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Skill gaps in the EU: role for education and training policies

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Abstract in English

Skill gaps are widely seen as a problem that lowers aggregate productivity growth. A question for the European Commission is whether and how governments should take action with education and training policies to reduce skill gaps and make Europe the best performing region in the world. European citizens can best decide for themselves on the type of education. Distribution of information on occupation prospects is effective to influence their choice of education. Moreover, it is important that the education system is sufficiently flexible to absorb unexpected shocks in skill needs of employees. Policies stimulating education targeted at government-assigned sectors are risky policies. Intensification of general education at the cost of specific education, and intensification of training of employees find little support.

Key words: Skill gaps, education and training policy, market failures

JEL code: I28, J24

Abstract in Dutch

De Europese Commissie wil dat Europa de sterkste economische regio in de wereld wordt. Onderwijs is belangrijk om dat doel te bereiken. Europese burgers kunnen zelf het beste kiezen in welke richtingen zij onderwijs willen volgen. Voorlichting over de toekomstige behoeften aan kennis en vaardigheden is effectief om de onderwijskeuze te beïnvloeden. Verder is het belangrijk dat het onderwijssysteem flexibel kan reageren op onverwachte veranderingen in opleidingseisen aan werknemers. Het stimuleren van de onderwijsdeelname gericht op door de overheid aangewezen economische sectoren is risicovol beleid. Meer beleid om algemeen onderwijs te steunen ten koste van specifiek onderwijs en om leren in werktijd te bevorderen, vindt weinig ondersteuning.

Steekwoorden: Onderwijstekorten, onderwijspolitiek, markt falen

Een uitgebreide Nederlandse samenvatting is beschikbaar via www.cpb.nl.

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Preface

The European Council defines as a goal for the European Union to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth in 2010. The EU regards people as its main asset, and considers investments in education and training as a main instrument to provide its citizens with the needed skills to reach the goal (European Council, Lisbon, 23 and 24 March 2000, Presidency conclusions). As one of the consequences of this goal, the European Commission has initiated a project called “Skill problems in European industrial sectors” to obtain a better insight into the relationship between skills and manufacturing competitiveness of the EU in order to provide input for the development of policies to reduce skill gaps. Skill gaps are widely seen as a problem that lowers productivity growth. An important question is whether and how governments should take action to reduce skill gaps.

This document aims to answer this question for education and training policies. More precisely it discusses the role for education and training policies to reduce skill gaps and it discusses five options of education and training policies on their effectiveness to reduce skill gaps.

This analysis has been requested by the European Commission together with contributions of WiiW (Vienna Institute for International Economic Studies) and Applica/Alphametrics according to the framework contract B2/ENTR/05/091. The main results of this document are summarized in the Competitiveness Report 2007 published by the European Commission (2007) in section 3.6.

The authors have benefited from comments of the Commission and from Michael Landesmann (WiiW) and Terry Ward (Applica) and various CPB colleagues.

Coen Teulings
Director CPB

Summary

Questions

The European Council defined as a goal for the European Union to become the most competitive and dynamic knowledge-based economy in the world in 2010 at its meeting at Lisbon in 2000. Also the Council assigned skills of people as its main target and it considers education and training as a main instrument to provide its citizens with the needed skills to reach the defined goal. In a follow-up the European Commission asks how to reduce skill gaps with education and training policies in order to acquire an industrial structure which fits the productivity level of the most competitive economy in the world.

This paper addresses this problem with the following three questions:

- What is a skill gap?
- What is the role for education and training policies among policies in other fields to reduce skill gaps?
- Which options of education and training policies are effective to reduce skill gaps and consequently increase aggregate productivity?

Answers

The answer to the first question is that the concept of a 'skill gap' is not clearly defined, both theoretically as well as empirically. This provides risks for miscomprehension and ineffective policies that aim to address skill gaps.

The answer to the second question is that there is a role for policies on education and training workers linked to the uncertainty about the future prospects on employment and earnings of skills. Skill gaps can also be due to market failures linked to barriers to enter product markets or rigidities in the labour market. These barriers can be more effectively addressed by policies in the fields of competition, trade, immigration and the labour market.

For an answer to the last question we investigate five policy options in the field of education and training policy. The starting point is the question whether markets shape a welfare optimum or that additional policy interventions are needed to acquire optimal welfare. Generally European citizens can best decide for themselves on the type of education. Still there are market failures which legitimize education and training policies.

Firstly, the option to distribute scenarios on skill perspectives seems to be most effective among the options. The market does not produce sufficient information on skill needs and government interventions may repair the market failure of lack of transparency. The occurrence of skill gaps is no immediate reason for education policies, because the gaps will lead to higher

wages for the relevant skills, and in their turn these higher wages will increase enrolment in fields of study linked to the scarce skills. The costs to the tax payer of this option are low.

The second option is the improvement of the flexibility of the education system. This option is effective. Nobody can predict the future well. Therefore an education system is needed which effectively responds to unexpected demand for types of skills.

The third option is to stimulate education targeted at government-assigned sectors in Europe to create comparative advantages of Europe. This option is risky. The market failure is spillovers from specific skills applied in the assigned sectors within Europe. Therefore policymakers may aim to build up a critical mass of these skills. This policy is risky because governments do not know the future better than the citizens, and therefore governments may bet on the wrong horses. It will harm Europe's productive performance if governments have chosen wrongly after all. Moreover, governments take the risk to become toys in the hands of lobby groups which have advantage of the chosen spearheads and which have little concern for sectors which bear the disadvantages of these policies.

The fourth option stimulates education of general skills instead of specific skills. We do not have robust evidence on the effectiveness of this option. Specific skills are more productive in specific firms, but after dismissal it takes longer to find a new job than for workers with general skills. In consequence workers with specific skills more appeal on public unemployment benefits. The market failure is that people who choose to learn specific skills do not account for these extra payments. However, until the 15th year of age pupils follow general education. More general education may be at the cost of the productive advantages of specific skills.

The last option is to intensify training policies. We have no robust evidence that the option is effective. Training programs for employees can reduce skill shortages. At present there is no evidence for barriers to participation in training of the employees. Often, employers' organizations and trade unions have repaired this market failure. For instance in the Netherlands, they have set up funds for the training of employees.

Definitions of skill gaps

Measurement of skills

A skill is a developed ability to perform certain tasks competently. This definition is ambiguous and therefore difficult to measure.

General and specific skills

The distinction between general and specific skills is useful for analytical purposes. General skills may be defined as skills that can be used in a large number of other firms (or sectors), and hence are portable across firms as individuals change jobs. Firm- (or sector-) specific skills can be defined as skills that are only productive in the firm (sector) where the individual is employed, and which are not valuable in other firms (sectors).

Quantitative versus qualitative gaps

The concept of a 'gap' is also not clearly defined. First of all, we may distinguish quantitative gaps and qualitative gaps. A quantitative gap (shortages) is defined as an excess demand for workers with a particular type of skill. For instance, there is excess demand for welders. A qualitative skill gap exists when the actual skill requirements for a certain type of skill deviate from the skills current workers with that type of skill (occupation) possess. For instance, there is excess demand for up-to-date welders, but not for welders in general.

In this paper, we define two concepts of a quantitative skill gap which we discuss below.

Quantitative skill gap as an adjustment problem

The first concept defines quantitative skill gaps as an adjustment problem. Skill gaps (shortages) may emerge after an increase in demand for (or fall of supply of) a certain skill. Examples of causes of (structural) shifts in skill demand are trends such as skill-biased technical change, outsourcing and deindustrialisation, whereas shifts in skill supply can be caused by demographic trends such as ageing of the population and shifts in international migration patterns.

A higher demand for skills will drive wages up and the market will reach a new equilibrium in which there is no quantitative skill gap. The path to the new equilibrium gives adjustment costs. As long as (relative) wages can be flexibly adjusted in an upward direction, there are no quantitative skill gaps in this definition. We have no reason to assume that wages will be upwardly rigid as employers will always be able to pay higher wages if they want to. In consequence, skill gaps cannot exist in the form of excess demand, but there is a 'gap' between employment of a skill in the long run and the short run.

A typical characteristic of the labour market, however, is that it takes time to acquire skills. Therefore, in a situation of an unanticipated increase in demand for certain skills (or a drop in supply), it is likely that additional workers with the demanded skill are not available in the short run, that is; the short-run supply of skills is inelastic. Workers will be able to receive higher wages in the short-term equilibrium. The higher wages will induce people to enrol in the demanded types of education (or induce workers in other sectors to retrain themselves) and the market will eventually reach the long-term equilibrium, in which wages are lower and employment of that skill is higher than in the short-term equilibrium.

It can be inferred that total welfare (i.e. the sum of surplus of employees and employers) is larger in the long-term equilibrium compared to the short-term equilibrium. Hence, a smooth adjustment from the short-term to the long-term equilibrium will increase welfare. There may be a role for the government in facilitating a smooth adjustment process. This can be done by reducing or eliminating possible rigidities in education systems or labour markets, or barriers to international movements of workers or goods.

Quantitative skill gap as a non-optimal mix of skills in the economy

The second definition of a quantitative skill gap defines a skill gap as a distribution of skills in the economy (in current steady state) which differs from the mix of skills which generates optimal welfare. This definition of skill gaps implies that shortages as well as surpluses of certain skills may exist at the same time. Explanations for the occurrence of such gaps are market failures such as a lack of transparency or (policy-induced) institutions such as barriers to entry in labour or product markets. The market failures and institutions which prevent the economy from reaching a welfare optimal mix of skills coincide with the rigidities mentioned in the definition of skill gap as an adjustment problem (the first definition).

In conclusion

'Skill gaps' is a concept which is defined in many ways. Moreover, most definitions have considerable measurement problems. Therefore the concept may lead to misunderstanding and ineffective policies.

Roles education policies and other policies to reduce skill gaps

A justification for policy intervention may be provided by certain market failures or rigidities which prevent a smooth adjustment from the short-term to the long-term equilibrium or which result in a mix of skills in the economy which is not welfare-optimal.

Each rigidity has its own most effective policy field. Education and training policies may play a role to address a lack of transparency about future prospects on employment and earnings of skills, or to improve the flexibility of the education system in the wake of shifts in skill demand or supply.

As far as skill gaps are caused by rigidities in (international) product or labour markets, however, policies in the fields of competition, trade, immigration and the labour market aimed at removing these barriers are more effective.

Options of education and training policies to reduce skill gaps

Education and training policies which reduce skill gaps in Europe also lead to an industrial structure with a higher aggregate productivity of Europe. We assessed five options in case of skill gaps. The starting point is the question whether markets for skills shape a welfare optimum or that additional policy interventions are needed to acquire optimal welfare. The first two education policy options are targeted towards providing a smooth adjustment towards the long-term equilibrium after shifts in skill demand or supply. The latter three are targeted particularly at changing the skill distribution in the economy to obtain a higher welfare equilibrium.

Produce and distribute scenarios on skill prospects

The first option is to produce and distribute scenarios on the prospects of different skills. This type of information gives students better opportunities to decide which skills they prefer to learn. Promoting transparency is a potential task of the authorities as lack of transparency is a market failure. An increase of transparency about the future labour market will facilitate a smooth adjustment of the labour market in cases of shocks.

A concrete example of a policy option to increase transparency is to extend the current practice of producing forecasts of occupations to forecasts of skill demands in order to capture changes in skill demands *within* occupations as well, which seem to be rather important. Another policy option is to make the produced information on skill prospects more customer-oriented and less fragmented, that is, to improve the distribution of this information to the relevant actors (e.g. students, providers of education and training, firms).

However, predicting the future situation on the labour market is a difficult task. With the exception of particular occupations where demand is to a large extent driven by demographic factors, such as teaching, there is a lot of uncertainty about the future labour market. Hence, it is important to make clear that most of the predictions about the future labour market are associated with much uncertainty.

Improve adaptability of education system

The second policy option is to improve the adaptability of the national education systems to unexpected shifts in skill demand or supply. This option also aims to facilitate a smooth adjustment of the labour market in a changing environment. Examples are apprenticeship or dual education systems in vocational education, removing barriers to entry for new private suppliers of education, and targeted grants for students to stimulate enrolment in particular types of education. Coordination of the (content and quantity of) education programs between the business sector, education authorities and national and regional governments may improve adjustment from the short-term equilibrium to the long-term equilibrium after shifts in skill demand or supply.

Shape comparative advantage by education policy

The third policy option is to shape comparative advantages by education policy, for instance by subsidizing education of certain skills more than education of other skills. The main argument for government intervention is the market failure of external effects involved in the employment of the selected skills. The main example of these external effects is agglomeration effects: spillovers in a region. . In that case, multiple equilibriums may exist. Critical mass of skills in Europe is needed to prevent that Europe falls in a trap of a mix of skills which is below the welfare optimum in the absence of government intervention. Education policies that promote the supply of particular skills with the aim of shaping EU's comparative advantages are an option in that case.

However, this is a risky policy for several reasons. First of all, the government generally has information problems to provide convincing evidence that the social returns of the selected skills exceed the private returns. Moreover, there is a risk that the government may select the wrong skills after all. Further, the government takes risks of an uncoordinated race of countries to attempt to specify in the same direction. Finally, selective policies often attract interest and lobby groups which will benefit from selection of certain skills and which neglect the negative welfare effects in the rest of the economy.

Stimulate general skills rather than specific skills

The fourth option is to stimulate education in general skills and discourage education in specific skills. The reason is a potential external effect, because students may insufficiently take into account the possible social costs of unemployment (unemployment benefits, public retraining costs), if they decide which type of skill they want to acquire. This argument is more important for specific skills than for general skills, since generalists are better protected against unexpected shifts in skill demands than specialists.

However, there is no clear general case for education policies targeted at stimulating general skills and discouraging the acquisition of specific skills. An important reason is that there are no clear indications for an increasing uncertainty about future demand for skills due to technological progress or other changes in markets. In addition, in most countries, a certain amount of general skills is already taught (and publicly financed) during initial education, which may have already internalised the potentially (larger) negative externalities of investments in specific skills. Moreover, the benefits of this policy should be weighed against its costs, since workers with specific skills are expected to be more productive than generalists in the industry in which they are active.

Training policies

The fifth option is to address the problem of skill gaps through training policies. Sufficient training participation by employees is important to narrow qualitative skill gaps, that is, to assure that the skills of employees maintain updated to actual skill requirements by employers. Economic theory has identified several possible market failures which lead to underinvestment by private parties in the market for training from a welfare point of view. The market failure linked to general training is poaching. Future employers may earn profits from general training by poaching general trained employees from other employers. This profit is an external effect which is not taken into account by employers when deciding to invest in general training of their employees. The market failure for firm-specific training is hold-up. The employee who followed a course in the time of his employer can try to renegotiate a higher wage after passing his exams at this employer. This perspective discourages employers to subsidize specific training of their employees.

However, due to a lack of convincing empirical evidence, no clear case for underinvestment in training relative to the socially optimal level can be made. It is not clear whether social returns exceed private returns, and whether - or to what extent - workers or firms are constrained to invest in training. Therefore, it is not clear whether there is a case for (additional) policy interventions. This is the more so, because the market (e.g. social partners) may already provide various solutions to certain market failures such as sector-based training funds. Moreover, authorities in the EU are already implementing various training policies, such as legal frameworks and co-funding schemes of employees and employers. Some of these policies carry risks of deadweight losses, in the sense that training investments are subsidized that would have taken place anyway. This risk particularly occurs when public funding schemes occur in the form of direct contributions, which do not need to be matched by own contributions of firms or workers. Training policies should preferably be targeted at the marginal decision to invest in training. Little is known about the (cost) effectiveness of all these training policy instruments. Further research on their effectiveness and small-scale experiments could contribute to more evidence-based policy making regarding training.

Important to take all costs of policies into account

It should be noted that there are costs involved when applying these education and training policy options, which do not only encompass the direct or partial costs, but also indirect costs in terms of for instance potential negative effects on other sectors (or on other types of skills). Therefore, the benefits of these policies should be carefully weighed against all costs involved. We expect the ratio between benefits and costs to be more favourable in the first two mentioned education policy options (i.e. production and distribution of scenarios on the prospects of skills, and raising adaptability of the education system) than in the latter two education policy options (i.e. stimulating more general skills and shaping comparative advantages by selecting particular skills). Regarding training policies, robust evidence on their costs and benefits is mostly lacking.

1 Introduction

Reason

The Lisbon Agenda of 2000 defines as a goal for the European Union to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion in 2010. The EU regards people as its main asset, and considers investments in education and training as a main instrument to provide its citizens with the needed skills to reach the aims.¹

As one of the consequences of this goal, the European Commission has initiated a project called “Skill problems in European industrial sectors” to obtain a better insight into the relationship between skills and manufacturing competitiveness of the EU in order to provide input for the development of policies to reduce skill gaps, and hence improve competitiveness in the EU manufacturing industry. Skill gaps are widely seen as a problem that lowers productivity growth. For example, shortages of science and engineering graduates have been on the policy agenda for many years. An important question is whether and how the government should take action to reduce skill gaps.

Research questions

The European Commission asked CPB to contribute to the skills problem project with an analysis on the role for education and training policies to reduce skill gaps. More precisely, this paper addresses the following three questions:

- What is a skill gap?
- What is the role for education and training policies to reduce skill gaps?
- Which policy options in the field of education and training policies are effective to reduce skill gaps?

Structure of the paper

The paper is built up as follows. Section 2 discusses the question ‘What is a skill gap?’. We discuss the definition of skills and two definitions which hold for ‘quantitative’ gaps. We define a ‘quantitative’ skill gap as excess demand for workers with a certain type of skills in the labour market, that is, a gap across occupations. Also we discuss the market failures, which legitimate government intervention and the policy fields which may effectively address these failures. Section 3 discusses the effectiveness of several options to narrow skill gaps by education policy. Section 4 turns to training policies to reduce ‘qualitative’ gaps. We define a ‘qualitative’ skill gap as a situation in which the actual skill requirements for a certain type of skill (or occupation) deviate from the skills current workers once learned. The section assesses to which extent training policy is an effective answer.

¹ Lisbon European Council 23 and 24 March 2000, Presidency conclusions

2 Quantitative skill gaps and types of policy

2.1 Introduction

This section explores the concept of a quantitative skill gap and asks whether there is a role for government policy, and if so, for which policies. Firstly, we ask what a ‘skill’ is. Next, we present two definitions of a ‘quantitative gap’ (section 2.2).

The first definition of a quantitative gap in a skill is an excess demand for that skill on the labour market. Although this is a well-known and straightforward concept it is not clear whether skill gaps actually exist. We show that the main issue of skill gaps is the adjustment process of a short-term equilibrium to a long-term equilibrium after a shift in demand for or supply of a skill. This adjustment will be smoother if there are less rigidities in the education system, the labour market and international movements of people and goods. A smooth adjustment of the economy to the long-term equilibrium will increase welfare (section 2.3).

The second definition of a skill gap focuses on the total mix of skills in the economy from a welfare perspective (section 2.4). The main question is whether the mix of skills (in steady state) differs from the welfare-optimal mix of skills. We show that the same rigidities or institutions that may prevent a smooth adjustment from the short-term to the long-term equilibrium may also lead to a sub-optimal mix of skills in the economy in steady state.

2.2 Skills

There is no single definition of a ‘skill’. In practice, it is a multidimensional concept, which refers to a learned (or developed) ability to perform certain tasks in the labour market competently. For example, skills may concern cognitive abilities, social abilities, communication abilities, organizing abilities, or vocational abilities. There is some, but no full overlap between ‘skills’ and ‘occupations’ and ‘qualifications’, concepts that are more easily measurable.²

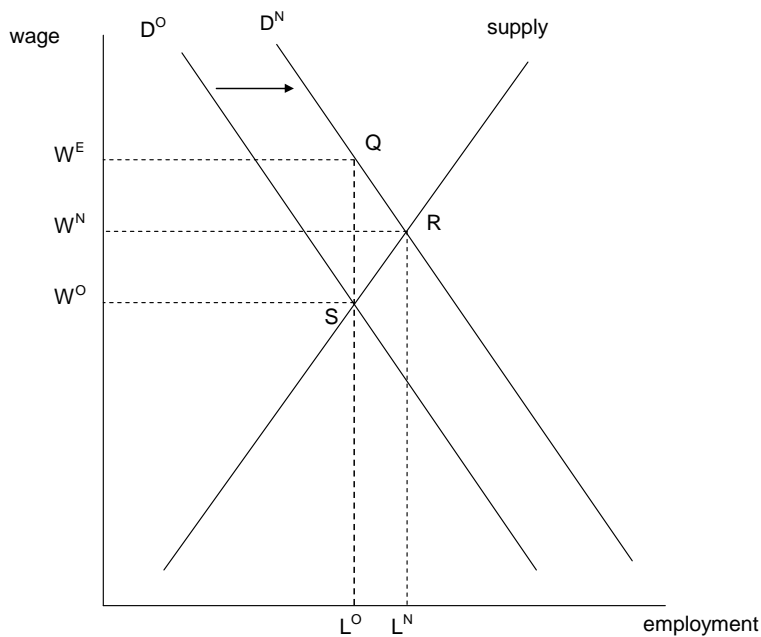
For the design of education policies the distinction between ‘specific’ skills and ‘general’ skills is relevant. The distinction between both types of skills dates back to Becker (1964) in his theory of human capital. Becker defines general skills as skills that can be used at countless other firms, and hence are portable across firms as individuals change jobs. Firm (or sector)-specific skills can be defined as skills that are only productive in the firm (sector) where the

² Qualifications do not always equate to skills. It could be that certain qualifications do not, or only partly, provide individuals with the skills firms need for a certain occupation. In practice, part of the required skills by firms are acquired through formal education, but training and on-the-job learning are also important ways to acquire the required skills to fulfil a certain occupation.

individual is employed, and which are not valuable in other firms (sectors).³ Empirically, a strict dividing line between the two types of skills is hard to draw, and we should view the total distribution of skills more as a continuum of skills from highly general to highly specific skills.⁴

In conclusion, the concept of ‘skill’ is not defined clearly. The distinction between ‘specific’ and ‘general’ skills is useful for analytical purposes, but its interpretation is not clear either, both theoretically as well as empirically. The vagueness provides risks of ineffective policies regarding skills.

Figure 2.1 Adjustment after a shift (increase) in demand for a skill



2.3 Skill gaps as an adjustment problem

2.3.1 Do skill gaps actually exist?

We start with defining a skill gap as a situation in which there is an excess demand for that skill on the labour market.⁵ The first question which arises is: can there be (a sustained) excess demand for a skill at all? There are arguments for a negative answer. Figure 2.1 illustrates them. The figure starts with a demand curve D^0 and a long-term supply curve showing the demand for (by employers) and supply of (by workers) a certain skill at each wage level. There is no skill gap if demand equals supply, which occurs in the base situation S, where L^0 people with the skill are employed, each one earning W^0 euros.

³ An example of specific skills would be bricklaying skills, whereas literacy or numerical skills would be an example of more general skills.

⁴ Moreover, the distinction between general and specific skills may change over time. When the personal computer was just introduced, computer skills could be regarded as specific skills, whereas nowadays they could be regarded as general skills.

⁵ The reasoning in this section holds both for different *levels* as well as for different *types* of skills.

Next assume, that demand for the skill increases.⁶ Examples of causes of shifts in skill demand (or supply) are discussed in the box below. Graphically, this can be interpreted as a shift in demand to the right, from D^O to D^N . If demand exceeds supply then wages will go up and the market will reach a new equilibrium in R where there is no skill gap (demand equals supply). L^N people with the demanded skill are employed, each one earning W^N euros. The new equilibrium asks adjustment of the supply of that skill as the increase in demand equals $L^O L^N$.

However, a typical characteristic of the labour market is that it takes time and costs to educate people and to switch jobs. Therefore, it is likely that additional workers with the demanded skill are not available in the short run, so their supply is fixed to L^O .⁷ Then, the short-term supply curve is the vertical line $L^O Q$ and there is a short run equilibrium in Q, where workers will be able to receive a wage of W^E euros. The main point is that also in the short term there is a new equilibrium where demand and supply meet. Hence, as long as wages adjust upwardly there are no quantitative skill gaps. In fact, there is only a 'gap' between employment in the short run and the long run, which is equal to $L^O L^N$. Which brings the question: is there a role for the government?

From figure 2.1 we can derive two reasons which may involve a role for government intervention.

A first reason may arise if wages are upwardly rigid. In that case, a skill gap would arise after a shift of the demand curve from D^O to D^N . However, it is not clear why upward wage rigidity would exist in practice. It seems that employers will always be able to pay higher wages if they want to. Paying lower wages may be prevented by labour market institutions such as minimum wages, but paying higher wages always seems possible. Hence, it is not likely that government action is needed to ensure upward wage flexibility.

A second - and more convincing - legitimation for government intervention is that the long run equilibrium (R) entails a higher welfare level than the short-run equilibrium (Q). Stated otherwise, the sum of the total surplus of employers and employees is larger in the long-run equilibrium than in the short-run equilibrium.⁸

⁶ An analogous reasoning holds for a fall in the supply of a skill, for instance linked to the retirement of elder workers with their skills and built up experience. The conclusions are the same as in case of a rise in demand.

⁷ The degree of specificity of the skill matters for the inelasticity of supply in the short run, see also section 3.4.

⁸ Graphically, the gain in total employer and employee surplus from the short-run to the long-run equilibrium is equal to the surface of triangle SQR.

Causes of shifts in skill demand and supply

Several causes of shifts in skill demand or supply are mentioned in the literature. This box briefly mentions some examples.

Demand

On the demand side, it is important to distinguish structural versus cyclical shifts in skill demand. Examples of causes of recent structural shifts in skill demand are trends such as skill-biased technological change, globalisation and de-industrialisation.^a

Skill-biased technological change (SBTC) is technological change that raises demand for (high) skilled workers more than for lower skilled or unskilled workers. A substantial body of literature states that technological change in recent decades was biased towards high-skilled workers. Two influential papers are Acemoglu (2002) and Autor et al. (2003). The latter paper, for example, finds that the adoption of computer-based technologies in recent decades is associated with reduced demand for routine manual and routine cognitive skills and increased demand for skills necessary to carry out non-routine cognitive tasks such as problem-solving and complex communication tasks (which are generally carried out by high-skilled workers).

Globalisation and deindustrialisation are other trends that may explain recent shifts in the composition of skill demands in various countries of the EU. For example, European economic integration and the removal of several trade barriers through trade agreements under GATT have increased opportunities (and competitive pressures) for countries (or regions) to exploit comparative advantages in certain skills, as well as to outsource production of intermediary products to other countries (with different relative skill intensities). The exploitation of these comparative advantages has led to industrial restructuring in various countries (or regions), with consequent shifts in (relative) skill demands.

It should be stressed that the relative importance of trends in trade and technological change in explaining shifts in (relative) skill demands is heavily disputed. Feenstra and Hanson (1999), for example, found that outsourcing of production accounts for 15 per cent of the shift in relative skill demand towards skilled workers in US manufacturing, whereas the increased use of computers within industries account for about 35 per cent of this shift. However, Autor et al. (1998), using another measure of computer investment, found that outsourcing is insignificant in explaining the shift in skill demand towards skilled workers in the US in recent decades, whereas computers explain 30 to 50 per cent of the increase in relative demand for skilled labour. Yet another paper by Lemieux (2006) states that the importance of skill-biased technical change in explaining patterns in relative skill demand (and returns to skills) is much more limited once composition effects of the labour force are taken into account. We refer to WIIW (2007) for a more detailed overview of this debate.

Supply

Important causes of shifts in (types and levels of) skill supplies on the labour market are demographic factors such as ageing of the population and international migration. Ageing of the population is an important policy issue in the EU nowadays. Retirement of the baby-boom generation after World War II will lead to a reduction of skill supplies in certain industries. Clearly, new cohorts of young people enter the labour market and partly replace leaving cohorts, but as these cohorts differ from the retiring cohorts in terms of the acquired level and types of skills as well as in terms of size, the total amount as well as the mix of skill supply irrevocably changes in these economies.

Finally, another important trend that has affected the quantity and composition of skill supplies in the EU has been the increasing labour participation of women. It is one of the factors that explain the upgrading of the skills of the labour force that has occurred in many EU countries, as also witnessed by the rising average participation rates in higher education over the last couple of decades.

^a We refer to part I of the skills study (WIIW, 2007) for empirical work on the relevance of skill-biased technical change and international trade integration in explaining recent shifts in the composition of skill demand in the EU.

In practice, the extra supply ($L^O L^N$) needed to move from the short-run equilibrium (R) to the long-run equilibrium (Q) can be obtained by two different mechanisms (or a combination of both): (1) the increased wage level W^E will induce (relatively) more people to enrol in the type of education that produces the demanded skill, such that after some time supply of that skill in the labour market is higher; and (2) through movement from current workers employed elsewhere to the industry employing the demanded skill in response to the higher (relative) wage level for that skill in the short-term.⁹ This implies that the path from the short-run equilibrium (Q) to the long-run equilibrium (R) entails certain adjustment costs, such as the costs of education and of job switching and (re-)training.¹⁰

There may be a role for the government in facilitating a smooth adjustment process. This can be done by reducing or eliminating those rigidities that hinder the (natural) adjustment mechanisms to a long-run equilibrium after a shift in demand or supply. However, it should be stressed that the authorities should weigh the welfare gains of a smoother adjustment process against the (welfare) costs of these policies.

2.3.2 Rigidities which may prevent a smooth adjustment

Several rigidities may prevent a smooth adjustment from the short-term equilibrium to the long-term equilibrium after a rise in demand or a fall in supply of a certain skill.

Rigidities to supply additional workers with the demanded skill

Educating people takes time. As a consequence, the short-term supply curve of skills may be inelastic (vertical). This will especially be the case for types of skills requiring many years of education and for scarcely available skills. Short-term supply will differ from the long-term supply of a certain skill because of uncertainty about the skills that are needed in the future. In a situation without uncertainty, the citizens and the authorities of the EU would know the future employment prospects of skills rather well. Under these conditions, each citizen would learn the skill which best combines her/his preferences and of lifetime income. As a consequence, the adjustment to the new equilibrium would be very smooth. In the real world, however, there is a lot of uncertainty about the skills that will be demanded in the future labour market. Given the fact that it takes several years to educate new workers short-term supply will always differ from long-term supply. A reduction of the uncertainty about the demand for future skills and a flexible and up to date education system may facilitate a smooth adjustment.

⁹ The extent to which workers move from other industries after an increased (relative) demand for skill X depends, among others, on the specificity of that skill, and on the costs involved in acquiring that skill through (re-)training. Workers from other industries will only switch if they expect the gain in income to be larger than the costs involved in acquiring that skill through (re-)training.

¹⁰ It should be noted that, though education costs are involved in creating the extra amount of workers to produce the extra amount of skills after a hike in demand, *total* education costs in the economy are not necessarily higher, since less expenses on education of other types of skills will be made. That is, the distribution of education expenses among different types of education changes, rather than the total costs of education.

Rigidities to import

Rigidities to import may contribute to slow or costly adjustment from the initial equilibrium S to the new equilibrium R in figure 2.1. For instance, assume that demand in the EU for products which are intensive in a skill X increases and import barriers for these goods are high. Then the domestic wages of skill X will rise considerably, which makes these products more expensive. When barriers to import are absent, however, imports of these goods may increase at potentially lower prices and the domestic wage increase will be lower than in the situation of high import barriers (i.e. less international competition).¹¹ This implies that the welfare costs during transition to the long-term equilibrium via job switching or education are lower when rigidities to import are absent.

Rigidities to immigration of people with certain skills

Rigidities to immigration of people into (or within) the EU can hinder the adjustment process. An amount of $L^O L^N$ of immigrants with demanded skills would immediately adjust the market to the long-term equilibrium. However, immigration is a complex issue which, next to the benefits also may involve certain costs.

Generally, for manufacturing goods, international trade in goods is a fair substitute for international migration of people, if two conditions are fulfilled. The first one is that the barriers to trade are rather small. Examples of these barriers are transportation costs, import taxes in these goods or 'voluntary trade restrictions' of these goods. The second one is that the skills in EU are not strongly different from the skills outside the EU.¹² If imports are not effective to reduce a skill gap, immigration could be an alternative.

Rigidities on the labour market

Rigidities for people to move across firms and industries may prevent a smooth adjustment to a new equilibrium after shifts in skill demand or supply. Examples of these barriers are costs of job searching, firing costs of employees (depending, among other things, on the degree of employment protection) and costs of moving from one town to another. Another rigidity is agreements between social partners or regulations which work out as barriers to substitute skills by machinery.

¹¹ This is under the assumption that the shift in skill demand does not occur (to the same extent) abroad, that is, foreign rewards for that skill are not experiencing the same upward-driving forces.

¹² It concerns relative factor endowments outside the so called 'cone of diversification'. See Helpman and Krugman (1989).

2.3.3 Which policies are needed for reducing or eliminating the rigidities?

Which policy may be the more effective to reduce or eliminate these rigidities, and for which rigidity is education and training policy most effective?¹³ The answers follow next.

Education and training policy does not seem effective to lift barriers on the product and labour markets.¹⁴ Policies in other fields seem more effective, because they are more directly targeted at reducing or eliminating the rigidities, and often work faster. In fact, many policies have been and are carried out to increase competitiveness on the international product market and the labour markets. It is likely that these policies have reduced potential skill gaps.

Rigidities to import can be more effectively reduced by international trade agreements. Since World War II, import barriers have been significantly reduced by European economic integration and WTO-arrangements. Also policy instruments which lead to a decline in the costs of international transportation and communication are more effective. These measures have promoted competition on the international product market.

Rigidities to immigration are more effectively attacked by the reform of regulations in the EU and member countries, which discourage immigration of people with the skill in shortage. In particular lifting immigration barriers for highly skilled specialists seems to be an effective instrument, because it works much faster than education and immigrants also take their international networks with them.

Rigidities to switch jobs on the labour market of the EU are more effectively addressed by a reduction of job finding and firing costs, which actually discourage people to switch jobs. Lower hiring and firing costs lead to a shift in the distribution of the demand for types of skills, and consequently for the demand of individuals for different types of education. The reason is that lower hiring and firing costs probably lead to more demand for general skills and less demand for specific skills, as Wasmer (2006) argues (see also section 3.4).¹⁵ Also, abolishment of agreements or regulations which discourage the substitution of skills by machines is more effective than education policy.

¹³ It should be noted that we only evaluate policies in terms of their (relative) effects on economic *efficiency*, whereas certain rigidities may also be implemented with the aim of promoting *equity*.

¹⁴ In principle, education policy may be a second best policy, but this issue is not addressed in this paper.

¹⁵ For some explorative empiricism, we refer to Lamo et. al. (2006).

More interpretations of skill gaps in practice

There are other interpretations of skill gaps in practice. We discuss them in this box because they do not coincide with the definitions presented in this paper

Gap between social and private optimum amount of skills

This gap occurs when there are externalities (or spillovers) involved in the production of a certain type of skill. Skills in research and development are supposed to generate these externalities. The consequences of this interpretation of gap are discussed in section 3.5.

Gap between high-level skills and low-level skills

The skill gap is the difference in skills between people with high skills and those with low skills in a region. An example of this definition can be seen in OECD (2005). This interpretation is relevant for the role of the different roles of high level skills and low level skills for productivity growth. There are indications that high-level skills are important for productivity growth by shifting the technological frontier, whereas low-skilled people have comparative advantages to adopt existing technologies, leading to productivity growth by catching up (Vandenbussche et al., 2005). Furthermore there are indications that high-skilled people are complementary to machines, whereas low-skilled people are easily substitutable for machines such as computers (cf. Autor et al., 2003, 2006). A dichotomy in the economy may be a result (cf. Iranzo and Peri, 2006).

Gap between total demand and supply of workers in the economy during boom period

A general shortage of human resources, such as in the boom of the business cycle, is sometimes also referred to as a skill shortage (gap). In practice, it is difficult to make a distinction between an overall cyclical-driven shortage of labour occurring in a boom in practically all sectors and at all levels of skills, and a more structural shortage of particular skills in specific sectors. During an economic boom newspapers regularly quote employer organizations reporting shortages of skills in their sectors, which in fact often fade away when the boom period ends and an economic downturn sets in. These overall labour shortages due to cyclical factors cannot be averted by policy interventions aimed at increasing investment in education and training in those sectors reporting shortages. This is due to the time period involved in acquiring these skills, in combination with the difficulty to predict cyclical shifts in the economy. By the time the skills in short supply today are created, the economy may have entered a recession, and shortages may have turned into surpluses.

Thus, policies aimed at correcting cyclical-driven movements in skill demands carry high risks and may be even counterproductive. Finally, it is important not to observe reported shortages in particular skills in particular sectors in isolation, but to analyze every particular shortage relative to shortages in other skills and other sectors.

Government failures due to a partial view

Policies that target on reducing or eliminating specific skill gaps bear the risk of not taking into account the costs and benefits in the rest of the economy. Usually, net benefits are acquired by the industry which gains by the reduction of skill gaps. The rest of the economy, often bears net costs, for instance less production due to the move of workers to the skill gap industry and the costs of education if paid by subsidies. Generally, a partial approach overestimates the benefits as the main welfare costs are in the rest of the economy, which may be neglected.

2.4 Skill gaps as a non-optimal mix of skills in the economy

The second definition of a skill gap focuses on the total mix of skills in the economy in a social welfare perspective.¹⁶ In this approach, a skill gap is the difference between employment of a skill in current steady state and employment of that skill in a welfare-optimal equilibrium. This approach is more useful compared to the approach in section 2.3 to give analytical answers on the welfare effects of skill gaps. From this definition, it follows inevitably that skill shortages and skill abundances co-exist at the same time. Whereas a skill shortage arises when the employment of a certain skill in steady state is lower than the welfare-optimal employment of that skill, a skill abundance arise when the employment of that skill in steady state is larger than the welfare-optimal employment of that skill.

Now what may cause a distribution of skills in an economy which is different from the welfare-optimal distribution of skills? Certain market failures or institutions may provide an explanation of the occurrence of skill gaps in this definition. An important market failure regarding skills is a lack of transparency on future skill perspectives on the labour market. Examples of institutions that may result in a non-welfare optimal mix of skills are barriers to enter product or labour markets. It should be noted that some of these barriers have been deliberately created, for instance with the aim of limiting income inequality (e.g. minimum wages) or to support infant industries (trade barriers). However, these failures and institutions distort decisions of individuals to acquire certain skills - and decisions of firms to employ certain skills -, which may result in a non-optimal distribution of skills in the economy from a social welfare perspective.¹⁷ Stated otherwise, the comparative advantages and disadvantages in certain skills of the EU countries compared to the rest of the world in current steady state differ from those in a situation where these market failures would be absent.

The market failures and institutions mentioned here coincide with the rigidities mentioned in the definition of skill gap as an adjustment problem (cf. section 2.3). Lack of transparency coincides with uncertainty on future employment and earnings of skills. Rigidities to entry are barriers to enter the product markets of the EU, rigidities to enter the labour markets of the EU through restrictions on labour migration, and rigidities that prevent a flexible movement of workers across firms or industries in response to shifts in skill demand or supply, such as a large

¹⁶ A mix of skills may refer to a mix of different *types* of skills, as well as to a mix of different *levels* of skills.

¹⁷ For example, when an economy imposes (relatively) large barriers to import products produced with certain skills, returns to those skills, and hence, employment of those skills would be relatively large compared to a situation in which these barriers are absent (and faces stronger competition from abroad). This may result in a surplus of investments in those 'over-protected' skills, and a shortage of investments in other skills from a social welfare perspective. A similar story can be presented for barriers on labour markets.

degree of employment protection.¹⁸ Therefore, for the purpose of this paper, no new market failures or institutions are introduced compared to the ones mentioned in the previous section.

Role for policy

Which type of policy actions is legitimate when we look at the notion of skill gaps using the second definition? The answer is that policies that effectively address the rigidities (or institutions) will increase welfare. Since there are no new rigidities introduced compared to the barriers mentioned in section 2.3, the earlier identified corresponding policy fields to address these market failures or barriers are the same as well. For example, trade barriers can be more effectively resolved via trade or competition policy, whereas there may be a role for lowering hiring and firing costs (labour market policy) to address barriers to switch jobs (cf. section 2.3). Education and training policies could be effective to address a (potential) lack of transparency about future skill prospects, whereas these policies are less effective to address barriers in trade or labour markets. To conclude, every market failure has its own most effective policy area.

In practice, governments may also try to alter the composition of skills through education policy by actively choosing or targeting a specific combination of skills in the economy. For instance, the government may try to stimulate the supply of general skills instead of specific skills by changes in the content of initial education programmes or stimulate investments in a particular type of skills (say science and engineering skills) through extra subsidies or grants. In the context of the whole project ‘Skill problems in the European industrial sectors’, policies aimed at shaping comparative advantages in certain skills can be regarded as efforts to improve the competitiveness of EU countries. We will discuss these policies in more detail in sections 3.4 and 3.5, with particular attention to the risks and costs involved in these policies.

It should be noted that whereas, in theory, skill gaps can be defined from a social welfare perspective, the identification or measurement of skill gaps using this second definition is very difficult in practice. This is because it is difficult to locate the occurrence and size of market failures, and to what extent and in which direction these market failures affect the distribution of skills in the economy. Moreover, the exercise should not only imply identification of particular skill shortages, but also skill surpluses should be identified in order to design welfare improving policies. These practical difficulties shape considerable risks of government failures.

¹⁸ Wasmer (2006) argues that the degree of employment protection may affect the mix of skills in the economy. High employment protection raises the probability that workers will choose specific skills, by two effects: in raising the duration of jobs, it raises the relative returns to specific skills; by depressing mobility on the labour market, it reduces the return to general skills.

2.5 Conclusions

The concept of 'skill' has not been defined clearly. The distinction between 'specific' and 'general' skills is useful for analytical purposes, but its empirical and theoretical interpretation is not clear either. Further, the concept of a 'quantitative gap' is not clearly defined in practice. The vagueness of these concepts provides risks of ineffective policies. We present two definitions of a 'quantitative gap'.

The first definition defines a skill gap as an adjustment problem in the transition from a short-term equilibrium to a long-term equilibrium after an increase in demand for (or fall in supply of) a certain skill. Examples of causes of (structural) shifts in skill demand are trends such as skill-biased technical change, outsourcing and deindustrialisation, whereas shifts in skill supply can be caused by demographic trends such as ageing of the population and shifts in international migration patterns.

A typical characteristic of the labour market is that it takes time to educate or train people. Therefore, it is likely that additional workers with the demanded skill are not available in the short run after an unexpected increase in skill demand, so the short run supply is inelastic. As long as wages can be flexibly adjusted in an upward direction, a hike in demand (or lower supply) for a certain skill will drive wages up and the market will reach a new (short-term) equilibrium in which there is no quantitative skill gap in the sense of a mismatch between demand and supply. We have no reason to assume that wages will be upwardly rigid as employers will always be able to pay higher wages if they want to. The higher wages in the short-run will induce people to enrol in the demanded types of education or move from other industries and the market will eventually reach the long-term equilibrium, in which wages are lower and supply of the skill is larger than in the short-term equilibrium.

It can be inferred that total welfare is higher in the long-term equilibrium compared to the short-term equilibrium. Hence, a smooth adjustment from the short term to the long term equilibrium will increase welfare. There may be a role for the government in facilitating a smooth adjustment process. This can be done by reducing or eliminating possible rigidities in the education system, the labour market or barriers to international movements of people or goods that prevent a smooth adjustment to the long-term equilibrium.

Uncertainty (a lack of transparency) about future skill prospects, in combination with the inherent time element involved in acquiring skills through training or education, causes a difference between short-term and long-term equilibrium supply of skills after shifts in demand or supply. Education and training policies that succeed in reducing this uncertainty and in increasing the adjustability of the education and training systems to shifts in skill demands or supplies can increase welfare. International trade agreements are most effective to reduce rigidities in international movements of goods, whereas labour market policies (or changes in

labour market institutions) are most effective to address rigidities in the labour market. Thus, each rigidity has its own most effective policy field.

The second definition of a 'quantitative gap' focuses on the total mix of skills in steady state that may differ from the welfare-optimal mix of skills in general equilibrium. Explanations for this gap are market failures such as a lack of transparency and barriers to enter labour or product markets. These market failures may distort decisions of individuals and firms to invest in certain skills and thereby lead to a non-optimal mix of skills. They coincide with the rigidities mentioned in the definition of skill gap as an adjustment problem.

Therefore, the most effective policy fields to address these rigidities do not differ from the ones mentioned in the first definition in the sense that each rigidity has its own most effective policy field.

In practice, governments may also try to affect the mix of skills in the economy by actively choosing or targeting a specific combination of skills in the economy with the aim of bringing the economy on a higher growth path. For instance, the government may try to stimulate the acquisition of general skills instead of specific skills by changing the content of education programs or by stimulating investments in particular types of skills which the government considers to be important to reach a high productivity level in the future. We will elaborate these policy options in sections 3.4 and 3.5.

Whereas this second definition is more useful to analyse skill gaps in a social welfare framework conceptually, it is difficult to identify or measure specific skill gaps on the basis of this definition in practice. These measurement problems create considerable risks of government failure.

3 Role of education policies to narrow quantitative gaps

3.1 Introduction

In this chapter, we elaborate four options for education policy targeted at reducing skill gaps:

- Production and distribution of scenarios on future skill demand;
- Improving the flexibility of the education system;
- Stimulating general education instead of specialist education;
- Shaping comparative advantages by education policy.

The options are related to the two definitions of skill gap in the former chapter. The first two options refer to the definition of an adjustment process of the economy after a shift in demand for (or supply of) a certain skill. The last two options refer to the definition of an optimal mix of skills in the economy from a welfare perspective. For each policy option we discuss the market failures and the role for education policy. We show examples of how policymakers carry out the role in practice.

3.2 Production and distribution of scenarios on skill outlooks?

More and better information on outlooks of skill demand may help to adjust more smoothly to shocks on the labour market, as this would improve the capacity of citizens to anticipate changes in skill needs when they take their education and training decisions.

Market failure

A potential market failure is lack of transparency on the market of skills. It is likely that private actors do not have strong incentives to forecast future skill needs for the whole labour market and to distribute them to the actors that could benefit from this information in their decision-making process in which skills to invest.

Government actions

As transparency is an important condition for the functioning of markets, there is a role for public intervention. Governments may stimulate transparency about future demand and supply of skills by financing research on future skill needs, as well as assuring a proper distribution of this information to the actors who make decisions on the basis of this information, such as students, workers, employers, and education and training providers. However, predicting the future situation on the labour market is a difficult task. With the exception of specific occupations where demand is to a large extent driven by demographic factors, such as teaching,

there is a lot of uncertainty about the future labour market. Hence, it is important to make clear that most of the predictions about the future labour market are limited by a lot of uncertainty.

Now, which gaps and weaknesses do exist in practice and which particular policy options are available to assure a more adequate provision of labour market information on future skill demands?

First of all, there are indications that current forecasts of skill needs (or shortages) are not sufficient and should be extended (see the box on the next page for a discussion of current practices). Economists generally attempt to forecast skill needs by forecasting occupations. These occupational forecasts seem to perform reasonably well in capturing changes in skill demand that follow from changes in the occupational structure (i.e. *across* occupations). However, there is some concern in several countries that existing occupational forecasts do not capture changes in skill demands (or ‘skill upgrading’) *within* occupations and are slow in capturing and describing new occupations. There is some evidence that only half of the changes in skill needs are associated with occupational change, which suggests that changes in skill needs within occupations are rather important (cf. Autor et al, 2003). Therefore, it has been suggested to complement existing occupational forecasts with forecasts of skill (and task) needs underlying occupations (cf. OECD, 2004 and Haskell and Holt, 1999).¹⁹ This may help people to consider moves across occupational boundaries, such that they can adapt and anticipate more easily to declining demand in existing occupations or to the opening of new occupations.

More attention could also be paid to extend the mostly national occupational forecasts to local or regional forecasts (in order to pay sufficient attention to differences between local labour markets), and to forecasts of returns to qualifications (cf. Haskell and Holt, 1999).

Furthermore, the OECD recommends that career information - among which information on future skill demand and supply - should become more customer-oriented instead of provider-driven, that is working from questions which individuals want to ask, rather than from the information which providers want them to have.

Finally, the production and provision of career information is often fragmented, in the sense that separate ministries and government agencies often produce their own information and outlooks, and the provision of this information to the relevant actors is often not well coordinated.²⁰ Therefore, there may be a role for public policy to improve coordination of the production of the different streams of career information (e.g. education and training

¹⁹ The main reason why economists generally do not forecast skill needs is that in most countries, little direct, consistent and quantitative information is available about past skill patterns. This makes it difficult to generate useful and accurate quantitative forecasts about skill needs in the future.

²⁰ In Finland, for example, the main national product containing information on the training needed in order to become a carpenter was separate from the product containing information on the content of occupation of carpenter. Each in turn, was separate from the major source of information on labour market supply and demand for carpenters (OECD, 2004).

information, occupational information and labour market information), as well as to assure a more coherent provision of these different pieces of information to the relevant users.²¹

Current practices in labour market (skills) forecasts

Lots of countries have institutions which attempt to forecast future demand and supply on the labour market. This box discusses some current practices.

OECD (2004) concludes that the quality of labour market information varies largely across countries. Canada, Korea and the Netherlands are mentioned as countries with good practices. In Canada for instance, the collection and analysis of labour market information is a major activity in the public employment services. Human Resources Development Canada (HRDC) has a legal responsibility to produce and disseminate information on jobs, occupations, as well as labour market trends. One of the key products from Herd's labour market information work is *Job Futures*, which includes supply and demand projections by occupation and by field of study. Information is gathered from own internal sources, as well as through a number of partnerships with the provinces. The data collection systems are claimed to be among the best in the world.

In The Netherlands, a database of projected labour-market demand in over 2500 occupations has been developed, which is linked to related education and training routes.

In Korea, among other labour market information, occupational outlook data (*Korean Job future*) are produced, comprising five-year forecasts based on extensive employment surveys. This publication is sent to schools and universities, and is revised every two years.

The contribution of Applica to the study "Skills problems in European industrial sectors" (cuff Applica, 2007) contains some examples of practices of skill forecasts in six EU member states, and discusses main advantages and disadvantages of the various initiatives. It follows that analyses of future skill needs, if present, are mostly carried out by public bodies or committees or by research organisations/groups which are publicly financed. This reflects the public good character of this type of information. In some cases, however, studies are also produced by employers' federations (e.g. Luxembourg, Belgium).

Further, it appears that there is quite some variation among the countries in the scope, quality and stage of development of current instruments to forecast future skill needs. For instance, in some countries, the focus lies on producing forecasts for particular sectors (e.g. Spain), whereas in other countries, instruments focus more on identifying future skill needs on a regional level (e.g. Austria and Belgium).

The main target groups of the produced information also vary, and the information is not always actively used to the same extent by the actors which could benefit from it (e.g. employers, students, career guidance officers, education and training providers, and policymakers responsible for labour market, education and immigration policies). We refer to Applica (2007) for a detailed description of the various forecast instruments in place in the six EU countries under consideration.

²¹ We refer to OECD (2004) for some interesting examples of good practices in a number of countries.

Conclusion

The production and distribution of scenarios on future skill demand may help individuals to make decisions on which skills to acquire. Promotion of transparency about the future labour market prospects of different skills may facilitate a smooth adjustment of the labour market in cases of shifts in skill demands or supplies. There is a role for government intervention in promoting transparency, since a lack of transparency about future labour market prospects can be considered as a market failure. However, promotion of transparency is a difficult task. Hence, it is important to make clear that most of the predictions about the future labour market are limited by much uncertainty.

3.3 Improve flexibility of education system?

In the presence of imperfect foresight, changes in skill demands (shocks) may emerge as a surprise. These shocks affect the nature and composition of skill demands by firms. Unforeseen changes in skill demands may follow for example from cyclical changes in demand for certain products and services, but also from (skill-biased) technical change or trends such as globalisation. Training of workers after initial education is undoubtedly important for workers to be able to adjust to changes in skill requirements. This topic will be discussed in the next chapter. Besides training, a flexible (or adaptable) education system may also help to limit the prevalence of skill gaps in the economy and increase welfare.

Role for education policy

Governments may try to increase the adaptability of national education systems. This can be done by building various links between ‘the world of education’ and ‘the world of work’. It should be noted that many countries already have institutional arrangements in place to assure frequent and timely adaptation of education systems to changes in skill demands, such as frequent structured contacts between the government, the business sector and the schools in order to exchange views on the demand of both firms and students, in particular to adjust vocational skills to new needs.

Policies in practice

Several measures or institutional settings have been applied in practice that have affected the adaptability of the schooling system to changes in skill needs by firms.²² Let us briefly discuss some examples.

First of all, a common feature across countries is institutionalised involvement of firms and firm organisations in the (re-)design of education programs, particularly in the design of vocational

²² Though this section only focuses on the adaptability of the *education* system to changes in skill needs, there are also practices known which attempt to ensure that *training* programmes for workers adjust to changes in skill needs. An example is a mentoring instrument recently introduced in Belgium, “Technology watch”, which aims to anticipate technological developments in particular areas of specialization in order to inform the design of training programmes (cf. Applica, 2007).

qualifications. It can take the form of either advisory committees that assist educational authorities (such as in the United States and Canada), or of tripartite decision-making bodies with strong firm as well as trade union agreement. This institutionalised involvement of firms and firm organisations in the design of occupational qualifications is important to ensure adaptability of vocational education programs to shifts in skill demands in the economy, at least to shifts that occur within nominally identical occupations.

A potential disadvantage of a larger influence of the business sector on the type of skills students learn is that the business sector may have stronger incentives than (education) authorities to stimulate supply of vocational programs with a large focus on the acquisition of (narrow) occupation-specific skills as opposed to general skills. A larger focus on occupation-specific skills does not need to be in the interest of students and/or the general taxpayer, particularly not in case of frequent job reallocation shifts in the economy. This is because adjustment costs in terms of retraining, which are often paid for by workers and authorities, are larger for workers which possess a relatively large share of (occupation-)specific skills. See also section 3.4 for more details on this issue.

Notwithstanding the available institutional settings, Bowers et al. (1999) state that in countries with strong traditions of vocational education and training, there is real concern about how to adjust the content of vocational education to changes in skill demands. These concerns have led to a search for ways to update curricula and qualifications in faster and more flexible ways.²³ In countries with a less developed vocational education system, an approach to ensure better matches between (the skill supply of) students and (the skill demand of) firms has been to develop unified qualification frameworks.²⁴ These systems of national standards, provided they are updated regularly, may help to inform education providers and students of their skill needs.²⁵

A common feature across countries is the gradual shift of certain planning and monitoring tasks from national to sectoral, regional and local levels in order to make education provision more immediately responsive to identifiable skill needs by firms at those lower aggregation levels.

Finally, though timely redesign of qualifications and curricula is important to prevent the prevalence of skill mismatches on the labour market, it should be mentioned that too frequent adjustments may involve large adjustment costs in terms of bureaucracy and fast depreciation of study materials.

²³ In Switzerland, for instance, the authorities attempt to encourage the responsiveness of vocational education to economic change through the creation of enterprise networks. In such networks, apprentices acquire a broad range of qualifications by moving through several enterprises according to carefully planned and coordinated training programme.

²⁴ An example of this system can be found in the United Kingdom, where vocational educational after compulsory schooling is organised within a framework of nationally-recognised qualifications: the General National Vocational Qualifications (GNVQs) and the National Vocational Qualifications.

²⁵ Another argument in favour of this system is that it helps firms to evaluate the skill levels of applicants.

A second example of an institutionalised setting that may potentially raise the flexibility of the education system to changes in skill needs is a dual education or apprenticeship system. Dual education systems are characterised by trainees that are trained in State-recognised occupations requiring formal training, defined in close cooperation with official bodies, school management and labour. The training element is a mix of regular education and on-the-job training supervised by the educational authorities and the social partners. A potential advantage of this system is that changes in skill demands by firms may be accommodated faster, since firms have an important role in teaching apprentices the necessary skills in this system. Bowers et al. (1999) states that apprenticeship systems (such as present in Austria, Germany, Switzerland and Denmark) have a good track record in keeping youth unemployment at low levels and at quickly integrating a high proportion of new school leavers into jobs. This suggests that these programs may be associated with better matching (or adaptation) of the skills of school leavers to (changes in) skill demands by firms.

On the other hand, it is also mentioned that these systems suffer from mismatches between supply of, and demand for training places, differentiated by occupations, sectors and regions. Moreover, firms themselves raise questions as to the costs and appropriateness of training for “rigidly” defined occupations. Countries with well-established apprenticeship systems appear to show large unemployment among older people who previously went through the apprenticeship system, which suggests that there is an increased obsolescence of (occupation-) specific skills due to rapid technical change (Wößmann and Schütz, 2006).

All in all, this suggests that the overall effects of these dual education systems on reduction of skill gaps may be less positive than their direct effects (or even negative), since students in dual systems learn relatively more occupation-specific skills (which may outdate faster), and less general skills than students in more academic pathways. The net effect of these dual education or apprenticeship systems on the prevalence of skill gaps is unclear.²⁶

A third policy option is to provide more room to (new) private suppliers of (vocational) education by entitling them to receive public financing. This may improve adjustment of education supply to changes in skill demands by the business sector. Secondly, allowing new entrants in the market for education raises competitiveness across education institutions, which may yield larger incentives for all institutions to adjust the content of their programs to the demand in the labour market.

Generally, the share of private supply of education programmes in Europe is still relatively small.²⁷ Giving more room to private suppliers of education can be accomplished by removing

²⁶ Wößmann and Schütz (2006) further state that apprenticeship systems and their success differ substantially in Europe. The design of adequate schemes seems important to generate satisfactory skill formation. Among others, a sufficient duration (Euwals and Winkelmann, 2004) and a high level of competition among firms offering apprenticeships and among students (Heckman, 2000) are mentioned as success factors. However, empirical knowledge on what determines a successful system of vocational education is limited (Wößmann and Schütz, 2006).

²⁷ An example of a privately funded education institution is Nijenrode Business University in the Netherlands, which offers higher education vocational programmes in the field of law, accountancy and management.

or limiting entry barriers for new private suppliers of education programmes. In the Netherlands an experiment was recently setup wherein selected private suppliers of higher education are entitled to receive public financing under certain conditions. Effects on the quality of education are still to be examined.

Finally, the government could also attempt to improve the adaptability of the education system to 'quantitative' changes in skill demands by introducing (or changing the level of) grants or subsidies to stimulate enrolment in particular education programs.

An important drawback of this strategy is that the government may not know better than the market which skills will show a shift in demand, how large these shifts will be, and what their nature is (see also section 3.5). This makes detailed manpower planning by the government a difficult task. Particularly in the wake of cyclical-driven shifts in skill demands, the risks of government failure may be substantial. The main reason is that it takes time - often a couple of years - to produce the required amount of skills in response to an unexpected increase in skill demand (or decrease in skill supply). This yields the possibility that demand for a certain skill may have already fallen by the time larger specific grants or subsidies have succeeded in raising enrolment in the desired type of studies and these extra students have entered the labour market. This would make such a policy even counterproductive.

The risk of government failure of policy options targeted at altering incentives for students to enrol in specific education programs does not mean that the government lacks any options in the area of education policy to promote adaptability to quantitative changes in skill needs. For instance, by raising tuition fees across the board, the government may make students decisions to enrol in a particular type of study more responsive to relative changes in labour market returns, which in turn follow from relative changes in skill demands across different occupations (see Powdthavee and Vignoles, 2006).²⁸

Conclusion

Governments may try to increase the adaptability of national education systems to changes in skill needs. In practice this is done by building various links between (initial) education and the labour market to various degrees. Examples are institutionalised contacts between firms and educational authorities on the content of curricula, apprenticeship systems in vocational education, providing more room to private education suppliers by entitling them to receive public financing, and specific grants or subsidies to students to influence enrolment in particular studies. Likewise the first policy option (i.e. producing and distributing scenarios on skill prospects), the aim of these policies is to facilitate a smooth adjustment of the labour market in a changing environment.

²⁸ A general hike of tuition fees, however, may trigger concerns of accessibility.

3.4 Stimulate education in general skills?

Another policy option for governments is to stimulate education in general skills and discourage education of specific skills. This could be done in practice either by changing the content of curricula towards more general skills, or through the promotion of education programmes which by themselves involve relatively more general skills. Before we discuss the rationale and potential costs and benefits involved in such a policy, let us first clarify the distinction between specific and general skills.

Trade off between general skills and specific skills

In section 2.2, we introduced the distinction between general and specific skills, and stated that it is a useful distinction for analytical purposes. The reason is that there is a trade off between both types of skills. Workers with specific skills have an advantage in productivity on workers with general skills in industries which can exploit their specifics. On the other hand, workers with general skills have an advantage on workers with specific skills because they can switch jobs cheaper across industries. Policymakers should trade off both aspects when designing their education and training policies.²⁹

The trade off implies that it is more profitable to learn specific skills instead of general skills the more persistent the barriers on the labour market and the less technology shifts occur, because then specific skills are more productive for a long period. If instead, barriers on the labour market decline or technology shocks are expected to accelerate, learning general skills becomes more favourable, because it takes less expenditures to find a new job. A recent study suggests that the larger emphasis on general education in the USA and on specific education in Europe is contributing to the lagging of European (productivity) growth in a world of shocks (Krueger and Kumar, 2004). However, too much emphasis on general education in a world of shocks may have disadvantages as well. Brunello (2006) warns that comprehensive schools could produce skills that are too general, and which require expensive additional training to become operational.

If the future demand for skills would become more uncertain, and more shifts in skill demand take place, we expect that on average the returns to general skills will become more favourable than the returns to specific skills. The reason is that generalists can better cope with shocks than specialists, as generalists have more options to work in other firms and industries compared to where they are currently working.

²⁹ See Wasmer (2004). Krueger and Kumar (2004) describe the trade off in other way. Specific skills have an advantage on general skills as they can be acquired cheaper. On the other hand workers with general skills have an advantage on workers with specific skills as they have better abilities to innovate. This trade off leads to similar interpretations as in Wasmer.

Role for policy

A potential market failure is that if students decide to learn a specific or a general skill, they do not take fully account of the difference in the costs of social benefit payments to them later. In fact, the expected costs are higher for specific skills than for general skills. The reason is that generally skilled people sooner find a new job and at lower re-entry costs, because generalists do not have to invest as much in retraining as specialists. The external effect may lead to underinvestment in education in general skills and overinvestment in education in specific skills.

Risks of government failure

Government failure may play a role as it is not clear what is the optimal combination of general and specific skills. In addition, most countries have many years of compulsory education in which a considerable amount of general skills are taught. We do not know if this fully resolves potential underinvestment in general skills from a welfare point of view.³⁰

An acceleration in technological progress would increase the value of general skills as generalists can move more easily to new jobs. Hence, indications for an acceleration in technological process or institutional change could support a policy of stimulating more general skills and discourage the acquisition of specific skills.

However, there are no reliable forecasts that the rate of technological change is accelerating or will accelerate. For more than a century technology has changed at a rather stable pace. During that period cars, aircraft, chemistry, electronics and information technology have emerged. New emerging technologies should be considered from that historical perspective. The present composition of supply of general and specific skills in education programmes may have tacitly adjusted to the present rate of technology growth, and therefore, there is no clear case for an adjustment of that composition.

Also, we do not have reliable forecasts of an acceleration in the speed of institutional change, such as removing rigidities on the product markets and labour markets. During the last half a century, rigidities on the international product market have been lifted by economic integration in Europe and international trade agreements. Also, barriers on the labour markets in the EU have been reduced. New foreseen policies or technologies which will further reduce the rigidities should be assessed from this historical perspective. The present composition of special and general education has probably tacitly adjusted to the present rate of reduction of rigidities, and therefore, there are no indications to adjust that composition.

³⁰ Considerable variation may exist in the distribution of general versus specific skills in different education systems in Europe. Hence, it is hard to draw overall conclusions for the whole EU on the question whether there is under- or overinvestment in general skills from a social welfare perspective.

Conclusion

It seems that there is no clear case for education policies targeted at stimulating more general skills and discouraging the acquisition of specific skills. A rationale for this policy would be a potential external effect, because students may insufficiently account of the expected appeal on social benefit payments to them later, if they decide which type of skill they will learn. This appeal is higher for workers with specific skills than for workers with general skills in the wake of (unforeseen) shifts in skill demands, as generalists are better protected against these shocks.

However, there are no clear indications for an increase in uncertainty about future demand for skills due to technological progress or other changes in markets. Moreover, the benefits of this policy should be balanced against its costs, since workers with specific skills are expected to be more productive than generalists in the industry in which they are active. In addition, in most countries, a considerable amount of general skills is already taught during initial education, which may have corrected for the potential externalities of investments in specific skills.

Decreasing benefits of extra financial support of education leads to cautiousness

This paper refers to *additional* financial support in assessing the benefits of education policies. The reason is that the extra social benefits of an extra euro public support on education decline with the amount of public support that is already given. These decreasing returns to scale hold for any input. For education it is particularly relevant, because the EU members already spend substantial amounts of money on education.

For this reason, policymakers should be cautious in considering more intense financial support on education to narrow skill gaps. Benefits of current policies are generally larger than benefits of additional policies, because current benefits are often gained at lower levels of support. Policymakers can hardly base their decisions on facts, as there is little empirical evidence available on the size of the decreasing returns at the current expenditure levels. This also holds for training in general, in small and medium sized enterprises (SMEs), and for training of low-skilled people and elderly.

3.5 Shaping comparative advantages by education policy?

Introduction

Policymakers in the EU may consider stimulating the education of selected skills in order to shape the comparative advantages in certain types of skills relative to other countries. This may be done through for instance (higher-than-average) subsidization of selected skills during initial education. The selected skills are specific and not general. The reason is that the EU only can shape comparative advantages with interventions in the supply of specific skills. Instead, a focus on general skills would lead to better adaptability of skills to changes in demand. Then the comparative advantages are not shaped, but are endogenous.

Market failures

There are two market failures that may legitimate selection of particular types of skills. The first one is external effects, which lead to increasing returns in production. Examples of these externalities are agglomeration effects and first mover effects with learning by doing afterwards and knowledge spillovers across industries.³¹ They have in common that the external effects create a common stock of know-how across firms and citizens, which is locked in a region. The common stock works as a kind of fixed costs leading to increasing returns to scale in production. Economic theory predicts that under such conditions multiple equilibriums may occur.³² It is imaginable that the EU falls into an equilibrium with a mix of skills which produces less than maximal welfare. This legitimates authorities to consider stimulating to learn selected skills in order to change the mix of skills and reach an other equilibrium which provides more welfare. In doing so, the authorities shape the comparative advantages of the EU with education policy.

The second market failure is lack of transparency. A lack of transparency legitimates policy intervention. If the authorities are better informed on the future prospects of skills than the citizens, they may select skills and subsidize education of the selected skills. In doing so, authorities may shape comparative advantages.

However, if the authorities try to address both market failures, they also take risks of the costs of government failure. These are discussed next

Risk of government failure: the identification problem

The first market failure is a fall into a non-optimal welfare equilibrium due to increasing returns to scale. However, the government should face the costs of failing as well. The authorities face the problem of identifying the skills that should be promoted. The identification needs much information. As regards the benefits the information should include the foresight that the future equilibrium will be a non-optimal one. Hence, that the social returns of the skills produced by the additional government spending exceed the private returns of these skills.

Also, the authorities should have information to account for the costs. The costs include the costs of tax-distortions and the production foregone in the rest of the economy, where resources should be withdrawn in order to use them as inputs to educate the selected skill. Moreover, the costs of rent seeking and labelling by social partners should not be neglected. The design of the education instrument needs a definition with only one interpretation. However, this is difficult in practice, and rent seekers may exploit vagueness for their own purposes. The costs may be considerable as the education subsidies often should be large in order to create sufficient mass in the selected skills. Finally, the EU should take costs of the probability of retaliation by for instance the USA, if the EU tries to shape its comparative advantages. If the USA would

³¹ See e.g. Redding (1999) and Fujita et al. (1999).

³² The idea of several equilibriums due to increasing returns and externalities dates back to A.A. Young (1928). Countries may fall into a poverty trap if there is a certain minimum threshold value above which increasing returns to scale occur. Only above that value, countries are able to catch up. For a recent overview, see Azariadis and Stachurski (2005).

retaliate and also subsidizes education of the same skills selected by the EU, it may lead to overinvestment in the skills, at welfare losses in the EU and the USA and gains to the rest of the world

If the authorities do not dispose of reliable information on these subjects, they take a considerable risk to select skills that will reduce welfare instead of enhance it. As the EU generally operates near the technological frontier selection gives more risks of government failure than of developing countries, which can benefit of the experience built up of the developed countries.

Employment is decreasing for long in many manufacturing industries in the EU and employment is transferred to Asia and India. In the EU these industries are in transition and some are even in decline. This triggers the question to which extent the arguments on market failures and government failures mentioned above should be adjusted regarding these industries. The following reasoning may at first sight give arguments for stimulating to learn specific skills in these industries. Assume that citizens in the EU derive the prospects of skills on the labour market by extrapolation of historical trends. If they notice that industries are declining, they expect a further deterioration of the prospects of earnings and employment. Therefore, they decide to learn other skills. These decisions aggravate the decline and the prophecies have been self fulfilled. Generally, the previous arguments do not change as the information problem on identification of skills remains. We have no evidence that the authorities have better information on the future welfare optimizing equilibrium of industries in transition or decline than the citizens. Therefore the authorities cannot discern if prophecies are self fulfilling or not. An exception to the general arguments is that yearly subsidies may prevent a collapse of an industry and keep the external effect of built-up experience in the EU. However, authorities should put forward plausible information that such a policy gives more net benefits than the alternative: taking the once-only costs of adjustment and save the yearly subsidies. Generally, the latter option gives more welfare.

Risk of government failure: education not most efficient instrument

Less important than the identification problem is the question to which extent subsidies of education of selected skills is the most efficient instrument after their selection. For instance, a government that aims to increase research and development (R&D) may use patent protection and R&D subsidies instead of education subsidies for beta education. R&D subsidies have the advantage that they are directly targeted at R&D, whereas education subsidies may generate deadweight losses, in the sense that a certain share of the subsidized students eventually does not engage in R&D, and a certain share would have chosen these types of skills anyway. Romer (2000) gives reasons for a role of education institutions in the case when supply of R&D-workers is (very) inelastic. Then, R&D subsidies lead to extra demand for these workers, resulting in higher wages for them, rather than to extra R&D activities.

Risk of government failure: attacking transparency

The second market failure is lack of transparency. However, there are also several government failures. Firstly, subsidising is not an efficient instrument. If the authorities would have an information advantage, the distribution of that information among the citizens is more efficient. In their turn, the citizens are able to decide for themselves the skills they prefer to learn. Secondly, the authorities may overestimate their advantage in information on the citizens and select skills which later turn out to not be 'the winning skills'. As a consequence, the education subsidies have reduced welfare.

Conclusion

Shaping comparative advantages in particular skills by education policy is a risky strategy. There may be benefits for the selected skills, but costs and risks in the rest of the economy. These costs encompass the direct costs of the education policies themselves (which carry welfare costs of tax distortions), but also indirect costs such as lower production elsewhere in the economy. Information problems of the authorities give considerable risks of subsidies of the education of selected skills which lead to a loss in welfare. Therefore, authorities who consider selection of skills should make a careful cost-benefit analysis, before they decide. It is probable, that this analysis will fail to produce convincing evidence that selection skills will increase welfare.

3.6 Conclusions

In this chapter, we have assessed four options for education policy in case of (quantitative) skill gaps. Whereas the first two policy options are targeted towards providing a smooth adjustment towards the long-term equilibrium after shifts in skill demands (or supply), the latter two are targeted particularly at changing the skill distribution in the economy to obtain a higher welfare equilibrium than the current one.

The first option is to distribute and produce scenarios on the prospects of different skills. This type of information gives students better opportunities to decide which skills they prefer to learn. Promoting transparency is a potential task of the authorities as lack of transparency is a market failure. An increase of transparency about the future labour market will facilitate a smooth adjustment of the labour market in cases of shocks. However, predicting the future situation on the labour market is a difficult task. With the exception of particular occupations where demand is to a large extent driven by demographic factors, such as teaching, there is a lot of uncertainty about the future labour market. Hence, it is important to make clear that most of the predictions about the future labour market are limited by a lot of uncertainty.

The second option is to improve the adaptability of the national education systems to the occurrence of skill gaps due to shifts in skill demand or supply. This option also aims to facilitate a smooth adjustment of the labour market in a changing environment. Examples of policies in this area are institutionalised contacts between educational authorities and trade unions and firms representatives on the content of curricula, apprenticeship (or dual education) systems in vocational education, removing barriers to entry for new (private) suppliers of education, and grants to stimulate enrolment in particular types of education.

The third option is to stimulate education in general skills and discourage education in specific skills. The reason is a potential external effect, because students may insufficiently take into account the expected appeal on social benefit payments to them later, if they decide which type of skill they will learn. This appeal is higher for specific skills than for general skills, since generalists are better protected against shifts in skill demands.

However, there is no clear case for education policies targeted at stimulating general skills and discouraging the acquisition of specific skills. An important reason is that there are no clear indications for an increase in uncertainty about future demand for skills due to technological progress or other changes in markets. Moreover, the benefits of this policy should be weighed against its costs, since workers with specific skills are expected to be more productive than generalists in the industry in which they are active. In addition, in most countries, a considerable amount of general skills is already taught during initial education, which may have already corrected for the potential negative externalities of investments in specific skills.

The fourth option is that the authorities shape comparative advantages by education policy. The main argument for intervention is external effects, which lead to increasing returns in production. In that case several equilibriums may occur, and the EU may fall in a trap of a mix of skills which is below the welfare optimum in the absence of government intervention. Selection of skills which improve EU's comparative advantages is an option. However, this is a risky policy. Generally, the government has information problems to provide convincing evidence that the external effects of the selected skills are greater than of other skills. Moreover, there is a risk that the government may select the wrong skills after all. And the government takes risks of inefficient skill support races across competing countries. Finally, selection attracts interest groups which will benefit from selection and neglect the costs in the rest of the economy.

It should be noted that there are costs involved when applying these policies, which do not only encompass the direct or partial costs, but also indirect costs in terms of for instance potential negative effects on other sectors (or on other types of skills). Therefore, the benefits of these policies should be carefully weighted against all costs involved. We expect the ratio between benefits and costs to be more favourable in the first two policy options (i.e. production and

distribution of scenarios on the prospects of skills, and raising adaptability of the education system) than in the latter two (i.e. stimulating more general skills and shaping comparative advantages by selecting particular skills).

4 Role for training policies to narrow qualitative gaps

4.1 Introduction

We have defined a qualitative skill gap as a gap between the actual skill requirements of an occupation and the skills current workers within that occupation possess (cf. section 1) .

Qualitative skill gaps seem to be rather important in practice. For instance, Autor et al. (2003) provide indications that changes in skill demands within nominally identical occupations are about of equal importance as changes in skill demands across occupations in explaining changes in skill needs in the economy over the last couple of decades. Narrowing qualitative skill gaps (i.e. mismatches between demand and supply *within* occupations) is probably cheaper than narrowing quantitative skill gaps (i.e. mismatches *across* occupations), because narrowing qualitative gaps needs rather marginal improvements, whereas narrowing quantitative gaps needs investments in skills relatively more from scratch.³³

Average participation in training varies largely across the member states of the EU. The average training participation of workers between 25-64 years old in a year ranges from 60 per cent in Sweden to about 15 per cent in some new member countries of the EU (cf. Bassanini et al., 2005).

In addition, training participation differs largely across different types of workers. It follows rather systematically that participation of younger workers, better skilled workers, workers with fixed contracts and workers in larger firms is above average, whereas participation of lower skilled and older workers, workers with flexible contracts, and workers in small and medium sized enterprises (SMEs) is lower than average (cf. Brunello, 2006; Bassanini et al., 2005; Ok en Tergeist, 2003).

Employers appear to finance the largest share of training costs. On average, the entire cost of about 75 per cent of the training courses is directly paid by employers. Employers' training investments amount to 2.3 per cent of total labour costs for the EU-15 on average, ranging from 0.9 per cent in Greece to 3.0 per cent in Denmark.

The outline of the remainder of this section is as follows. Section 4.2 discusses the question whether there is underinvestment in training from a social perspective, and thereby discusses the rationale for (additional) policy intervention. Section 4.3 provides an overview of the main training policies and institutions in place in practice in the EU, and discusses their main advantages and disadvantages, with particular reference to the risk of government failure.

³³ It should be noted that the distinction between qualitative and quantitative skill gaps is not a clear-cut one in practice. We could for instance consider a general shortage of engineers as an example of a quantitative gap, whereas a qualitative gap exists when there are in principle enough engineers available to meet demand, but these engineers do not meet the actual skill needs anymore in terms of the capacity to deal with new computer-based design packages for instance. The more one analyzes occupations at a disaggregated level, the more qualitative gaps eventually become quantitative.

Sections 4.4 and 4.5 discuss the particular rationale for - and examples of - training policies targeted at SME's, and at low-skilled and older workers, respectively. Section 4.6 concludes.

4.2 Underinvestment in training and scope for policy?

Market failures: theory

Economic theory mentions several market failures which may lead to underinvestment in training from a social welfare perspective, notably capital market imperfections, labour market imperfections and training market imperfections.³⁴ The most prominently mentioned reasons for potential underinvestment in training are poaching problems and hold up problems.

Poaching problems are particularly linked to underinvestment in *general* training, that is training which raises productivity both inside as well as outside the firm. In the theory of Becker (1964), which assumes perfectly competitive labour markets, employers will not invest in general training of their employees, because the employee may move freely to another firm after the training, since the acquired general skills are (by definition) equally productive in outside firms as well.³⁵ Future employers may earn a profit from general training by poaching general trained employees from other firms. This profit or 'poaching externality' is not taken into account by firms when deciding to invest in general training of their employees. This may lead to underinvestment in general training by firms.

As long as employees can afford to invest in general training, there will be no underinvestment in general training. However, underinvestment in general training may occur if workers are credit-constrained and cannot borrow money as well (because of capital market imperfections).³⁶ The government could solve this market failure by providing loans to employees.

Hold up problems are particularly linked to underinvestment in *firm-specific* training, that is, training of skills which raises productivity of the employee only inside the firm providing the training (and which are therefore not or less productive in other firms). Hold up problems arise when labour contracts cannot be committed upon ex-ante. In principle, employers and employees could agree on participation in firm-specific training and the salary before and after

³⁴ For a review of the literature, we refer to Leuven (2005) Bassanini et al. (2005) and Brunello and de Paola (2006).

³⁵ However, theory provides an exception to the prediction formulated in the classical theory of Becker that firms do not invest in general training. In practice, we observe that employers indeed co-finance general training (cf. Barron et al., 1989, Lynch, 1992, Loewenstein and Spletzer, 1998), Barron et al. 1999). Possible theoretical explanations can be found in labour market imperfections (cf. Acemoglu and Pischke, 1999). If the labour market is not fully competitive, general training may effectively become firm-specific in the sense that it can only be used inside the firm. Possible explanations for labour market imperfections are asymmetric information between the current employers and potential future employers or transaction costs to move from one job to another.

³⁶ Capital market imperfections may follow from a lack of a collateral or a lack of insurance possibilities due to moral hazard behaviour. Bassanini et al. (2005) mention that the empirical evidence on the importance of credit constraints for training is limited.

the training. However, after the training, the productivity gains could be lower (or higher) than expected or the employee could move to another firm where he or she can earn a higher salary. In that case, renegotiation of the contract may occur afterwards or the labour contract could be ended. However, in case of renegotiation, the actor that did not invest in the firm-specific training can capture part of the return to training. This would lead to a lower return for the investor. The prospect of renegotiation may be a source of underinvestment in training.

To reduce hold up problems, both parties (the employer and the employee) would have to contribute to the financing of training. This sharing of costs ensures that both firms and workers have the incentive to maintain the relationship and to reap the returns.

Finally, a lack of transparency on the market for training may lead to underinvestment in training. Better information on the content and quality of training programmes, certification and standards are instruments that may enhance transparency.

Market already provides solutions for market failures

The possible existence of market failures does not necessarily imply that underinvestment in training actually takes place. An important reason is that the market may already provide market-based solutions to certain market failures. An example is the existence of sector-based schooling funds (agreed upon among employers within a certain industrial sector), which may provide a solution to poaching problems. Another example of a market solution are pay-back clauses agreed upon by employers and employees, which may provide a solution to potential poaching problems, as well as to credit constraints of employees. We will discuss these institutions in more detail in section 4.3.

No clear empirical case for underinvestment and hence for (additional) policy

There is little robust empirical evidence on the occurrence of market failures in practice (after market solutions are taken into account), or more generally, on the occurrence of underinvestment in training relative to the socially optimal level (cf. Bassanini et al., 2005; Ok and Tergeist, 2003; Wößmann and Schutz, 2006). An important reason is that it is not clear whether social returns to training exceed private returns.³⁷ Second, it is not clear whether, or to what extent, firms and workers are constrained to invest in training. Third, as already mentioned, training participation appears to differ largely across countries in the EU, as well as across different groups of workers. This implies that we should be careful in drawing general conclusions for all countries and all groups of workers on the question of underinvestment in training or not.

³⁷ Estimates of private returns to training differ widely. For instance, estimated private returns to training based on OLS or fixed effects models are generally rather large, ranging up to 30 per cent. Recent research based on instrumental variables techniques, however, finds much lower (or even insignificant) returns (cf. Bassanini et al., 2005). They conclude that it is still an open question whether these findings can be generalized.

Given the fact that there is scant empirical evidence for underinvestment in training in the EU, there is also little consensus on the necessity of (additional) policy interventions in the market for training.

4.3 Training policies employed in the EU

Training policies have received increasing attention by policymakers across Europe recently, and there are frequent calls to increase the level of public intervention so as to stimulate life long learning.³⁸ Apart from the (unanswered) question of what is the optimal *scale* of policy intervention, it is important to know which *types* of policy interventions are promising and which not. This is because participation in training may also be increased by changing the mix of policy instruments towards more (cost-)effective instruments, instead of adjusting the scale of policy intervention.

In what follows, we present a brief overview of the main types of training policies employed in Europe, and briefly discuss their main (potential) pro's and con's.³⁹ We distinguish three broad categories of training policies, notably co-financing schemes directed at workers (affecting demand for training), co-financing schemes directed at firms (affecting supply of training), and institutional and regulatory arrangements.⁴⁰

4.3.1 Co-financing schemes directed at workers

Widespread examples of public co-financing schemes directed at workers are tax deductions, training leave schemes and individual subsidies in the form of individual training accounts or vouchers. A potential advantage of financing demand for training by workers (instead of firms) is that these systems are expected to generate a larger competition among providers of training, which could ultimately raise the quality and efficiency of training supply. However, this would only work if sufficient information on the variety and quality of training supply is available for workers, something which is questionable. Moreover, if the supply side does not expand, subsidies that increase demand for training may lead to higher prices and produce only a small increase in training participation (cf. Bassanini et al, 2005).

Tax deductions are schemes that allow workers to deduct training expenses from their taxable income. They have been introduced only recently in some countries (for example Germany, Italy and the Netherlands). A rigorous evaluation of one such scheme in the Netherlands

³⁸ For example, increasing participation in - and quality of and accessibility to - training (lifelong learning) is one of the major goals defined in the Lisbon strategy to make Europe the most competitive and dynamic knowledge-based economy in the world by 2010. A detailed work programme, called "Education and training 2010" was developed by the European council to reach these goals.

³⁹ This overview draws heavily on Bassanini et al. (2005) and Ok and Tergeist (2003).

⁴⁰ Training policies targeted at unemployed workers - part of active labour market policies - are outside the scope of this study.

indicates that tax deductions for workers can be effective: the level of the tax deductibility rate has a significant positive impact on the probability that individuals spend money on training and on the amount they invest in training (Leuven and Oosterbeek, 2006). However, Bassanini (2004) mentions that these schemes are more likely to be effective for high-wage workers, because low-wage workers are less responsive to tax deductions and more reluctant to finance training through loans.

Training vouchers offer direct financial support for individuals who undertake training activities. They are used in certain regions in Austria, Italy and Switzerland. The main problem with these schemes is the high expected dead weight loss, particularly in the case of vouchers that consist of a fixed public contribution to training costs. That is, a large share of vouchers may be used for training activities that would have been undertaken anyway. The available evidence suggests that these vouchers are mainly used by high-skilled workers, the ones which already participate relatively more in training.

Individual learning accounts combine tax arrangements or loans with subsidies. Different types have been introduced in for instance The Netherlands, Spain and the UK. An advantage of this system is that the use turned out to be relatively more widespread among disadvantaged categories of workers, which are the ones that participate less in training on average. At the downside is the risk of abuse, fraud and low quality of training, which is particularly high in the case of direct contributions from third parties. This risk may be reduced - but not abolished - by requiring the contribution of the co-financing partner to be matched with own contributions of workers.

All in all, because of a lack of rigorous evaluations, it is difficult to compare different co-financing schemes for workers. However, these schemes are likely to be more efficient when they are matched with own contributions of workers and reduce the *marginal* costs of training for individuals (Bassanini et al, 2005).

4.3.2 Co-financed schemes directed at firms

The most widespread examples of policies that attempt to alter incentives for firms to invest in training are so-called levy-grant schemes and tax deductions for firms.

Levy-grant schemes are of a compulsory nature, and combine a tax levied on all firms - usually a fixed percentage of the payroll - with grants awarded to training projects requested by some firms. They are present in the form of compulsory financing schemes at a national level (such as in Belgium, Italy and Spain), but also at a sector level (such as in the UK or The Netherlands). An advantage of these systems could be that they may reduce the poaching externality by spreading the load for funding training between firms. Another possible advantage is that this

system makes it possible to control, to some extent, the content and quality of training provided by firms, since generally a set of conditions has to be fulfilled by training projects eligible for financing. Arguments against this system are the high administrative costs of the funds, the likely risk of abuse (fraud), and the risk of funding of inappropriate and inefficient training, which occurs particularly if low investment levels in training in particular sectors or for specific groups of workers reflect low return on skills, rather than distortions in investment decisions (cf. Coulombe and Tremblay, 2005; Ok and Tergeist, 2003; Bassanini et al., 2005). Moreover, these funds have been criticized because large firms with well-established human-resource departments tend to benefit disproportionately from such schemes, whereas many SMEs fail to benefit from them.

Tax deductions allow firms to deduct some or all training costs from revenues and thereby to reduce corporate taxes. This instrument has been used in several European countries (such as Austria, Italy and Luxembourg). The potential advantages of this system are the low costs of administration and the relatively low expected deadweight losses, since tax deductions directly affect the marginal decision of firms between training and poaching by reducing the profits from poaching (see Bassanini et al., 2005).

A disadvantage of this system is that when tax deductions are financed through general tax revenues, taxpayers are required to pay for the training obtained by only a small portion of the workforce. Another disadvantage is that these schemes generally operate only as long as there are positive profits. Finally, it is mentioned that both tax deductions and levy-grant schemes carry the risk of deadweight losses because of substitution between formal and informal training. Moreover, these firm-targeted instruments do not address the low participation of particular groups of workers, such as older workers and low-skilled workers, since firms have relatively weak incentives to invest in training for these groups.

One of the scarce rigorous evaluations of training policies is the study of Leuven and Oosterbeek (2004). They have evaluated a Dutch tax deduction scheme for firms investing in training of employees aged 40 years and older. It turns out that this scheme led to mere postponement of training (beyond the eligible age of 40), instead of additional training activities.

4.3.3 Institutional and regulatory arrangements

Examples of regulatory arrangements introduced to stimulate training activity are working-time accounts, pay back clauses and skill certification systems. Often, these regulations are carried out in cooperation between social partners and central or local authorities.

Pay-back clauses require a worker leaving the firm within a specified period after the training spell to (partially) reimburse the training costs. These schemes raise the incentives for firms to invest in training of their workers, since the risk of poaching is reduced. They could also help to

alleviate possible credit constraints faced by workers (cf. Ok and Tergeist, 2003). These clauses are legally allowed in many European countries (e.g. Germany, Italy, The Netherlands, and Norway). However, their practical use is limited, because it is difficult for firms and workers to agree on the content and quality of the training contract (cf. Bassanini et al., 2005).

Training-time accounts are arrangements between workers and firms through which workers are allowed to work longer hours for a certain period of time in order to accumulate time credits that can be used later to follow an intensive training program. They are commonly used in a number of European countries, including France, Germany and Denmark (cf. OECD, 2003). The advantage of this system is that it may overcome time-constraints to invest in training. However, these training-time accounts may suffer from contractibility problems (cf. Bassanini et al., 2005).

Skill certification systems may raise marginal benefits of post-initial training for workers, since it facilitates contracting between firms and workers at the individual level, and it may improve the portability of skills to new jobs (cf. Wößmann and Schütz, 2006). However, training certification systems would tend to reduce the incentives of current firms to invest in training by improving the outside options of trained workers (cf. Coulombe and Tremblay, 2005). An example of a skill certification system is the so-called EVC-system in The Netherlands that is being extended at the moment to more and more sectors, which allows for certification of vocational skills acquired on the job.

4.3.4 Towards effective training policies

From the previous section, it turns out that rigorous empirical evaluations of training policies are scarce, despite the frequency with which these policies are employed in Europe. This makes it difficult to determine which training policies are effective and which not. Experimental setups of policy measures on a small scale, in combination with rigorous evaluations of these experiments, would enhance the stock of knowledge about effective and ineffective policy options. This would contribute to more evidence-based training policy.

Nonetheless, two general preconditions for the design of effective training policy can be presented. First, it is important that the design of policies is targeted at the perceived market failure at hand. For instance, if workers are perceived to be credit-constrained, loans to workers can be considered as an appropriate policy intervention. But if, on the other hand, poaching externalities are perceived, then the allowance of pay-back clauses may be considered, whereas subsidies to workers would not solve poaching problems.

Second, policies addressing market failures should affect the marginal decision to invest in training in order to avoid subsidization of training that would have taken place anyway (that is,

in the absence of these policies). Some of the implemented policies respect this principle, but others do not and tend to generate large deadweight losses.

4.4 Training of workers in small- and medium-sized enterprises (SME's)⁴¹

Training participation of workers in small- and medium-sized enterprises (SMEs) is relatively low compared to larger firms. The small scale discourages training due to two reasons. Firstly, absence (for training) disrupts the production process in SMEs more than in larger firms, as personnel in SMEs carries out multiple tasks and there are substitutes and specialists in larger firms. Secondly, the administrative costs to acquire financial support and information on courses are about fixed, by consequence per worker they are higher in SMEs than in larger enterprises.

In some countries, authorities have introduced specific instruments to promote training participation of workers in SMEs. For instance, SMEs have been given extra tax deductions for training their personnel (e.g. in France and the Netherlands). The Netherlands abolished the regulation in 2004 due to a high deadweight loss and the substantial fiscal burden. Another example is Korea, which is experimenting with consortia, where larger firms receive grants to train workers of partner SMEs. To our knowledge, this pilot has not been evaluated yet.

4.5 Training of low-skilled and older workers⁴²

From the point of view of welfare, training of low-skilled workers and elderly may give more reason for concern than of other workers, as the former groups train less on average. Their incentives to train are relatively low, firstly because their fall back positions in terms of early retirement schemes and unemployment benefits are relatively favourable in most EU countries. Secondly, the private returns of training of older workers to firms and employees may be lower due to the shorter recovery period of the training investments.⁴³ Thirdly, low-skilled people often work relatively more on temporary contracts, which makes it less attractive for firms to facilitate their training. Finally, the low participation of low-skilled and older workers may just signal relatively low learning abilities.

⁴¹ This subsection is based on OECD, 2005, pp. 61-63.

⁴² This subsection is based on the surveys IALS and ELFS [on participation in training], Brunello (2006) [on empirical evidence on fall back positions], OECD (2005, 2006) [on low-skilled people], Heckman (2000), and Kubeck et. al. (1996) [on older workers].

⁴³ It should be noted, though, that the recovery period of training investments by younger workers is not always much longer than that of investments by older ones. This depends on the rate of depreciation of trained skills, which in turn may be determined by the rate of technological change. If trained skills depreciate fast, the recovery period of investment in those skills by older workers may even be equal to that of investments by younger workers.

From the point of view of welfare, training of these people may give higher social returns than private returns, as the social returns may encompass less public expenditures on social benefits, lower unemployment payments and more social cohesion which are not fully covered by the private returns. Therefore, the authorities are already involved to encourage low-skilled and older workers to participate in training.

Low-skilled workers are stimulated, for example, with training vouchers, training allowances and intergenerational programmes on literacy. A number of local experiments have been evaluated. It turns out that the effectiveness of the local programmes improves if the firms are convinced that it is in their own interest to participate; if the courses are carefully individually tailored; and if skill demand is anticipated through regional skills observatories. From these evaluations, however, it remains unclear whether the social benefits of specific training policies targeted at low-skilled workers and elderly outweigh the public expenditures.

Logically, a worsening of the favourable fall back positions (in terms of for example lower unemployment benefits, or less generous early retirement systems) would be effective to encourage low-skilled or older workers to participate more in training. However, policymakers should weigh these gains against potential negative effects on income inequality. Therefore, in the wake of labour market rigidities, certain explicit training policies may act as a second-best policy option, provided they result in additional participation in training.

4.6 Conclusions

Sufficient training participation by employees is important to narrow qualitative skill gaps, that is, to assure that the skills of employees maintain updated to actual skill requirements by employers. Economic theory has identified several possible reasons for underinvestment by private parties in the market for training, of which poaching (general training) and hold up problems (firm-specific training) are the most prominent ones.

However, due to a lack of convincing empirical evidence, no clear case for underinvestment in training relative to the socially optimal level can be made. It is not clear whether social returns exceed private returns, and whether - or to what extent - workers or firms are constrained to invest in training. Therefore, it is not clear whether there is a case for (additional) policy interventions. This is the more so, because the market (e.g. social partners) may already provide various solutions to certain market failures such as sector-based training funds. Moreover, authorities in the EU are already implementing various training policies, such as legal frameworks and co-funding schemes of employees and employers. Some of these policies carry risks of deadweight losses, in the sense that training investments are subsidized that would have taken place anyway. This risk particularly occurs when public funding schemes occur in the form of direct contributions, which do not need to be matched by own contributions of firms or workers. Training policies should preferably be targeted at the marginal decision to invest in training. Little is known about the (cost) effectiveness of all these training policy instruments.

Further research on their effectiveness and small-scale experiments could contribute to more evidence-based policy making regarding training.

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