, Cedefop (2010) is more reserved. It anticipates the impact of the recession to last longer and does not expect employment to make up for lost employment growth in the past. Cedefop foresees differences within Europe: relatively high employment growth is forecasted for the Anglo-Saxon and Scandinavian clusters, while the level of employment

²⁵ Cedefop (the European Centre for the Development of Vocational Training) is a EU-commissioned research centre supporting the development of European vocational education and training (VET) policies and contributing to their implementation. One of its main programs is forecasting and exploring future European skill needs. The BLS (Bureau of Labor Statistics) is the United States' principal fact-finding agency for the Federal Government in the broad field of labor economics and statistics. It also produces long term labor market forecasts on two year basis.

²⁶ Employment growth rates are derived from model simulations of GDP growth minus the projected labor productivity. As labor productivity growth is generally positive, employment growth will always be lower than GDP growth.

declines in West EU-Rhineland and Eastern Europe.²⁷ In addition to projections of overall employment growth, the forecasts by Cedefop and the BLS also provide information about the size of the future labor force and trends in the educational and occupational makeup of labor demand and supply (see Appendix C for detailed information).

Historical extrapolation

Future employment trends can also be based on an extrapolation of the historical experience. A possible way to do this is assume that annual employment growth in the period 2011-2020 equals the average annual rates in the last decade, 2000-2010. This last decade contains the crisis years 2002, 2008, 2009 and 2010 and hence the average annual rate reflects the full experience of both economic up- and downturns. These historical rates are shown in the second column in Table 12. For the EU27 historical average annual employment growth rates (0.66%) are higher than the expert forecasts (0.11%). For the US the opposite holds. Expert opinion from the BLS is more optimistic than the historical extrapolation (1.55% employment growth in column 1 versus 0.23% in column 2).

To build the scenario's a mix of the results of expert forecast and historical extrapolation is made in such a way that there is a low employment growth scenario (scenario 1) combining the low expert forecast for the EU27 and the low historical extrapolation forecast for the US. The high employment growth scenario (scenario 2) combines the high forecasts of each of the approaches. This simplifies the analysis to two simple scenarios: one that is low growth and another that is high growth in both the EU27 and the US.

Table 12 From input values to scenario values

	Expert forecasts	Historical extrapolation	Scenario 1: Low employment growth	Scenario 2: High employment growth
Anglo-Saxon (ANG)	0.36	0.58	0.36	0.58
Scandinavia (SCA)	0.41	0.56	0.41	0.56
West-EU Rhineland (WRH)	-0.04	0.64	-0.04	0.64
West-EU Francophone (WFR)	0.10	0.97	0.10	0.97
Mediterranean (MED)	0.24	1.04	0.24	1.04
Eastern Europe (EAS)	-0.11	0.15	-0.11	0.15
EU27	0.11	0.66	0.11	0.66
US	1.55	0.23	0.23	1.55

Average annual employment growth 2009-2020, percentages

Source: Scenario 1, Cedefop (2010) and BLS (2012); Scenario 2, Eurostat (2012) and OECD (2012)

New predictions for labor demand and supply

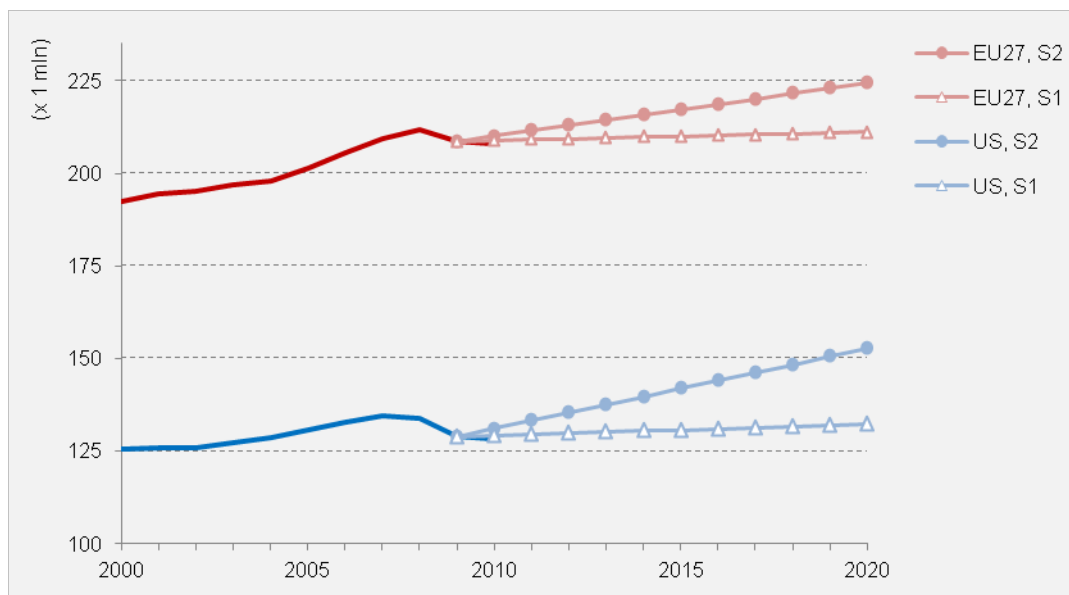
Employment in the EU27 and United States rapidly declined in 2009 (look in particular at the end of the full line in Figure 10). This decline marks the start of the long period of recession and slowing down of economic growth that the world economies are experiencing now. This economic slowdown will cast its shadow over the labor market in the years to come in terms of a lower labor demand than was expected before the crisis hit. Starting from the dismal year 2009 and using both scenarios new predictions can be made for employment growth between now and 2020.

²⁷ See section 2.4 for a detailed description of the regions.

In Scenario 1 annual employment growth is modest. In the EU27 employment will grow 0.11 percent annually on average, only slightly more than one percent during the whole decade. For the US the average rate is low at 0.23 percent, but still doubles that of Europe. In this slow growth scenario, Europe's employment peak of 212 million employed persons in 2008 will not be reached again this decade. For 2020 the level of employment is projected at 211 million persons. Something comparable holds for the US in the low growth scenario 1. Employment in 2020 will be 132 million, lower than 135 million peak in the pre-crisis year 2007.

Employment growth in high growth scenario 2 is more optimistic, especially for the US. With an annual US employment growth rate of 1.55 percent the level of employment in the United States will be over 152 million persons in 2020, much higher than the pre-crisis peak. For the EU27 the average annual employment growth rate in the high growth scenario is 0.66 percent. By the end of this decade the level of employment has risen to 224 million workers, which is also higher than the pre-crisis peak.

Figure 10 Different employment growth paths in the aftermath of the recession: Scenario 1 (S1) versus Scenario 2 (S2)²⁸



Employed population 20-64; solid lines are realizations; dotted lines are projections

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

In both scenarios employment growth rates differ across Europe. Table 12 already made clear that employment declines in Eastern Europe and West EU-Rhineland cluster in low growth scenario 1. Positive employment growth rates are expected in the other clusters. Employment growth in scenario 2 is higher across the board, but again differs between the clusters. Eastern Europe is at the lower end of the scale and the Mediterranean cluster at the higher end. Detailed figures per country (not shown here) reveal individual country differences within the Eastern European cluster.²⁹ Employment declined in Romania, Hungary and Lithuania during 2000-2010, whereas Slovakia, Poland, Slovenia and Bulgaria realized considerable employment growth.

²⁸ In this study 2009 is the most recent year for which statistical information is available for all countries. Consistent European statistics are always lagged. By the time of publication of this report the year 2010 will be available, but this information came too late to be useful for the prognosis in this study.

²⁹ Detailed country reports are available on request at Public.Affairs@randstadholding.com.

Labor supply growth paths are also different between the EU27 and the US (see Table 13). The US labor force will continue to grow from 141 million in 2009 to 149 million by the end of the decade, almost 0.5 percent annually. With an average annual growth rate of 0.13 percent there is far less growth of labor supply in Europe. In Eastern Europe and the West EU Rhineland the labor force even declines. In the Anglo-Saxon region considerable supply growth is expected.

Table 13 Labor force in US continues to grow; within EU some regions face decline

	Labor force 2009 (mln)	Labor force 2020 (mln)	Average annual growth (%)
ANG	31.0	33.1	0.58
SCA	12.2	12.6	0.30
WRH	51.7	51.1	-0.11
WFR	32.4	33.1	0.18
MED	56.8	57.8	0.16
EAS	45.9	45.7	-0.05
EU27	228.2	231.5	0.13
US	141.2	149.1	0.49

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Developments in labor supply are mainly the result of two components: the size of the population aged 20-64 and the activity rate (percentage of the population 20-64 that is employed). The EU27 population declines. This has a negative effect on labor supply. This negative effect is offset by a limited increase in the activity rate. The net result is a rather low supply growth. For the US the opposite will happen. The population continues to grow as net migrations is positive, but as the labor force ages the US activity rate drops. A more detailed discussion is available in Appendix B.1.

5.2 A new look at the quantitative gap

Will there be enough workers to fill all jobs in 2020? Based on the new predictions in the previous section of the future time paths of labor demand and supply Table 14 presents the level of employment (total available jobs) and the size of the labor force in 2009 and 2020 for both scenarios. The labor force is the number of workers willing to work: they have a job and are working or they do not have a job but are looking for work. In the EU27 228.2 million persons were willing to work in 2009 (the labor force). A total of 208.6 million of those had a job. This leaves over 19 million people looking for a job and being unemployed. Out of the total EU27 labor force that is a surplus of 8,6%. In the US the number of unemployed is more than 12 million. That is a comparable surplus of 8,7% of the labor force.

In the decade to come employment is expected to grow at a slow pace in scenario 1 and somewhat more substantial in scenario 2. In most (clusters of) countries the labor force increases as well (Table 14). In both scenarios employment growth is usually not high enough to outpace labor force growth in the years to come. Surpluses remain dominant except in a few cases, such as in the United States and in West EU-Rhineland in scenario 2. In those few cases labor supply falls short and shortages develop. In the low scenario case in 2020 the percentage surplus does not change very much compared to 2009 and is around 8,8 percent for the EU27(20,4 million surplus out of a 231,5 million labor force). The percentage surplus goes up to 11,3% for the US (16,9 out of 149,1 million). Supply growth is three to four times as high in the US compared to

the EU27 (Table 13) and hence the American economy requires much more employment growth than Europe to offset the growth of the number of workers willing to work in the next years. Scenario 2 on the other hand suggests that higher employment growth might be sufficient to turn a surplus in a shortage in the US. That is not the case for the EU. In a high growth scenario the European surplus diminishes a lot, but does not turn into a shortage yet. What Table 14 makes clear is that the expectations that were held before the recent crisis about the early appearance of labor market shortages were premature. The crisis has dramatically changed the fortunes of the world economy. In its aftermath the slowdown of the economy is such that surpluses will occur more often than shortages. The demographic picture is still that population growth will keep on slowing down and turn negative in the future. As soon as employment growth picks up again in the next decades surpluses are bound to happen.

Table 14 Labor demand (employment) and supply (labor force) in 2009 and 2020

		Labor force	Employment	Surplus
2009	ANG	31,0	28,9	2,2
	SCA	12,2	11,5	0,7
	WRH	51,7	48,3	3,5
	WFR	32,4	29,7	2,8
	MED	56,8	50,1	6,7
	EAS	45,9	42,1	3,8
	EU27	228,2	208,6	19,6
	US	141,2	128,9	12,3
	2020 Scenario 1	ANG	33,1	30,0
SCA		12,6	12,0	0,6
WRH		51,1	48,0	3,1
WFR		33,1	30,0	3,1
MED		57,8	51,4	6,4
EAS		45,7	41,6	4,1
EU27		231,5	211,1	20,4
US		149,1	132,2	16,9
2020 Scenario 2		ANG	33,1	30,7
	SCA	12,6	12,2	0,4
	WRH	51,1	51,8	-0,6
	WFR	33,1	33,0	0,1
	MED	57,8	56,1	1,6
	EAS	45,7	42,8	2,9
	EU27	231,5	224,4	7,1
	US	149,1	152,7	-3,6

All numbers in million persons.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Why is the potential employment gap postponed?

The surpluses shown in Table 14 might be surprising for readers of the earlier Gap-studies. Those studies mentioned a 'potential employment gap' which would develop between 2010 and 2050, while the current study mentions surpluses in 2020. What explains the different results?

To start: the labor market surplus indicator in this study is not directly comparable with the 'potential employment gap' forecasted in the previous studies, as it is based on a different definition of the labor force. In the calculation of the labor market surplus indicator people between 15-19 years of age are not taken into account. And unemployed people who are looking for a job are added. But these changes are of minor consequence for the explanation of why the gap turned into a surplus. What does explain the different outcome, are the new employment projections. These new projections are much more pessimistic than the assumptions made in the previous Gap-studies.

In the years before the financial crisis labor markets were preparing for future shortages and tight labor markets. The dominant view was that the withdrawal of the 'babyboom generation' would cause labor supply to decrease rapidly, and a 'potential employment gap' would emerge. Hence, most policy initiatives were directed at increasing participation and targeting migration.

More recent forecasts reveal that the negative impact of the financial crisis and the current recession is quite severe. Not that the demographic process of ageing has stopped; the babyboom generation will still leave the labor market in the coming years. But all Western economies were set back in their economic growth path. First in 2008 by the credit crisis and in following years by the euro-debt crisis. Many governments have to deal with the burden of high debts and interest rates forcing them to implement drastic policies cutting expenses and raising taxes. The toxic combination of an economic crisis with deflationary policies slows down economic growth, much more than expected only some years ago. As the Cedefop projections make clear only little economic growth can be expected and even less employment growth.

In the previous publication *Bridging the Gap* it was assumed for the EU27 that over the period 2009-2020 labor demand would grow by 4% while the number of workers available would slightly decrease. In the new scenario's in this study a much lower demand growth is expected together with a slightly higher supply growth. The new growth paths turn projected shortage of workers in 2020 into a surplus. A similar story holds for the year 2020 in the United States.

Still, the ageing process will continue, labor supply will eventually decrease.³⁰ It can safely be assumed that the dire effects of the present economic crises will not go on forever and that labor demand will pick up again at some point after 2020. The labor market will tighten up, as the demographic ageing process will not stop before 2050. The 'potential employment gap' has not disappeared, it has been postponed. The estimated potential quantitative gap of 35 million workers for 2050 in the EU is still relevant.

5.3 Surpluses and shortages at the sector level

The previous section researched the question whether there will be enough workers to fill all the available jobs at the national level. This section goes one level below that and extends the quantitative question to the sector level. This adds a new dimension to the scenarios, revealing shortages and surpluses for every industrial sector in the economy. With few exceptions section 5.2 concluded that labor surpluses will be dominant at the national level. However a surplus at the national level can coexist with shortages at some sector levels within the same country. In many countries business services face shortages, whereas in manufacturing labor is abundant.

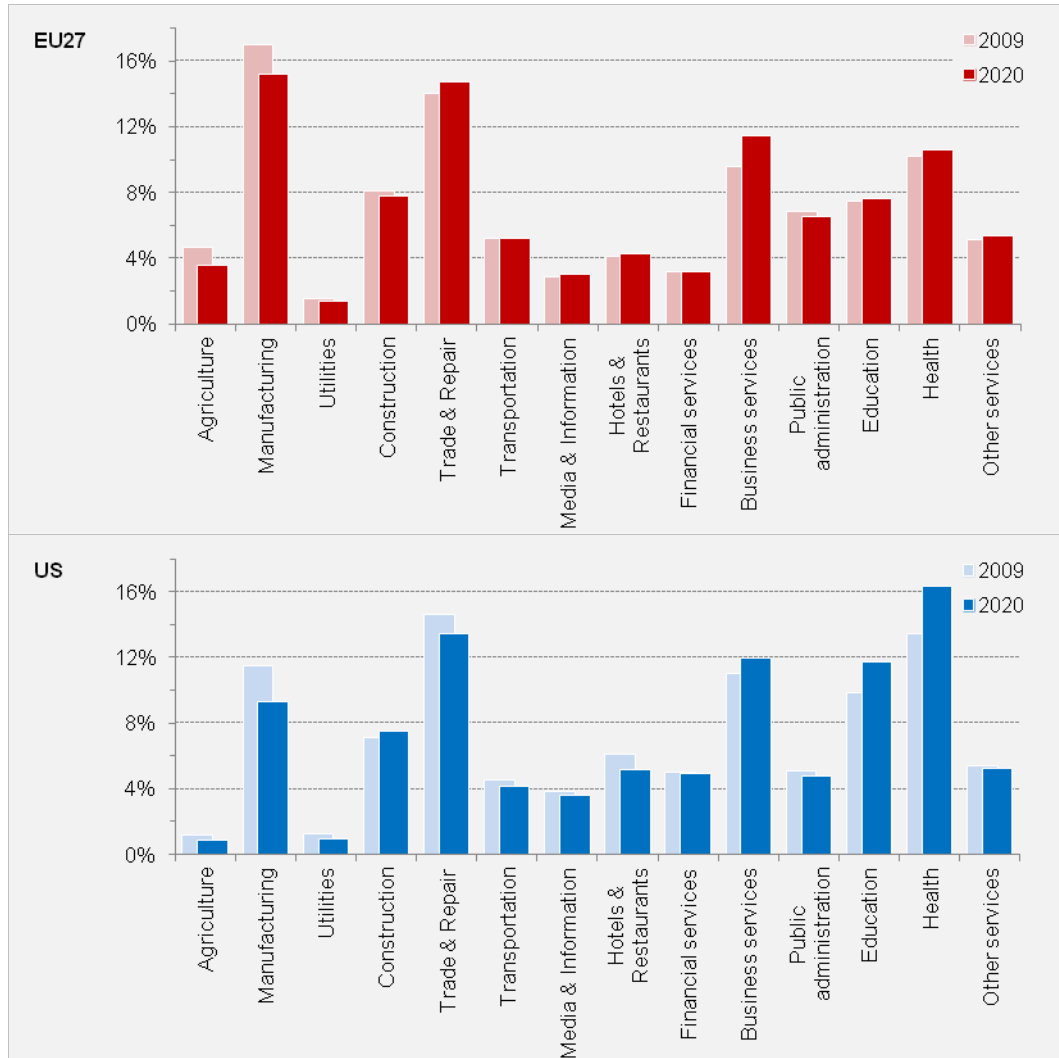
5.3.1 Structural demand shift: from primary sector to services

The coexistence of shortages and surpluses are driven by different developments of sector labor demand. In most if not all economies there is a continuing trend from less employment in the primary sectors (agriculture, manufacturing, utilities and construction) towards more employment in various services sectors (from sales to consulting to health care). The BLS and Cedefop argue

³⁰ Apart from the postwar babyboom, the availability of birth control from the 1960's onward is responsible for the long run decline in fertility rates.

that the current recession has not distorted this trend, maybe even reinforced it as the primary sectors suffer more from the crisis than the service sectors. Figure 11 demonstrates this shift graphically by presenting the shares of each industry in the EU27 and the US in 2009 and in 2020.

Figure 11 Sectoral shift towards employment in services



Share in total employment (percentages)

Source: Cedefop (2010) and BLS (2012), adapted by SEO Economic Research

In the EU27 the move from primary production to services is illustrated by declining shares of agriculture (minus 1.1 %-points) and manufacturing (minus 1.6 %-points). At the same time the employment share of business services and trade & repair increases. In the United States the sectoral shift is even more apparent. The share of manufacturing declines by 2 percentage points, while the shares of business services (0.8 %-points), health (2.4 %-points) and education (1.6 %-points) all increase.

Additional analysis reveals that the sector shift, from primary production towards services, varies across regions (see Appendix C). Employment in Western EU regions and in Scandinavia shifts

to information & media and to financial and business services. In Eastern and Mediterranean Europe employment also shifts to trade & repair and transportation.

5.3.2 Sector shortages and surpluses coexist

Figure 3 shows that across sectors shortages and surpluses coexist. For instance, in the EU27 the business services sector will face shortages (even under the low growth scenario 1), while manufacturing will have surpluses. More sectors show shortages under the high growth scenario than under the low growth scenario. The coexistence of shortages and surpluses is also seen in the US: the health sector will be short of labor while the manufacturing sector and trade & repair has a surplus of labor. In contrast to the EU27 the US has either a shortage or surplus in the business sector depending on the high or low growth scenario.

Towards a job-rich recovery

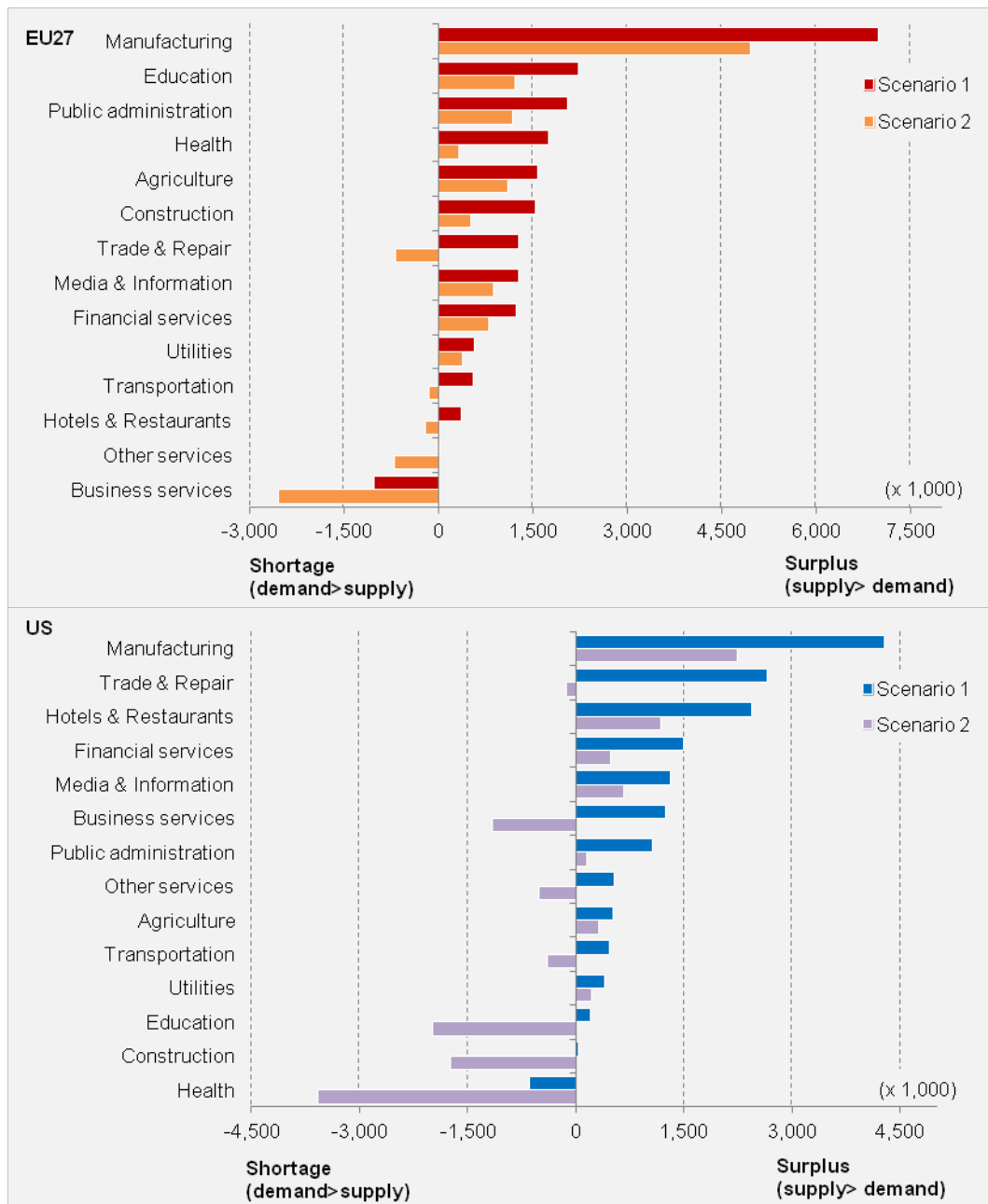
In April 2012 the European Commission launched 'Towards a job-rich recovery'³¹ an employment package aimed at job creation, and detailing policy proposals such as subsidies and reduced taxes on labor or support for business start-ups. It also identifies the areas with the biggest job potential for the future: the green economy, health services and ICT.

In a Commission Staff Working Document 'On an Action Plan for the EU Health Workforce' an important conclusion reads that the health sector "*will remain a growing sector according to the forthcoming CEDEFOP skills forecasts, even though employment growth will be more modest compared to 2000-2010. More than 1 million new jobs are expected to be created between 2010-2020.*"

The projection of 1 million new jobs is perfectly in line with the results of of the low growth scenario 1 in this study.. As can be seen in Appendix C, – first table of Scenario 1 employment in the EU Health sector rises from 21.4 million in 2009 to 22.4 million in 2020).

³¹ europa.eu/rapid/pressReleasesAction.do?reference=MEMO/12/252&format=HTML&aged=0&language=EN

Figure 12 No overall shortages on the labor market, though services sectors do face challenges



Balance of labor supply minus labor demand in 2020 for scenario 1 and scenario 2 (x 1000).
 Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Table 15 analyses sector surpluses and supply using the Labor Markets Surplus indicator (LMS). The LMS indicator gives the ratio of labor supply over labor demand (labor force over employment). If the value of the LMS is higher than 1 there will be a surplus (labor supply greater than demand). Shortages (supply smaller than demand) are present for values of the LMS smaller than 1.

Table 15 Shortages and surpluses vary across Europe

	US	EU27	ANG	SCA	WRH	WFR	MED	EAS
Scenario 1								
Agriculture	1.64	1.20	1.00	1.12	1.07	1.15	1.11	1.51
Manufacturing	1.42	1.22	1.27	1.08	1.16	1.19	1.20	1.37
Utilities	1.27	1.20	1.30	1.01	1.09	1.15	1.19	1.24
Construction	1.14	1.10	1.14	1.14	1.06	1.10	1.28	1.03
Trade & Repair	1.14	1.04	1.00	1.09	1.08	1.12	1.05	1.01
Transportation	1.06	1.05	1.05	1.06	1.04	1.08	1.24	0.97
Information & Media	1.19	1.20	1.19	1.15	1.22	1.12	1.28	0.96
Hotels & Restaurants	1.52	1.04	1.21	1.18	1.03	1.12	1.03	1.11
Financial services	1.28	1.19	1.28	1.05	0.98	1.11	1.58	0.94
Business services	1.10	0.96	0.91	0.94	0.99	1.00	0.97	0.80
Public administration	1.13	1.15	1.27	1.00	1.11	1.11	1.15	1.09
Education	1.00	1.13	1.12	1.06	0.98	1.20	1.11	1.03
Health	0.88	1.08	1.15	1.03	1.05	1.05	1.10	0.96
Other services	1.06	1.00	0.92	1.02	1.00	1.01	1.06	1.07
Scenario 2								
Agriculture	1,42	1.13	0.98	1.10	1.00	1.04	1.02	1.47
Manufacturing	1,23	1.15	1.24	1.06	1.07	1.08	1.10	1.33
Utilities	1,10	1.13	1.27	1.00	1.01	1.04	1.09	1.20
Construction	0,99	1.03	1.12	1.12	0.98	1.00	1.17	1.01
Trade & Repair	0,99	0.98	0.98	1.07	1.00	1.02	0.96	0.99
Transportation	0,92	0.99	1.02	1.04	0.97	0.99	1.14	0.94
Information & Media	1,03	1.13	1.16	1.13	1.13	1.02	1.18	0.93
Hotels & Restaurants	1,32	0.98	1.18	1.16	0.96	1.02	0.94	1.08
Financial services	1,11	1.12	1.25	1.03	0.91	1.01	1.45	0.91
Business services	0,95	0.90	0.89	0.92	0.91	0.91	0.89	0.78
Public administration	0,98	1.08	1.24	0.98	1.03	1.01	1.05	1.06
Education	0,87	1.06	1.10	1.04	0.91	1.09	1.02	1.00
Health	0,76	1.01	1.12	1.01	0.97	0.96	1.01	0.93
Other services	0,91	0.94	0.90	1.01	0.93	0.92	0.97	1.04

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

In Table 15 the manufacturing sector has a LMS above 1 and hence a surplus in both scenarios and for all clusters. Also, in both scenarios and for almost all clusters business services has a distinct value below 1 signaling shortages. The US and the West Europe-Rhineland are an exception in the low growth scenario. In Eastern Europe shortages also emerge in construction, trade & repair and transportation in both scenarios. In other European regions this is only the case in Scenario 2.

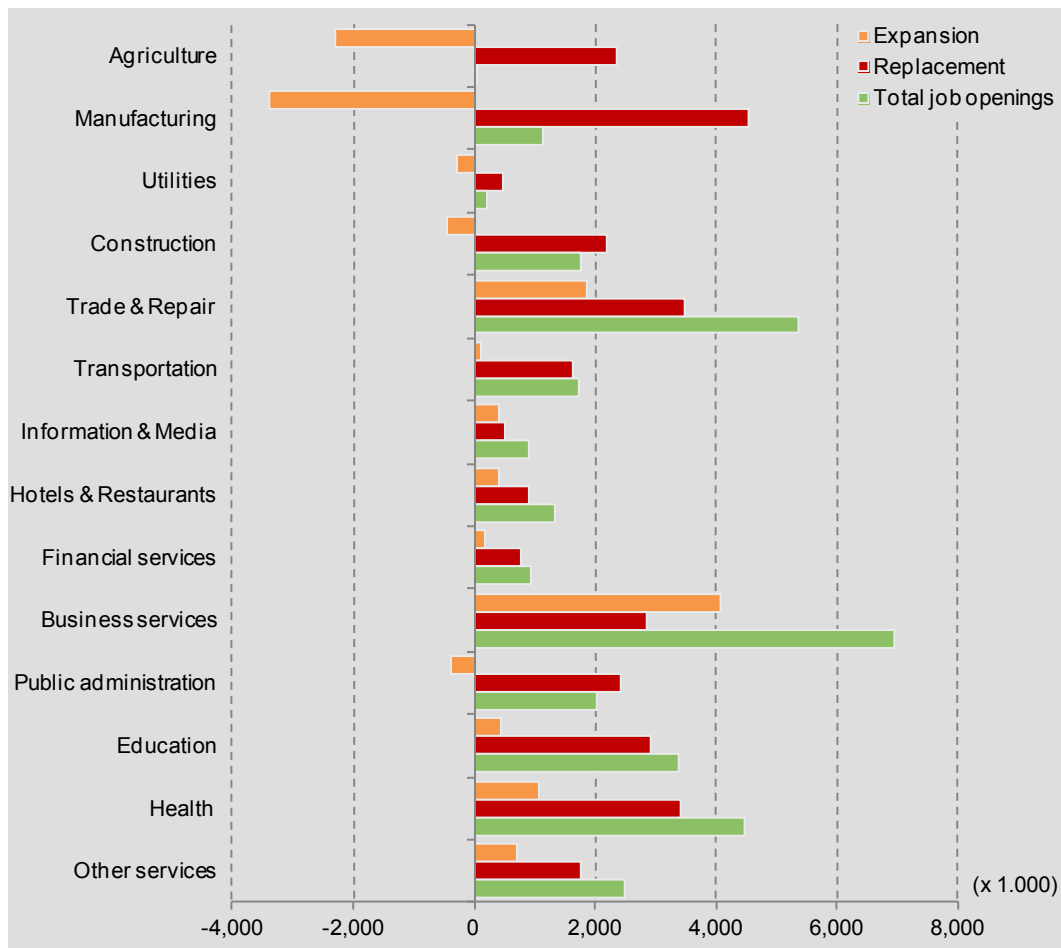
Table 15 gives LMS values higher than 1, pointing to surpluses, for information & media and financial services. This is a somewhat surprising result as labor demand in these sectors is expected to grow in the structural employment shift from industry to service. An explanation would be that on the supply side -given the educational background of the future labor force- too many people have qualifications that direct them to these sectors. It could be for instance that in the future more people will hold a qualification in economics or information sciences than the financial services sector or the information and media sector can absorb.

Job openings and vacancies in times of contraction and in declining sectors

The results of section 5.3.2 may give the false impression that there are no employment opportunities or vacancies at all in the manufacturing sector (or any other primary sector). Even if employment falls, there will be numerous vacancies and new job opportunities in a declining sector. The net contraction of the number of jobs in a declining sector is the end result if on the one hand of new jobs opportunities are created and on the other hand existing jobs are destroyed. Even within a declining sector there are firms that expand employment while other firms in the same sector contract employment. A declining sector is a sector where contracting firms contract more than expanding firms expand. In the end more jobs are destroyed than created, but there is always creation. Appendix B provides all the details. in this box job creation and destruction will be explained for the EU27 in Scenario 1.

New job openings arise from multiple sources. First, the economic business cycle by itself creates and destroys jobs. The number of job openings that follow from economic growth is called **expansion demand**. As a company or sector expands additional workers are needed to increase production. During economic downturns production falls and people will be laid off. Second, vacancies arise when workers retire from the labor market. They leave behind job openings. **Replacement demand** is the total of all job openings needed to maintain the same level of employment. The sum of expansion demand and replacement demand adds up to total job openings.

Job openings in all industries, even in case of negative expansion demand



All figures (x 1.000), people aged 20-64
 Source: calculations by SEO Economic Research.

The figure above illustrates this interaction of expansion demand; replacement demand and job openings Take the manufacturing industry. Due to the structural shift in sector employment away from the industrial sector explained earlier, employment falls with 3 million workers (negative expansion demand). In the same period, more than 4.5 million workers leave the industry for retirement (implying an equivalent replacement demand). While not all these retirees need to be replaced due to the negative expansion demand, still more than 1.5

million jobs open up. Even in this low growth scenario there is always enough positive replacement demand to compensate for negative expansions demand in all the sectors where this occurs. Of course for sectors with positive expansion demand, replacement demand is simply added increasing total job openings even more.

In the final three sections the labor market surplus indicator will be calculated for a higher level of specificity than in this and the previous section. The focus will be on skill mismatch in terms of level of education (vertical mismatch) and on the field of education and type of occupation (horizontal mismatch). In this way the next sections will give an indication of the extent on qualitative mismatch. The central question will be whether the *right* workers will be available in the labor market given the requirements of the jobs?

5.4 Vertical mismatch by level of education

The current section measures vertical mismatch, by analyzing the LMS for different levels of education. Vertical mismatch will arise if there are differences between levels of education supplied by the labor force and demanded for employment (see Chapter 2 or Appendix A.3). This section looks for an answer to the question whether the future number of workers with high, medium and low education matches the number necessary given future job requirements?

There are three possible outcomes as far as vertical mismatch is concerned. Either there will be more workers with a given level of education on the labor market in 2020 than employers need, in which case a surplus of workers with this educational level will arise (and the Labor Market Surplus(LMS) indicator for workers with that educational level will be greater than 1). Or there will be fewer workers with a given level of education than there is demand and then there will be a shortage of workers with that educational level (and the LMS indicator will be smaller than 1). Finally it is also possible that there are exactly enough workers with a given level of education than will be demanded in the future (in which case the LMS indicator is exactly 1) .

In developed and developing economies more capital intensive production as well as innovation in the production technology are expected to increase the demand for higher educated workers more than the demand for groups with less education. More capital intensive production and new technologies³² often imply that lesser skilled and lesser educated workers are substituted away as machines, robots and computers take over. At the same time these intricate production techniques require more skilled and higher educated workers to develop, monitor and manage them. Globalization and more intense international competition between trading nations also requires them to specialize more and more in knowledge intensive production. This trend also favors higher educated over lower educated workers. In most countries higher education has improved and has become more accessible over the years. The number of people graduating from higher vocational institutes and universities has increased substantially in the past and continues to do so. Clearly in most economies both labor demand and labor supply are upgrading.³³ Do these developments match?

³² New production technologies are often said to be *skill-biased* meaning that technical change favors skilled (high educated) labor over unskilled or lesser skilled labor.

³³ For a more detailed discussion of this matter see Appendix B.

Table 16 present LMS calculation per level of education for the United States and the EU27 in 2009 and 2020. ³⁴ In 2009 the EU27 runs surpluses on all levels of education. Lower educated labor is most abundant (an LMS of 1.15) while the surplus for higher educated workers is the smallest (1.05). The same conclusion holds for the United States in 2009. Again there are surpluses at all levels of education; the largest surplus is among lower educated workers (LMS of 1.22) and the smallest among higher educated (1.05).

In both scenarios past developments of increased demand for higher educated workers are projected to continue in the future (see Appendix B.3 for details). The increased demand for higher educated workers is clearly reflected in the results in Table 16 for both the EU27 and the US. Surpluses for higher educated persons decline in both scenarios. The surplus for higher educated workers changes into a shortage in the high growth scenario 2 in the EU27. In the US even the low growth scenario 1 leads to high education shortage in 2020.

For the medium and lower educated patterns are different between the EU27 and US and between scenarios. In the EU27 the surplus of medium educated workers increases (from 1.09 to 1.15) whilst that of lower educated decreases (from 1.15 to 1.13) in the low growth scenario. In the US the surplus of the lower educated workers increases substantially in the low growth scenario (from 1.22 to 1.65). It remains high (and is in any case always higher than in the EU27) even in the high growth scenario. In both scenarios and in both the EU27 and the US the surplus of medium educated workers increases in the low growth scenario and decreases in the high growth scenario compared to 2009 (more information is available in Appendix B.3).

Table 16 Different outcomes of LMS indicator in both scenario's, for EU27 and US

	2009	Scenario 1 (low)	Scenario 2 (high)
EU27			
Low	1.15	1.13	1.07
Medium	1.09	1.15	1.08
High	1.05	1.02	0.96
United States			
Low	1.22	1.65	1.43
Medium	1.11	1.23	1.06
High	1.05	0.99	0.86

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Table 17 presents trends in shortages and surpluses per level of education for all clusters within Europe. Remarkable in this table is that in the Anglosaxon and Scandinavian clusters shortages for lower educated workers appear in both scenarios. In the high growth scenario and only in the Anglosaxon cluster both higher and lower educated workers reveal shortages, whereas the medium educated still show a surplus. This is an example of what is sometimes called the 'squeezed middle' of the labor market, meaning that employment grows more at the lower and the upper end than in the middle. In Scenario 1 shortages of higher educated workers appear in the Mediterranean and Eastern Europe. With the exception of the Scandinavian cluster shortages of higher educated workers appear in all clusters a result of the relatively strong growth of the demand for higher skills in the future.

³⁴ See Appendix A.3 for a detailed definition of the education level classification.

Table 17 The LMS indicator for different countries and different level of education

	US	EU27	ANG	SCA	WRH	WFR	MED	EAS
2020, Scenario 1								
Low	1.65	1.13	0.89	0.87	1.09	1.17	1.22	1.24
Medium	1.23	1.15	1.25	1.13	1.06	1.12	1.19	1.19
High	0.99	1.02	1.02	1.03	1.06	1.07	0.98	0.93
2020, Scenario 2								
Low	1.43	1.07	0.87	0.85	1.02	1.06	1.12	1.20
Medium	1.06	1.08	1.22	1.12	0.99	1.01	1.09	1.15
High	0.86	0.96	0.99	1.01	0.98	0.97	0.89	0.90

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Structural unemployment and the interpretation of the LMS

When the value LMS is lower than 1 there are more jobs than workers and this effectively implies that there is a shortage. Similarly, a LMS value above 1 literally implies that there is a surplus with more workers than jobs. The dividing value of 1 is however too strict for the real labor market. A certain amount of unemployment is inevitable in every labor market, given that it always takes time to find a job. Vacancies have to be advertised, advertisements have to be read, applications be written, applicant to be interviewed and selected, and so on.

This inevitable unemployment percentage goes under different names such as structural unemployment, frictional unemployment, natural rate of unemployment and the Non Accelerating Inflation Rate of Unemployment (NAIRU). The latter term refers to the minimal level of unemployment below which the economy would start overheating and a wage and price inflation spiral would emerge. Structural unemployment is present on all national labor markets at any time. Its magnitude depends on institutional details (such as the settings of the unemployment benefit system or the strictness of dismissal protection) and may change over time. A lower structural rate of unemployment can be seen as the result of a better functioning labor market. The OECD provides estimates of the NAIRU percentage for the different OECD countries in 2011.³⁵ The NAIRU can be as low as 3.3 percent for Norway or 3.7 for the Netherlands and Korea, but also as high as 11.8 percent for Greece and 16 percent for Spain. The average NAIRU for the EU15 countries is 9.0 percent according to the OECD and 6.1 percent in the US.

Taking into account an inevitable percentage of unemployment at any time on the labor market, how should one read the LMS value? Take for example the small surplus of high skilled workers in the EU27 in the low growth scenario 1, signaled by a LMS of 1.02. This would mean that around 2 percent of the available labor force is without a job, so unemployment is also around 2 percent. Does that mean that there is no labor market tightness, and that employers can choose among an abundance of candidates for a vacancy? Not really. LMS of 1.02 means that the unemployment rate is below the inevitable level of unemployment in all countries. Using the NAIRU as a measurement of the minimal inevitable level, that 1.02 is certainly below the Eurozone NAIRU of 9 percent in 2011 which would correspond with a LMS value of 1.09.

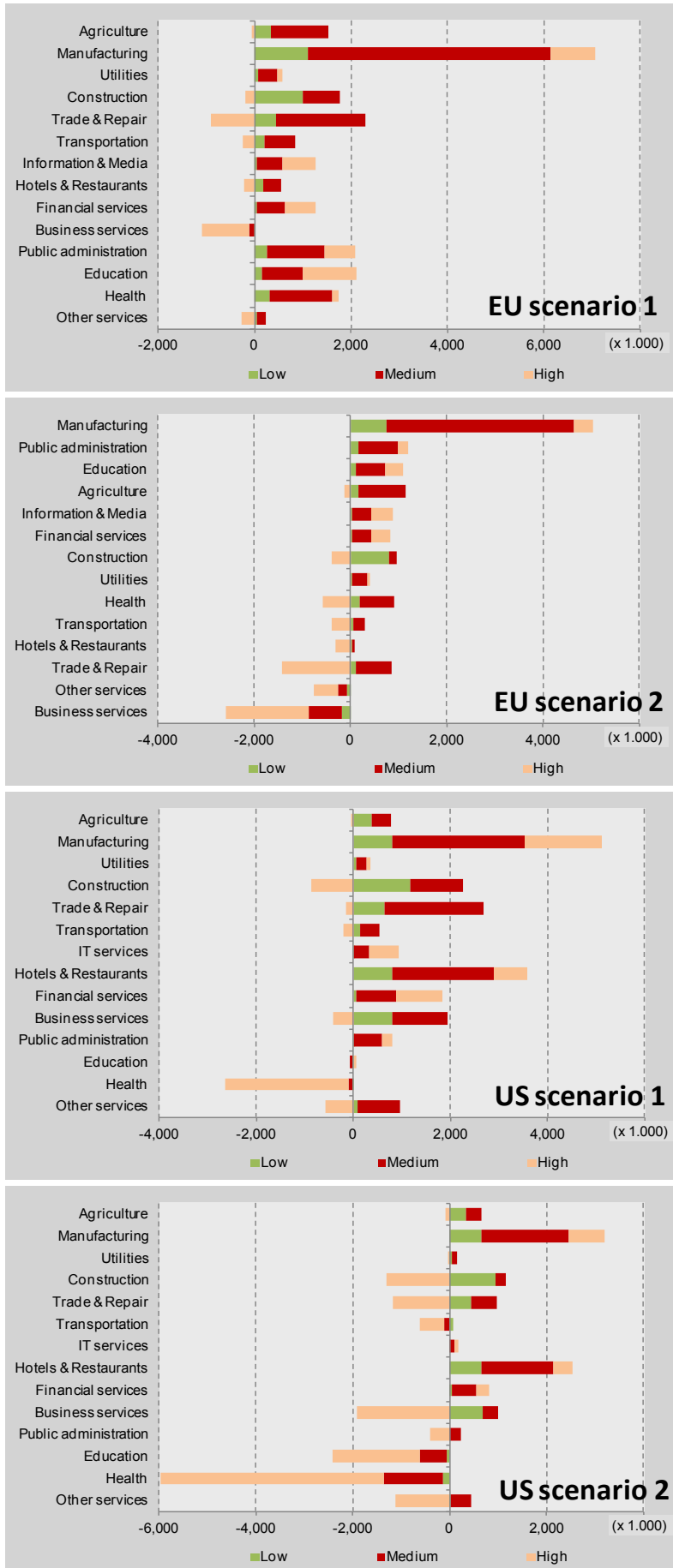
Interpreting the LMS value, it is maybe not realistic to use the value of one as a dividing line between surplus and shortage. As the value of the inevitable level of unemployment varies substantially between countries and will probably be different in 2020 compared to what it is now in each country, it is hard to pin down a fixed value. As a rule of thumb one could suggest that maybe a 6 percent (the US value of the NAIRU) could be used as representative for what a decent functioning labor market would show. Hence a LMS value of 1.06 would be the dividing line between a tight labor market for values lower than that and a loose labor market for higher values.

Shortages and surpluses by industry and level of education

Within industries shortages and surpluses of workers with different qualifications coexist. For example, a shortage of higher educated workers in an industry can exist together with abundance of medium and lower educated workers. Appendix C contains detailed tables.

³⁵ see <http://stats.oecd.org/Index.aspx?QueryId=32456>

Figure 13 Even within industries shortages and surpluses coexist



Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

By way of illustration Figure 13 shows the results for the EU27 and US in both scenario's. A positive number indicates a surplus, while a negative number points to a shortage. In manufacturing there is a surplus of workers for all levels of education. In construction the situation is different: there is a surplus of low and medium educated workers, but at the same time a shortage of high educated workers. Mixed outcomes are also present in many other sectors, such as health, trade & repair or agriculture. In the business services sector and other services there is an overall shortage on all educational levels.

Even though Figure 13 is quite illustrative, a table with LMS indicators makes it possible to compare results in a compact way across scenarios and between US and EU27. Table 18 provides such an overview. Here the surplus of labor in the manufacturing sector for all levels of education (as seen in Figure 13) is reflected by a LMS above 1 for all those levels. The existence of vertical mismatch in construction is reflected by a LMS above 1 for lower and medium educated workers together with a LMS below 1 for higher educated.

Table 18 The coexistence of surpluses and shortages within industries

EU27	Scenario 1			Scenario 2		
	Low	Medium	High	Low	Medium	High
Agriculture	1.13	1.31	0.94	1.06	1.23	0.89
Manufacturing	1.19	1.28	1.11	1.12	1.20	1.05
Utilities	1.18	1.26	1.11	1.11	1.19	1.04
Construction	1.30	1.08	0.94	1.22	1.01	0.88
Trade & Repair	1.09	1.10	0.89	1.02	1.04	0.83
Transportation	1.10	1.10	0.89	1.03	1.03	0.84
Information & Media	1.23	1.24	1.18	1.15	1.16	1.11
Hotels & Restaurants	1.07	1.07	0.87	1.01	1.01	0.82
Financial services	1.14	1.20	1.18	1.07	1.13	1.11
Business services	1.00	0.99	0.92	0.94	0.93	0.86
Public administration	1.20	1.20	1.10	1.13	1.12	1.03
Education	1.22	1.24	1.09	1.15	1.17	1.03
Health	1.15	1.14	1.01	1.08	1.07	0.95
Other services	1.03	1.03	0.93	0.96	0.97	0.87

United States	Scenario 1			Scenario 2		
	Low	Medium	High	Low	Medium	High
Agriculture	2.72	1.71	0.90	2.35	1.48	0.78
Manufacturing	1.78	1.46	1.30	1.54	1.26	1.12
Utilities	1.63	1.32	1.15	1.42	1.14	1.00
Construction	1.83	1.19	0.69	1.58	1.03	0.60
Trade & Repair	1.54	1.21	0.98	1.34	1.05	0.85
Transportation	1.40	1.12	0.89	1.21	0.97	0.77
Information & Media	1.23	1.23	1.17	1.07	1.07	1.02
Hotels & Restaurants	1.83	1.53	1.36	1.58	1.32	1.18
Financial services	2.70	1.38	1.22	2.33	1.19	1.06
Business services	2.04	1.22	0.96	1.77	1.05	0.83
Public administration	1.22	1.26	1.06	1.06	1.09	0.91
Education	0.93	0.98	1.01	0.81	0.85	0.87
Health	0.97	0.99	0.81	0.84	0.86	0.70
Other services	1.21	1.29	0.83	1.05	1.12	0.72

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Table 17 did not reveal an overall shortage of higher educated workers in Scenario 1 for the EU 27, yet Table 18 shows that even in this low growth scenario many sectors potentially face

shortages. In the EU27 the LMS is below 1 for higher educated workers in both scenarios for agriculture, construction, trade & repair, transportation, hotels and restaurants, business and other services. Table 17 already signaled an overall shortage of higher educated workers in Scenario 1 in the US. Table 18 reveals that this is not the case in all sectors. A potential shortage of higher educated workers is highest in construction (LMS = 0.69) but also substantial in the health sector (LMS = 0.81). In manufacturing, hotels & restaurants and financial services higher skilled labor is relatively abundant (with LMS above 1.2). In education there is no shortage of higher educated workers, but in this case lower and medium educated workers fall short.

The right hand side of Table 18 shows the results for the high growth scenario 2. Sectors already prone to potential shortages of higher educated workers in Scenario 1 now face even bigger challenges. In the EU27 labor shortages remain limited to the higher educated. Only in business services and other services does the supply of low and medium educated falls short. This general shortage of higher educated workers, could under conditions of high employment growth lead to under qualification. Jobs for higher educated workers might then be filled with medium educated workers. This also holds for the US. The LMS is predominantly below 1 for the higher educated. Again construction and health show substantial shortages (LMS = 0.60 and 0,70). Shortages of low and/or medium educated workers are limited to health, education and transportation.

Australia³⁶

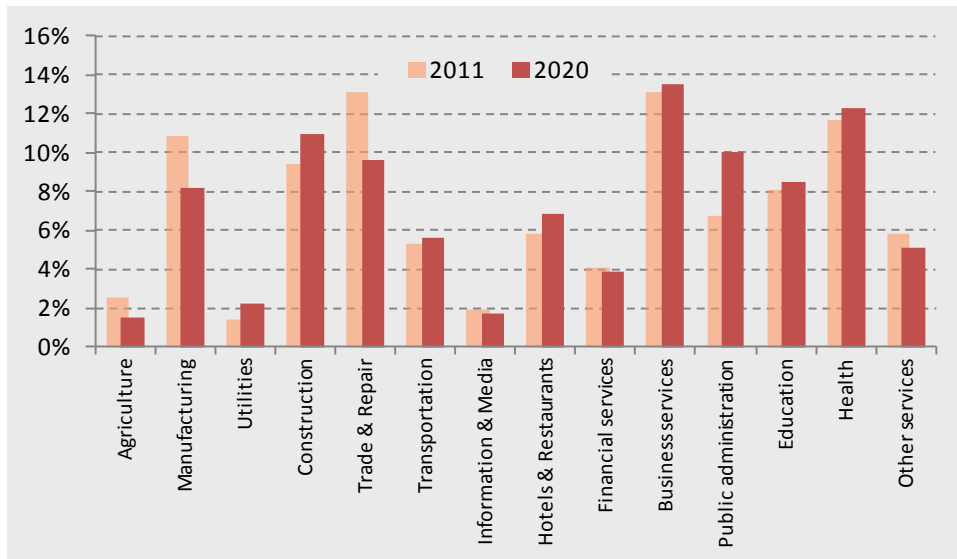
More than 10 million people are employed in Australia in 2011. Most people in employment are medium educated (45%), closely followed by the share of people with high education. The size of the labor force in 2011 is almost 11 million. The rate of unemployment is on average 4.6%. Unemployment is more severe among the lower educated (7.7%). The total number of people aged 20 to 65 years old is 13.4 million. Not all of these people choose to participate in the labor market. About 2.5 million are not in the labor force.

	Low	Medium	High	Total (x1,000)
2011				
Employed	16%	45%	39%	10,378
Unemployed	26%	46%	28%	479
<i>unemployment rate</i>	7.7%	4.7%	3.3%	4.6%
Labor force	16%	45%	39%	10,857
Not in labor force	34%	40%	26%	2,513
Total population	20%	44%	36%	13,371

³⁶ This analysis in the textbox on Australia is based on customized tables obtained from the Australian Bureau of Statistics (ABS) and on data from the 2006 Australian Census (publically available via the ABS-website). As a result, classifications are not completely comparable to those for the other countries. The base year for Australia is 2011 and not 2009 as for other countries. For some projections 2006 Census data are used. The projection year is still 2020. The projections are based on the SkillsInfo forecast for 2011-2016 by the DEEWR in Australia (DEEWR, 2011). The DEEWR prognoses an annual employment growth of 2.2 percent. Projected growth of the population 20-64 is 1.1 percent. Without increasing participation, employment growth easily outpaces growth of the labor force, resulting in shortages in all sector. To make the analysis more insightful and to take account of possible long run effects of the economic and financial crises, a more conservative estimate of 75% of 2.2 percent employment growth is used in the projections. To summarise. The following assumptions are made in the projections for Australia:

- o Average annual employment growth: 0.75 * 2.2 percent
- o Average annual growth of the population 2064: 1.1 percent
- o Labor Force Participation rate is assumed to remain constant over time. Historically the participation rate rises, but the ABS expects a slight decrease in the future(ABS, 2006)
- o Level of education: both in employment and in the labor force the share of low educated is assumed to decrease (considerably) and for higher educated to increase. The share of people with medium level of education slightly falls (about one percentage point) in employment and in the labor force.

In 2020 most people will work in business services and the health sector. Other services sectors such as health, trade & repair and public administration have substantial employment shares. The high share of construction is remarkable.

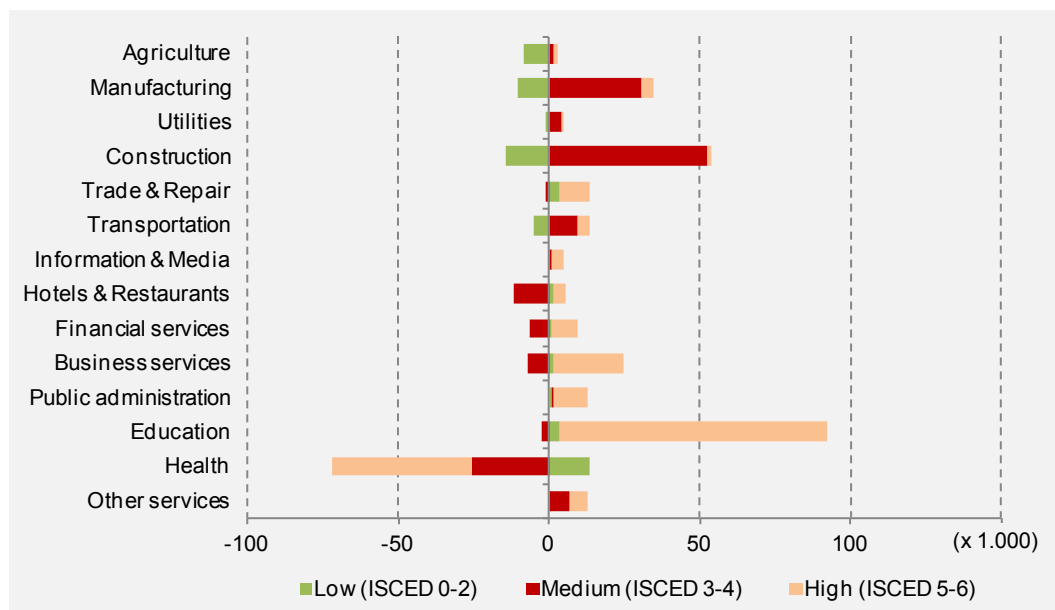


Scenario results

As a result of the relatively high employment growth (higher than the growth of the population) shortages will arise in 2020. The LMS is lower or close to one overall and in most sectors in 2020 signalling tightness of the labor market. As can be seen from the two bottom rows the LMS value gets smaller between 2011 and 2020 for all levels of education signalling increased tension or even a shortage. In particular the LMS for lower educated falls. This is not the result of an increased demand for lower educated but follows from of a sharp decline of the share of lower educated that is expected. Historically the share of lower educated workers in the Australian has been declining quickly. This shortage of lower educated may induce overqualification. People with medium education may fill jobs suitable for lower educated workers.

	Low	Medium	High	Total (all levels)
Agriculture	0.89	1.01	1.01	0.98
Manufacturing	0.93	1.05	1.01	1.02
Utilities	0.95	1.05	1.01	1.02
Construction	0.91	1.06	1.00	1.03
Trade & Repair	1.02	1.00	1.02	1.01
Transportation	0.96	1.03	1.02	1.01
Information & Media	1.02	1.01	1.03	1.02
Hotels & Restaurants	1.01	0.97	1.02	0.99
Financial services	1.04	0.96	1.03	1.01
Business services	1.02	0.99	1.02	1.01
Public administration	1.02	1.00	1.03	1.02
Education	1.13	0.98	1.11	1.09
Health	1.13	0.95	0.96	0.97
Other services	1.01	1.02	1.03	1.02
Total – 2020	0.99	1.01	1.02	1.01
Total – 2011	1.08	1.05	1.03	1.05

As shown below shortages and surpluses coexist across sectors. Compared to other countries the shortage of lower and medium educated workers in many sectors is striking. The shortage in the health sector is similar to other labor markets.



Sources:

ABS (2006). Labour Force Projections, Australia, 1999 - 2016 (latest update 2006). Available online via: <http://www.abs.gov.au/ausstats/abs@.nsf/productsbytitle/7B1790B756ACDB40CA2568A900139407?OpenDocument> (retrieved April 12th, 2012)

ABS (2012a). Census 2006. Available online via: <http://www.abs.gov.au/census> (retrieved March, 2012)

ABS (2012b). Customized tables on request by SEO

DEEWR (2011). Employment Projections by Industry, Occupation and Regions. Available online via: <http://www.deewr.gov.au/LMIP/default.aspx?LMIP/Publications/IndustryEmploymentProjections> (retrieved March 11th, 2012)

5.5 Horizontal mismatch by field of education

Do workers have the right field of education? Even if there are enough people in terms of level of education, there may still be horizontal mismatch. For instance, assume that there are enough people with a medium level of education and the labor market requires 18 percent medium educated health care graduates. Horizontal mismatch in terms of field of education would arise in this example if only 15 percent of these people with medium education have a degree in health care.

In this chapter two kinds of horizontal mismatch will be discussed. This section presents projections of horizontal mismatch by field of education. The next section addresses horizontal mismatch by type of occupation. Horizontal mismatch by field of education will occur in 2020 when there are more workers with a given field of education than there are jobs requiring that field. For instance there might be more workers with a degree in social science than employers need in the future. In that case there will be a surplus of workers with a social science degree and

the LMS will be higher than one for workers having studied in the social sciences field. For other fields of education the reverse could be true. For instance there might be less workers with a degree in engineering than needed in the future. In that case there will be a shortage and the LMS will be smaller than one for workers having studied engineering. If there are exactly as many workers with a given field of education as there are jobs requiring that field the LMS is equal to one for that field.

As explained in Section 3 there are acceptable economic explanations for the observed trend in increasing demand for higher educational levels and good reasons why this would continue in the future. There is nothing comparable concerning views on the longer term developments in the demand for particular fields of education. It would seem safe to assume that future economies will need different fields of education in the same way as now. In the projections of both scenarios it is assumed that per level of education the distribution per field of education in 2020 is equal to the distribution in 2009 (for details see appendix B).

Table 19 presents the results for Europe and United States.³⁷ There is a surplus for all fields of education in 2009. In the EU27 this is highest for those with general education. This is consistent with the results of section 5.4. There the LMS was the highest for lower educated and all low education programs are classified as ‘general’. Among the other fields of education the LMS is either 1.07 or 1.08. The US tells a different story. Labor is especially abundant among those with a degree in social sciences & humanities and engineering, science and agriculture.

In Scenario 1 surpluses slightly increase in the EU27 as employment growth is limited. Only for those workers with a degree in health does the value of the LMS drop ever so slightly (from 1.07 to 1.06). The LMS ranges between 1.06 (for health) and 1.13 (for general educated). In 2009 the LMS ranged between 1.07 and 1.13. Hence the incidence of horizontal mismatch does not change a lot. Results are more varied for the United States. There are shortages for people with a degree in health and social sciences & humanities.³⁸ For the general educated and people with a degree in services³⁹ the LMS increases. In 2009 the LMS-range was between 1.09 and 1.21; in Scenario 1 it will range between 0.91 (for health) and 1.30 (for general educated) in 2020. This wider range indicates a small increase in potential horizontal mismatch.

In Scenario 2 the LMS declines in the EU27 for all fields of education because of higher employment growth. Especially workers with degrees in health and social sciences & humanities benefit. Their LMS is close to 1. Still, the range of LMS values for the various fields remains relatively narrow. There is little change in the incidence of horizontal mismatch. In the United States the results of Scenario 2 vary much more. The LMS increases for workers with a degree in general education programs and services. For all the other fields the LMS declines considerably. This is mainly related to level of education. It is mostly the higher educated workers who hold these degrees and demand for higher educated workers increases (as seen in section 5.4).

³⁷ See Appendix A.3 for a detailed definition of the educational field classification.

³⁸ This field also includes educational programs in economics and business studies. See Appendix A.3 for an overview of fields of education.

³⁹ Including education in hospitality, beauty services and transport services

Table 19 Horizontal mismatch more stable in the EU27 than in the US

	2009	2020 - Scenario 1	2020 - Scenario 2
EU27			
General	1.13	1.13	1.07
Education, Humanities & Social	1.07	1.07	1.01
Science, Engineering & Agricultural	1.08	1.10	1.03
Health & welfare	1.07	1.06	1.00
Services	1.08	1.11	1.04
United States			
General	1.03	1.30	1.12
Education, Humanities & Social	1.21	0.99	0.86
Science, Engineering & Agricultural	1.16	1.09	0.94
Health & welfare	1.08	0.91	0.79
Services	1.00	1.18	1.03

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

Table 20 shows the Scenario 1 and Scenario 2 results for clusters of countries in Europe. Most striking are the differences in the LMS for workers with a degree in health care. In the Anglosaxon cluster the LMS is high for health in both scenarios, while at the European mainland the LMS is relatively low. In both scenarios there are even shortages (signaled by an LMS below 1) for particular clusters. The difference is explained by the limited employment growth in the health sector in the Anglosaxon cluster employment growth in the health sector is limited combined with a growing number of workers in the labor force with a health degree.⁴⁰

Table 20 shows that the considerable surplus of general educated workers for the EU27 as a whole is consistently reflected in all European regions. For all regions the LMS for general education is above 1. Scandinavia is the only exception. Only here a shortage is expected (LMS is 0.97).⁴¹

For the EU27 in general there is little horizontal mismatch (in both scenarios the range of the LMS along fields is limited, disregarding general education). For some European clusters however horizontal mismatch can be more extensive. For instance in Eastern Europe in Scenario 2 the LMS ranges from 0.94 to 1.17.

⁴⁰ Cedefop (2010) does not expect increased employment in the health sector in the UK. In their analyses of structural demand trends (discussed in section 5.3.1) the share of health care does not increase, but declines instead.

⁴¹ Scandinavia does show a large decline of low educated workers. Low educated workers are all classified as general.

Table 20 LMS Indicator for field of education per region, 2020

	US	EU27	ANG	SCA	WRH	WFR	MED	EAS
Scenario 1								
General	1.30	1.13	1.12	0.99	1.10	1.15	1.20	1.20
Education, Humanities & Social	0.99	1.07	1.06	1.04	1.05	1.10	1.07	1.00
Science, Engineering & Agricult.	1.09	1.10	1.08	1.11	1.06	1.10	1.07	1.13
Health & welfare	0.91	1.06	1.15	1.03	1.07	1.04	0.99	0.96
Services	1.18	1.11	1.19	1.12	1.06	1.12	1.11	1.14
Scenario 2								
General	1.12	1.07	1.09	0.97	1.02	1.05	1.10	1.17
Education, Humanities & Social	0.86	1.01	1.03	1.03	0.97	1.00	0.98	0.98
Science, Engineering & Agricult.	0.94	1.03	1.06	1.09	0.99	1.00	0.98	1.10
Health & welfare	0.79	1.00	1.12	1.01	0.99	0.95	0.90	0.94
Services	1.03	1.04	1.16	1.10	0.99	1.02	1.02	1.11

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

5.6 Horizontal mismatch by type of occupation

A second dimension of horizontal mismatch is along type of occupation (see appendix B for more details). Horizontal mismatch by type of occupation will happen in 2020 when there are more workers with a given type of occupation than there are jobs requiring that occupation. For instance there might be more workers with a clerical occupation than there is demand for that particular type of occupation in the future. In that case there will be a surplus of clerical workers and the LMS for clerical occupations will be higher than one. The reverse can be true for other types of occupation. Professionals could be in short supply in the future when there are fewer workers with a professional occupation than there are jobs for them. In that case the LMS for professional occupations will be less than one in 2020. If for a given type of occupation supply equals demand, the LMS is one.

Both Cedefop (2010) and BLS (2012) present trends in the occupational makeup of employment. Combined, this information yields potential future surpluses and shortages by type of occupation. In the results in the tables the occupational type ‘managers’ is disregarded as these positions can easily be created or destroyed and pose no real challenges.

The most important result in this section is that there is a shortage of elementary workers in almost all regions in 2020 for both scenarios (see Table 21 and Table 22).⁴² Only for the United States and for Scenario 1 the LMS is above 1. But note that not only the lower educated workers work in an elementary occupation. About half of the workers employed in elementary job have a medium level of education.⁴³

Table 21 also illustrates that in both the EU27 and US in both scenarios more traditional skilled manual labor (farmers, craftsmen and plant and machine operators) are in surplus. The LMS is highest for the cluster Agri, Craft & Plant for every combination of country and scenario. These

⁴² See Appendix A.2 for a detailed definition of the occupation type classification.

⁴³ This is a clear example of overqualification. Students with a high school degree are counted as medium educated, and many of them work in elementary occupations, which are associated with the lowest skill level (see Appendix A).

are occupations that with increasingly clever information technology are more easily automated nowadays than previously. Similar substitution effects are also happening for clerical and service occupations reducing the demand for these occupations. However this negative effect is counteracted by a positive demand effect generated by the structural growth of the service sectors in most countries. The result of these opposing demand effects is that the surplus of clerical and service occupations is not as pronounced as for farmers, craftsmen and operators and that the LMS becomes even smaller than one in the high employment growth scenario in the US and in some of the European countries.

Table 22 presents the results for the European clusters in Scenario 1 and Scenario 2 for 2020. The table supports the main conclusions discussed earlier. There is a general shortage of elementary workers across all clusters. What stands out are shortages of professionals in the Mediterranean in Scenario 2 and of clerical and services workers in East Europe in 2020.⁴⁴ The results in Table 21 and Table 22 also show that in all countries, in particular in Europe, there is more horizontal mismatch in terms of type of occupation than in terms of field of education. Ranges in LMS indicators (the difference between the highest and lowest LMS value) are broader in this section than in the tables in section 5.5.

There is much discussion among labor market researchers and in the popular press about the ‘squeezed middle’. What seems to be going on in a number of labor markets is that there is a relative increase in the demand for occupations in the top and the bottom of the labor market, while occupations in the middle part are somehow squeezed out. Assigning profession occupations to the top of the labor market, elementary occupations to the bottom and the clerical and service occupations and the agricultural, craft and plant operators to the middle, then the results of tables 10 and 11 point in the direction of the hypothesis of the squeezed middle. The results are not clear cut, but shortages of elementary workers and professionals occur in a number of countries and agricultural, craft and plant operators show a surplus in all countries in both scenarios.

Table 21 Shortages mostly for elementary occupations in the EU and the US

	2009	2020 - Scenario 1	2020 - Scenario 2
EU27			
Professionals	1.07	1.11	1.05
Clerical & Service	1.10	1.11	1.05
Agri, Craft & Plant	1.11	1.16	1.09
Elementary	1.12	0.91	0.85
United States			
Professionals	1.08	1.06	0.91
Clerical & Service	1.08	1.13	0.98
Agri, Craft & Plant	1.13	1.24	1.07
Elementary	1.13	1.14	0.99

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

⁴⁴ A possible explanation for this observation is related to different stages of economic development. Compared to northern and western European regions, the Mediterranean and Eastern Europe regions are in the middle of transiting from lower to higher services economies.

Table 22 All European clusters have shortages for elementary occupations in 2020

	US	EU27	ANG	SCA	WRH	WFR	MED	EAS
Scenario 1								
Professionals	1.06	1.11	1.10	1.05	1.08	1.15	1.09	1.09
Clerical & Service	1.13	1.11	1.16	1.10	1.06	1.13	1.19	1.02
Agri, Craft & Plant	1.24	1.16	1.10	1.08	1.09	1.14	1.23	1.23
Elementary	1.14	0.91	0.94	0.94	0.91	0.84	0.95	0.88
Scenario 2								
Professionals	0.91	1.05	1.07	1.03	1.00	1.05	1.00	1.06
Clerical & Service	0.98	1.05	1.13	1.08	0.99	1.03	1.09	0.99
Agri, Craft & Plant	1.07	1.09	1.08	1.06	1.02	1.04	1.12	1.20
Elementary	0.99	0.85	0.91	0.92	0.84	0.77	0.87	0.86

LMS indicator is the ratio of labor supply over labor demand.

Source: SEO Economic Research, based on Cedefop (2010), BLS (2012), Eurostat (2012) and OECD (2012).

5.7 Conclusions

Possible future labor market developments were analyzed on different levels in this chapter. The following results are noteworthy:

- Demographic gaps are postponed. As a result of the economic crisis levels of employment have fallen and employment growth paths are predicted to be much weaker than expected earlier. Labor demand growth will generally lag behind labor supply growth and in most countries a labor surplus will result. Once economic growth picks up again and employment starts growing faster, shortages will become visible in the future as the demographic process of aging has not been stopped by the crisis.
- All economies in Europe and the United States are moving more and more towards a service economy. Especially in terms of employment. This implies that employment falls in primary sectors: agriculture, manufacturing and utilities. In most regions employment in health care and business services will grow substantially. Employment growth in other sectors differs across (clusters of) countries.
- An increased demand for higher educated workers is growing in most countries. Under the assumption of a high employment growth scenario, shortages of high educated workers will become dominant in the US and in Europe. The shortage of higher educated workers combined with surpluses of medium educated workers might lead to more vertical mismatch, in particular under qualification, as medium educated workers might move into jobs requiring higher education.
- Currently there is little horizontal mismatch by field of education at the EU27 level and this will probably remain at a low level in the future. In the United States there is currently a higher level of horizontal mismatch, which will probably continue into the future. Surpluses are to be expected for workers with general education and a degree in services in the US. In most countries health care graduates will be in short supply, with the one exception for Anglosaxon Europe. In all European country clusters general educated workers, with the exception of the Scandinavian cluster..
- Horizontal mismatch by type of occupation is persistent. In all regions and all scenarios there will be shortages of elementary workers. This seems counterintuitive as lower educated workers are abundant. However only half of elementary occupations are done by lower

educated workers as also medium educated workers occupy elementary occupations. Traditional manual skilled labor occupations (farmers and plant or machine operators) are in excess supply.

- Assigning profession occupations to the top of the labor market, elementary occupations to the bottom and the clerical and service occupations and the agricultural, craft and plant operators to the middle, then the results in this chapter provide some support for the hypothesis of the squeezed middle. The hypothesis of the squeezed middle predicts that demand for occupations in the top and the bottom of the labor market will grow faster than demand for occupations in the middle of the labor market.
- Although the outcomes of the analysis on horizontal and vertical mismatch describe labor markets on a detailed level, they are still national averages. Those averages may conceal large differences on the level of the individual company.

6 Policy recommendations

The EU employment target for the new EU 202 strategy for smart, sustainable and inclusive growth is that 75% of the 20-64 year-olds should be employed in 2020. According to Eurostat, the Statistical Bureau of the European Union, the employment rate for 20-64 year olds is 68.9 percent.⁴⁵ There is a gap of roughly six percent to be bridged in the next 8 years. To reach the ambitious employment goals in 2020 the member countries of the European need to create jobs and increase labor force participation.

On the other side of the Atlantic Ocean the US is struggling with an unemployment rate of around 8 percent. An unemployment rate that is substantially higher than it was in the recent past and that has also stayed stubbornly high longer than expected. US Job creation is not growing as fast as one would hope. The employment rate for 20-64 year olds is 70.5 percent.⁴⁶ There has been some reduction in the unemployment rate in recent months, but that is to a large part due to discouraged workers withdrawing from the labor market. Policies aiming at increased job creation and labor force participation are needed also in the US.

The previous “Bridging the Gap” report, published in June 2010, which focused among other things on a study of the main drivers of labor participation, proposed a large number of policy recommendations aimed at increasing labor supply in the years to come. Policy recommendations were divided into solutions for the short and the long run. Major recommendations from this earlier publication are summarized in the textbox ‘Recommendations from Bridging the Gap’.

These recommendations are still relevant today. The analysis of this report has added two extra dimensions to the previous set of recommendations. First, whereas the previous report stressed quantitative shortages that will arise in future labor market, the present report focuses on future qualitative mismatch. It stresses the divergence between the skills of the worker and those required for the job. The educational level of the worker can be too low or too high for what his job demands (vertical mismatch) or his field of study or occupational qualification can be completely different from what would be appropriate for the job (horizontal mismatch). As documented in the previous chapter vertical and horizontal mismatch will occur in various degrees in all national labor markets in the coming years. Mismatches affect workers and employers. A mismatched worker earns a lower wage and is less productive than a well matched comparable worker.

A mismatch is a match that by definition can be improved upon and spontaneous rematches happen all the time in the labor market. Still policies that restore and stimulate the dynamics of the labor market would be beneficial to counter and repair future mismatches. The first list of recommendations to be added to the ones from the previous report will consist of policies to improve the dynamics of labor market.

⁴⁵ reference year 2011

⁴⁶ reference year 2010

RECOMMENDATIONS FROM BRIDGING THE GAP (*)

Short Run Recommendations

DO NOT:

- Let government budget deficits run out of control
- Create ‘artificial’ public jobs that compete with market jobs
- Take measures that decrease labor supply, like early retirement schemes

DO:

- Use the recession to restructure the labor market
- Keep unemployment periods short
- Keep skills and competences up to date
- Recognize the potential of private employment agencies in easing transitions from work to work and from sector to sector

Long run Recommendations

DO NOT:

- Overdo the generosity of welfare benefits as they might stimulate withdrawal from the labor market
- Expect general training programs and wage subsidies to be effective, specific targeting is essential
- Expect childcare subsidies alone to stimulate women’s participation, availability at the right time and place is even more important

DO:

- Make participation pay
- Promote life long learning of workers
- Stimulate flexible contractual agreements to ease the work – private life balance
- Use employment agencies as transition managers, stimulate cooperation between public and private employment agencies

(*) Policy recommendations to increase participation in the labor market from the 2010 “Bridging the Gap” report.

Second, the findings of this report stress that the economic crises that most countries have experienced recently will have long run effects on employment growth. Fewer jobs will be created in the next years than had been expected before the economic crisis. As a result the shortage of workers that was expected in earlier studies, when the economic outlook was better, will be postponed. This report finds surpluses rather than shortages in most labor markets in 2020. This motivates a second list of policy recommendations to be added to those of the previous report. This list is geared towards support for the creation of jobs in the coming years.

However it should also be stressed that the overall surpluses of workers in 2020 conceals a lot of labor market hiring that will be going on in the coming years when employers will replace the large number of older retired workers. Given the age distribution of the workers quite a number of them will retire from the labor market between now and 2020. Not all of them will be replaced one on one, but still a large number of new workers will be needed to fill the gaps the retired will

leave. So even though there is a general surplus there will still be large number of vacancies arising in the years to come for which workers are needed.

An important message of this report is that there will be surpluses at the macro level of national labor markets in 2020 as a long run consequence of the severe economic crisis in recent years, but at the same time and at the more disaggregated sector levels surpluses and shortages will coexist. There will also be shortages and surpluses for different levels and fields of education in the coming decade. At the disaggregated level the picture is not uniform. In the near future labor markets will to a large extent have to reshuffle workers from sectors with surpluses to sectors with shortages. This combination of an overall surplus and sectoral and educational gaps points to matching problems: there will be enough workers for the available jobs if one is just counting numbers, but the skills of the workers do not always correspond to what is needed in the different sectors of the economy. This again stresses the importance of the double set of policy recommendations following from the scenario analyses for both the EU and the US in this report: create jobs to attenuate the overall surplus and at the same time improve the dynamics of the labor market.

In April 2012 the European Commission published a communication appropriately called ‘Toward a job-rich recovery’ containing a framework of policy recommendations in which it was also stressed that the dynamics of the labor market should be restored and improved and that job creation should be supported⁴⁷. The recommendations below are mostly in line with what the European Commission is also advocating.

Restore and improve the dynamics of the labor markets

As was stressed over and over again in this report matches are not always perfect and rematching makes it possible to attain better matches in terms of higher productivity and more job satisfaction. There are many policies that fall under the label ‘restoring and improving the dynamics of the labor market’ and that are helpful in improving the matches in the labor market and that stimulate rematching.

Start with policies to improve labor mobility. Policies to improve mobility in national labor markets will make it possible to achieve better matches. Labor mobility means that the worker changes jobs. The job change can be within the firm or can be between firms. Both forms of labor mobility are important. Internal labor mobility occurs when the worker changes functions or makes an upward or sideways promotion with the same employer. Human resource management within the firm is responsible to organize this in an optimal way. But internal mobility can sometimes be restricted by collective labor agreements forbidding, regulating or restricting job and function moves within the firm.

External job mobility, whereby the worker changes jobs and moves from one employer to another is often restricted by legal and institutional provisions such as pension arrangements that cannot be carried forward between different employers or loss of entitlements to unemployment benefits after changing jobs.

⁴⁷ Apart from recommendations related to increased job creation and improving the dynamics of labor market the EU Commission communication also mentions a set of recommendations to enhance EU governance.

Job mobility can be voluntary or involuntary. Voluntary job mobility happens when the worker freely decides to move to another job. Involuntary job mobility happens when the worker is forced to look for another job because he is fired or expects to be fired shortly. In the case of involuntary job mobility policies should help and encourage workers to find new jobs as fast as possible as soon as their present job is threatened. Various policies are relevant in this case, for instance retraining programs, the help of labor market intermediaries, temporary agency work as a stepping stone to other jobs, and unemployment benefit provisions that provide incentives to actively seek for a new job.

In a number of countries the labor market is divided in insiders and outsiders. Insiders are usually defined as workers who have secure jobs with attractive monetary and non monetary benefits. Outsiders are workers who have no jobs, or jobs that don't have these attractive characteristics. More importantly outsiders have a hard time to obtain an insiders job. The dividing line between insiders and outsiders is often also a dividing line between older and younger workers. If mobility between outsider and insider jobs is hard or even impossible than it is said that there is a dual (or segmented or polarized) labor market. Dual labor markets restrict the possibilities for rematching and for improving matches. Strict employment protection laws can be instrumental in creating a dual labor market.

In its communication the EU Commission stresses international mobility, in this context as free movement of labor, is a key European objective. In the next decade shortages will develop for higher educated workers on national labor markets. Improvements in the international mobility of young workers in the EU countries would obviously have benefits in reducing high youth unemployment in Southern countries and alleviate upcoming shortages in knowledge workers in the North. In contrast with the national differences between labor markets in the EU, the US labor market has the advantage of being one national labor markets. Geographical labor mobility occurs more often in the US than in Europe.

This is an obvious context to stress again the important role that labor market intermediaries, such as public and private employment services, can play to help in the matching and rematching process. That is a never ending process as labor demand and supply change all the time. Private and public employment services are transition agents and play a role as a lubricant in the matching process. Private and public employment services know about both sides of the labor market. They and can make use of the information they have on the characteristics of the job seekers and the requirement of the jobs openings to increase the number of matches in the labor market and improve their quality avoiding mismatches. Research shows that rematching improves the functioning of the labor market as it often moves workers from less productive to more productive matches and to matches that are more satisfying for the worker. The labor market gets better over time, in the sense that bad matches are replaced by better ones.

Future labor markets move in the direction where a large number of higher educated workers are required and fewer middle educated workers. The direction of the low educated workers is not completely clear. There would seem to be a surplus of lower educated workers in the future, but at the same time a shortage for people with an elementary occupation. One would expect a substantial overlap between these two categories. In any case the growing need for higher

educated workers would clearly necessitate education and training policies to invest in the skills of workers.

The policy recommendations in this sections can be summarized in the following list of DO's and DO NOTs

Recommendations to restore and improve the dynamics of the labor market

DO NOT:

- Get stuck into a dual labor market with insider and outsider groups
- Let institutional arrangements (such as pension provisions and unemployment schemes) restrict external labor mobility
- Let collective agreements or other outside agreements interfere with optimizing internal labor mobility

DO:

- Formulate policies to stimulate direct job to job mobility for workers that have lost their job or are threatened to loose their jobs shortly
- Create labor market institutions that stimulate mobility between all sectors in the economy
- Encourage international labor mobility (in EU) and geographical mobility within countries (within EU member states and in the US)
- Use reliable flexible contracts such as temporary agency work to stimulate matching and rematching
- Improve educational and training provisions to counter horizontal and vertical mismatch and to counter the expected shortage of higher educated workers
- Use private and public employment agencies as transition agents and exploit their informational advantages to stimulate rematching in the labor market

Support Job Creation

With the European and US employment growth still struggling with the aftermath of the recent recession job creation should be high on the agenda in all countries for the next years. Starting in the first half of 2012 the balance between taking austerity measures and stimulating economic growth seems to be shifting more towards the latter. Not only has Mr. Draghi, the President of the European Central Bank, been calling for a 'Growth Pact', urging European leaders to agree on labor and structural reforms to boost future growth, similar encouragement have been coming from Mr. Barroso and the European Commission. Election results in France and Greece and structural economic problems in the Spanish and Italian economies are also pushing in the direction of measures to stimulate economic and employment growth.

A 'Growth Pact' means different things for different people. For some a growth pact will consist for instance of more public investment in infrastructure (for instance road and high speed railway) boosting the construction sector and hoping that multiplier effects will ripple through the whole economy and create more employment everywhere. Given the size of the budget

deficit in most European countries and in the US the possibilities of huge public expenditure are limited.

In its ‘Toward a job-rich recovery’ communication the EU commission mentions active labor market and fiscal policies such as hiring subsidies, reduced tax wedges and boosting ‘take home’ pay to both increase labor demand and make sure that lower educated workers have decent labor incomes. In this study it is found that surpluses occur more often at the lower end of the labor market than at the upper end (for instance in terms of education). Specific policies geared toward the lower end of the labor market are supported by the research results in this report. The EU Commission especially encourages improvements in the labor market situation of more vulnerable groups such as young, female, less skilled and older workers, as well as those from a minority background. Not all these groups are covered by this study but the less skilled certainly are. The recommendations in the earlier study on “Bridging the Gap” already pointed at the importance of directing active labor market policies such as training and wage subsidies at specific vulnerable groups of the labor market.

In another batch of recommendations regarding job creation, the Commission wants to stimulate job growth in the green economy and in the health and social care sectors and in the demand for ICT professionals. These are the places in the labor market where a growth in employment can be expected in spite of the dire economic situation. This report confirms the expected expansion on the health and care sector. This report does not have a separate specification for the green sectors and the labor market for ICT professionals. But the report does show that employment in the business service sector will be growing stronger than in other sectors. The business service sector is a crucial employer for ICT professionals.

The previous study “Bridging the Gap” stressed that job creation should be directed at private sector jobs rather than artificial public jobs. In the spirit of that earlier recommendation it would be advisable to flesh out the ‘Growth Pact’ with structural policies that improve the functioning of the labor market and stimulate private sector employers to create more jobs. A fresh look at employment protection, unemployment benefits, training on the job provisions, and pension schemes could be part of a growth pact leading to structural changes in the labor market.

One of the central messages of the present study is the importance of re-matching in the labor market as a safety valve to repair the mismatches that will occur in the future. Policies to ease and accommodate re-matching would be an essential part of any Growth Pact. In this respect policy makers should look at the special role that modern labor relations such as part time work, temporary agency work and self employment can play in improving the working of the labor market and the creation of more jobs in the private sector. Making modern labor relations work means that the legal setting should be such that these new contracts can function as stepping stones towards permanent employment over a workers career. In the present turbulent labor markets it is maybe not possible to guarantee life time employment in the same job, but it should be possible to guarantee ‘life time work’ for every worker. A set of well defined modern labor contracts can help in making sure that every worker always has a job. Clearly unemployment is unavoidable in a dynamic labor market and many workers will experience unemployment spells during their lifetime. The policy recommendations to restore and improve the dynamics of the labor market and to support job creation should also result in minimizing unemployment and

help workers who lost their job find new jobs as fast as possible without long spells of unemployment.

The policy recommendations in this sections can be summarized in the following list of DO's and DO NOTs

Recommendations to support job creation

DO NOT:

- Increase public expenditures and investments too much if at all, as public deficits are already too high in most countries
- Create 'artificial public jobs that compete with private sector jobs (see also the previous report on 'Bridging the gap')
- Look for guarantees of lifetime employment in the same job, but formulate policies that guarantee work for everybody during their career.

DO:

- Find a balance between the need for austerity measures to clean up budget deficits and a growth program to encourage job creation
 - Direct active labor market policies (such as training programs and wage subsidies) at specific groups of the labor market where job creation is most needed (such as lower educated, young, female and older workers and ethnic minorities)
 - Give shortage sectors (health sector, business services) room for expansion in the future, make sure they are provided with workers having the level and field of education needed in these sectors.
 - Take a fresh look at employment protection regulation, unemployment benefit schemes, training on the job provisions, and pension schemes as part of growth pact to structurally improve the functioning of the labor market.
 - Look at the special role that modern labor relations such as part time work, fixed term contracts, temporary agency work and self employment can play in support of job creation
-

The recommendations in this concluding chapter are all geared towards the labor market in the next ten year. In the next years the economic crisis will cast a long shadow resulting in the creation of fewer jobs than expected earlier. Policies recommendations to promote job growth and to improve labor market dynamics are crucial in the years to come. Is it possible to say something about the more distant future? Not much, because the more distant the future the harder to predict changes in the world economy and in technology and how that will translate into employment structure. For instance a scenario whereby the industrial sector reduces to its essential core in the US and the EU is as probable as one whereby industrial production using new technologies returns back to these continents. History teaches that even severe economic crises do not go on forever. In the more distant future the effects of demographic changes and the aging process will have a defining influence on the supply and demand for labor. As a consequence labor markets will become tighter and quantitative mismatch will rise. The 'potential employment gap' of 35 million workers for 2050 in the EU that was projected in the earlier study on "Bridging the gap" is still relevant. Can something be said about the extent of qualitative

mismatch in 2050? Again disappointingly little, as it is impossible to predict with any confidence what the employment structure and hence the demand for education levels and fields and occupations will look like in 2050. Still with some hesitation two possible long run developments that might have an influence on the extent of vertical mismatch can be sketched. First, the rise of the potential employment gap in the next decades should translate in generally tighter labor markets and a reduction of the structural level of unemployment over the years. Unemployment periods often result in higher levels of mismatches with overeducation as higher educated job seekers take jobs that only require lower levels of education. Hence this specific form of vertical mismatch might occur less in the long run. Second, most labor markets show a long run relative increase in the demand for higher educated workers and professionals. As the economy becomes more capital and knowledge intensive the demand for high educated and highly skilled people increases. Demographic predictions for the next decades do not only predict larger generations of older people but also smaller generations of younger people. Given these demographic trends, too few high educated schoolleavers will enter the labor market in the future and the employment gap might become relatively more severe at the top end of the labor market. This could again result in fewer mismatches with the worker having a higher level of education than required in the job. If these two long run developments do effectively come through it could mean less mismatches with overeducational would occur in the long run. The flip side of this prediction is of course that more mismatches with undereducation will happen. The obvious recommendation following from this is more investment in schooling and training in the future. It is not possible to say anything sensible about the long run development of the extent of horizontal mismatch in the field of education or occupation.

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References

BLS (2009). Employment Outlook: 2008-2018. Monthly Labor Review, November 2009

BLS (2012). Employment Outlook: 2010-2020. Monthly Labor Review, January 2012

Cedefop (European Centre for the Development of Vocational Training) (2010). Skills Supply and Demand in Europe: Medium Term Forecast up to 2020, Publications Office of the European Union, Luxembourg. <http://www.cedefop.europa.eu/EN/publications/15540.aspx>

CPS (2012). Educational Attainment in the United States: 2000 - Detailed Tables. Available online: <http://www.census.gov/hhes/socdemo/education/data/cps/2000/tables.html> (retrieved January 27th 2012).

Eurostat (2012). Employment and unemployment (LFS). Available online: http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_unemployment_lfs/data/database (Retrieved January 2012)

Euwals, R. and K. Folmer (2009). Arbeidsaanbod en gewerkte uren tot 2050, Een beleidsneutraal scenario. CPB Memorandum No. 225. CPB: The Hague.

OECD (2012). Labor force survey (LFS) by sex and age. Available online via OECD.Stat (retrieved January 27th 2012).

R. Euwals en K. Folmer (2009), Arbeidsaanbod en gewerkte uren tot 2050, Een beleidsneutraal scenario, CPB. Memorandum No. 225, 23 april, Den Haag.

Acronyms

active labor force	the number of employed plus the number of unemployed (normally defined within the 'working age' population).
active population	same as 'labor force' or 'active labor force'
activity rate	number of employed plus unemployed ('labor force') as a percentage of the 'potential labor force'.
aging outflow rate	share of people in the workforce aged 55-64
ALMP	Active labor Market Policies; policies aiming to activate the inactive.
AOR	abbreviation of 'aging outflow rate'
babyboom generation	the generation born after the Second World War, between 1945 and 1960.
BLS	US Bureau of Labor Statistics
Cedefop	European Centre for the Development of Vocational Training
Ciett	International Confederation of Private Employment Agencies
CPS	Current Population Survey
EES	European Employment Strategy: employment guidelines for EU member countries.
effective retirement age	age at which an individual retires, regardless of the statutory retirement age.
ELFS	European Labor Force Survey.
employment population ratio	synonym for employment rate
employment rate	number of employed as a percentage of the 'working age population'.
EPL	Employment Protection Legislation.
EU	European Union.
Eurociett	European Confederation of Private Employment Agencies
expansion demand	the demand for labor that is induced because people demand more goods and services and hence more labor. It can also be negative, if the demand for goods and services falls. Or if the demand for goods and services can be accommodated by increasing labor productivity instead of labor supply.
fixed term contract	temporary contract directly concluded between employer & employee, with a defined end date or defined project.
flexicurity	an integrated EU labor market strategy to enhance, at the same time, job flexibility and income security .
FTE	Fulltime equivalent (1 FTE is usually 36-40 hours per week, depending on country and sector).
GDP	Gross Domestic Product.
grey rate	population aged 65+ as percentage of population aged 15-64.
horizontal mismatch	mismatch between the field of education of the worker (regardless of the level) and the the field of education required for the job
IDEAL	International Database of Employment and Adaptable labor.
ILO	International labor Organization: tripartite United Nations agency with a membership of 183 countries that draws up international labor standards.
IMF	International Monetary Fund: monitors the international monetary system and the economic and financial position of its 186 member countries.

inactive	not working and also not actively searching for a job. E.g. housewives and students who are actively looking for a job are not considered 'inactive', they are counted as 'unemployed'. Synonym for 'not in labor force'
inactive population	the people in working age that don't belong to the active population
ISCED	International Standard Classification of Education (see appendix A)
ISCO	International Standard Classification of Occupations (see appendix A)
ISIC	International Standard Industry Classification (see appendix A)
labor demand elasticity	the degree to which labor demand is affected by a change in wages.
labor force	synonym often used instead of 'active labor force': the number of employed plus the number of unemployed (normally defined within a 'working age' category).
labor productivity	the amount of goods & services that an employee can produce. Technical definition: total GDP / total employment
labor supply elasticity	the degree to which labor supply is affected by a change in wages.
LFS	Labour Force Survey.
LMS indicator	Labor Market Surplus indicator, actually the ratio of labor supply over labor demand. If $LMS=1$ the demand for labor is equal to the supply: the labor market is in equilibrium. If $LMS>1$, supply exceeds demand. If $LMS<1$ labor supply falls short of demand.
modern labor relations	all non-standard forms of employment.
non-standard employment	employment other than full time employment with an open-ended contract: part-time work, fixed-term contracts, temporary agency work and self-employment.
not in labor force	not working and also not actively searching for a job. E.g. housewives and students who are actively looking for a job are not considered 'inactive', they are counted as 'unemployed'. Synonym for 'inactive'
OECD	Organization for Economic Co-operation and Development. In Dutch: OESO.
open-ended contract	contract of unspecified duration; opposite of fixed-term contract. Equal to <i>permanent contract</i> .
overqualification	to hold a higher qualification than the current job requires.
penetration rate	average daily number of temporary agency workers <i>FTE</i> , as a percentage of total employment in persons.
permanent contract	contract of unspecified duration; opposite of fixed-term contract. Equal to <i>open-ended contract</i> .
potential employment gap	hypothetic employment gap due to a disequilibrium between future supply and demand of labor.
potential labor force	similar to 'working age population', every person between 15-64 years (or sometimes 20-64).
qualitative mismatch	mismatch between the type of 'labor supply' and the type of 'labor demand'. This term includes both 'horizontal mismatch' and 'vertical mismatch'. Often it is used to describe a situation where there is a sufficient number of employees and jobs, but where still both unemployment and job vacancies exists because the qualifications offered are not the same as the qualifications asked.
quantitative mismatch	mismatch between the size of the 'labor supply' (the number of employees) and the size of the 'labor demand' (the number of jobs). The type of labor is not taken into account.
replacement demand	the demand for labor which is directly induced by the retirement of older workers. (not by economic factors)
SIPP	US Survey of Income and Program Participation
skill level (of a job)	the level of education required for the job: e.g. high school, university etc.
skill level (of an employee)	the level of the highest successfully completed educational degree: e.g. high school, university etc.
skill mismatch	synonym of 'qualitative mismatch'
skill type (of a job)	the field of education required for the job: e.g. high school, university etc.
skill type (of an employee)	the field of the highest successfully completed educational degree: e.g. medicine, economics, law etc.
skills premium	higher wages as a reward for higher education and therefore higher productivity.
statutory retirement age	constitutional age of retirement.

stepping stone effect	the effect that people from the labor market margins are brought into permanent employment, through a gradual entry via temporary jobs.
subsidized job	artificially created job for disadvantageous job searchers.
temporary agency work	when the employee is working for a temporary working agency, but assigned to a user company. Mostly on a fixed-term base. Not similar to <i>temporary work</i> .
temporary work	used by Eurostat and many other official statistics: includes <i>temporary agency work</i> but mainly <i>fixed-term contracts</i> .
tempworkers	those categorized by the definition of <i>temporary work</i>
tight labor market	market situation in which labor is scarce; labor supply is low while labor demand is high
total job openings	sum of 'expansion demand' plus 'replacement demand'
training programs	programs aiming to enhance the productivity and employability of participants, by learning new skills.
underqualification	to hold a lower qualification than the current job requires.
unemployment	not working but actively searching for a job. E.g. housewives and students who are not actively looking for a job are not counted as unemployed, they are considered 'not in labor force' i.e. 'inactive'
upskilling of the population	increase in the average level of education of in a country, over time
vertical mismatch	mismatch between the level of education of the worker and the the level of education required for the job. Can be 'overqualification' or 'underqualification'.
workforce	synonym of 'Labor force'
working age population	similar to 'potential labor force', every person between 15-64 years (or sometimes 20-64).

Appendix A Classifications & definitions

Appendix A.1 Industry classification

This report uses the international ISIC-classification Rev.4. On the two-digit level this classification is similar to the Dutch SBI2008 and Eurostat's NACE Rev.2. Some small categories are grouped together. The table below provides some description.

Sector

ISIC codes	name	description
A	Agriculture	Agriculture, hunting and forestry, fishing,
BC	Manufacturing	Broad category of manufacturing of products; includes mining, food & beverages industry, machine industry, etc.
DE	Utilities	Electricity, gas & air conditioning supply; Water supply, sewerage, waste management and remediation activities
F	Construction	Residential and non-residential building, civil engineering, demolition, painting, plumbing etc.
G	Trade & repair	Wholesale trade, retail shops, plus trade and repair of motor vehicles and motorcycles
H	Transportation	Passenger & freight transportation, over land, water, or by air. Plus warehousing and postal services
I	Hotels & restaurants	All kinds of accommodation and food service activities, including campings, pensions, catering, beverage serving
J	Information & Media	Production of books, journals, television, video, audio, software; telecommunication services; information services, data processing, web portals
K	Financial services	Financial and insurance activities; includes banks, insurance companies, pension funds, financial intermediaries
LMN	Business services	Broad category, includes real estate activities, all kinds of professional, scientific or technical consulting, renting and leasing, employment services, travel agencies, security services, plus all kinds of administrative support services
O	Public administration	including police, military and compulsory social security activities
P	Education	All public and private education activities
Q	Health	All public and private health activities, including social work, child day-care etc.
RSTU	Other services	Arts, entertainment, recreation; repair; community services; personal services: cleaning etc.

Appendix A.2 Occupation classification

This report uses the international ISCO-88 classification of occupations. The US SIPP data originally come with a different classification (SOC) which is translated to ISCO-88 by SEO Economic Research. The first level of ISCO-88 distinguishes nine occupation classes, grouped into four skill levels. Military occupations are left out of the analysis, managers are assigned to either skill level 2 or skill level 4 based on their detailed occupation code.⁴⁸

⁴⁸ ISCO88 sub-major group 13 (General managers) is assigned to skill level 2, the rest to skill level 4. This is not an official procedure defined by the ILO classification, but introduced by SEO for empirical purposes. It reflects the modal skill level found empirically in these groups.

Type (and level) of occupation

name	ISCO major occupational group	ISCO skill level
1 MAN	Legislators, senior officials and managers	mainly level 4, sometimes level 2
2 PRO	Professionals	level 4
3 TEC	Technicians and associate professionals	level 3
4 CLE	Clerical support workers (secretaries, receptionists, production clerks, accounting clerks)	level 2
5 SER	Service workers and shop and market sales workers	
6 AGR	Skilled agricultural workers	
7 CRA	Craft and related trades workers	
8 PLA	Plant and machine operators	
9 ELE	Elementary occupations	level 1

Please see <http://www.ilo.org/public/english/bureau/stat/isco/intro.htm> for a more detailed description of the occupations within the categories.

Appendix A.3 Educational classification

See <http://www.uis.unesco.org/Education/ISCEDMappings/Pages/default.aspx> for a translation of the international ISCED97-classification to national education systems. The ISCED distinguished between level of education and education field. For the US the original dataset used a somewhat different classification of educational fields, which was made comparable to the ISECD classification described below. One exception: the category 'other' is only defined for the US.

Level of education

level	name	description
0-2	Low	Primary (normally compulsory education until the age of 12)
3-4	Medium	Secondary (normally compulsory education from age 12; plus lower vocational)
5-6	High	Tertiary (higher vocational, university)

Field of study

field	name	description
0	GEN	General programmes (mainly at the lower levels)
1	EDU	Education: teacher training, education science
2	HUM	Humanities & Arts: languages, religion, history, media, design, craft skills
3	SOC	Social sciences, business & law: psychology, economics, journalism, finance, marketing, secretarial, law
4	SCI	Science: biology, physics, chemistry, mathematics, statistics, computing
5	ENG	Engineering, manufacturing & construction: includes architecture, civil engineering
6	AGR	Agriculture & veterinary: includes crop & livestock, horticulture, fishery
7	HEA	Health & welfare: medicine, nursing, dental studies, pharmacy, child care, social work & counselling
8	SER	Services: hospitality, tourism, beauty services, transport services, environmental protection, security
9	OTH	Other not elsewhere classified (exists only in the US, not in EU!)

Appendix A.4 Measuring horizontal mismatch

The type of skills provided by the employee is defined by the field of study. The type of job skills required is defined by clustering detailed occupation categories jobs into eleven categories. This classification is once again made comparable between the detailed ISCO-codes used in the EU countries and the detailed SOC-codes used in the US.⁴⁹ A horizontal match is defined in the table below. Most lower educated graduates do not have a specific field of education, these persons are also regarded as a sufficient match. Managers are not taken into account in this definition.

Optimal match:			
<u>Field of education</u>		<u>Occupation type</u>	
1	Education	1	Teachers and Instructors
2	Humanities	2	Cultural
3	Social	3	Economics, business and administration
3	Social	4	Social and legal
4	Science	5	Science
5	Engineering	6	Engineering and construction
6	Agriculture	8	Agriculture
7	Health and social services	9	Health
7	Health and social services	4	Social and legal
8	Services	10	Services
Sufficient match:			
<u>Field of education</u>		<u>Occupation type</u>	
2	Humanities	4	Social and legal
2	Humanities	1	Teachers and Instructors
3	Social	1	Teachers and Instructors
3	Social	2	Cultural
4	Science	6	Engineering
5	Engineering	5	Science
5	Engineering	7	Production
6	Agriculture	6	Engineering
7	Health and social services	10	Services
8	Services	3	Economics

⁴⁹ This clustering is defined at the SOC 2-digit level for US and the ISCO 3-digit level for the other countries. Detailed comparison tables can be obtained from the authors on request.

Appendix A.5 Explaining measurement differences in vertical mismatch

Explaining measurement differences in vertical mismatch OECD vs. SEO

The method to calculate over- & underqualification that OECD uses (in 'Employment Outlook 2011') differs from the SEO method in many respects. Firstly, other datasets are used.⁵⁰ Secondly, the OECD numbers refer to 2005 where the rest of this publication is based on 2009 figures. But most importantly, their definition of the required educational level of a job and the highest completed educational level of the employee is different. Three methods are available, every one with its own advantages and drawbacks:

- OECD uses the '*statistical method*' which defines the modal educational qualification within each occupational group as the required level.
- SEO uses the '*normative method*': the required educational level for each occupational group is assessed by ILO experts.
- Alternatively, a '*self-declared*' method is sometimes used in other literature: the respondent declares if he feels over- or undereducated for his current job. OECD uses an alternative label for the outcomes of the 'self-declared' method, overskilled resp. underskilled.

The '*statistical method*' applied by OECD is very sensitive to sampling errors and therefore unstable over time.⁵¹ It is also sensitive to the relevance of the educational categories chosen: in the OECD case 5 different education levels are used in theory (corresponding to ISCED levels 1 through 5). But in practice the resulting required educational level will almost always be either ISCED3 or ISCED5. Even if the statistical method is applied to 28 occupational groups separately.

Thus, the distribution of required qualifications is much more bipolar than the distribution of available qualifications. That implies that in countries with a large share of upper secondary employees (Eastern Europe), the required level will also be upper secondary in most occupation groups. An advantage of this method is its objective measurement. It also allows country-specific definitions.

The '*normative method*' applied by SEO depends heavily on the relevance of the expert assessment: in this case the ILO assessment used in the ISCO88 classification. Results are more stable over time, but they might not pick up changing (long-term) skill requirements unless the assessment is updated. The assessment of course is based on subjective measurement, and is constant between countries.

As the normative method produces more variation in assignment of required qualifications (4 different skill levels are assigned) their distribution does better resemble the distribution of available qualifications, this method will produce lower estimates for both under- & overqualification.

⁵⁰ OECD takes their information regarding non-EU countries from the International Social Survey Programme (ISSP), for EU countries they use the European Survey of Working Conditions (ESWC). SEO uses the EU Labour force Survey (LFS).

⁵¹ For example, let's suppose a population where – in a certain occupation group - 41% of employees holds a tertiary qualification and 41% holds an upper-secondary qualification. In one year a sample is collected where 40% of employees within an occupation group has a tertiary qualification and 41% has an upper-secondary qualification. In this sample, upper-secondary education is assigned as the required level so 40% is regarded as overqualified. If the next year's sample contains not 40% but 42% tertiary graduates the results will differ dramatically: the required educational level for this occupation is now tertiary education, which means that there is no overqualification anymore, while at the same time underqualification has gone up with 41%. Because those with upper-secondary qualifications are no longer considered a perfect match, but considered underqualified. However, this change is only caused by sampling error, it might not reflect real changes in the population.

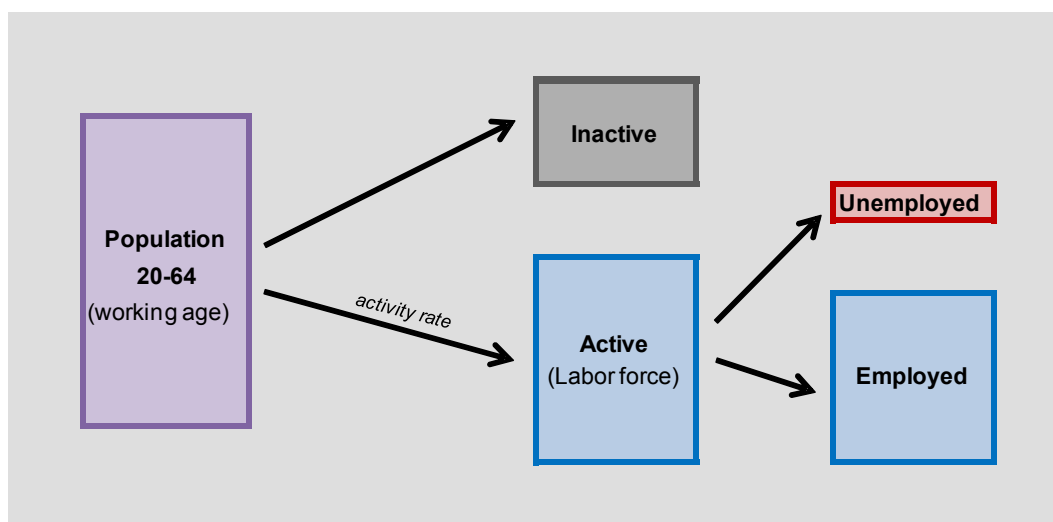
Appendix B Scenario calculations in detail

Appendix B.1 Labor supply in detail

Components of labor supply

The supply of labor is equal to what is called the ‘active labor force’. Figure 14 gives an illustration of the active labor force and its components. The size of the labor supply is bounded by the size of the population of working age. But then, not everyone of working age is active in the labor market. Some prefer to take care of their household or are in fulltime education, they are the so-called ‘inactive population’. The people that are willing to work are called the ‘active population’ or ‘labor force’. The ‘activity rate’ is the percentage of the working age population that is willing to work.⁵² The majority of those are willing to work find a job. They make up the employed population, the remainder remains unemployed.

Figure 14 From population to labor force and employed population



Source: SEO Economic Research

Changes in the size of the labor force thus depend on (i) developments in the population of working age and (ii) the activity rate. And so is the projection of total labor supply in 2020: the BLS and Cedefop projections of the future population 20-64 and activity rate are combined, resulting in the total number of people that will supply their labor capacity on the 2020 labor market. This projection is the same in both scenarios.

⁵² Please note that the ‘activity rate’ is different from the ‘employment rate’.

Allocating labor supply to 'their' sectors

To facilitate analysis on the sectoral level, one needs to know how many workers will look for a job in every sector. Starting point is the distribution of the 2009 workforce (aged 20-54) over level of education, field of education and sector of employment. In the simulations the assumption is made that this distribution remains the same in 2020. For example: if currently 60 percent of the high educated with a degree in engineering work in the manufacturing industry, it is assumed that in 2020 also 60 percent of the people with the same qualifications will want to work in manufacturing as well.⁵³

In reality however, the presented shortages are unlikely to materialize. Employment will move from the labor abundant industries to those sectors that are short in supply and have a high demand. Returning to example of the engineer: if all vacancies in manufacturing can be filled with less than 60 percent of the high educated with a degree in engineering, the surplus workers are still allocated to manufacturing. That means: a labor market surplus would materialize, and the LMS-indicator will be higher than 1.

In reality the redundant engineers will probably find work elsewhere. If so, there is no problem in terms of quantitative mismatch. But it is not an optimal solution, because the potential of these workers potential is not completely utilized. Thus there is still qualitative mismatch. In this sense the LMS-indicators are valuable in pointing to a qualitative mismatch, although the absolute numbers do not have an empirical meaning of their own.

Population projections

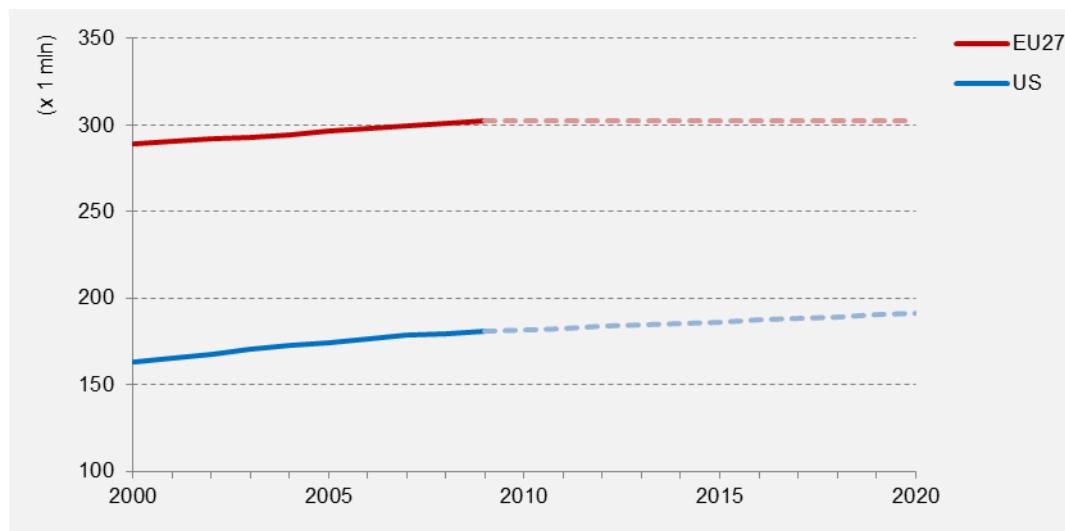
Developments of the population of working age differ from country to country. Yet, many developed countries are experiencing (to some extent) a process of ageing and feature low fertility rates. New generations are smaller than older generation. As a result the size of population of working age declines. The purple bar in Figure 14 gradually shrinks. In addition, the share of workers aged 55 and above increases and the average age of the population of working age increase.

The effects of ageing and low fertility rates can be offset by migration. If net migration of people of working age is large and positive the population of working increases. This is for instance the case for the United States where the size of the population 20-64 is increasing.

All calculations in this study are based on the population projections by Cedefop (2010a) for the EU27 and BLS (2012) for the United States. Figure 15 presents recent growth and projections. For the EU27 only minimal growth is projected. Most Western European countries experience declining populations. Population growth is concentrated in Eastern European countries, but cannot do more than compensate for the decline elsewhere. In the United States the population continues to grow, roughly at the pace of the previous decade. As said the United States benefit from net positive migration.

⁵³ This modus operandi is what economists call a 'strictly static model' whereby the allocation principles remain constant.

Figure 15 Minimal growth of population of working age in the EU27



Population 20-64; solid lines are realizations; dotted lines are projections

Source: Realizations Eurostat (2012) and OECD (2012); projections Cedefop (2010a) and BLS (2012), adapted by SEO Economic Research

Activity rates

The path of the labor force is also determined by developments in the activity rate. Theoretically it is possible to maintain a constant size of the labor force with a declining population as long as this is compensated by an increasing activity rate.

The decision to work is a personal decision, carefully weighted against the pro's and con's of employment and leisure time. Research points out a number of elements that influence the activity rate (Euwals and Folmer, 2009):

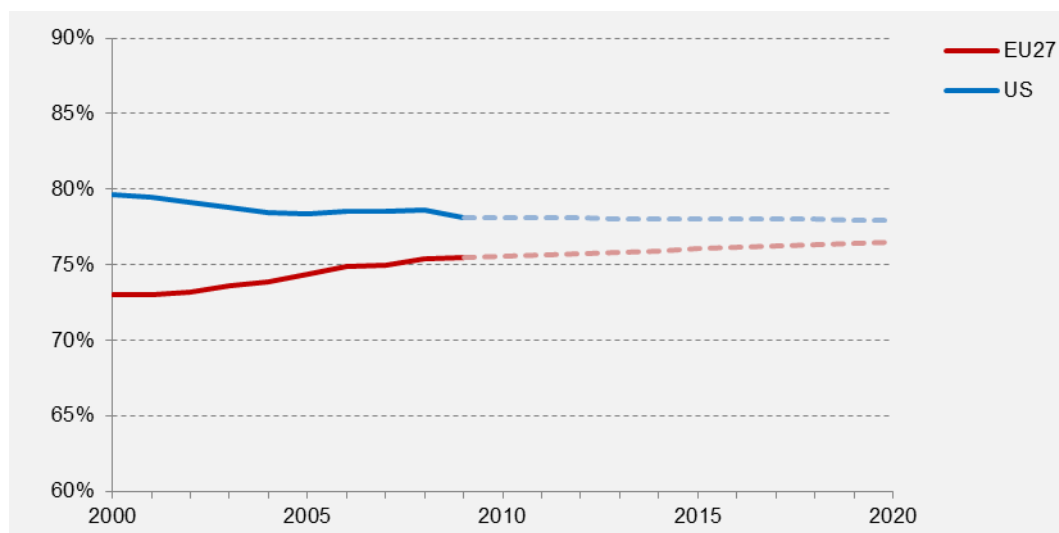
- Firstly, the business cycle. In periods of economic growth more employment opportunities arise, wages are increasing, so more people enter the labor market, the activity rate rises. Vice versa, during times of recession vacancies decline and this discourages people to search employment. As a result the activity rate falls.
- Secondly, demographic composition effects. The activity rate is not uniform across different groups in the population. For example:
 - Activity rates vary with age. The workers aged 55 and above have lower levels of participation than people in their thirties or forties. The youngest cohorts (aged 24 or younger) participate even less as many of them are still in full time education.
 - Gender has an effect too. Female participation is lower, though differences between male and female participation becomes smaller. Women participate more and more. In part this is a cohort-effect: old (less participating) cohorts are replaced by younger (more participating) cohorts. In addition, there are socio-cultural developments that foster persistent growth of female participation.

Depending on the relative sizes and growth rates of these and other groups in the population overall activity rates increase or decline.

- Thirdly, activity rates are also influenced by previously implemented (social security) policies, like changes in (early-) retirement policies and disability arrangements.

Figure 16 shows opposite trends in the activity rate for the EU27 and United States. In the latter activity rates have fallen and are expected to do so in the future. The BLS (2009) attributes this decline to ageing. As the American population becomes older on average activity rates fall. Older people participate less than younger people. On the contrary, in the EU27 rates gradually increased in the past and continue to grow in the coming decade as well. Though a number of countries face severe ageing (which depresses activity rates), new policy and policy changes and demographic development in emerging economies compensate the negative effect of ageing.

Figure 16 Opposite trends in the activity rate



Activity rate (in %); solid lines are realizations; dotted line are projections

Source: Realizations Eurostat (2012) and OECD (2012); projections Cedefop (2010) and BLS (2012), adapted by SEO Economic Research

Appendix B.2 Labor demand in detail

Components of labor demand

Total demand for labor is a complex result defined by several elements:

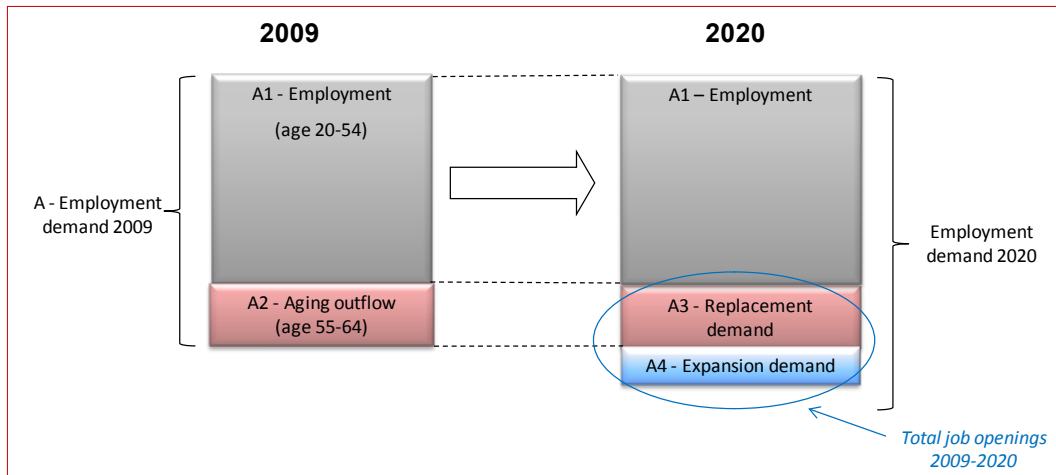
- the current level of employment,
- the ageing outflow rate (AOR, see Section 4),
- replacement demand, and
- net expansion demand.

Their relation is illustrated in the stylized Figure 17. The current level of employment is the sum of blocks A1 and A2. As Chapter 4 showed, ageing causes many workers to leave employment between 2009 and 2020. These retirees compile group A2. The jobs of these pensioners need to be filled again in 2020: the ageing outflow causes the replacement demand A3.

On top of that might come additional ‘expansion demand’. Expansion demand might come from economic growth or from population growth: either the same people ask for more goods & services, or more people ask for goods & services. Additional workers are then needed to make increased production possible. But expansion demand can also be negative. If purchasing power

declines, people can afford less goods & services. Or if labor productivity increases, the same amount of goods & services can be produced by using less labor. The sum of all these effects is the net expansion demand (A4).

Figure 17 Development of labor demand



The figure is meant for illustration only. It does not necessarily reflect the actual situation. For example, net expansion demand can also be negative. Labor productivity growth (in real terms) will cause lower employment demand.

The sum of replacement demand (A3) plus expansion demand (A4) is the total number of net job openings over the period. Table 23 describes in more detail what is actually happening to all these components in the two scenarios.

Table 23 The components of labor demand

		US	EU27	ANG	SCA	WRH	WFR	MED	EAS
Scenario 1									
Expansion demand	(A4)	3.3	2.5	1.2	0.5	-0.2	0.3	1.3	-0.5
Replacement demand	(A3)	23.1	30.3	4.8	2.3	7.7	3.8	6.6	5.4
Total job openings	(A3+A4)	26.4	32.8	6.0	2.8	7.5	4.2	7.9	4.9
Scenario 2									
Expansion demand	(A4)	23.8	15.8	1.9	0.7	3.5	3.3	6.1	0.7
Replacement demand	(A3)	23.1	30.3	4.8	2.3	7.7	3.8	6.6	5.4
Total job openings	(A3+A4)	46.9	46.0	6.7	3.0	11.2	7.2	12.6	6.1

All figures in millions, people aged 20-64

Source: Realizations Eurostat (2012) and OECD (2012); projections Cedefop (2010) and BLS (2012), adapted by SEO Economic Research

In both scenario's employment increases in the US and for the EU27, resulting in a positive expansion demand (A4 in Figure 17). However, within Europe there are differences. In Scenario 1 employment falls in West-EU Rhineland and Eastern Europe, respectively with 0.2 million and 0.5 million workers. Positive expansion demand in the other European clusters offset this decline, overall the number of European jobs increase with 2.5 jobs. In Scenario 2 all clusters feature employment growth.

Next to expansion demand, all economies have a considerable share of replacement demand (A3 in Figure 17). The workers aged 55 and above (A2) are assumed to retire in the coming decade.⁵⁴ Thus, replacement demand (A3 in Figure 17) is 30 million jobs in EU27 and 23 million in the US. The number of retirees is the same in both scenarios.

Together expansion demand (A4) and replacement demand (A3) add up to 32.8 million job openings in the EU and 26.4 million job openings in the US in Scenario 1 (and respectively 46.0 and 46.9 million in Scenario 2). Note that in Scenario 1 replacement demand is positive and sufficiently large in West EU Rhineland and Eastern Europe to offset the negative expansion demand. These clusters will have numerous job openings, in spite of employment contraction.

Expansion, replacement and total job openings per industry

The dynamic of expansion and replacement demand can also be calculated per industry. Chapter 5 demonstrated that surpluses and shortages coexist. But this does not mean that industries with a surplus do not have any job openings at all. Table 24 shows that in both the US and the EU27, in both scenarios and in all industries, replacement demand compensates for contractions in employment.

Table 24 Dynamics of replacement and expansion per industry: replacement demand compensates contractions in primary industries⁵⁵

	EU27 - S1			EU27 - S2			US - S1			US - S2		
	Total job openings	Replacement	Expansion	Total job openings	Replacement	Expansion	Total job openings	Replacement	Expansion	Total job openings	Replacement	Expansion
Agriculture	0.0	2.3	-2.3	0.5	2.3	-1.8	0.0	0.4	-0.4	0.2	0.4	-0.2
Manufacturing	1.1	4.6	-3.4	3.2	4.6	-1.4	0.1	2.6	-2.5	2.0	2.6	-0.6
Utilities	0.2	0.5	-0.3	0.4	0.5	-0.1	-0.1	0.3	-0.4	0.1	0.3	-0.2
Construction	1.8	2.2	-0.4	2.8	2.2	0.6	2.0	1.3	0.7	3.5	1.3	2.3
Trade & Repair	5.4	3.5	1.9	7.3	3.5	3.8	2.1	3.2	-1.1	4.8	3.2	1.6
Transportation	1.7	1.6	0.1	2.4	1.6	0.8	0.8	1.2	-0.3	1.7	1.2	0.5
Media & Information	0.9	0.5	0.4	1.3	0.5	0.8	0.5	0.6	-0.1	1.3	0.6	0.6
Hotels & Restaurants	1.3	0.9	0.4	1.9	0.9	1.0	-0.3	0.7	-1.1	0.7	0.7	0.0
Financial services	0.9	0.8	0.2	1.4	0.8	0.6	1.1	1.0	0.1	2.1	1.0	1.1
Business services	6.9	2.9	4.1	8.5	2.9	5.6	4.3	2.7	1.6	6.8	2.7	4.0
Public administration	2.0	2.4	-0.4	2.9	2.4	0.5	1.2	1.4	-0.2	2.2	1.4	0.8
Education	3.4	2.9	0.4	4.4	2.9	1.5	5.7	2.9	2.8	8.1	2.9	5.2
Health	4.5	3.4	1.1	5.9	3.4	2.5	7.6	3.3	4.2	10.9	3.3	7.6
Other services	2.5	1.8	0.7	3.2	1.8	1.4	1.4	1.4	0.0	2.5	1.4	1.0

All figures in millions, people aged 20-64; S1 is Scenario 1, S2 is Scenario 2

Source: Realizations Eurostat (2012) and OECD (2012); projections Cedefop (2010) and BLS (2012), adapted by SEO Economic Research

⁵⁴ In fact the scenario calculates for 11 years, while the age groups are defined in 10-year brackets. To compensate, the number of people aged 55 to 64 is multiplied by 1.1.

⁵⁵ Note that the total number of job openings per industry differ between Scenario 1 and Scenario 2 per country. This is the result of the second difference between the two scenario's: labor demand's reaction to structural changes in labor supply.

Agriculture, manufacturing and utilities are the industries with negative expansion demand in all scenario in both the US and the EU27. For instance, for the EU27 in Scenario 1 employment falls with almost 6 million workers in these sectors due to the structural demand shift described in section 5.3.1. However, in the same period almost 7.5 million workers leave these industries and retire (implying an equivalent replacement demand). These retiring workers compensate for the negative expansion demand, 1.5 million jobs will open up. Note that in case of positive expansion demand, this additional demand is simply added to the replacement demand.

Table 25 presents the number of job openings for all clusters. Again the table demonstrates that replacement demand mostly compensates for contraction (negative expansion demand). Important exceptions are the productive industries in Eastern Europe, where the contraction will be higher than the replacement demand: a net loss of jobs is the result.⁵⁶ In the low growth scenario, Scenario 1, construction and financial services in the Mediterenean and agriculture and hotels & restaurants in the US replacement demand and negative expansion demand is slightly larger than replacement demand as well, hence there will be no job openings⁵⁷.

⁵⁶ Obviously in reality there will be vacancies in these sectors. These macro tendencies do not necessarily hold for all individual firms. Moreover, the workers that not retire will also switch jobs in the coming decade this will create vacancies in these industries as well. Throughout this text it is important to take note of the difference between national balances and the dynamics at the level of the firm.

⁵⁷ Note, these are still macro figures. On the level of the firm there will be jobs openings opening up in these sectors.

Table 25 No job openings in agriculture and manufacturing in Eastern Europe

	US	EU27	ANG	SCA	WRH	WFR	MED	EAS
Scenario 1								
Agriculture	0.0	0.0	0.1	0.0	0.1	0.0	0.2	-1.1
Manufacturing	0.1	1.1	0.2	0.3	0.6	0.2	0.5	-1.1
Utilities	-0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.0
Construction	2.0	1.8	0.4	0.1	0.5	0.2	-0.2	0.5
Trade & Repair	2.1	5.4	0.9	0.2	0.8	0.4	1.7	1.2
Transportation	0.8	1.7	0.3	0.1	0.3	0.2	0.1	0.6
Media & Information	0.5	0.9	0.2	0.1	0.1	0.2	0.2	0.4
Hotels & Restaurants	-0.3	1.3	0.1	0.0	0.2	0.1	0.6	0.1
Financial services	1.1	0.9	0.1	0.1	0.5	0.2	-0.1	0.4
Business services	4.3	6.9	1.5	0.5	1.3	0.8	1.9	1.4
Public administration	1.2	2.0	0.2	0.2	0.5	0.4	0.6	0.5
Education	5.7	3.4	0.7	0.3	1.0	0.4	0.9	1.0
Health	7.6	4.5	0.8	0.6	1.1	0.8	0.9	0.7
Other services	1.4	2.5	0.6	0.1	0.5	0.4	0.6	0.2
Scenario 2								
Agriculture	0.2	0.5	0.1	0.0	0.2	0.1	0.3	-1.0
Manufacturing	2.0	3.2	0.2	0.3	1.3	0.6	1.2	-0.8
Utilities	0.1	0.4	0.0	0.0	0.1	0.1	0.1	0.0
Construction	3.5	2.8	0.4	0.1	0.7	0.4	0.2	0.6
Trade & Repair	4.8	7.3	1.0	0.3	1.3	0.8	2.5	1.4
Transportation	1.7	2.4	0.3	0.1	0.5	0.3	0.3	0.7
Media & Information	1.3	1.3	0.2	0.1	0.2	0.3	0.3	0.4
Hotels & Restaurants	0.7	1.9	0.1	0.0	0.4	0.2	0.9	0.1
Financial services	2.1	1.4	0.2	0.1	0.6	0.4	0.0	0.5
Business services	6.8	8.5	1.6	0.6	1.8	1.1	2.5	1.5
Public administration	2.2	2.9	0.3	0.3	0.7	0.6	0.8	0.6
Education	8.1	4.4	0.8	0.4	1.2	0.6	1.2	1.1
Health	10.9	5.9	0.9	0.6	1.6	1.2	1.2	0.8
Other services	2.5	3.2	0.7	0.1	0.7	0.5	1.0	0.2

All figures in millions, people aged 20-64

Source: Realizations Eurostat (2012) and OECD (2012); projections Cedefop (2010) and BLS (2012x), adapted by SEO Economic Research

Appendix B.3 Adjustment to labor market imbalances

When judging the scenario results it should be kept in mind that the labor market in the real economy will react and adjust to labor surpluses and shortages. For instance if there is a surplus of highly skilled workers, showing up in increasing unemployment for those groups, this will depress the wages for the high skilled and make them more attractive for employers to hire. The demand for high skilled workers will adjust *because of the surplus* in supply. In this way the surplus of highly skilled workers is alleviated over time. In both scenarios such an adjustment mechanism to skill level imbalances is incorporated.

Although the adjustment mechanism tends towards complete adjustment, such perfect adjustment is never reached in practice. In the scenarios the demand for low, medium and high skilled workers changes in the same pace as was seen historically. In effect, the percentage points

change in the last decade is extrapolated to the future.⁵⁸ For example, in West-EU Rhineland the share of higher educated in employment has increased by 3.9 %-points in an 11-years period, while the share of lower educated has decreased by the same amount. In the scenarios these changes are extrapolated to the 2009-2020 period.

Table 26 Change of the share within skill distribution, 2009-2020

	share low skilled	share medium skilled	share high skilled
Anglosaxon	-12.8%	+3.8%	+8.9%
Scandinavia	-2.8%	-5.0%	+7.7%
West EU-Rhineland	-3.9%	+0.0%	+3.9%
West EU-Francophone	-8.5%	+0.0%	+8.5%
Mediterranean	-12.5%	+4.4%	+8.1%
Eastern Europe	-7.1%	-2.6%	+9.8%
EU27	-8.2%	+0.6%	+7.5%

In theory the labor market would adjust to all kinds of structural imbalances. The employer also may change his production on the medium or long term to make more efficient use of abundant supply of:

- industry experience,
- field of education,
- type of occupation.

The outcomes of the scenario's result in shortages or surpluses per industry. In general shortages are most apparent in business services and surpluses in manufacturing. A real surplus will probably not manifest, people with experience in manufacturing will simply find a job in a different sector. Unfortunately it is hard to determine this behavior empirically. It is impossible to predict into which industries the surpluses will flow. Hence, the scenario's in this publication will not have an adjustment mechanism to these type of imbalances. Nor will they adjust automatically to structural imbalances in fields of education or occupation types.

⁵⁸ Of course after calculating the growth on a yearly base. The change over the 10-year period 2000-2010 is recalculated to the growth of the 11-year period 2009-2020.

Appendix C Detailed scenario outcomes

Appendix C.1 Scenario 1 - US

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	2,016	1,563	1,886	1,150	736
Manufacturing	16,735	14,809	17,423	12,309	5,114
Utilities	1,635	1,638	1,612	1,271	341
Construction	10,805	9,143	11,254	9,883	1,371
Trade & Repair	19,497	18,867	20,287	17,738	2,549
Transportation	5,857	5,860	5,839	5,513	327
Information & Media	5,035	4,909	5,726	4,804	921
Hotels & Restaurants	9,456	7,886	10,387	6,812	3,576
Financial services	7,597	6,501	8,387	6,551	1,836
Business services	16,260	14,230	17,327	15,800	1,527
Public administration	6,934	6,529	7,169	6,355	813
Education	14,590	12,695	15,524	15,532	-9
Health	17,444	17,328	18,923	21,550	-2,627
Other services	7,355	6,968	7,321	6,931	390
Total	141,216	128,926	149,066	132,199	16,867
<i>level of unemployment</i>		8.7%		11.3%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	2.72	1.71	0.90	1.64
Manufacturing	1.78	1.46	1.30	1.42
Utilities	1.63	1.32	1.15	1.27
Construction	1.83	1.19	0.69	1.14
Trade & Repair	1.54	1.21	0.98	1.14
Transportation	1.40	1.12	0.89	1.06
Information & Media	1.23	1.23	1.17	1.19
Hotels & Restaurants	1.83	1.53	1.36	1.52
Financial services	2.70	1.38	1.22	1.28
Business services	2.04	1.22	0.96	1.10
Public administration	1.22	1.26	1.06	1.13
Education	0.93	0.98	1.01	1.00
Health	0.97	0.99	0.81	0.88
Other services	1.21	1.29	0.83	1.06
Total	1.65	1.23	0.99	1.13
Total 2009	1.22	1.11	1.05	1.10

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	2.05	0.84	1.02	1.40	1.62	1.64
Manufacturing	1.52	1.29	1.33	1.29	1.38	1.42
Utilities	1.36	1.21	1.11	1.56	1.05	1.27
Construction	1.34	0.71	0.89	0.70	1.05	1.14
Trade & Repair	1.25	0.99	1.03	1.05	1.12	1.14
Transportation	1.14	0.87	1.05	0.89	1.15	1.06
Information & Media	1.23	1.12	1.25	1.05	1.06	1.19
Hotels & Restaurants	1.60	1.36	1.39	1.44	1.36	1.52
Financial services	1.41	1.21	1.29	1.19	1.30	1.28
Business services	1.33	0.94	1.04	1.05	0.95	1.10
Public administration	1.25	1.02	1.13	1.07	1.28	1.13
Education	0.99	1.01	1.01	0.87	0.97	1.00
Health	0.99	0.80	0.88	0.84	1.02	0.88
Other services	1.27	0.84	0.91	1.09	1.30	1.06
Total	1.30	0.99	1.09	0.91	1.18	1.13
Total 2009	1.03	1.21	1.16	1.08	1.00	1.10

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.46	1.59	1.66	1.68	1.93	1.64
Manufacturing	1.38	1.47	1.43	1.42	1.35	1.42
Utilities	1.17	1.28	1.32	1.30	1.27	1.27
Construction	1.02	0.95	1.07	1.20	1.32	1.14
Trade & Repair	1.13	1.11	1.15	1.17	1.15	1.14
Transportation	1.05	1.03	1.04	1.08	1.05	1.06
IT services	1.21	1.21	1.18	1.11	1.12	1.19
Hotels & Restaurants	1.51	1.55	1.55	1.52	1.38	1.52
Financial services	1.32	1.26	1.27	1.25	1.22	1.28
Business services	1.12	1.04	1.10	1.16	1.22	1.10
Public administration	1.10	1.11	1.18	1.07	0.90	1.13
Education	1.03	1.03	0.93	0.84	0.78	1.00
Health	0.85	0.89	0.87	0.83	0.79	0.88
Other services	1.03	0.97	1.12	1.13	1.04	1.06
Total	1.15	1.06	1.13	1.24	1.14	1.13
Total 2009	1.09	1.08	1.08	1.13	1.13	1.10

Appendix C.2 Scenario 1 – EU27

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	10,938	9,803	8,984	7,495	1,489
Manufacturing	39,013	35,487	39,138	32,083	7,055
Utilities	3,453	3,154	3,464	2,886	578
Construction	18,624	16,844	17,988	16,402	1,586
Trade & Repair	32,200	29,269	32,537	31,151	1,386
Transportation	12,004	10,890	11,607	11,003	604
Information & Media	6,470	6,023	7,702	6,423	1,279
Hotels & Restaurants	9,556	8,619	9,368	9,036	332
Financial services	7,127	6,603	8,036	6,772	1,264
Business services	21,783	20,056	23,049	24,125	-1,076
Public administration	15,477	14,256	15,939	13,860	2,079
Education	16,682	15,585	18,138	16,030	2,108
Health	23,172	21,355	24,185	22,441	1,744
Other services	11,726	10,673	11,353	11,387	-34
Total	228,226	208,618	231,490	211,095	20,395
<i>level of unemployment</i>		<i>8.6%</i>		<i>8.8%</i>	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.13	1.31	0.94	1.20
Manufacturing	1.19	1.28	1.11	1.22
Utilities	1.18	1.26	1.11	1.20
Construction	1.30	1.08	0.94	1.10
Trade & Repair	1.09	1.10	0.89	1.04
Transportation	1.10	1.10	0.89	1.05
Information & Media	1.23	1.24	1.18	1.20
Hotels & Restaurants	1.07	1.07	0.87	1.04
Financial services	1.14	1.20	1.18	1.19
Business services	1.00	0.99	0.92	0.96
Public administration	1.20	1.20	1.10	1.15
Education	1.22	1.24	1.09	1.13
Health	1.15	1.14	1.01	1.08
Other services	1.03	1.03	0.93	1.00
Total	1.13	1.15	1.02	1.10

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.17	1.18	1.23	1.13	1.21	1.20
Manufacturing	1.22	1.21	1.22	1.24	1.28	1.22
Utilities	1.21	1.21	1.19	1.19	1.26	1.20
Construction	1.21	1.03	1.04	1.04	1.10	1.10
Trade & Repair	1.09	1.02	1.03	0.95	1.08	1.04
Transportation	1.09	1.01	1.05	1.04	1.06	1.05
Information & Media	1.23	1.19	1.20	1.23	1.20	1.20
Hotels & Restaurants	1.08	0.97	1.00	0.95	1.05	1.04
Financial services	1.19	1.19	1.16	1.18	1.18	1.19
Business services	0.99	0.96	0.92	0.94	0.99	0.96
Public administration	1.21	1.14	1.12	1.11	1.21	1.15
Education	1.21	1.11	1.11	1.21	1.21	1.13
Health	1.14	1.07	1.06	1.06	1.14	1.08
Other services	1.04	0.96	0.96	1.00	1.04	1.00
Total	1.13	1.07	1.10	1.06	1.11	1.10

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.02	1.12	0.99	1.24	1.11	1.20
Manufacturing	1.13	1.17	1.23	1.28	1.08	1.22
Utilities	1.30	1.15	1.11	1.28	1.16	1.20
Construction	0.99	1.08	1.11	1.12	1.01	1.10
Trade & Repair	1.08	1.01	1.07	1.09	0.83	1.04
Transportation	1.14	1.02	1.14	1.05	0.87	1.05
IT services	1.08	1.22	1.34	1.06	0.90	1.20
Hotels & Restaurants	1.07	1.05	1.07	1.07	0.84	1.04
Financial services	1.06	1.15	1.34	0.88	0.87	1.19
Business services	0.87	1.02	1.07	0.87	0.76	0.96
Public administration	1.06	1.14	1.26	0.93	1.00	1.15
Education	0.99	1.16	1.12	0.93	0.95	1.13
Health	1.06	1.12	1.05	0.88	0.96	1.08
Other services	0.94	1.11	1.05	0.93	0.85	1.00
Total	1.04	1.11	1.11	1.16	0.91	1.10

Appendix C.3 Scenario 1 - Anglosaxon

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	401	377	338	338	0
Manufacturing	3,363	3,121	3,454	2,728	726
Utilities	421	390	441	338	103
Construction	2,629	2,419	2,720	2,377	343
Trade & Repair	3,977	3,703	3,978	3,964	14
Transportation	1,591	1,474	1,525	1,458	67
Information & Media	1,107	1,034	1,358	1,145	213
Hotels & Restaurants	1,373	1,273	1,475	1,222	253
Financial services	1,434	1,329	1,734	1,355	379
Business services	3,710	3,471	3,990	4,361	-371
Public administration	2,023	1,879	2,295	1,814	481
Education	3,285	3,084	3,566	3,172	394
Health	4,114	3,833	4,503	3,930	574
Other services	1,577	1,464	1,683	1,831	-149
Total	31,006	28,852	33,059	30,032	3,028
<i>level of unemployment</i>		6.9%		9.2%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	0.78	1.18	0.89	1.00
Manufacturing	0.93	1.44	1.17	1.27
Utilities	0.96	1.50	1.18	1.30
Construction	0.73	1.28	1.13	1.14
Trade & Repair	0.88	1.16	0.81	1.00
Transportation	0.95	1.17	0.84	1.05
Information & Media	1.02	1.31	1.14	1.19
Hotels & Restaurants	1.08	1.38	0.94	1.21
Financial services	1.02	1.39	1.22	1.28
Business services	0.74	1.01	0.88	0.91
Public administration	1.10	1.45	1.14	1.27
Education	1.05	1.35	1.05	1.12
Health	1.02	1.29	1.07	1.15
Other services	0.73	1.02	0.86	0.92
Total	0.89	1.25	1.02	1.10

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	0.99	0.89	1.06	0.93	1.11	1.00
Manufacturing	1.26	1.30	1.25	1.32	1.47	1.27
Utilities	1.29	1.34	1.28	1.23	1.47	1.30
Construction	1.08	1.22	1.23	1.15	1.38	1.14
Trade & Repair	1.05	0.92	0.94	0.98	1.08	1.00
Transportation	1.08	0.95	0.98	0.99	1.10	1.05
Information & Media	1.25	1.16	1.16	1.16	1.05	1.19
Hotels & Restaurants	1.27	1.04	1.14	1.08	1.29	1.21
Financial services	1.31	1.25	1.23	1.35	1.31	1.28
Business services	0.92	0.92	0.90	0.91	1.00	0.91
Public administration	1.36	1.20	1.18	1.20	1.44	1.27
Education	1.20	1.08	1.09	1.32	1.30	1.12
Health	1.17	1.11	1.06	1.15	1.26	1.15
Other services	0.92	0.88	0.86	0.93	1.07	0.92
Total	1.12	1.06	1.08	1.15	1.19	1.10

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	0.81	1.43	0.86	0.93	1.60	1.00
Manufacturing	1.22	1.19	1.43	1.44	0.87	1.27
Utilities	1.35	1.44	1.01	1.29	1.64	1.30
Construction	1.08	1.26	1.19	1.18	0.94	1.14
Trade & Repair	1.14	0.97	0.97	1.03	0.87	1.00
Transportation	1.34	1.15	1.29	0.89	1.05	1.05
IT services	1.11	1.21	1.54	0.92	1.13	1.19
Hotels & Restaurants	1.34	1.15	1.23	1.13	1.03	1.21
Financial services	1.14	1.19	1.60	1.00	1.03	1.28
Business services	0.84	0.93	1.19	0.77	0.76	0.91
Public administration	1.32	1.16	1.34	1.09	1.31	1.27
Education	1.18	1.16	1.08	0.87	0.97	1.12
Health	1.31	1.13	1.14	0.99	1.13	1.15
Other services	0.85	0.91	1.08	0.74	0.74	0.92
Total	1.10	1.10	1.16	1.10	0.94	1.10

Appendix C.4 Scenario 1 - Scandinavia

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	319	297	278	248	29
Manufacturing	1,652	1,543	1,649	1,526	123
Utilities	137	128	132	131	2
Construction	837	778	807	707	100
Trade & Repair	1,527	1,424	1,569	1,438	131
Transportation	683	634	638	602	36
Information & Media	487	462	583	506	78
Hotels & Restaurants	330	307	350	298	52
Financial services	312	296	347	331	16
Business services	1,393	1,316	1,490	1,588	-98
Public administration	705	669	733	736	-3
Education	1,102	1,052	1,199	1,130	69
Health	2,165	2,042	2,272	2,210	62
Other services	551	518	561	548	14
Total	12,201	11,465	12,610	11,999	611
<i>level of unemployment</i>		6.0%		4.8%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	0.86	1.30	1.02	1.12
Manufacturing	0.89	1.14	1.10	1.08
Utilities	0.87	1.06	1.02	1.01
Construction	0.87	1.26	1.04	1.14
Trade & Repair	0.87	1.24	0.94	1.09
Transportation	0.87	1.21	0.91	1.06
Information & Media	1.00	1.12	1.19	1.15
Hotels & Restaurants	1.02	1.31	1.00	1.18
Financial services	0.85	0.99	1.12	1.05
Business services	0.82	0.93	0.97	0.94
Public administration	0.76	1.00	1.02	1.00
Education	0.83	1.19	1.05	1.06
Health	0.83	1.11	1.02	1.03
Other services	0.91	1.04	1.04	1.02
Total	0.87	1.13	1.03	1.05

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	0.95	1.08	1.22	0.96	1.25	1.12
Manufacturing	0.96	1.10	1.12	1.06	1.10	1.08
Utilities	0.92	1.06	1.02	1.37	1.16	1.01
Construction	0.95	1.11	1.22	1.19	1.27	1.14
Trade & Repair	1.04	1.10	1.14	0.98	1.21	1.09
Transportation	0.99	1.03	1.15	1.01	1.14	1.06
Information & Media	1.08	1.15	1.18	1.17	1.23	1.15
Hotels & Restaurants	1.16	1.12	1.23	1.18	1.23	1.18
Financial services	0.97	1.05	1.12	1.07	1.04	1.05
Business services	0.89	0.95	0.95	0.91	0.96	0.94
Public administration	0.87	0.99	1.04	1.01	1.07	1.00
Education	1.06	1.04	1.12	1.08	1.18	1.06
Health	0.99	1.05	1.07	1.03	1.07	1.03
Other services	1.02	1.02	1.02	1.05	1.06	1.02
Total	0.99	1.04	1.11	1.03	1.12	1.05

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	0.78	1.07	0.82	1.20	0.55	1.12
Manufacturing	1.12	1.07	1.19	1.09	0.84	1.08
Utilities	0.98	1.19	0.98	1.11	0.64	1.01
Construction	0.87	1.05	1.08	1.19	1.38	1.14
Trade & Repair	1.05	1.02	1.20	1.00	0.88	1.09
Transportation	1.00	0.97	1.08	1.12	0.91	1.06
IT services	1.05	1.18	1.23	0.76	1.17	1.15
Hotels & Restaurants	1.12	1.07	1.31	1.04	0.95	1.18
Financial services	0.89	1.04	1.22	0.77	1.06	1.05
Business services	0.78	0.99	1.02	0.68	0.95	0.94
Public administration	0.78	0.97	1.17	0.98	1.05	1.00
Education	0.88	1.06	1.09	1.12	1.10	1.06
Health	0.92	1.06	1.01	0.92	0.99	1.03
Other services	0.85	1.11	1.04	0.78	1.03	1.02
Total	0.95	1.05	1.10	1.08	0.94	1.05

Appendix C.5 Scenario 1 – West-EU Rhineland

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	967	894	831	774	56
Manufacturing	9,924	9,236	9,807	8,479	1,327
Utilities	664	620	653	599	53
Construction	3,497	3,249	3,417	3,234	183
Trade & Repair	7,061	6,550	6,856	6,367	489
Transportation	2,555	2,363	2,385	2,283	102
Information & Media	1,673	1,578	1,852	1,519	333
Hotels & Restaurants	1,953	1,791	1,850	1,796	54
Financial services	1,872	1,759	1,933	1,970	-37
Business services	5,580	5,212	5,666	5,751	-85
Public administration	3,700	3,474	3,580	3,235	345
Education	3,282	3,111	3,334	3,387	-53
Health	6,606	6,176	6,671	6,358	314
Other services	2,406	2,242	2,281	2,277	4
Total	51,741	48,253	51,113	48,030	3,084
<i>level of unemployment</i>		6.7%		6.0%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.21	1.08	0.97	1.07
Manufacturing	1.19	1.15	1.16	1.16
Utilities	1.17	1.10	1.05	1.09
Construction	1.39	1.06	0.91	1.06
Trade & Repair	1.01	1.08	1.14	1.08
Transportation	1.05	1.03	1.12	1.04
Information & Media	1.20	1.18	1.25	1.22
Hotels & Restaurants	1.01	1.02	1.13	1.03
Financial services	0.84	0.96	1.04	0.98
Business services	0.95	1.00	0.98	0.99
Public administration	1.19	1.08	1.14	1.11
Education	1.10	1.07	0.95	0.98
Health	1.16	1.03	1.05	1.05
Other services	0.99	1.01	1.00	1.00
Total	1.09	1.06	1.06	1.06

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.19	1.11	1.05	1.05	0.96	1.07
Manufacturing	1.19	1.14	1.15	1.20	1.13	1.16
Utilities	1.20	1.09	1.06	0.88	1.12	1.09
Construction	1.35	0.99	1.02	1.00	1.09	1.06
Trade & Repair	1.06	1.08	1.07	1.12	1.09	1.08
Transportation	1.06	1.04	1.02	1.11	1.07	1.04
Information & Media	1.23	1.22	1.22	1.32	1.12	1.22
Hotels & Restaurants	1.04	1.02	0.97	1.06	1.04	1.03
Financial services	0.90	1.00	0.92	0.96	0.91	0.98
Business services	0.99	1.00	0.96	0.98	1.02	0.99
Public administration	1.18	1.12	1.00	1.12	1.17	1.11
Education	1.12	0.95	1.02	1.08	1.01	0.98
Health	1.14	0.99	0.96	1.06	1.02	1.05
Other services	1.02	1.00	0.91	1.03	1.05	1.00
Total	1.10	1.05	1.06	1.07	1.06	1.06

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.43	1.06	0.85	1.04	1.09	1.07
Manufacturing	1.16	1.16	1.14	1.17	1.08	1.16
Utilities	1.76	0.99	0.94	1.15	1.24	1.09
Construction	1.14	0.92	0.90	1.11	0.99	1.06
Trade & Repair	1.19	1.03	1.07	1.19	0.89	1.08
Transportation	1.13	0.97	1.16	1.02	0.82	1.04
IT services	1.05	1.28	1.22	1.06	0.86	1.22
Hotels & Restaurants	1.11	1.05	1.05	1.17	0.83	1.03
Financial services	0.87	1.00	1.00	0.47	0.74	0.98
Business services	0.88	1.08	1.04	0.86	0.82	0.99
Public administration	1.20	1.10	1.19	0.95	0.96	1.11
Education	0.85	0.98	1.08	1.07	0.93	0.98
Health	1.19	1.07	1.04	0.85	0.96	1.05
Other services	0.97	1.16	0.99	0.86	0.77	1.00
Total	1.10	1.08	1.06	1.09	0.91	1.06

Appendix C.6 Scenario 1 – West-EU Francophone

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	904	819	781	680	101
Manufacturing	4,565	4,162	4,621	3,882	739
Utilities	468	429	491	428	63
Construction	2,396	2,169	2,327	2,116	211
Trade & Repair	4,294	3,918	4,413	3,933	479
Transportation	1,736	1,575	1,707	1,574	133
Information & Media	925	861	1,111	991	120
Hotels & Restaurants	1,126	1,021	1,113	990	123
Financial services	1,131	1,050	1,264	1,142	122
Business services	3,152	2,896	3,329	3,320	9
Public administration	3,065	2,802	2,962	2,671	292
Education	2,362	2,202	2,695	2,240	456
Health	4,269	3,914	4,357	4,147	210
Other services	2,033	1,846	1,891	1,870	20
Total	32,428	29,664	33,061	29,984	3,077
<i>level of unemployment</i>		8.5%		9.3%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.34	1.12	1.06	1.15
Manufacturing	1.36	1.21	1.09	1.19
Utilities	1.32	1.18	1.06	1.15
Construction	1.29	1.09	0.92	1.10
Trade & Repair	1.21	1.19	1.00	1.12
Transportation	1.15	1.14	0.94	1.08
Information & Media	0.90	1.13	1.14	1.12
Hotels & Restaurants	1.20	1.17	0.97	1.12
Financial services	0.86	1.05	1.15	1.11
Business services	0.96	1.01	1.01	1.00
Public administration	1.18	1.07	1.13	1.11
Education	1.29	1.11	1.22	1.20
Health	1.17	1.04	1.03	1.05
Other services	0.92	1.07	1.00	1.01
Total	1.17	1.12	1.07	1.10

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.32	1.06	1.12	1.11	1.09	1.15
Manufacturing	1.34	1.15	1.16	1.16	1.22	1.19
Utilities	1.27	1.10	1.13	1.04	1.16	1.15
Construction	1.27	1.01	1.06	1.05	1.05	1.10
Trade & Repair	1.20	1.10	1.12	0.99	1.15	1.12
Transportation	1.14	1.05	1.08	1.15	1.05	1.08
Information & Media	0.97	1.12	1.14	1.20	1.18	1.12
Hotels & Restaurants	1.18	1.07	1.13	1.03	1.13	1.12
Financial services	0.93	1.13	1.10	1.03	1.15	1.11
Business services	0.96	1.02	1.00	0.97	1.04	1.00
Public administration	1.16	1.10	1.08	1.09	1.17	1.11
Education	1.24	1.21	1.18	1.20	1.24	1.20
Health	1.15	1.05	1.01	1.03	1.09	1.05
Other services	0.94	1.03	1.03	1.03	1.08	1.01
Total	1.15	1.10	1.10	1.04	1.12	1.10

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.08	0.79	0.79	1.20	0.84	1.15
Manufacturing	1.07	1.14	1.36	1.22	1.12	1.19
Utilities	1.31	1.05	0.94	1.36	1.12	1.15
Construction	0.66	1.09	1.26	1.17	0.75	1.10
Trade & Repair	1.24	1.15	1.11	1.11	0.77	1.12
Transportation	1.30	1.17	1.13	1.05	0.84	1.08
IT services	1.02	1.15	1.18	0.86	0.77	1.12
Hotels & Restaurants	1.24	1.24	1.15	1.11	0.82	1.12
Financial services	1.01	1.09	1.24	0.83	0.69	1.11
Business services	0.97	1.09	1.14	0.87	0.79	1.00
Public administration	0.85	1.12	1.27	1.10	0.88	1.11
Education	0.95	1.26	1.21	1.14	0.83	1.20
Health	0.96	1.14	1.03	0.93	0.83	1.05
Other services	1.04	1.21	1.00	0.98	0.86	1.01
Total	1.06	1.15	1.13	1.14	0.84	1.10

Appendix C.7 Scenario 1 – Mediterranean

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	2,764	2,369	2,124	1,910	213
Manufacturing	9,585	8,370	9,512	7,932	1,580
Utilities	736	647	741	622	120
Construction	5,361	4,638	5,038	3,927	1,112
Trade & Repair	8,903	7,800	9,015	8,612	403
Transportation	2,740	2,394	2,670	2,151	519
Information & Media	1,433	1,305	1,800	1,403	397
Hotels & Restaurants	3,498	3,043	3,458	3,355	103
Financial services	1,443	1,311	1,696	1,072	624
Business services	5,435	4,875	6,082	6,292	-210
Public administration	3,382	3,027	3,546	3,085	461
Education	3,709	3,394	4,033	3,618	415
Health	3,897	3,514	4,237	3,853	384
Other services	3,887	3,402	3,809	3,578	232
Total	56,774	50,086	57,762	51,409	6,353
<i>level of unemployment</i>		11.8%		11.0%	

Appendix Table 2

				Total (all levels)
	Low	Medium	High	
Agriculture	1.11	1.19	0.92	1.11
Manufacturing	1.22	1.24	1.07	1.20
Utilities	1.21	1.25	1.10	1.19
Construction	1.51	1.09	1.11	1.28
Trade & Repair	1.16	1.09	0.82	1.05
Transportation	1.36	1.28	0.96	1.24
Information & Media	1.48	1.41	1.19	1.28
Hotels & Restaurants	1.11	1.06	0.80	1.03
Financial services	1.71	1.69	1.48	1.58
Business services	1.13	1.05	0.86	0.97
Public administration	1.16	1.35	0.99	1.15
Education	1.24	1.42	1.03	1.11
Health	1.15	1.39	0.97	1.10
Other services	1.14	1.10	0.89	1.06
Total	1.22	1.19	0.98	1.12

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.12	1.09	1.09	1.04	1.09	1.11
Manufacturing	1.23	1.19	1.16	1.14	1.26	1.20
Utilities	1.23	1.17	1.16	1.21	1.29	1.19
Construction	1.41	1.11	1.10	1.17	1.14	1.28
Trade & Repair	1.13	0.97	0.97	0.85	1.04	1.05
Transportation	1.32	1.13	1.16	1.11	1.18	1.24
Information & Media	1.40	1.25	1.26	1.25	1.34	1.28
Hotels & Restaurants	1.09	0.92	0.93	0.87	1.01	1.03
Financial services	1.64	1.57	1.57	1.49	1.65	1.58
Business services	1.09	0.92	0.90	0.95	0.98	0.97
Public administration	1.24	1.09	1.13	1.03	1.18	1.15
Education	1.33	1.07	1.03	1.14	1.19	1.11
Health	1.25	1.15	1.16	0.99	1.34	1.10
Other services	1.12	0.95	1.00	1.00	1.08	1.06
Total	1.20	1.07	1.07	0.99	1.11	1.12

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.01	1.07	1.12	1.10	1.16	1.11
Manufacturing	0.97	1.08	1.20	1.29	1.04	1.20
Utilities	1.27	1.07	1.43	1.23	1.16	1.19
Construction	1.27	1.24	1.77	1.25	1.41	1.28
Trade & Repair	1.04	0.96	1.09	1.17	0.84	1.05
Transportation	1.15	1.06	1.24	1.39	0.98	1.24
IT services	1.11	1.25	1.57	1.37	1.13	1.28
Hotels & Restaurants	1.04	1.04	1.05	1.15	0.85	1.03
Financial services	1.40	1.42	1.98	1.67	1.07	1.58
Business services	0.88	0.97	1.20	1.04	0.76	0.97
Public administration	0.80	1.10	1.36	0.76	1.04	1.15
Education	0.74	1.12	1.29	0.84	1.01	1.11
Health	0.85	1.11	1.15	0.81	0.99	1.10
Other services	0.95	1.13	1.23	1.21	0.93	1.06
Total	1.03	1.09	1.19	1.23	0.95	1.12

Appendix C.8 Scenario 1 – Eastern Europe

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	5,672	5,070	4,355	2,887	1,468
Manufacturing	10,118	9,246	9,896	7,208	2,687
Utilities	1,046	960	996	806	190
Construction	4,060	3,699	3,867	3,736	131
Trade & Repair	6,612	6,074	6,882	6,785	97
Transportation	2,793	2,559	2,724	2,813	-89
Information & Media	926	866	1,137	1,184	-47
Hotels & Restaurants	1,316	1,202	1,301	1,175	126
Financial services	955	894	1,172	1,250	-78
Business services	2,691	2,493	2,799	3,506	-707
Public administration	2,704	2,513	2,983	2,741	242
Education	3,115	2,920	3,591	3,498	93
Health	2,545	2,352	2,610	2,721	-111
Other services	1,352	1,245	1,355	1,268	87
Total	45,905	42,094	45,666	41,578	4,089
<i>level of unemployment</i>		8.3%		9.0%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.46	1.58	1.09	1.51
Manufacturing	1.46	1.43	1.13	1.37
Utilities	1.33	1.31	1.06	1.24
Construction	1.09	1.07	0.84	1.03
Trade & Repair	1.04	1.07	0.87	1.01
Transportation	0.87	1.01	0.83	0.97
Information & Media	0.92	1.11	0.89	0.96
Hotels & Restaurants	1.06	1.14	0.91	1.11
Financial services	0.80	1.06	0.88	0.94
Business services	0.74	0.89	0.73	0.80
Public administration	1.21	1.16	1.03	1.09
Education	1.11	1.11	1.00	1.03
Health	1.00	1.03	0.88	0.96
Other services	0.97	1.18	0.92	1.07
Total	1.24	1.19	0.93	1.10

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.50	1.41	1.53	1.38	1.52	1.51
Manufacturing	1.45	1.29	1.37	1.32	1.46	1.37
Utilities	1.31	1.22	1.22	1.38	1.26	1.24
Construction	1.10	0.95	1.03	0.99	1.05	1.03
Trade & Repair	1.07	0.98	1.01	0.91	1.06	1.01
Transportation	0.97	0.93	0.98	0.97	0.98	0.97
Information & Media	1.11	0.92	0.95	1.01	1.05	0.96
Hotels & Restaurants	1.15	1.04	1.09	0.98	1.14	1.11
Financial services	1.08	0.92	0.92	1.01	1.03	0.94
Business services	0.88	0.80	0.77	0.84	0.84	0.80
Public administration	1.17	1.07	1.07	1.05	1.16	1.09
Education	1.12	1.03	0.99	1.04	1.10	1.03
Health	1.02	0.95	0.95	0.95	1.04	0.96
Other services	1.15	0.97	1.08	1.13	1.20	1.07
Total	1.20	1.00	1.13	0.96	1.14	1.10

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.47	1.55	1.52	1.54	1.29	1.51
Manufacturing	1.32	1.42	1.36	1.38	1.25	1.37
Utilities	1.20	1.29	1.34	1.22	1.11	1.24
Construction	1.07	1.13	1.03	1.04	0.88	1.03
Trade & Repair	1.03	1.02	1.05	0.99	0.72	1.01
Transportation	1.04	1.01	1.02	0.96	0.72	0.97
IT services	1.02	0.97	0.96	0.86	0.63	0.96
Hotels & Restaurants	1.12	1.04	1.19	1.01	0.76	1.11
Financial services	1.00	0.94	0.95	0.77	0.55	0.94
Business services	0.89	0.90	0.72	0.76	0.57	0.80
Public administration	1.01	1.19	1.02	0.90	0.83	1.09
Education	0.94	1.10	0.84	0.72	0.80	1.03
Health	0.86	1.05	0.79	0.80	0.85	0.96
Other services	1.14	1.19	1.04	1.06	0.81	1.07
Total	1.07	1.09	1.02	1.23	0.88	1.10

Appendix C.9 Scenario 2 – US

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	2,016	1,563	1,886	1,328	558
Manufacturing	16,735	14,809	17,423	14,216	3,207
Utilities	1,635	1,638	1,612	1,468	144
Construction	10,805	9,143	11,254	11,415	-160
Trade & Repair	19,497	18,867	20,287	20,487	-200
Transportation	5,857	5,860	5,839	6,367	-527
Information & Media	5,035	4,909	5,726	5,549	177
Hotels & Restaurants	9,456	7,886	10,387	7,867	2,520
Financial services	7,597	6,501	8,387	7,566	821
Business services	16,260	14,230	17,327	18,249	-921
Public administration	6,934	6,529	7,169	7,340	-171
Education	14,590	12,695	15,524	17,939	-2,415
Health	17,444	17,328	18,923	24,889	-5,966
Other services	7,355	6,968	7,321	8,005	-684
Total	141,216	128,926	149,066	152,685	-3,619
<i>level of unemployment</i>		8.7%		-2.4%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	2.35	1.48	0.78	1.42
Manufacturing	1.54	1.26	1.12	1.23
Utilities	1.42	1.14	1.00	1.10
Construction	1.58	1.03	0.60	0.99
Trade & Repair	1.34	1.05	0.85	0.99
Transportation	1.21	0.97	0.77	0.92
Information & Media	1.07	1.07	1.02	1.03
Hotels & Restaurants	1.58	1.32	1.18	1.32
Financial services	2.33	1.19	1.06	1.11
Business services	1.77	1.05	0.83	0.95
Public administration	1.06	1.09	0.91	0.98
Education	0.81	0.85	0.87	0.87
Health	0.84	0.86	0.70	0.76
Other services	1.05	1.12	0.72	0.91
Total	1.43	1.06	0.86	0.98

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.78	0.73	0.88	1.21	1.40	1.42
Manufacturing	1.32	1.12	1.15	1.12	1.19	1.23
Utilities	1.18	1.05	0.97	1.35	0.91	1.10
Construction	1.16	0.62	0.77	0.61	0.91	0.99
Trade & Repair	1.09	0.86	0.89	0.91	0.97	0.99
Transportation	0.99	0.75	0.91	0.77	1.00	0.92
Information & Media	1.07	0.97	1.08	0.90	0.92	1.03
Hotels & Restaurants	1.38	1.18	1.20	1.24	1.18	1.32
Financial services	1.22	1.05	1.11	1.03	1.13	1.11
Business services	1.15	0.82	0.90	0.91	0.82	0.95
Public administration	1.09	0.88	0.98	0.93	1.11	0.98
Education	0.86	0.87	0.87	0.75	0.84	0.87
Health	0.86	0.69	0.76	0.73	0.88	0.76
Other services	1.10	0.73	0.79	0.94	1.12	0.91
Total	1.12	0.86	0.94	0.79	1.03	0.98

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.26	1.37	1.44	1.45	1.67	1.42
Manufacturing	1.20	1.27	1.24	1.23	1.17	1.23
Utilities	1.01	1.11	1.14	1.12	1.10	1.10
Construction	0.88	0.82	0.93	1.04	1.14	0.99
Trade & Repair	0.98	0.96	1.00	1.01	0.99	0.99
Transportation	0.91	0.90	0.90	0.94	0.91	0.92
IT services	1.05	1.05	1.02	0.96	0.97	1.03
Hotels & Restaurants	1.31	1.35	1.34	1.32	1.19	1.32
Financial services	1.14	1.10	1.10	1.08	1.06	1.11
Business services	0.97	0.90	0.95	1.01	1.06	0.95
Public administration	0.95	0.96	1.02	0.93	0.78	0.98
Education	0.89	0.89	0.80	0.73	0.68	0.87
Health	0.74	0.77	0.76	0.72	0.68	0.76
Other services	0.89	0.84	0.97	0.98	0.90	0.91
Total	0.99	0.91	0.98	1.07	0.99	0.98

Appendix C.10 Scenario 2 – EU27

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	10,938	9,803	8,984	7,967	1,018
Manufacturing	39,013	35,487	39,138	34,102	5,036
Utilities	3,453	3,154	3,464	3,067	396
Construction	18,624	16,844	17,988	17,434	554
Trade & Repair	32,200	29,269	32,537	33,111	-574
Transportation	12,004	10,890	11,607	11,696	-88
Information & Media	6,470	6,023	7,702	6,827	875
Hotels & Restaurants	9,556	8,619	9,368	9,605	-237
Financial services	7,127	6,603	8,036	7,198	838
Business services	21,783	20,056	23,049	25,644	-2,595
Public administration	15,477	14,256	15,939	14,732	1,207
Education	16,682	15,585	18,138	17,039	1,099
Health	23,172	21,355	24,185	23,854	332
Other services	11,726	10,673	11,353	12,103	-751
Total	228,226	208,618	231,490	224,380	7,110
<i>level of unemployment</i>		<i>8.6%</i>		<i>3.1%</i>	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.06	1.23	0.89	1.13
Manufacturing	1.12	1.20	1.05	1.15
Utilities	1.11	1.19	1.04	1.13
Construction	1.22	1.01	0.88	1.03
Trade & Repair	1.02	1.04	0.83	0.98
Transportation	1.03	1.03	0.84	0.99
Information & Media	1.15	1.16	1.11	1.13
Hotels & Restaurants	1.01	1.01	0.82	0.98
Financial services	1.07	1.13	1.11	1.12
Business services	0.94	0.93	0.86	0.90
Public administration	1.13	1.12	1.03	1.08
Education	1.15	1.17	1.03	1.06
Health	1.08	1.07	0.95	1.01
Other services	0.96	0.97	0.87	0.94
Total	1.07	1.08	0.96	1.03

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.10	1.11	1.16	1.06	1.13	1.13
Manufacturing	1.15	1.14	1.15	1.16	1.21	1.15
Utilities	1.14	1.14	1.12	1.12	1.19	1.13
Construction	1.14	0.97	0.98	0.98	1.03	1.03
Trade & Repair	1.03	0.96	0.97	0.89	1.02	0.98
Transportation	1.02	0.95	0.99	0.98	1.00	0.99
Information & Media	1.16	1.11	1.13	1.16	1.13	1.13
Hotels & Restaurants	1.02	0.91	0.94	0.90	0.99	0.98
Financial services	1.12	1.12	1.09	1.11	1.11	1.12
Business services	0.94	0.90	0.87	0.88	0.93	0.90
Public administration	1.14	1.07	1.05	1.05	1.14	1.08
Education	1.14	1.05	1.05	1.13	1.14	1.06
Health	1.07	1.00	1.00	1.00	1.07	1.01
Other services	0.97	0.90	0.90	0.94	0.98	0.94
Total	1.07	1.01	1.03	1.00	1.04	1.03

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	0.96	1.06	0.93	1.17	1.04	1.13
Manufacturing	1.06	1.10	1.15	1.20	1.02	1.15
Utilities	1.22	1.08	1.05	1.20	1.09	1.13
Construction	0.93	1.01	1.05	1.06	0.95	1.03
Trade & Repair	1.02	0.95	1.01	1.03	0.78	0.98
Transportation	1.07	0.96	1.07	0.99	0.82	0.99
IT services	1.01	1.15	1.26	1.00	0.85	1.13
Hotels & Restaurants	1.01	0.99	1.01	1.01	0.79	0.98
Financial services	1.00	1.08	1.26	0.83	0.82	1.12
Business services	0.82	0.96	1.01	0.82	0.72	0.90
Public administration	1.00	1.08	1.18	0.88	0.94	1.08
Education	0.93	1.09	1.06	0.88	0.89	1.06
Health	1.00	1.06	0.99	0.82	0.90	1.01
Other services	0.89	1.04	0.99	0.87	0.80	0.94
Total	0.98	1.05	1.05	1.09	0.85	1.03

Appendix C.11 Scenario 2 - Anglosaxon

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	401	377	338	346	-8
Manufacturing	3,363	3,121	3,454	2,793	661
Utilities	421	390	441	346	95
Construction	2,629	2,419	2,720	2,433	287
Trade & Repair	3,977	3,703	3,978	4,058	-80
Transportation	1,591	1,474	1,525	1,492	33
Information & Media	1,107	1,034	1,358	1,172	186
Hotels & Restaurants	1,373	1,273	1,475	1,251	224
Financial services	1,434	1,329	1,734	1,387	347
Business services	3,710	3,471	3,990	4,464	-475
Public administration	2,023	1,879	2,295	1,857	438
Education	3,285	3,084	3,566	3,247	319
Health	4,114	3,833	4,503	4,023	480
Other services	1,577	1,464	1,683	1,875	-192
Total	31,006	28,852	33,059	30,744	2,315
<i>level of unemployment</i>		6.9%		7.0%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	0.76	1.16	0.87	0.98
Manufacturing	0.91	1.41	1.14	1.24
Utilities	0.94	1.46	1.15	1.27
Construction	0.71	1.25	1.11	1.12
Trade & Repair	0.86	1.14	0.79	0.98
Transportation	0.93	1.14	0.82	1.02
Information & Media	1.00	1.28	1.11	1.16
Hotels & Restaurants	1.05	1.35	0.92	1.18
Financial services	1.00	1.36	1.19	1.25
Business services	0.72	0.99	0.86	0.89
Public administration	1.08	1.41	1.12	1.24
Education	1.02	1.32	1.03	1.10
Health	0.99	1.26	1.05	1.12
Other services	0.71	1.00	0.84	0.90
Total	0.87	1.22	0.99	1.08

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	0.97	0.87	1.03	0.91	1.08	0.98
Manufacturing	1.23	1.27	1.22	1.28	1.43	1.24
Utilities	1.26	1.31	1.25	1.20	1.44	1.27
Construction	1.05	1.19	1.20	1.12	1.35	1.12
Trade & Repair	1.03	0.90	0.92	0.96	1.05	0.98
Transportation	1.06	0.93	0.96	0.97	1.07	1.02
Information & Media	1.22	1.14	1.13	1.13	1.03	1.16
Hotels & Restaurants	1.24	1.01	1.11	1.06	1.26	1.18
Financial services	1.28	1.22	1.20	1.31	1.28	1.25
Business services	0.90	0.90	0.88	0.89	0.97	0.89
Public administration	1.33	1.17	1.15	1.17	1.41	1.24
Education	1.17	1.05	1.06	1.29	1.27	1.10
Health	1.14	1.08	1.04	1.13	1.23	1.12
Other services	0.90	0.86	0.84	0.91	1.05	0.90
Total	1.09	1.03	1.06	1.12	1.16	1.08

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	0.79	1.40	0.84	0.91	1.57	0.98
Manufacturing	1.19	1.16	1.40	1.41	0.85	1.24
Utilities	1.32	1.41	0.99	1.26	1.60	1.27
Construction	1.06	1.23	1.17	1.15	0.92	1.12
Trade & Repair	1.11	0.95	0.95	1.01	0.85	0.98
Transportation	1.30	1.12	1.26	0.87	1.02	1.02
IT services	1.09	1.18	1.50	0.89	1.11	1.16
Hotels & Restaurants	1.31	1.12	1.20	1.10	1.01	1.18
Financial services	1.12	1.16	1.57	0.97	1.00	1.25
Business services	0.82	0.91	1.16	0.75	0.74	0.89
Public administration	1.29	1.13	1.30	1.07	1.28	1.24
Education	1.16	1.14	1.05	0.85	0.94	1.10
Health	1.28	1.10	1.12	0.96	1.10	1.12
Other services	0.83	0.89	1.05	0.72	0.72	0.90
Total	1.08	1.07	1.13	1.08	0.91	1.08

Appendix C.12 Scenario 2 - Scandinavia

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	319	297	278	253	25
Manufacturing	1,652	1,543	1,649	1,551	98
Utilities	137	128	132	133	0
Construction	837	778	807	719	88
Trade & Repair	1,527	1,424	1,569	1,462	107
Transportation	683	634	638	612	26
Information & Media	487	462	583	514	69
Hotels & Restaurants	330	307	350	302	48
Financial services	312	296	347	337	11
Business services	1,393	1,316	1,490	1,614	-124
Public administration	705	669	733	748	-15
Education	1,102	1,052	1,199	1,148	51
Health	2,165	2,042	2,272	2,246	26
Other services	551	518	561	557	5
Total	12,201	11,465	12,610	12,195	414
<i>level of unemployment</i>		6.0%		3.3%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	0.85	1.28	1.01	1.10
Manufacturing	0.87	1.12	1.08	1.06
Utilities	0.85	1.04	1.00	1.00
Construction	0.85	1.24	1.02	1.12
Trade & Repair	0.86	1.22	0.92	1.07
Transportation	0.86	1.19	0.90	1.04
Information & Media	0.98	1.10	1.17	1.13
Hotels & Restaurants	1.00	1.29	0.98	1.16
Financial services	0.84	0.97	1.10	1.03
Business services	0.81	0.91	0.95	0.92
Public administration	0.74	0.98	1.00	0.98
Education	0.82	1.18	1.03	1.04
Health	0.82	1.09	1.00	1.01
Other services	0.90	1.02	1.02	1.01
Total	0.85	1.12	1.01	1.03

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	0.94	1.06	1.20	0.95	1.23	1.10
Manufacturing	0.95	1.08	1.11	1.04	1.09	1.06
Utilities	0.90	1.04	1.00	1.35	1.14	1.00
Construction	0.93	1.09	1.20	1.17	1.25	1.12
Trade & Repair	1.02	1.08	1.13	0.96	1.19	1.07
Transportation	0.97	1.01	1.14	0.99	1.12	1.04
Information & Media	1.06	1.13	1.16	1.15	1.21	1.13
Hotels & Restaurants	1.14	1.10	1.21	1.16	1.21	1.16
Financial services	0.96	1.03	1.10	1.05	1.02	1.03
Business services	0.88	0.94	0.93	0.90	0.94	0.92
Public administration	0.86	0.97	1.03	1.00	1.05	0.98
Education	1.04	1.02	1.10	1.06	1.17	1.04
Health	0.97	1.03	1.05	1.01	1.06	1.01
Other services	1.01	1.00	1.00	1.03	1.05	1.01
Total	0.97	1.03	1.09	1.01	1.10	1.03

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	0.76	1.05	0.81	1.18	0.54	1.10
Manufacturing	1.10	1.05	1.17	1.07	0.83	1.06
Utilities	0.96	1.17	0.96	1.09	0.63	1.00
Construction	0.86	1.03	1.06	1.17	1.36	1.12
Trade & Repair	1.03	1.00	1.18	0.99	0.87	1.07
Transportation	0.98	0.96	1.06	1.11	0.90	1.04
IT services	1.03	1.16	1.21	0.75	1.15	1.13
Hotels & Restaurants	1.10	1.05	1.29	1.03	0.93	1.16
Financial services	0.87	1.03	1.20	0.76	1.04	1.03
Business services	0.77	0.97	1.00	0.67	0.94	0.92
Public administration	0.77	0.96	1.15	0.97	1.04	0.98
Education	0.87	1.05	1.08	1.10	1.08	1.04
Health	0.91	1.04	0.99	0.91	0.98	1.01
Other services	0.84	1.09	1.02	0.76	1.02	1.01
Total	0.94	1.03	1.08	1.06	0.92	1.03

Appendix C.13 Scenario 2 – West-EU Rhineland

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	967	894	831	834	-4
Manufacturing	9,924	9,236	9,807	9,136	670
Utilities	664	620	653	646	7
Construction	3,497	3,249	3,417	3,485	-68
Trade & Repair	7,061	6,550	6,856	6,861	-5
Transportation	2,555	2,363	2,385	2,460	-75
Information & Media	1,673	1,578	1,852	1,637	215
Hotels & Restaurants	1,953	1,791	1,850	1,935	-85
Financial services	1,872	1,759	1,933	2,123	-190
Business services	5,580	5,212	5,666	6,197	-531
Public administration	3,700	3,474	3,580	3,485	94
Education	3,282	3,111	3,334	3,649	-315
Health	6,606	6,176	6,671	6,850	-179
Other services	2,406	2,242	2,281	2,453	-172
Total	51,741	48,253	51,113	51,752	-639
<i>level of unemployment</i>		6.7%		-1.2%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.12	1.01	0.90	1.00
Manufacturing	1.10	1.06	1.08	1.07
Utilities	1.09	1.02	0.97	1.01
Construction	1.29	0.98	0.85	0.98
Trade & Repair	0.94	1.00	1.05	1.00
Transportation	0.98	0.95	1.04	0.97
Information & Media	1.12	1.10	1.16	1.13
Hotels & Restaurants	0.94	0.95	1.05	0.96
Financial services	0.78	0.89	0.97	0.91
Business services	0.88	0.93	0.91	0.91
Public administration	1.10	1.00	1.05	1.03
Education	1.02	0.99	0.88	0.91
Health	1.08	0.96	0.97	0.97
Other services	0.91	0.94	0.93	0.93
Total	1.02	0.99	0.98	0.99

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.11	1.03	0.98	0.98	0.89	1.00
Manufacturing	1.11	1.06	1.07	1.11	1.05	1.07
Utilities	1.11	1.02	0.99	0.82	1.04	1.01
Construction	1.25	0.92	0.95	0.93	1.01	0.98
Trade & Repair	0.98	1.01	0.99	1.04	1.01	1.00
Transportation	0.98	0.97	0.95	1.03	0.99	0.97
Information & Media	1.14	1.13	1.13	1.22	1.04	1.13
Hotels & Restaurants	0.97	0.95	0.90	0.98	0.97	0.96
Financial services	0.84	0.93	0.86	0.89	0.85	0.91
Business services	0.92	0.92	0.89	0.91	0.94	0.91
Public administration	1.10	1.04	0.93	1.04	1.09	1.03
Education	1.04	0.88	0.94	1.00	0.93	0.91
Health	1.06	0.92	0.89	0.99	0.95	0.97
Other services	0.95	0.93	0.84	0.95	0.97	0.93
Total	1.02	0.97	0.99	0.99	0.99	0.99

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.33	0.98	0.79	0.97	1.01	1.00
Manufacturing	1.07	1.08	1.06	1.08	1.00	1.07
Utilities	1.63	0.92	0.88	1.07	1.15	1.01
Construction	1.06	0.85	0.83	1.03	0.92	0.98
Trade & Repair	1.11	0.96	0.99	1.11	0.83	1.00
Transportation	1.05	0.90	1.07	0.95	0.76	0.97
IT services	0.97	1.19	1.14	0.98	0.80	1.13
Hotels & Restaurants	1.03	0.98	0.97	1.09	0.77	0.96
Financial services	0.81	0.93	0.93	0.44	0.68	0.91
Business services	0.82	1.00	0.97	0.80	0.76	0.91
Public administration	1.11	1.02	1.10	0.88	0.89	1.03
Education	0.79	0.91	1.00	1.00	0.86	0.91
Health	1.11	0.99	0.97	0.79	0.89	0.97
Other services	0.90	1.07	0.92	0.79	0.72	0.93
Total	1.02	1.00	0.99	1.02	0.84	0.99

Appendix C.14 Scenario 2 – West-EU Francophone

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	904	819	781	748	33
Manufacturing	4,565	4,162	4,621	4,270	351
Utilities	468	429	491	471	20
Construction	2,396	2,169	2,327	2,328	-1
Trade & Repair	4,294	3,918	4,413	4,327	85
Transportation	1,736	1,575	1,707	1,731	-25
Information & Media	925	861	1,111	1,091	20
Hotels & Restaurants	1,126	1,021	1,113	1,089	24
Financial services	1,131	1,050	1,264	1,257	7
Business services	3,152	2,896	3,329	3,653	-324
Public administration	3,065	2,802	2,962	2,938	24
Education	2,362	2,202	2,695	2,464	231
Health	4,269	3,914	4,357	4,562	-205
Other services	2,033	1,846	1,891	2,058	-167
Total	32,428	29,664	33,061	32,986	76
<i>level of unemployment</i>		8.5%		0.2%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.22	1.02	0.97	1.04
Manufacturing	1.24	1.10	0.99	1.08
Utilities	1.20	1.07	0.96	1.04
Construction	1.17	0.99	0.84	1.00
Trade & Repair	1.10	1.08	0.91	1.02
Transportation	1.04	1.04	0.86	0.99
Information & Media	0.82	1.03	1.03	1.02
Hotels & Restaurants	1.09	1.06	0.89	1.02
Financial services	0.78	0.95	1.05	1.01
Business services	0.87	0.92	0.92	0.91
Public administration	1.07	0.98	1.02	1.01
Education	1.17	1.00	1.11	1.09
Health	1.06	0.94	0.93	0.96
Other services	0.83	0.97	0.91	0.92
Total	1.06	1.01	0.97	1.00

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.20	0.96	1.02	1.01	0.99	1.04
Manufacturing	1.22	1.05	1.05	1.06	1.11	1.08
Utilities	1.16	1.00	1.03	0.94	1.06	1.04
Construction	1.15	0.92	0.96	0.95	0.95	1.00
Trade & Repair	1.09	1.00	1.01	0.90	1.04	1.02
Transportation	1.04	0.95	0.98	1.05	0.95	0.99
Information & Media	0.88	1.02	1.04	1.09	1.07	1.02
Hotels & Restaurants	1.08	0.98	1.02	0.94	1.03	1.02
Financial services	0.84	1.03	1.00	0.94	1.04	1.01
Business services	0.88	0.93	0.91	0.89	0.95	0.91
Public administration	1.05	1.00	0.99	0.99	1.07	1.01
Education	1.13	1.10	1.07	1.10	1.12	1.09
Health	1.04	0.95	0.91	0.94	0.99	0.96
Other services	0.85	0.94	0.94	0.94	0.98	0.92
Total	1.05	1.00	1.00	0.95	1.02	1.00

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	0.98	0.72	0.72	1.09	0.76	1.04
Manufacturing	0.98	1.04	1.24	1.11	1.01	1.08
Utilities	1.19	0.95	0.85	1.24	1.02	1.04
Construction	0.60	0.99	1.14	1.07	0.68	1.00
Trade & Repair	1.12	1.04	1.01	1.01	0.70	1.02
Transportation	1.18	1.07	1.03	0.95	0.76	0.99
IT services	0.93	1.04	1.07	0.78	0.70	1.02
Hotels & Restaurants	1.13	1.12	1.04	1.01	0.75	1.02
Financial services	0.92	0.99	1.13	0.75	0.62	1.01
Business services	0.88	0.99	1.04	0.79	0.72	0.91
Public administration	0.77	1.02	1.15	1.00	0.80	1.01
Education	0.87	1.15	1.10	1.03	0.75	1.09
Health	0.88	1.04	0.94	0.84	0.76	0.96
Other services	0.94	1.10	0.90	0.89	0.78	0.92
Total	0.97	1.05	1.03	1.04	0.77	1.00

Appendix C.15 Scenario 2 – Mediterranean

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	2,764	2,369	2,124	2,086	37
Manufacturing	9,585	8,370	9,512	8,663	849
Utilities	736	647	741	679	62
Construction	5,361	4,638	5,038	4,288	750
Trade & Repair	8,903	7,800	9,015	9,406	-391
Transportation	2,740	2,394	2,670	2,349	321
Information & Media	1,433	1,305	1,800	1,532	268
Hotels & Restaurants	3,498	3,043	3,458	3,664	-206
Financial services	1,443	1,311	1,696	1,171	525
Business services	5,435	4,875	6,082	6,872	-790
Public administration	3,382	3,027	3,546	3,369	177
Education	3,709	3,394	4,033	3,952	81
Health	3,897	3,514	4,237	4,208	29
Other services	3,887	3,402	3,809	3,908	-98
Total	56,774	50,086	57,762	56,148	1,614
<i>level of unemployment</i>		11.8%		2.8%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.02	1.09	0.84	1.02
Manufacturing	1.12	1.14	0.98	1.10
Utilities	1.11	1.14	1.01	1.09
Construction	1.38	1.00	1.02	1.17
Trade & Repair	1.06	1.00	0.75	0.96
Transportation	1.24	1.17	0.88	1.14
Information & Media	1.36	1.29	1.09	1.18
Hotels & Restaurants	1.02	0.97	0.73	0.94
Financial services	1.57	1.55	1.36	1.45
Business services	1.03	0.96	0.79	0.89
Public administration	1.06	1.24	0.91	1.05
Education	1.13	1.30	0.94	1.02
Health	1.05	1.27	0.89	1.01
Other services	1.05	1.01	0.82	0.97
Total	1.12	1.09	0.89	1.03

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.03	1.00	1.00	0.96	1.00	1.02
Manufacturing	1.12	1.09	1.06	1.04	1.15	1.10
Utilities	1.12	1.07	1.06	1.11	1.18	1.09
Construction	1.29	1.01	1.01	1.08	1.04	1.17
Trade & Repair	1.03	0.89	0.89	0.78	0.96	0.96
Transportation	1.21	1.03	1.06	1.02	1.08	1.14
Information & Media	1.28	1.15	1.15	1.15	1.23	1.18
Hotels & Restaurants	1.00	0.84	0.86	0.80	0.92	0.94
Financial services	1.50	1.43	1.44	1.36	1.51	1.45
Business services	1.00	0.85	0.83	0.87	0.90	0.89
Public administration	1.14	1.00	1.03	0.94	1.08	1.05
Education	1.22	0.98	0.94	1.04	1.09	1.02
Health	1.14	1.05	1.06	0.91	1.23	1.01
Other services	1.03	0.87	0.92	0.91	0.99	0.97
Total	1.10	0.98	0.98	0.90	1.02	1.03

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	0.92	0.98	1.02	1.01	1.06	1.02
Manufacturing	0.89	0.99	1.10	1.19	0.95	1.10
Utilities	1.16	0.98	1.31	1.12	1.06	1.09
Construction	1.17	1.13	1.62	1.15	1.29	1.17
Trade & Repair	0.95	0.88	1.00	1.07	0.76	0.96
Transportation	1.05	0.97	1.14	1.27	0.90	1.14
IT services	1.02	1.14	1.44	1.26	1.03	1.18
Hotels & Restaurants	0.95	0.95	0.96	1.05	0.78	0.94
Financial services	1.28	1.30	1.81	1.53	0.98	1.45
Business services	0.80	0.89	1.10	0.96	0.69	0.89
Public administration	0.74	1.01	1.25	0.69	0.95	1.05
Education	0.68	1.03	1.18	0.77	0.92	1.02
Health	0.78	1.01	1.05	0.74	0.91	1.01
Other services	0.87	1.04	1.13	1.11	0.85	0.97
Total	0.94	1.00	1.09	1.12	0.87	1.03

Appendix C.16 Scenario 2 – Eastern Europe

Appendix Table 1

	2009		2020		Balance (A)-(B)
	Labor force	Employment	Labor force (A)	Employment (B)	
Agriculture	5,672	5,070	4,355	2,972	1,383
Manufacturing	10,118	9,246	9,896	7,421	2,474
Utilities	1,046	960	996	830	166
Construction	4,060	3,699	3,867	3,847	20
Trade & Repair	6,612	6,074	6,882	6,986	-104
Transportation	2,793	2,559	2,724	2,897	-172
Information & Media	926	866	1,137	1,219	-82
Hotels & Restaurants	1,316	1,202	1,301	1,209	91
Financial services	955	894	1,172	1,287	-115
Business services	2,691	2,493	2,799	3,610	-811
Public administration	2,704	2,513	2,983	2,822	161
Education	3,115	2,920	3,591	3,601	-10
Health	2,545	2,352	2,610	2,801	-191
Other services	1,352	1,245	1,355	1,306	49
Total	45,905	42,094	45,666	42,806	2,860
<i>level of unemployment</i>		8.3%		6.3%	

Appendix Table 2

	Low	Medium	High	Total (all levels)
Agriculture	1.41	1.54	1.06	1.47
Manufacturing	1.42	1.39	1.10	1.33
Utilities	1.29	1.27	1.03	1.20
Construction	1.06	1.04	0.82	1.01
Trade & Repair	1.01	1.04	0.84	0.99
Transportation	0.85	0.98	0.81	0.94
Information & Media	0.90	1.08	0.87	0.93
Hotels & Restaurants	1.03	1.11	0.89	1.08
Financial services	0.78	1.03	0.86	0.91
Business services	0.72	0.87	0.71	0.78
Public administration	1.17	1.13	1.00	1.06
Education	1.08	1.08	0.97	1.00
Health	0.98	1.00	0.85	0.93
Other services	0.95	1.15	0.89	1.04
Total	1.20	1.15	0.90	1.07

Appendix Table 3

	GEN	SOC & HUM	ENG, SCI & AGR	HEA	SER	Total (all fields)
Agriculture	1.45	1.37	1.48	1.34	1.48	1.47
Manufacturing	1.41	1.25	1.33	1.28	1.41	1.33
Utilities	1.28	1.19	1.19	1.34	1.23	1.20
Construction	1.07	0.92	1.00	0.96	1.02	1.01
Trade & Repair	1.04	0.96	0.98	0.89	1.03	0.99
Transportation	0.94	0.91	0.95	0.94	0.95	0.94
Information & Media	1.08	0.89	0.93	0.98	1.02	0.93
Hotels & Restaurants	1.12	1.01	1.06	0.95	1.11	1.08
Financial services	1.04	0.89	0.90	0.98	1.00	0.91
Business services	0.85	0.77	0.75	0.82	0.82	0.78
Public administration	1.13	1.04	1.04	1.02	1.13	1.06
Education	1.08	1.00	0.96	1.01	1.07	1.00
Health	0.99	0.92	0.93	0.92	1.01	0.93
Other services	1.12	0.95	1.05	1.10	1.16	1.04
Total	1.17	0.98	1.10	0.94	1.11	1.07

Appendix Table 4

	MAN	PRO	CLE & SER	AGR, CRA & PLA	ELE	Total (all occupations)
Agriculture	1.43	1.51	1.48	1.50	1.25	1.47
Manufacturing	1.29	1.38	1.32	1.34	1.21	1.33
Utilities	1.16	1.25	1.30	1.19	1.07	1.20
Construction	1.04	1.10	1.00	1.01	0.86	1.01
Trade & Repair	1.00	0.99	1.02	0.97	0.70	0.99
Transportation	1.01	0.98	0.99	0.93	0.70	0.94
IT services	0.99	0.94	0.93	0.83	0.61	0.93
Hotels & Restaurants	1.09	1.01	1.15	0.98	0.74	1.08
Financial services	0.97	0.91	0.92	0.74	0.53	0.91
Business services	0.87	0.88	0.70	0.74	0.55	0.78
Public administration	0.98	1.15	0.99	0.87	0.81	1.06
Education	0.92	1.07	0.81	0.70	0.78	1.00
Health	0.83	1.02	0.77	0.77	0.82	0.93
Other services	1.11	1.15	1.01	1.03	0.78	1.04
Total	1.04	1.06	0.99	1.20	0.86	1.07



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