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Origins and Consequences of Changes in Labour Market Skill Needs

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Considerations from a European Perspective

Analytical Report for the European Commission

prepared by the

European Expert Network on Economics of Education (EENEE).

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Opinions expressed in this report are those of the author alone and do not represent the point of view of the European Commission.

1. Future Skill Needs in Europe

In the framework of the social dimension of the Lisbon Strategy, the European Council identified the future of European Labour Markets as one of the crucial drivers of social cohesion and welfare in Europe. It encouraged the Commission to promote these issues, particularly to improve inclusion and employment opportunities for “those furthest from the Labour Market” (see the Presidency Conclusions). In this context, an outlook on future skill requirements was found as one important insight, as it can reveal current skill shortages and future skill needs in the presence of technological and demographic changes. The Commission assesses this mandate in its “New Skills for New Jobs” initiative.

With this analytical report, EENEE tries to contribute to this agenda by delivering an input to the Communication and Staff Working Document on “New Skills and New Jobs”. As a network of economists with a strong background in Labour and Education Economics, we link the most prominent theories regarding the current evolution of labour markets with convincing empirical evidence for the European countries. The main focus will be on the Skill-Biased Technological Change (SBTC) thesis and its implications. Moreover, we extend this presentation of the academic debate by commenting on the methods of macroeconomic forecasting of skill needs and by delivering some recommendations for the design of the European E&T systems to be prepared for the future requirements of Labour Markets.

Our report will be structured as follows: In the second chapter we give a short overview of overall economic and demographic trends Europe is confronted with. The third chapter deals with explanations for the shifts in relative labour demand, especially with the so-called Skill-Biased Technological Change thesis as this is one of the most widespread explanations for the observed changes in relative labour demand during the last decades. We provide an explanation of the main implications of these phenomena and present its peculiarities and limitations. In the fourth chapter, we focus on some specific characteristics of labour markets that are assumed to have evolved as a consequence of relative labour demand shifts: We will discuss the main features of Job Polarisation, Wage Inequality and Skill Mismatches, show some evidence on their appearance over Europe and try to derive some implications for future skill needs. Chapter five comments on the numerous attempts to forecast future skill needs within many countries. As we think that these approaches have serious drawbacks and can give a reliable outlook only under very strong conditions, we address this issue in this report. In chapter six we deliver implications for E&T systems that arise from the previously analyzed trends in Europe’s labour markets. Chapter seven concludes.

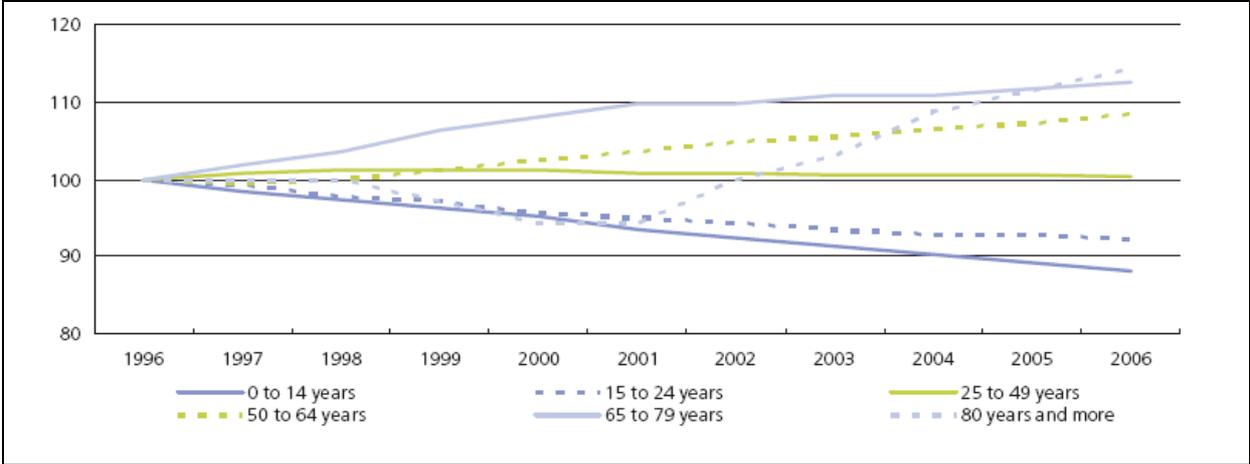
2. Overall Trends

In the first chapter we will briefly touch two general developments in Europe’s economies affecting the demand and supply of labour markets. The ageing of the population is assumed to have an influence on the age-earning and age-employment profiles of the European Economies. Educational upgrading is a phenomenon that directly leads to the main focus of this report as it can be interpreted as both a product and the cause of Skill-Biased Technological Change (SBTC).

2.1 Ageing of the Population

In its last analytical report EENEE highlighted demographic changes and in particularly the ageing of the population as a major challenge for European E&T systems. Figure 1 illustrates the development of the population for the EU 27 by different age classes indicating that the ageing processes are already in progress.

Figure 1: Development of the EU 27 population by different age classes



Source: Eurostat Yearbook 2008.

The consequences for European Labour Markets are also obvious. All European Countries experience a considerable relative shift of labour supply towards older people. Whether this cohort size shifting coincides with changes in the unemployment and/or earning structures and who is mainly affected by these evolutions is widely discussed in the economic debate. Under the assumption of better substitutability of individuals within specific cohorts an

increase in relative cohort size should - ceteris paribus - lead to a deterioration of relative earnings and an increase in the unemployment share.

According to current demographic patterns, Europe's labour markets should then be faced with a decrease in the relative earnings of the older generation and/or an increase in unemployment in this group. In terms of earnings, Brunello (2007) actually corroborates this, showing that substitution between younger and older workers is difficult, especially within the group of high-skilled workers.

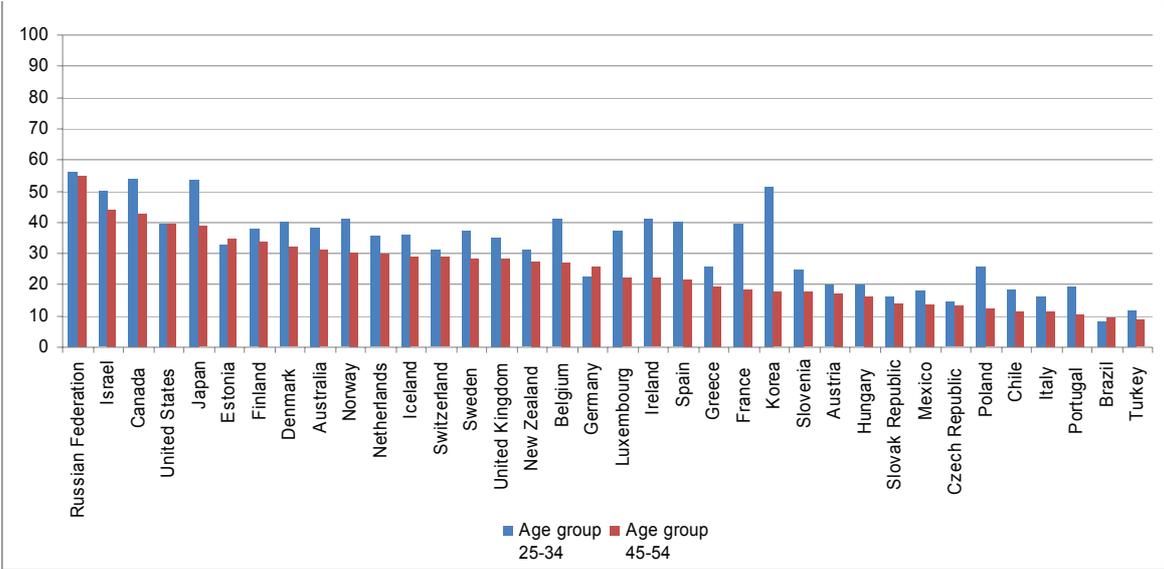
This is all the more a problem as we will see later on that the Educational Upgrading in Europe led to an increase in the share of high-skilled people and thus aggravates wage inequality between the older and the younger. According to the key issues of this report, which will be addressed, in the following chapters it will be crucial that in the presence of ongoing technological change older people can be matched with future skill needs to be able to participate in the labour market and to replace the 'missing' workers of younger cohorts.

2.2 Educational Upgrading

During the last decades a phenomenon that is called Educational Upgrading could be observed in almost all industrialized countries. This means that the workforce is currently more educated in terms of formal educational attainment and qualifications (Machin 2004). A comparison of the share of college graduates and non-graduates over time in the US and in the United Kingdom shows a considerable increase in the employment share of the graduates in both countries: Whereas in 1980 5 % of the workforce in the United Kingdom (19,3 % in the US) had a college degree, in 2004 this share reached 21 % (34,2 % in the US).

Increasing graduation rates from tertiary education across the OECD countries corroborate these findings and show that this process is still going on. Figure 2 demonstrates that in almost all countries the proportion of population with tertiary qualifications is much higher among the younger than the older cohorts.

Figure 2: Proportion of population with tertiary qualifications according to age (2005)



Source: Education at a Glance 2007 (OECD)

This upgrading pattern can be complemented by looking at employment growth by occupation: A comparison of several OECD countries over the 1980s and early 1990s (see Colecchia and Papaconstantinou 1996) does not only show a better educated workforce but also a sharp increase in the share of jobs complementary to the skills of high-skilled persons: The share of jobs compatible for white-collar workers (professional, administrative and managerial, clerical and sales) has increased and a decline of the share of jobs for blue-collar workers (transport and production workers and labourers) can be observed over almost all OECD countries.

At first sight, as supply of workers with higher educational degree goes up, a deterioration of wages for this group should be expected. This would lead to a reduction in the relative wages of high-skilled workers compared to low-skilled workers. But the changes in the occupational distribution during the last decades with the fastest growth in white-collar jobs have already indicated that labour markets are also faced with an increasing demand for high-skilled workers and, obviously, a race between supply and demand has happened (Manning and Manacorda 1998).

Actually, almost all empirical studies deliver clear evidence for an increase of the wage premium for high-skilled people during the last four decades. Obviously, the rising ratio of high-skilled people coincides with an even higher demand for their skills on the labour markets and as a consequence, earnings differentials between low and high-educated workers have been increased. Even if the extent and the specific patterns of these evolutions differ

both within Europe and between Europe and other regions, recent OECD figures affirm the general trend: People with lower secondary education earn mostly less than the median of the wage distribution, whereas tertiary education probably leads to earnings above the median (OECD Education at a Glance 2007) implying that the level of earnings strongly depends on educational attainment.

These shifts in the labour market structure – both the supply and the demand side changes - which could be observed over almost all industrialized countries give reason to find adequate explanations. Among others, the “Skill-Biased-Technological Change”-Thesis is probably the most widespread approach. In the next chapter we will discuss its feature, show some evidence and compare it to other theories.

3. Factors of Change in Skills Demand – Complementing and Competing Theories and European Evidence

By presenting some labour market patterns over the last decades, the previous chapter revealed a considerable shift in labour demand in favour of skilled workers. Whether these developments are driven by technologic and/or organizational changes or new patterns of international trade is one big issue in the economic debate. Others argue in a more political way and explain the demand shifts by a decline of labour market institutions. In another approach the observed labour demand shifts are not considered as the product of exogenously given developments, but rather as the driving force of upcoming trends, especially technologic changes.

The following sections will highlight the different ideas complemented by evidence for Europe.

3.1 Skill-Biased-Technological Change

The Skill-Biased Technological Change (SBTC) –Thesis is probably the most prominent approach explaining labour demand shift towards skilled workers. Actually, this approach evolved in the US during the emergence of the computer industry and the simultaneously observed wage inequality at the end of the 1970s and the beginning of the 1980s (Card and DiNardo 2002). The basic idea is that new technologies – for example information and communication technologies- that improve the effectiveness of the production process are “skill-biased” (Machin and van Reenen 2007) meaning that higher educated workers as one

input factor in the production process are more able to correspond to these new technologies than less educated workers. This non-neutral technological change makes higher educated workers much more attractive for employers and therefore increases the demand for this type of workforce. At the same time, less educated workers become relatively less productive and are less demanded what reduces their wages or increases unemployment within this group. The SBTC thesis emphasizes that the technological innovations really have to be in favour of the high educated workforce. One could also imagine technological innovations that affect all workers in the same manner or benefit the least-skilled and middle-skilled workers. Robotization is assumed to favour the least- and middle-skilled workforce whereas computerization is assumed not to show a clear complementarity to a specific skill level (Cahuc and Zylberberg 2004).

It is quite difficult to find good measures to identify the scale and scope of SBTC as a driving force for the observed labour demand shifts. A first insight into the relevance of the SBTC-thesis delivers the decomposition of overall shifts in skill demand (which is usually measured by wage bill/employment shares of skilled workers or by their wage premium) into the changes that occurred *within* industries or even plants and in changes that stem from shifts *between* industries (Machin 2004). Table 1 shows for several OECD countries that the change in the share of non-production employment (as a proxy for employment by the skilled workforce) predominantly took place *within* industries. The percentage that can be attributed to *within* changes was (on average) 84,3 between 1970 and 1980 and even increased to 91,5 between 1980 and 1990 (see columns 3 and 6 of Table 1).

Table 1: Proportion of increased use of skills *within* industries

Country	1970-80			1980-90			Note
	Change in % non production (annualized)	% within	Change in wage ratio (%)	Change in % non production (annualized)	% within	Change in wage ratio (%)	
US	0.20	81	-2	0.30	73	7	
Norway	0.34	81	-3	.	.	.	1970,80,n/a
Sweden	0.26	70	3	0.12	60	-3	
Japan	.	.	.	0.06	123	3	n/a,81,90
Denmark	0.44	86	-11	0.41	87	7	1973,80,89
Finland	0.42	83	-11	0.64	79	-2	

W.Germany	0.48	93	5	.	.	.	1970,79,n/a
Austria	0.46	89	7	0.16	68	7	1970,81,90
UK	0.41	91	-3	0.29	93	14	
Belgium	0.45	74	6	0.16	96	-5	1973,80,85
Average	0.40	84.3	-1.8	0.28	91.5	4.2	

Source: Berman, Bound and Machin (1998)

This pattern is actually a common finding of all relevant literature during the last 20 years (see Katz and Murphy 1992, Hanson and Harrison 1995, Berman and Machin 2002). This result does not provide direct evidence on the SBTC thesis. Nevertheless, it shows at least that technological change that has occurred over many industries possibly has driven the demand shifts. Computerization, for example, that entered into many industries could be at first sight one plausible explanation for the observed changes of the labour market. Indeed, there is much evidence that adopting computer technology reduces labour input of routine cognitive and manual tasks and increases input of non-routine tasks that are complementary to higher skills (Autor, Levy and Murnane 2003), a result that is still challenged (see below).

Subsequently, many studies (mostly for the US and the UK) tried to relate shifts in the skill structure directly to the most relevant technology indicators like computer use, R&D intensity or innovation counts in several industries. Summarizing, they corroborate the SBTC thesis by showing that the demand shifts are stronger in industries with an intensive use of these technologies. To find more pervasive evidence of SBTC for the whole industrialized world different industries are compared country-by-country. Obviously, the industries that experienced the largest shift in labour demand towards skilled workers are the same over the most OECD countries, especially Machinery, Electrical machinery and Printing & Publishing (Berman et al 1998). This is very clear evidence for the SBTC to be a phenomenon not only in the UK and in the US but in almost all industrialized countries (Machin and van Reenen 2007).

The overall finding that SBTC matters should not detract from the fact that the empirical studies showing the effects have their limitations and drawbacks. Using R&D intensity as a technology measure in an industry raises serious problems because it is difficult to disentangle whether the skill demand is a consequence of the investments in R&D or whether a firm or industry only tries to make its innovations complementary to current labour supply (Machin and van Reenen 1998) - this issue will be addressed in detail in 3.4.

Moreover, effects of computerization on relative labour demand shift are not as clear as it seems. It is difficult to show whether it is really the introduction of computers that causes the wage-premium for skilled workers. Discussing a study by Krueger (1993), Di Nardo and Pischke (1997) show some evidence for Germany that the wage-premium for computer usage only reflects some special unobserved characteristics of workers who use a computer. So, one can argue that computer usage is an indicator for higher wages but this is not due to have a good grasp of computers.

Summing up, SBTC is an important and international phenomenon (Machin and van Reenen 2007) although it is obviously not the only factor driving the relative demand shifts towards the skilled workforce.

3.2 Skill-Biased Organizational Change

Technological changes also frequently translate into new organizational methods of work. In earlier centuries inventions like the exploitation of thermal energy (first industrial revolution) or the combustion engine (second industrial revolution) led from handicraft production to manufacturing and later on to mass production (Cahuc and Zylberberg 2004). In last decades, the technological changes, mostly assigned to the development of the information technology (IT), have altered organization from the so-called “Taylorist Organization” which was characterized by mass production and bureaucratic controls to more flexible forms of work (Caroli and van Reenen 2001). In general, the main features of these new workplaces are characterized by a wide range of changes like a decision making process that is much more decentralized, Just-in-Time Job Rotation, Teamwork or multitasking. The OECD employment outlook of 1999 dedicated a whole chapter on these issues and paraphrased this new job design by “high performance work practices”, assuming that these new requirements coincide with higher skill needs for the workers (OECD Employment Outlook 1999).

In the meantime there exists a literature dealing with the relation between technological changes, organizational changes and skill requirements. Whereas literature on SBTC only focussed on the link between technological changes and the change in relative labour demand, these studies try to find some evidence for the contribution of organizational changes to the evolution of labour markets. In general, one has to distinguish two different questions: Are the organizational changes only a consequence of technological changes and do they only contribute to the changes in relative labour demand already identified by the existence of SBTC? Or are organizational changes in job design a phenomenon that is not necessarily

linked to technological changes and has per se altered relative labour demand towards skilled workers?

Addressing the first question, some evidence shows that new IT technologies considerably induce new organization of work. By looking at the internal structure of firms that adopted IT, Bresnahan et al. (2002) show with US data that the increase in the demand for skilled workers can rather be attributed to the requirements of new work organization than to the introduction of a new technology itself. IT will change labour demand in many aspects, mediated by organizational changes: Firms that adopt IT need workers that can get along in self managing teams and can complete a whole process that earlier was fragmented because of the lack of centralized databases. Moreover, non-cognitive skills like dealing with suppliers and customers or influencing team-mates and colleagues become more important (Breshanan et al. 2002).

The result that skill changes by SBTC are mostly driven by upcoming new organizational work forms is corroborated by Hujer (2003) and Greenan (2003). The latter study analyses the occupational structure of firms instead of directly looking at the educational pattern of the workforce and shows that organizational changes comes at the expense of the employment of clerks and favours mainly executives.

In the previous review, organizational changes were always induced by the introduction of new technologies, especially IT. Some studies, however, argue that the new organization of the workforce does not have to be complementary to technological changes. Caroli and van Reenen (2001) try to disentangle the effects of technologic developments and organizational changes on skill upgrading. They find indeed evidence for organizational changes being the source for the shifts in an increase in relative labour demand in favour of the skilled. Data for France and Britain show that organizational changes like delayering, on the job rotation or shorter command chains increase productivity of firms. More skilled workers easier cope with these challenges as they have better ability to communicate or can be trained for multitasking by lower costs than unskilled workers.

In sum, organizational changes seem to be more than just a by-product of technical changes and have intrinsically changed job requirements. Identifying a “Skill-Biased Organizational Change” is not exaggerated.

3.3 Globalization and Trade

The previous two arguments – assigning relative labour demand shifts to technological and/or organizational changes - are typically raised by labour economists (Berman et al. 1998). However, the evolution of international trade and the ongoing globalisation reveals other plausible arguments for a rising relative demand for skilled workers in Europe. During recent years, trade between the industrialized countries and the developing countries has risen. Especially emerging countries like the BRIC (Brazil, Russia, India and China) play a major role in the world economy. Within the next 40-50 years the GDP of the BRIC countries presumably will exceed those of the largest EU countries, the United States and Japan (OECD 2007).

At the same time, since the end of the 1970s increasing trade (calculated as the average share of GDP of imports plus exports of goods and services) coincides with a reduction in the relative demand for unskilled labour in the developed countries.

This can also be shown by the relative decrease of prices in products that are highly intensive in low-skilled labour: The import price of products in sectors exposed to foreign competition rose by 18 % on OECD average. Export prices of products in exporting sectors, however, even increased by 30 % in the OECD countries (Cahuc and Zylberberg 2004).

The empirical results can easily be explained by the Stolper-Samuelson Theorem: Developing and emerging countries dispose of relative more unskilled labour supply than the developed countries. Trade liberalization entails that the real remuneration of the scarce factor declines and that of the abundant factor rises. As a consequence, the developed world experiences a relative decline in the labour demand of unskilled workers in its countries because those will import the cheaper low-skill intensive goods from the developing and emerging countries (Cahuc and Zylberberg 2004) and concentrate on the production of high-skilled intensive goods. Up to this point, trade and globalization seem to be very plausible illustrations for the shift in relative demand towards skilled labour.

First of all, there is no doubt that international trade and ongoing globalisation have influenced the structure of labour demand in both developed and developing countries and certainly have contributed to the *acceleration* of the rate of growth of the relative demand for skilled workers (Wood 1998). Also, special groups like the lowest skilled people could particularly have suffered from the increasing trade with the lowest developed countries during the 90s (Berman et al. 1998). An interesting theoretical approach by Acemoglu (2002)

supposes SBTC to be aggravated by trade but evidence on this thesis is still lacking (Machin and van Reenen 2007).

Nevertheless, the caveats of considering trade as the driving force of relative demand shifts towards skilled labour are numerous:

- Trade flows with low-wage developing countries are not large enough to be able to explain the whole shift of labour demand in the developed countries (Machin 2004). Moreover, the industries that experienced the biggest increase in trade with developing and emerging countries do not coincide with the ones that have seen the major shifts in labour market demand towards skilled workers (Machin and van Reenen 1998).

Besides these arguments that only can explain quantitative limitations on the alternative trade story, there are also more conceptual drawbacks:

- Skill upgrading can also be observed in developing and emerging countries and therefore the theoretical idea of better conditions of less-skilled workers in developing countries can no longer be held. Berman and Machin (2000) show that within industry shifts of wage bill share towards non-production are a phenomenon all over the world, also in developing and emerging countries.
- Finally, Desjonqueres et al. (1999) show, that skill upgrading is also present in non-trading sectors. This is also counterintuitive to trade theory, as non-trade sectors should experience an increase in the relatively cheaper unskilled workforce. Wage differentials or unemployment of less-skilled workers should not be as high as in trade sectors. However, skill upgrading can be observed to the same extent in non-manufacturing sectors like retail trade implying that trade can not fully explain these evolutions.

Actually, trade does matter in explaining the relative demand shifts toward skilled labour but not to the extent it is presumed by some experts. However, as policy implications that arise from both SBTC and Trade do not differ considerably we can live with some puzzles in the relationship between SBTC and Trade (Wood 1998).

3.4 Endogenous Skill-Biased Technological Change

In the previous sections we assumed technological changes to be a factor affecting relative labour demand in the way that observed skill patterns were explained by new technologies that came up during the last decades. These technologies seemed to increase productivity but

only if firms or industries hire high-skilled workers that are complementary to the challenges of these technologies. Going back in history, one can find similar patterns but at that time, technology was complementary to low-skilled workers: New kinds of machinery that came up at the beginning of the nineteenth century were complementary to workforce that was able to handle simple repetitive manufacturing tasks (Acemoglu 2002).

The fact that technologic development does not necessarily evolve in favour of high-skilled workers leads to a more subtle interpretation of the shifts in relative labour demand, which considers technology as an endogenous factor of production. It would also be possible that the educational upgrading of the workforce during the last decades was, to some extent, the source of technological changes and not the other way round. By this explanation, firms or industries have an incentive to adopt a technology that coincides with the capacities of the labour markets. A large supply of skilled workers with relatively low wages could lead firms to introduce a technology their workforce can cope with. So, technology is a flexible parameter firms can choose to maximise their profits (Acemoglu 2002).

At first glance, this does not correspond to the relative high wages of high skilled workers that were identified in the previous analysis. We could not see a decrease in the relative wage of high skilled workers as a consequence of the increase in their supply. Machin and Manning (1997), however, describe a long-term mechanism that induces supply to create its own demand. If labour markets are not perfect and employers have to invest to find the unique workers that can perfectly be matched with a specific job, they will find it easier and less risky to create jobs for workers that come from a larger group, in this case the high skilled. Intuitively, being member of the high skilled workforce improves the possibility to get employed and supply has created its own demand.

Evidence on this explanation of relative shifts in labour demand versus skilled workers is quite rare. For the US it can at least explain why relative wages for workers with college degree first declined in the 1960s and later on increased (Acemoglu 1998). A more recent study in the United States compared PC adoption in different cities finding that cities initially endowed with abundant and cheap skilled labour more aggressively adopted the new technology (Beaudry et al. 2006).

Even if - to our best knowledge - European evidence does not really exist on this thesis, US evidence shows that it is reasonable to assume that innovations are at least partly the product of the available workforce. This has, in any case, policy implications that differ from that

arising from the simple SBTC story (Cahuc and Zylberberg 2004). This will be discussed later on in chapter six.

3.5 Labour Market Institutions

One additional point is the contribution of labour market institutions but as it is often quoted in the literature as an explanation of relative labour demand shifts, one should shed some light on it. It is argued that relative wages of less skilled workers are likely to have fallen because institutions that kept up wages of the less skilled became less important in the new economy (Machin 2004). This explanation mostly comes up in relation to the US and UK labour markets as these have experienced a decline of the institutions (especially a fall of the minimum wages in the US during the 1980s and a sharp decline of Unionization in both countries). However, this approach has serious difficulties: Labour market institutions can explain differences in wage inequality between different countries during several decades. But wage inequalities rather arise as a consequence of particular labour demand patterns and should not be seen as their source. Therefore, wage inequality will be discussed in the next chapter when addressing several specific labour market evolutions.

If the decline of the real wages of low-skilled workers really had been a driving force of labour demand shifts, one should mainly observe an increasing demand for this group as they become more attractive to employers. Thus, the positive association between relative wages and employment that was revealed until now can not be rationalized in this context (Machin 2004).

Moreover a decline in Labour Market institutions (for example less unionization or minimum wages) is not appropriate in directly explaining demand shifts in the top half of the wage distribution. The SBTC approach and its described variations particularly emphasize a wage premium for the skilled workforce. A fall in the minimum wage or a decrease in unionization only play a role for demand shifts in the lower tail of the wage distribution (Machin and van Reenen 2007).

However, there exists some interesting association between labour market institutions and new organizational forms of work: Countries with relative restrictive labour market institutions and collective regulations (for example Germany but also the Scandinavian countries) are predominantly characterized by work forms that require high skills like problem solving and, especially, worker autonomy. In countries with more flexible labour markets (for example the UK and Ireland), however, organisational forms of work are rather

based on methods that imply the employment of less skilled workforce. One possible explanation could be that countries with flexible labour markets do not have institutional settings that establish substantial forms of work autonomy (Lorenz and Valeyre 2004). So, in a sense, the design of labour market institutions could enhance Skill-Biased Organizational Change.

4. Consequences of Changes in relative Labour Demand

In the previous chapter we gave some insights in different approaches describing the sources of shifts in relative labour demand. Sometimes they complemented one another, sometimes they based on completely different assumptions. In this chapter we concentrate on some typical characteristics of labour markets and their implication for different skill groups. Mostly, but not always, one can derive these patterns from the above described evolutions. We will also see that different labour market institutions play a major role determining outcomes for different skill groups.

4.1 A Risk of Job Polarisation and rising Wage Inequality?

In general, theories like the SBTC approach try to explain relative labour demand shifts towards the skilled workforce. Evidence also concentrates on showing higher wage bill share of the skilled workers in combination with firms and industries that apply new technologies. However, reality reveals a more subtle pattern of labour market evolutions: The observed demand shifts do not necessarily favour the high skilled but also benefit workers with very basic skills and they explicitly go at the expense of workers with middle skills. This section sheds some light on this phenomenon that is called “Job Polarisation”, provides some evidence and relates it to the SBTC thesis.

4.1.1 Job Polarisation: Definition and European Evidence

The debate about Job Polarisation actually came up when observing that the demand for low skilled workers did not evolve in the way it was presumed. The SBTC thesis and its variations which developed during the 1980s focussed on the explanation of a relative higher demand of the high skilled and thus, emphasized demand changes in the upper tail of the skill distribution. However, developments in the rest of the skill distribution, especially changes in relative demand for middle and low skilled workers were largely neglected.

In the meantime there exists a whole literature dealing with Job Polarisation stating that technological or organizational changes that came up during the last decades definitely increased demand for the high skilled. But the new technologies (and especially the computerization) did not only increase productivity of the high skilled workers. At the same time, they have replaced work that normally was done by middle skilled workers. Additionally, new technologies often can not substitute work typically done by low skilled workers. There are rather many tasks new technologies do not cope with and the low skilled workforce performs very well in doing them.

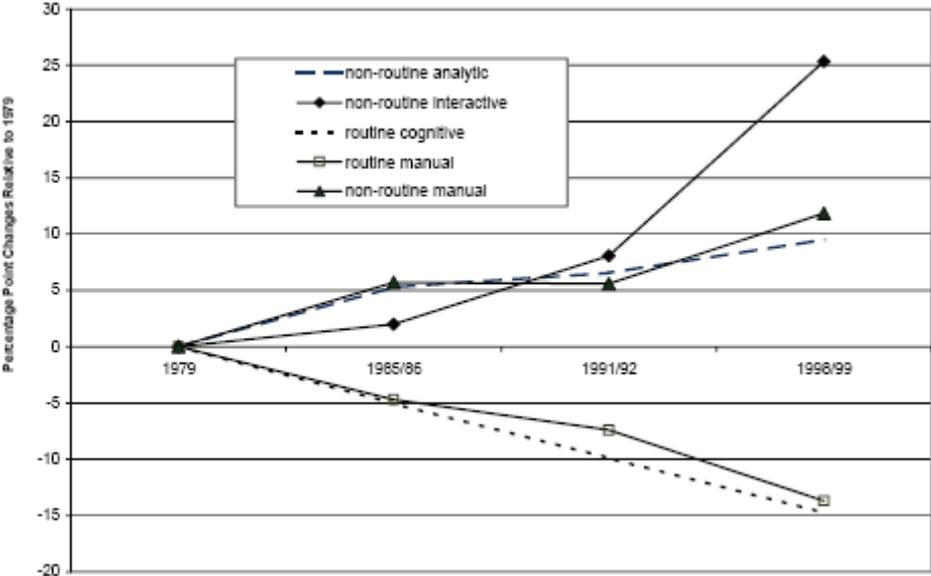
Autor et al. (2003) show for the US, that the challenges arising from computerization show exactly this pattern. According to their findings, the IT is complementary to what they call 'non-routine tasks'. Typical analytic and interactive tasks that come up with this new technology are hypothesis testing and formal and legal writing, but also characteristics we would call 'soft skills' like persuading, selling or managing others. One could subsume that demand for problem-solving and communication qualities has risen and as these capacities mainly coincide with characteristics of the high skilled workforce, this corroborates the SBTC hypothesis. But 'non-routine' tasks also cover things like janitorial services, truck driving or comprehensive bibliography searches, services typically delivered by the low skilled. 'Routine tasks' like repetitive and predictable work, however, usually will be replaced by automation and computerization. This comprises things like calculations or repetitive customer services which are normally done by middle skilled-workers.

This implies that highly educated and low educated workers are mainly favoured by the new technologies. This is a quite reasonable conclusion but Autor et al. (2003) emphasize that the shifts towards more flexible and non-routine tasks are 'as evident *within* education and occupation groups as *between* them'. So, neither high education nor low education can be considered as a sufficient condition for success in the labour market. Formal educational attainment should be supplemented by the relevant skills described above. In this sense, job polarisation is not only a phenomenon that predicts labour market success for groups with specific educational attainment but also for those who, independently of their formal educational attainment, provide the crucial skills.

European evidence corroborates these findings to a large extent. Goos and Manning (2003) confirm the US findings providing an insightful list of jobs at the upper and the lower tail of the wage distribution. As employment growth in jobs at the upper tail of the distribution is not very surprising and corroborates the SBTC hypothesis, the development at the lower tail is

interesting: Obviously ‘lousy’ jobs where it is difficult to replace human capital by machines or computers have experienced considerable growth during the last decades. Non-routine *manual* tasks done by hairdressers or kitchen porters are as demanded as non routine *cognitive and interactive* tasks delivered by care assistants or software engineers. Routine task jobs, normally found in the middle of the wage distribution, however, decreased tremendously. Dustman et al. (2007) show for Germany that since the end of the 1970s occupations which require routine manual or clerical skills have largely decreased whereas the demand for jobs characterized by the need of interactive and non-routine skills have experienced the highest growth rates. Figure 3 gives an overview of these trends by illustrating the evolution of aggregate skill inputs from the late 1970s to the late 1990s.

Figure 3: Evolution of aggregated skill inputs during the last decades



Source: Spitz-Oener (2006)

Additionally, the French report on the occupations in 2015 by the Centre d’analyse stratégique emphasizes that job polarisation is strongly associated with a tertiarisation of work. This means that the favoured jobs, both for the low and the high skilled, mainly stem from the service sector. The routine task jobs of the middle-skilled that have been substituted by the adoption of new technologies are predominantly part of the manufacturing sector.

To sum up, job polarisation is an important phenomenon in European Labour markets that is consistent with the more nuanced version of SBTC. It reveals that the basic SBTC approach can not fully explain the realities in the development of labour supply and demand and the effects of new technologies are more subtle. However, one should be aware of the different

implications of job polarisation for future skill needs as this approach already indicates that formal educational attainment and acquired skills are different things to be considered.

4.1.2 Wage Inequality as a Consequence of Labour Demand Shifts

Rising wage inequality and its origins is widely discussed among labour economists and mostly is considered as a phenomenon arising due to labour demand shifts induced by SBTC and/or trade. However, there are many puzzles to this hypothesis, irrespective of the fact that the extent of wage inequality differs considerably between countries due to different labour market institutions. We will challenge this idea interpreting the evolutions during the last decades.

There is widespread concern that the increase in wage inequality during the 1980s actually can be explained by technological changes. Especially, higher wage inequality in the upper tail of the wage distribution is an obvious consequence of the wage premium for high skilled workers that came along with the introduction of IT (Dustman et al. 2007, Machin and van Reenen 2007, Card and Di Nardo 2002). The differences in the wage inequality between the US and the UK on the one hand, and continental Europe on the other predominantly have occurred in the lower tail of the wage distribution. Continental Europe is traditionally characterized by more restrictive labour market institutions with minimum wages or high degrees of unionization. Welfare systems that implicitly impose minimum wages or affect wage inequality by very progressive tax systems are also more prevalent in Europe. This, on the one hand, compresses wage differentials, but on the other has led to broad welfare states and to higher unemployment in continental Europe among the unskilled workforce. In any case, measured wage inequality has always to be considered against the background of transfer and tax systems of the respective economies.

However, during the 1990s European Countries also experienced a decline in their labour market institutions with the result of lower wages for the unskilled and an increase in overall wage inequality in Europe (Dustman et al 2007).

Moreover, patterns of wage inequality actually corroborate the idea of job polarisation. This can be shown by the convergence of the wages of the middle-skilled and the low skilled workforce. Whereas at the top of the wage distribution we see an increase in the wage inequality, the bottom is characterized by less inequality. As mentioned above, this is partly a consequence of more rigid labour markets and/or broader welfare systems in Europe's economies. But it also affirms the previously described fact that middle-skilled workers loose

ground in relation to the high skilled and the convergence towards the low skilled is reflected in the wage distribution.

It is crucial for future skill needs whether relative demand shifts towards the high skilled really are persistent and can explain increasing wage inequality and/or unemployment. Recent studies, however, predominantly agree that there are also other factors inducing wage inequality. They argue that the observed wage patterns are not necessarily a result of a relative shift in skill prices but rather can be explained by a new composition of the workforce (see Autor et al 2005, Dustman et al. 2007 Lemieux 2006). The argument is that there are considerable differences in wage inequality *within* skill groups. Hourly wage dispersion is typically higher among the group of high skilled workers than the group of the low skilled. Why workers with higher education differ more in their earnings can be due to many factors. Intrinsic ability or even effort could matter more within this group than among the lower skilled (Lemieux 2006). Moreover, within defined skill groups work experience reduces earnings dispersion meaning that an older workforce could also lower wage inequality. Therefore a higher share of the skilled workforce can mechanically increase inequality without an ongoing boost of skill prices (Autor et al. 2005).

Wage inequality has to remain on the research agenda as it is difficult to disentangle its sources and many puzzling factors are still existent. Nevertheless, the relative demand shift towards high skilled labour and to non-routine cognitive and manual tasks are partly transferred into higher wage dispersion (Machin and van Reenen 2007), even though other factors like labour market institutions, tax systems or the composition of the workforce also contribute to earnings inequality. And the empirical results show very clear that wage inequality has evolved to a European phenomenon during the last decades, also at the bottom of the wage distribution where (continental) European countries traditionally were characterized by more rigid labour market features.

4.2 Skills Matches and Mismatches

Albeit it is difficult to exhibit its sources, it is a fact that educational upgrading could be observed all over the industrialized world and also developing and emerging countries revealed first similar patterns during the last years. Education has been considered as a “self evident vehicle” in promoting desirable goals like economic growth or more income equality (Hartog and Osterbeek 1988). Against the background of these evolvments a big debate has been developed (over all disciplines of the social sciences) on the match between this

valuation of education and upskilling and the needs of labour markets (Goos and Manning 2003). Mostly “over- and undereducation¹” are the catchwords in these discussions even though this does not describe the whole story. In this chapter we challenge the issue whether shifts in relative labour demand have really evoked a phenomenon that could be named “skill mismatches” and try to show its relevance in European Labour markets.

4.2.1 Different Forms and Definitions of Matches and Mismatches

The theoretical view that an individual’s skills or education - in the broadest sense - could not be in line with the requirements of labour markets came up in the 1970s when Spence (1973) challenged the classic human capital theory by Gary Becker. He argued that education in the form of schooling or training does not necessarily improve productivity of the individuals. Productive efficiency is rather determined by other factors like family milieu or other innate abilities. However as these characteristics often can not be observed by employers, individuals invest in education to signal their productivity. More talented individuals who perform best in active life will also perform best in studying so that they invest more in education than the less educated. Different educational attainment then reflects different unobserved ability of individuals. However, as education per se does not yield any productive elements for the labour market, the most able persons tend to invest too much in education and are presumed to be “overeducated”. This can lead to an ineffective level of educational budgets.

Whether the signalling theory or the human capital approach is the appropriate idea depends strongly on educational systems of different countries and is also field/subject specific.

And even though vast empirical studies limit the significance of the signalling theory by showing that education actually increases individual’s productivity, the idea of skill mismatches in the form of over- and undereducation has still remained a relevant research topic for other reasons.

In the baseline human capital theory an individual finds a job that is strongly associated with its personal productivity level and will be paid according to this. Actually, in this supply side theory earnings are not affected by the requirements of a specific job (Hartog and Oosterbeek 1988). The assignment theory, however, assumes that every occupation is characterized by a

¹ Actually, we use (according to the whole literature on skill mismatches) the notion “Over- and Undereducation” instead of “Over- and Underqualification”: However, we implicitly also deal with the latter idea when referring both to (formal) educational mismatches and to skill mismatches and to their linkages.

fixed productivity level that is necessary to perform well (Allen and van deVries 2001). This implies that a person only can make use of the productivity that coincides with the specific job, independent of its own productivity level. So there is no claim of equality between earnings and marginal productivity (Hartog and Oosterbeek 1988). Consequently, a non-perfect match between the productivity level of a specific job and the productivity level of the individuals will produce “over- and undereducation” in the labour markets. Especially, working in a job below one’s own level of productivity imposes a limitation to one’s own capacities and leads to “overeducation”. According to this approach an optimal allocation would match the most competent person with the most complex job (Allen and de Weert 2007). Mismatches then occur because of different shares of complex jobs and skilled workers and are due to difference between the skills a worker provides and the skills that are necessary for the respective job.

Institutional theories, however, emphasize the information asymmetry of employers and employees when explaining mismatches. This goes back to Thurow (1975) who argued that employers have to base wages on observable characteristics of the workforce. As formal educational attainment can easily be observed, it often builds the basis of collective bargaining agreements and can be the reason for wage differentials. However, differences in educational attainment do not perfectly reflect individual differences in productivity and therefore can lead to the same skill mismatches described in the assignment theory (Verdugo and Verdugo 1989).

Besides these theories that consider skill mismatches as a persistent phenomenon, others argue that it is rather a transitional problem. According to the occupational mobility theory young workers are assigned to jobs that do not coincide with their formal education because they lack experience. As they will get older they become more productive and the temporary overeducation disappears (Alba-Ramirez 1993). This so-called “waiting-room-effect” implies that differences in demanded and available skills diminish over time.

Mismatches are assumed to have significant economic effects. “Overeducation”² on the one hand has an overall effect on the productivity level as - according to the theory - the allocation between jobs and workers is not efficient. On the other hand individual outcomes like wages and job satisfaction can be affected because overeducated workers are not paid according to

² We will focus on overeducation (and neglect undereducation) as it empirically much more evident and presumably generates the worst labour market effects.

their marginal productivity and do not feel well in jobs that do not coincide with their competencies (Allen and de Weert .2007).

4.2.2 Empirical Evidence

Measuring “overeducation” is a rather difficult task and most of the approaches do not deliver satisfying results. For empirical research, skill mismatches are normally classified into “objective” and “subjective” definitions (Groot and Maassen van den Brink 2000). Subjective measures rely on what individuals report themselves on the utilization of skills. Normally, workers are directly asked whether they feel under- or overeducated or what the minimum educational requirements are for the job. Sometimes they have to answer on whether ‘their current job offered sufficient scope to use their knowledge and skills’.

More objective measures usually compare the years of schooling attained by a worker with the average level of schooling within the occupation of the worker. Others look at the educational level of the worker and compare this to the requirements of a specific job. Some studies even try to combine both approaches to show whether mismatches by formal educational attainment coincide with perceived skill mismatches by the workers (Allen and van der Velden 2001), thereby bringing together “overeducation” and “overqualification”.

Empirical evidence usually studies wage differentials and differences in job satisfaction that are due to the respective mismatches. There is a huge literature especially on the effects of “overeducation” on wages and job satisfaction. Many studies seemingly confirm the above described assignment theory. They show that people who work in a job that formally requires less than their own level of educational attainment or schooling earn less than workers who provide the same formal educational attainment but who perfectly match with the formal requirements of the job (see for example Hartog 2000). Moreover job satisfaction is much lower among this group of workers. However, when looking whether the “overeducated” perceive an underutilisation of their skills there is no clear evidence for that. Therefore, educational mismatches are neither a necessary nor a sufficient condition for skill mismatches (Allen and van der Velden 2001).

It is difficult to identify why the “overeducated” receive lower wages than those who formally match with their job, although they often do not experience underutilisation of their skills. Whereas cross-sectional studies only can speculate, panel data analysis that manage to

control for unobserved individual effects of the “overeducated” provide a very plausible explanation: Graduates with the same formal level of education are sorted in the market according to their competencies with the most competent obtaining jobs ‘above their own level’ (the undereducated) and the least competent ‘below their level’ (the overeducated). Bauer (2004) corroborates this idea with German panel data showing that wage differentials between ‘overeducated’ workers and perfectly matched workers (according to their formal educational attainment) almost diminish when considering fixed characteristics of all individuals. Apparent effects of “over- and undereducation” simply reflect ability differences of workers who received the same level of formal education. So the wage differentials only reveal differences in real productivity of the individuals what is in line with human capital theory (Allen and van der Velden 2001).

The previous paragraph indicated that “overeducation” mostly appears as a label and does not really explain what is presumed from the respective theories. However, there remain some puzzles if formal “overeducation” coincides with a properly perceived difference in acquired and required skills by individuals: First of all, “overeducation” that coincides with a reliable perceived skill mismatch often is observed for young graduates. This is in line with the above mentioned waiting-room theory. People accept jobs that do not match their educational level but can make up their initial arrears with work experience (Allen and de Vries 2004). This shows that “overeducation” really exists, but then it is only a temporary phenomenon that can be overcome by upward mobility on the labour market or inside the firm. Actually, these transitional discrepancies mostly refer to a lack of ICT skills for young graduates at the beginning of their working career (Allen and de Vries 2004). In this case, the match is the more difficult the faster are the changes in specific industries and individual firms. As globalization leads to more frequent and faster changes, it is not easy to prepare suitable skills for some ex-ante defined and narrowly focussed professions.

Furthermore one can consider whether observed skill mismatches – if reliable identified – are rather a result of ‘wrong education’ than of “overeducation”. Allen and deWeert (2007) deliver some evidence on asking individuals whether they work in the field they studied. They show that working in another field increases skill mismatches even though the level of education is perfectly matched³. They also present consequences of these skill-mismatches on

³ The data stem from the 1998 CHEERS survey and the study was examined with participants from five countries (Spain, Germany, the Netherlands, the UK and Japan)

wages and show different effects for different field of studies. However, they are far away from presenting any reliable patterns that could be used to derive implications for specific fields of education or studies.

To sum up, “overeducation” in the way it is studied until now to great extent reflects unobserved heterogeneity of abilities or skills within given educational levels (Sloane 2003) and can not be interpreted as a failure of labour markets due to relative demand shifts towards skilled labour. Much more convincing research is necessary to show that educational mismatches can explain more than simple productivity differences that perfectly cope with human capital theory. The implications of these findings for educational politics will be addressed later on in chapter six.

5. Forecasting Skill needs: a Reasonable Tool?

In this chapter different methods of forecasting skill needs will be evaluated. We try to assess whether skill need forecasting is a suitable tool to overcome the above described consequences of shifts in relative labour demand. In general, one could imagine that the prediction of future labour market conditions solves or at least dampens problems arising with job polarization, wage inequality and skill mismatches. And if so, we will identify the advantages and drawbacks of different approaches that emerged in different countries over the years.

Actually, forecasting skill needs has a long tradition and goes back to the post-World War II era. Both industrial and developing countries aimed at increasing investment in physical capital to ensure a given rate of economic growth. The methodological link between investment and economic growth was the so-called “capital-output” ratio, i.e. a coefficient denoting the necessary amount of physical capital per unit of output. In the early 1960s the importance of “qualified” or “high-level manpower” was identified and led to the so-called “Manpower Forecasting Method”, consisting in estimating the necessary amount of scientists, engineers and the like needed to produce a unit of output in the various sectors of the economy.

Consequently, almost every labour and education ministry across the western world had a unit engaged in manpower forecasting. At that time, the forecasting methods were assumed to predict the major skills that would be necessary to ensure economic growth in a given

country. But with the first evaluation of the results of manpower forecasting that came up in the UK during the 1970s and the simultaneously emerging human capital theory and its applications brought the manpower forecasting method under severe criticism: Manpower forecasting was abstracting from the relative costs of providing different levels of qualified manpower. Also, the benefits side of manpower forecasting was in terms of heads of people, rather than in terms of the relative productivity of each head. In addition, manpower forecasting neglected substitution possibilities between different kinds of skills, let alone substitution between capital and labour. Most of all, this was a static model, completely disregarding dynamic changes in the economy – the very driving force of economic growth.

Empirical applications of human capital theory and estimates of the returns to education in particular revealed the need of investing in primary education rather than “high level manpower” typically dictated by the application of manpower forecasting. Such findings instigated the end of manpower forecasting activity during the 1980s.

However, many countries and institutions recently readopted approaches coming under the name “early identification of skill needs” which are very similar to the manpower forecasting of previous decades. The designs of the approaches differ considerably between countries and institutions and it is important to reveal their advantages and drawbacks.

First of all, when forecasting skill needs the approach should be an economic one rather than a method that could be assigned to engineering. Applying simple input-output models in the framework of a Leontief production function cannot reflect real developments in labour markets. Such an approach completely disregards the economic environment that affects the demand for skills and that can differ considerably between states, regions or even firms (think of different management practices, employee incentives, unionization power and labour market regulations).

Moreover, a simple occupational headcounting (as done in all manpower forecasting applications) systematically neglects the educational content and the quality of skills. For example, as already shown above in the overview of the SBTC and job polarization literature, research shows the importance of very general, rather than specific skills (Levy and Murnane 2004). Employers favor workers that are more flexible and can react to unforeseen changes and shocks in labour market conditions. Typical competencies that are required are problem solving, complex communication skills, adaptability and systems thinking. A pure forecast of

a specific number of occupations could never reveal such needs. We simply can not predict changing skill contents of occupational cells simply because there are no past time series of skills tested. This also indicates that it makes much more sense to instill in workers such traits, rather than predicting the number of heads in a given occupation.

Most important, however, skill-needs forecasting has to consider education quality and should be applied in a more demand-driven analysis. Among the different forecasting exercises that evolved during the last years the Leitch Report in the UK performs best in meeting these requirements. As this report is aware of the weakness of a centrally planned skills production, it favors a system that can flexibly orient itself to the demands of employers. “Under a planned system, the incentives are for providers to continue doing what they have done in the past so long as that meets the requirements of planning, rather than responding flexibly as demand changes”, argues the Leitch report.

The demand of employers and the transformation of their demand into the production of economically valuable skills should be at the heart of the analysis rather than routing educational investments into channels that are promoted by a central planning agency. If this coincided with investments in general education quality rather than a production of specific occupations, future skill requirements would be automatically met by a system that can flexibly react to labour market needs. Forecasts of skill needs that try to predict occupational needs for a long planning horizon are today obsolete.

Nevertheless, the traditional methods can at least deliver some quantitative information about most recent trends. In combination with the choice of plausible outlook periods (up to five years) and a concentration on professions where demand prediction is much more easier than in others (for example the need for teachers or public administrators can be better predicted than the demand for IT personnel), it can help market agents better form their expectations.

6. Implications for E&T-Systems

The previous analysis revealed different origins of relative labour demand shifts towards the skilled workforce with SBTC as one of the key drivers. Different labour market patterns like job polarization, wage inequality and skill mismatches seemed to coincide with these relative demand shifts. Empirical results could identify some of them as really crucial problems,

others are not that important as it seems. How should E & T systems be designed to meet the requirements of shifts in relative labour demand and to be prepared for future skill needs?

First of all, the developments in the labour market seem to be a persistent problem, irrespective of its origins. As ongoing SBTC is of course one source of these evolvments, future E & T systems have to remain compatible with the challenges that arise with new technologies. In general, future generations of workers that enter the labour market should possess the skills needed to utilize present-day technologies in the workplace (Machin 2004). It is obvious that the less skilled workforce will be confronted with increasing difficulties in terms of low wages and a high risk of unemployment. This indicates, first of all, that one should start skill formation already at an early stage of the lifecycle. As the Nobel Laureate James Heckman argues it is crucial that education does not begin at the age of five or six but in early childhood. This is the period where children will be most effectively acquiring skills and therefore the returns of investment in human capital will be the highest. Moreover, it is really difficult to catch up what you did not learn at an earlier stage in your life. Children who begin learning in early childhood will probably be favoured during their whole life and others will be faced with difficulties when trying to pick up skills during youth or even adulthood. This fact also reveals the equity dimension of early childhood education.

Nevertheless, in spite of the awareness of investments in early childhood education, ongoing demographic patterns can not be neglected at all. In the first chapter, we already showed that Europe will be confronted with an ageing workforce that also has to get along with future technological trends. Even though we know that investment in training policies often is not as efficient as investments in early childhood education and primary schooling, we can not completely abstain from it.

With this in mind, the remaining task will be to design training as productive as possible. The 'Train to Gain' approach that is recommended by UK Leitch report seems to provide a reasonable tool: Training, especially during adulthood, has to meet the requirements of employers and employees. Funding of vocational training should orient itself on the effectiveness of specific training mechanisms and providers should only receive funding if they meet the needs of their customers. This flexible demand-led system of training is more promising in providing the skills that are really crucial in the future (see Final Report of the Leitch Review).

Obviously, this is not easy to implement as there could be a trade-off that markets can not handle. An individual employer prefers narrowly educated workers, especially in the case of secondary education. However, this is perhaps not optimal from the standpoint of a future graduate who is uncertain about future (occupational) offers and life-long career often is much longer than the planning horizon of a firm.

Going beyond these more systemic features that education and training should provide, we specifically have a look inside the systems and show the crucial skills that should be in the focus of learning processes. Krueger and Kumar (2004) developed a model that attributed the gap in economic growth between the US and Europe to different features of the educational systems. They argued that the US systems focusing on a more “general” education do better in meeting the requirements of technological and organizational changes. Europe, however, that traditionally has concentrated on “vocational” systems perceived less economic growth in the presence of rapid technological and organizational change.

Actually, empirical findings we already presented in chapter three corroborate these theoretical assumptions. Being able to get around with technological and organizational innovations mainly means to possess non-specific general skills like problem-solving, management techniques or the capability for complex communication (Levy and Murnane 2004 for US evidence or Spitz Oener 2006 for Germany and overall Europe). Besides these cognitive skills, non-routine manual skills are still highly demanded and service occupations like health care or the catering industry experience a considerable increase both in employment and in wages. Interpersonal and environmental adaptability or flexibility will probably be the main competencies required in these jobs (Autor and Dorn 2007).

What do we learn from this for European E & T systems? Empirical results show that the main focus should lie on the generation of these more general skills. At first sight, high formal educational attainment seems to be a necessary condition for being able to cope with these skills, but empirical evidence shows that the demand shift towards more analytical and interactive thinking and less routine skills takes place on every educational and occupational attainment level (see Autor et al. 2003, Spitz-Oener 2006). Therefore, the provision of basic formal attainment does not automatically exclude workers from labour markets if they possess the crucial skills for being attractive in the job market (for example manual non-routine skills often required in simple service occupations). Analogously, even though high formal educational attainment is of course a promising prerequisite of success in the labour market, it is not a wild card entry if important skills are not at hand.

One potential solution can be found in less stratified school systems. There are many countries in Europe that have vocational tracks with an emphasis on the development of particular skills. General education is assumed to be more appropriate to deliver the crucial labour market skills described above.

To sum up, education quality that adequately matches skill demand - on all relevant levels from early childhood education to training for the elderly – will be the key-driver European systems should provide to adequately assess the challenges of relative demand shifts. Many features of a high-quality E&T systems could be named, however this would go beyond the scope of this report (for more details see EENEE’s last Analytical Report on “Future Challenges of E&T Systems”). Some European surveys that were conducted by Eurofund illustrate that about 80 % of the EU workforce is already engaged in jobs that require dealing with non-routine tasks. Albeit one should be careful when interpreting results that are based upon a self-reporting of individuals, Europe seems to be on the right track tackling the challenges that emerge with future skill needs.

As the previous paragraph indicated, formal educational attainment does not necessarily predict the skill level of individuals or its intrinsic ability. This fact leads directly to the implications of skill mismatches, especially “overeducation”, for E&T Systems. We revealed that “overeducation” mostly does not reflect a skill mismatch and therefore does not represent a failure of the educational market. One could rather argue in a more provocative way and consider “overeducation” as a desirable feature of E&T systems: As “overeducation” is mostly observed with low-skilled workforce that tries to compensate skill/ability lacks by additional education, this could serve to gain their employment which otherwise would have been more difficult (Sloane 2003). So, “overeducation” is to a great extent supervalued. Nevertheless, reliable reported “overeducation” that leads to job dissatisfaction can exist. This could be rather a result of “wrong education” than “overeducation”. However, convincing evidence on this does not exist and deriving any policy recommendations would therefore be very speculative.

Moreover, although formal educational attainment can not perfectly indicate productivity of individuals in the labour market, one should bear in mind the materializing (indirect) effects that often coincide with higher formal education and which may seem redundant at first glance for labour market opportunities (for example less crime and better health among educated individuals).

If skill mismatches – in certain cases – exist, the question is how to overcome this problem. Stratified school systems on the one hand can help to create special skills that can be spent more readily in labour markets and that could reduce skill mismatches, but – as discussed above – they seem to be less adaptable to the ongoing technological and organizational changes than the skills provided by less stratified school systems.

Additionally, less stratified school systems can compensate the lack of providing special skills with higher training incidence. This is, however, more difficult for smaller firms which find it difficult to bear the training costs required to match existing qualifications to skills.

So, less stratified systems that perform better in meeting the requirements of the skills that come up with technological and organizational changes can also get along with skill mismatches if they are combined with a good training system.

Are the challenges for E&T systems self-inflicted? Considering the endogenous nature of technologic and organizational progress, we showed that relative demand shifts towards the skilled workforce could rather be the source than the result of technological and organizational developments. Consequently, an ongoing educational upgrading and the promotion of a high skilled workforce, that can cope with exogenous given technological and organizational changes, would not lead to a better match of E&T systems with the challenges of future skills. As technological and organizational changes again would adjust to the educational upgrading, E&T systems would be faced with the same problems than before (Cahuc and Zylberberg 2004). Even though this typical “The Chicken or the Egg” causality dilemma exists in this context, it should not lead to the conclusion that investment in high-quality education does not yield anything. It rather illustrates the complexity of the problem and the challenge to give appropriate advice.

7. Conclusion

This report aimed to illustrate the economic trends and patterns that have affected labour demand and supply during the last decades and that are still responsible for the ongoing developments in labour markets. We tried to focus especially on explanations for the shift in relative labour demand towards the skilled workforce as this seems to be one key driver for future skill needs in European labour markets.

SBTC, especially the more nuanced version highlighted by Autor et al. (2003), could indeed be identified as an important source of current demand shifts and seems to be a persistent phenomenon in Europe. However, other explanations like organizational changes, trade/globalization and the endogenous nature of SBTC should not be neglected. So it is still difficult to correctly disentangle the effects and to assign a specific magnitude to the different drivers.

Looking at the consequences of the demand shifts, we found job polarization and wage inequality as significant results. There are groups of workers that suffer from the evolution of the labour markets. It is difficult to identify these groups but it seems to be a question of crucial skills that match with future labour market requirements, rather than the provision of formal educational attainment or specific occupations. So the slogan “new *skills* for new jobs” hits the mark as it already indicates the importance of future skill contents.

What do E&T systems have to contribute to meet the requirements of future labour market needs? Presumably, it is educational quality that matters during all periods of learning, and although a shift of investments towards earlier life cycles is reasonable, demographic patterns also call for an efficient design of lifelong learning. As future requirements are mainly based on providing general skills that are important within all occupation groups and on all educational levels, the efforts should go towards less stratified school systems where students receive a broader and more versatile education.

Needless to mention that the derived implications of the labour market changes and the solutions given to arising problems cannot provide a made-to-measure policy that perfectly reacts on future skill needs up to 2020. It is rather important to continue observing the ongoing evolutions and to remain flexible in responding on emerging trends.

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