"THE DEFINITION OF SKILLS SHORTAGES"

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1 Introduction

Education and training are generally regarded as major factors in competitiveness and economic development. Their important role in the production process is reflected in the term human capital, indicating that in addition to physical equipment an adequately educated labour force is crucial for economic success. Following the human capital concept, the White Paper on Education and Learning: Towards the Learning Society of The European Commission (1995) suggests as the fifth guideline for action to ‘treat material investment and investment in training on an equal basis.’ In order to support investment decisions in human capital adequate information is needed. This information should point at skills for which shortages occur or are expected to occur. The term skills shortages, however, is a rather vague one and is interpreted in different ways by different authors.

For that reason in this contribution a theoretical framework will be sketched in which the various definitions of skills shortages can be placed. This framework enables to develop a typology of the various measurements of skills shortages and to valuate the different measures on their construct validity, i.e. to what extent does the theoretical construct measured fit into a broader theoretical framework? Based on foregone production a definition is introduced that links skills shortages with underinvestments in education. These shortages might be both of a quantitative and qualitative nature and possibly differ from the shortages perceived by employers. It will be shown that depending on the causes of skills shortages and on the reaction of employers to the shortages, these skills shortages can reveal in different ways. Firstly, it will be shown that wage competition between employers as a reaction to skills shortages might reduce perceived skills shortages, but will not diminish the major economic consequences of skills shortages, i.e. the foregone production it leads to. Secondly, it will be discussed what consequences it will have for skills shortages when employers use, probably costly, alternatives as an adjustment to skills shortages. These adjustments can be viewed upon as curative policies. Thirdly, attention is paid to preventive ways to avoid skills shortages. Finally, it will be shown what consequences a shift in the level of aggregation will have for the measurement of skills shortages.

The contribution ends with a scheme which summarizes the theoretical framework. This scheme is a proposal for a set of indicators that seems to be adequate for the monitoring of skills shortages.

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1 This paper is based on chapter 2 of Borghans, de Grip and Van Smoorenburg (1997).
2 Skills as an investment in human capital

Skills can be defined as abilities to perform certain productive tasks. This means on the one hand that a skill is associated with a certain task, or job and on the other hand that people who do not possess this skill will not be able to perform this task or will be less productive in this task compared to those who do possess the skill concerned. Skills can affect productivity in different way. Skills can be acquired in three different ways:
1. people differ in their natural abilities;
2. education and schooling will improve the skills people have;
3. experience could increase skills.

The acquisition of skills is therefore partly determined by factors which are not under control but also partly determined by factors that can be influenced by choices regarding schooling and experience. In economic literature skills are usually indicated by the term human capital. Continuing this analogy with physical capital the natural talents of people can be regarded as natural resources, whereas schooling is equivalent to an investment in human capital. Experience can be regarded as a by-product of production – in the case in which productivity is the first priority – but also as a form of training – in the case in which the tasks which have to be done are chosen to increase experience for its own sake as e.g. in apprenticeship training. The first case can be classified as ‘learning by doing’ while the second case is classified as ‘training on the job’ (see Killingsworth, 1982). Skills shortages therefore also can be both result from underinvestments in education and in training and experience on the job.

For the analyses of skills shortages it is important to distinguish between the natural resources and the investments in human capital. As will be discussed later, skills shortages is a relative concept. A shortage indicates a deficiency compared to a certain ideal position. However, it seems not very fruitful to discuss shortages of natural resources, since there is (except for migration) no way in which these resources can be increased. The analyses of skills shortages will therefore be based on the question whether more or other investments in human capital would have been desirable given firms’ demand for skills.

Definition of skills shortages

Speaking about skills shortages implies that there are less skills available than could be regarded as normal. As skills shortages are a relative concept a consistent use of the concept of skills shortages requires this point of reference to be defined. From the point of view in which investment in skills are regarded upon as human capital it seems evident to take a situation in which all persons have developed their skills optimally as a point of reference. This means that everyone’s investments in skills are developed to such an extent by education and experience that additional investments are not cost-effective anymore. The optimal investments in skills are therefore restricted by the costs of training, but also by the capabilities and preferences of the persons involved. This optimality refers to the macro level. This means that these investments should contribute to the economic development of the country. Skills shortages therefore directly lead to foregone production, compared to the situation of optimal investments in skills. The definition of skills shortages therefore is:

A skill shortage is the difference between the skills actually available and the skills that would have been available if all persons developed their skills optimally – from a macro-
point of view – by education, training and experience.

With respect to this definition of skills shortages two remarks have to be made.

Firstly, a skills shortage refers to a mismatch situation in which for a certain skill there has been an underinvestment in human capital. On the other hand also overinvestments are possible. People might invest in education and experience to an extent in which the benefits do not cover the costs anymore. The investment could be too large per se, but more likely investments in the ‘wrong’ skills could occur. This means that people invest in certain skills that do not contribute enough to production to recover the costs while more investments in other skills would have been useful. This might mean that people choose less valuable learning programmes, but also that the quality of a learning programme is low in the sense that it focuses too much on the acquisition of skills that are not important (or not important anymore) for a good labour market performance. Skills shortages and overinvestment might therefore occur at the same moment. Improvements in investments in human capital are therefore not only a matter of an increase of gross investments in education and training, but might also be obtained by an improved allocation of these investments.

Secondly, skills have been defined as abilities to perform certain productive tasks. Central in the concept of skills is therefore the actual ability people have and not their formal educational status as indicated by their diploma’s. Although the point of reference is the optimal amount of skills that could have been acquired, this does not mean that formal education is the only means by which skills can be obtained. As mentioned before also training on the job and experience (‘learning by doing’) might increase the skills of workers, while on the other hand people might acquire formal diploma’s without satisfactory abilities for the job concerned. Although for measurement purposes it will often be necessary to use classifications of education, it is therefore important to keep in mind that discrepancies will exist between the expected and actual skills of people within a certain formal educational category. An indicator for skills shortages should therefore also take these discrepancies into account.

Examples

Skills shortages as defined above can take very different forms. To illustrate these different kind of manifestations six examples are provided in which past decisions concerning skills acquisition turn out not to be optimal.

1. There are not enough plumbers for all the installation work to be done. This means that it would have been beneficial for society if this quantitative shortage would have been anticipated and more people would have acquired these skills.

2. Older civil servants do not have enough managerial experience. The work of younger civil servants is too much focused on direct production, while another allocation of tasks would have generated additional managerial skills that are very valuable later in the career.

3. Employers do not realize the value of craftsmanship at intermediate level. Findings like this are frequently obtained by comparative research of the British National Institute for Economic and Social Research (see Steedman and Wagner, 1987, and Ryan, 1991). It also implies that if employers would recruit more people with these skills, and thus value
these skills more, productivity would be improved. If undervaluation of these skills leads to lower participation in education and training for these skills, skills shortages occur. Employers do however not notice this skills shortage themselves.

4. Eye doctors earn extreme high incomes. Due to restricted enrolment in these courses eye doctors are scarce and their fees are high. As a consequence people who would normally have used the services of these doctors, go to an optician instead, leaving the eye doctors with only the more complicated cases. Matching the need for these specific task with the supply of eye doctors will not indicate at a shortage, however.

5. Electrical engineers do have sufficient skills for design, but commercial skills are becoming more and more important. This indicates at a qualitative skills shortage. Although the level at which these electrical engineers perform design tasks might be sufficient, changes in the character of the job might require other skills. Investment in these skills at school or by experience or training during their working career would have improved the employability of these people.

6. Expensive retraining of graduates to computer sciences is needed. Scarcity of computer scientists makes computer firms to invest in training programs for graduates from other disciplines. This implies relative expensive educational routes. Although double qualifications certainly will have additional value, anticipation of these shortages could have saved costs. Therefore such retraining indicates at skills shortages.

The examples show that skills shortages can take very different forms. Furthermore, the investments in learning that remained undone might refer to education, but also to schooling during the working career and the acquisition of certain experience by an appropriate organization of the work. Skills shortages can occur due to the absence of certain learning investments, but also due to a low quality of certain schooling, the emphasis on aspects that are not the most relevant for the work or investments in skills that are not the most relevant for the labour market.

_Reasons for skills shortages_

As a consequence of the definition, a skills shortage implies a situation in which at a given moment in time it appears that certain investements in skills would have been appropriate in the sense that the benefits of an additional unit of these skills exceed the costs of investment. The observation of skills shortages therefore naturally leads to the question why this investment has not been done.

The reasons for such underinvestments could refer both to the supply and the demand side of the labour market. On the supply side people might underinvest in education because:

1. There are _institutional obstructions_ for such investments. In formal education there may be e.g. a numerus fixus, rationing the number of students. Training on the job could be hindered by a 'prisoners dilemma' in which employers are not prepared to invest in training for certain skills if competing firms might profit from these investments, whereas learning by doing could be obstructed by the pressure for direct productivity which might obstruct the allocation of labour over tasks which stimulate the formation of experience.
2. Misperception of the costs and benefits of investments in certain skills. The costs include not only the pecuniary costs, but also depend on the capabilities and preferences of individual persons. People might think that they are not capable to obtain certain skills, or may have a false perception about the satisfaction certain jobs will provide. A misperception about the benefits of skills could arise if students and workers have a wrong view on the value of specific skills for employers. Here the dynamics on the labour market become important. Adequate learning investments require anticipation of the future needs for certain skills. Both qualitative and quantitative aspects of work will change. Technological progress plays an important role, but also organizational changes will lead to changes in job requirements. De Grip et al. (1997) show that the introduction of total quality management and ISO-certification is a major reason for schooling at firms. To avoid skills shortages future skills requirements have to be anticipated therefore.

3. There might be a discrepancy between the individual versus the social balance of costs and benefits of investing in a certain skill. These discrepancies might be caused by unattractive conditions of employment, e.g. low wages, unfavourable working conditions or bad career prospects.

On the demand side skills shortages can also be caused by obstructions, misperceptions and discrepancies in the balance of costs and benefits:

1. Obstructions to recruit people with certain skills might be introduced by legal restrictions that prescribe certain formal qualifications for particular jobs, while e.g. persons who do not have the formal educational qualification, but to have relevant experience could be a good (and less expensive) alternative.

2. Misperceptions occur if employers have a wrong view on the value of certain skills for their production processes. Again this means that the dynamics of the labour market are important. To avoid skills shortages employers have to anticipate future skills requirements. Early anticipation makes it possible for them to promote that their employees get used to new developments in an early stage.

3. Discrepancies between the balance of costs and benefits for employers versus society might be caused by high additional costs employers have to pay for certain skills, e.g. in the form of taxes.

3 Consequences of skills shortages

All possible causes of skills shortages lead to a situation in which fewer people have certain skills than would have been the result of an optimal investment in education, training on the job and learning by doing. As a consequence there will be other skills (or people missing certain skills) which are overrepresented compared to the optimal situation. The way in which such a skills shortage reveals itself and its economic consequences depend on the way employers react to these skills shortages. These reactions might depend on the cause of the shortage.

Since a skills shortage is a non-optimal economic situation employers probably follow certain adjustment policies to reduce the costs of the shortage. If these adjustments policies are absent
a direct discrepancy between supply and demand of a certain skill will show up. This is called a classical skills shortage. If employers are aware of the productivity possibilities of the skills concerned, they will perceive this discrepancy. This discrepancy can be formulated in quantities, or in qualities. Employers might perceive that for the specific skills they require supply does not meet demand, or they might perceive that the quality of the skills they can obtain does not meet their needs. If employers are not aware of this productivity gap, because they underestimate the potential productivity of certain skills, de facto the same situation occurs, but indirect measurement is required since employers perception will not point at these shortages.

For the measurement of skill shortages it is important to take into account the possibility that employers react to the situation. As will be shown below such reactions might fundamentally change the observed situation, although the essence of the skills shortage, i.e. the foregone production, is unaffected. In a broad sense there are two different ways in which employers can react. Firstly, employers might start to compete on the market for the ‘scarce good’ – the skill which is in shortage – by increasing the wages for workers which have these skills, or by increasing the recruitment efforts. Such a competition does not reduce the shortage, but determines the distribution of the skill over the firms at the demand-side of the labour market. Secondly, employers might undertake actions which reduce the problems they face. Such adjustments do not fully compensate the effects of skills shortages, but might diminish its negative effects. In the following subsection attention is focused on the aspect of wage competition, while the next subsection will deal with adjustments to reduce the costs of skills shortages.

Market reactions to skills shortages

In the economic literature non-market-wages are often assumed to be the cause for skills shortages (cf. Bosworth and Warren, 1992). Such a theory of skills shortages suggests that these shortages only exist up to the moment on which the market equalizes supply and demand by adjusting the wages. Consequently, skills shortages only seem to be possible in cases where the market is not well-functioning in the sense that wages do not clear the market. Sneessens (1995) provides an example of such research in which ‘skill mismatch’ is regarded as a situation in which wages do not adequately reflect the need for certain skills. Causes for such imbalances can be wage rigidities or high wages due to the market power of so-called insiders on the labour market. These analyses do however take the availability of skills for granted and therefore do not focus on the question that precedes the investigation of the allocation of skills, i.e. the question of the acquisition of skills and its adequacy for the labour market. Regardless the adequate working of the wage mechanism, employment growth and economic development will depend to a large extent on adequate investments in skills.

Restricting the view on skills shortages to wage adjustment processes neglects the major relevance of the skills shortages concept. Even if wages react to the scarcity of a certain skill, the scarcity itself, and therefore the foregone production, does not disappear. It is therefore important to analyse what will happen in the case in which employers react to the situation of shortages they face.

Competition for scarce labour will indeed improve the allocation of skills over the firms which demand for the skills. Rising wages in such a competing environment, or other policies
that aim at the recruitment of the scarce skills at the cost of other employers such as an intensified search, will indeed reduce demand since the skills concerned will become too expensive for some employers. Jobs for which the productivity of a certain skill is relatively low will be the first for which demand is reduced when wages or other labour costs go up. Rising wages or costs therefore lead to a selection of the more productive jobs. This wage competition will however not increase the supply immediately. As mentioned before the formation of skills can be regarded as an investment in human capital and as most investments also schooling will take time. In practice this gestation period might take several years.

However, after the short term wage adjustments, the measurement of skills shortages might suggest that the problem has vanished. The skills shortages an employer perceives become equal to zero: supply equals demand at the prevailing wage. However, in this situation skills shortages in terms of production foregone do still exist as supply is still below the optimal level. Comparing the actual skills shortages before and after short term wage adjustment therefore leads to the picture that in both situations the quantitative measures are equal, but that before short-term wage adjustments the wage is equal to or lower than normal, while after wage adjustment the wage exceeds the normal wage. Compared to the optimal situation the underinvestment in human capital is still present and therefore this situation has also to be regarded as a skills shortage. This enables us to distinguish a high wage skills shortage from the classical skill shortages mentioned before. Opposed to a classical skills shortage in which supply is below the optimal level and the wage is equal to or lower than optimal level, high wage skills shortages are characterized by supply below the optimal level but labour costs above the normal situation.

Adjustment mechanisms to reduce costs of skills shortages

The wage competition process described above refers to the situation in which employers for their production process depend on a particular specific skill and that they have in the short term no possibilities to substitute this specific skill for related skills. The only way to meet their demands are therefore increased competition for the scarce skills. In practice however an employer has several alternative options to cope with the skills shortages, such as:

1. to recruit people with different educational backgrounds, with higher costs or lower productivity
2. to provide additional training to workers who lack the skills required but have a second-best educational background
3. to stimulate overtime of adequately skilled workers
4. to substitute physical capital for human capital
5. to stimulate interregional or international labour mobility
6. to reduce the level of production

In general these adjustments will have costs compared to the normal situation in which there is no shortage for the skilled labour concerned and labour costs for this skill are not exceptional. If an employer faces recruitment problems, or if due to wage competition the skills concerned become more expensive, these adjustments might become attractive alternatives. This implies that these substitution possibilities enable the employer to reduce the costs of skills shortages. The lower the costs of these substitution possibilities, the higher the potential reduction of the costs of skills shortages. It is important however to notice that
again the presence of these adjustment mechanisms does not mean that skills shortages have been "solved". On the one hand the costs of skills shortages are reduced, since cost reduction forms the rationale for the adjustment strategy, but on the other hand adjustments lead to higher costs than in an optimal situation in which no skills shortages occur. Since adjustment policies might hide the existence of the shortages, we call this a masked skills shortage.

Structural ways to avoid skills shortages

Until now the analyses focused on skills shortages and the adjustment processes these shortages could lead to. These adjustment processes can be viewed upon as curative policies. However also preventative policies are possible. Factors that increase the risk of skills shortages can be influenced by structural characteristics which might prevent skills shortages to some extent. An educational system, for example, in which a high degree of specialization is reached, might more easily lead to discrepancies between supply and demand than an educational system in which more general skills are taught. Borghans (1992) argues however that these general skills might lead to more flexibility of supply but also might decrease direct productivity. Similar to adjustments as a reaction to shortages, also structural ways to avoid skills shortages might have their costs. Another example of preventative actions might be to monitor the labour market with respect to skills and provide forecasts which enable firms, individual workers as well as policy makers to anticipate on future skills shortages. This policy to make the relationship between education and the labour market more transparent will improve the investment decisions in human capital and therefore decrease future skills shortages (Borghans, 1993).

4 The level of aggregation

The investigation concerning the causes of and firms' reaction to skills shortages provide a picture of the consequences of skills shortages. However, this model is a partial model. In a certain way such a partial analysis might mislead the interpretation of the situation. A partial model is based on the assumption that on other markets no changes occur. The model therefore analyses what happens if on the market concerned wage and quantity adjustments take place while at other markets everything remains the same. This implies that the scope of the partial model determines the outcome to a large extent. Suppose for example that we analyse the skills shortages at the firm level. An employer observes that he can make large profits by producing a certain good, but the firm is hampered in its production since the supply of skilled labour for the production of this good or service is low. Facing the possibilities of the product market the individual employer might have an impression about the skill shortage the firm faces, which depends on the assumption that the firm will be able to serve the whole market. The reason that other firms do not produce for the same market might however be due to the fact that they also face these skills shortages. Asking other employers about their perceived skills shortages might therefore lead to double countings. Adding up these perceived skills shortages of all firms this leads to an overestimation of total skills shortages at a more aggregated industry of macro-economic level.

Analyzing the situation at the level of the sector of industry might compensate for this. In that case demand is determined for the sector as a whole, assuming that other sectors will not change their level of production. Again, however, if the goods produced in this sector have important substitutes or complements the results of the analyses might be misleading. The
same holds for cases where the skill concerned is also demanded in other sectors of industry. The determination of skills shortages therefore requires an explicit statement about the level of aggregation at which they have been measured.

5 Summary: proposal for a set of indicators

The discussion of the concept of skills shortages shows that skills shortages can reveal themselves in different ways. In all these different manifestations there is however a situation of foregone production that could have been avoided if adequate educational investments would have taken place. It is therefore important for the measurement of skills shortages to treat these different types of skills shortages on an equal basis. In this final section the main findings are summarized, leading to a proposal for a set of indicators that can be used to catch up every form in which skills shortages might show up. Figure 1 provides an overview of the indicators that seem to be necessary to monitor skills shortages.

In the first place, all skills shortages can be characterized by a supply of the skill concerned which is below the normal or optimal quantity. There has been an underinvestment by education, training and experience in this specific skill. The quantitative shortage of skills is therefore the first indicator which seems to be relevant. Note however that this quantitative shortage not necessarily relates to a certain category of formal skills, but might also relate to the number of people that have skills at a certain quality level. In practice the quantitative measurement of actual rather than formal skills shortages will be hampered by practical limitations however.

In addition to this in order to measure the supply of skills therefore not only the quantity, but also the quality of these skills have to be measured, to avoid that judgements concerning skills shortages are based on labels in the form of diploma’s only and not on the real content of the skill concerned. Connected to the supply of skills an indication is needed therefore about the quality of the skills in the form of the productivity or the type and quality of work that can be performed.

Depending on whether market competition is at work or not, skills shortages can occur with on the one hand normal or relatively low and on the other hand relatively high wages. The costs of labour therefore form a third relevant factor for the determination of the type of skills shortages. Classical skills shortages for which no adjustment processes have occured are indicated by both a low quantity of supply in the skill concerned and a normal or relatively low wage. Only if employers are aware of the lost production possibilities these classical skills shortages will also be perceived, however. An indicator of perceived skills shortages might therefore determine the cause of the shortages. In case of structural barriers in demand there will be no perceived skills shortages, while in case of barriers on the supply side, due to structural barriers or due to information problems, employers will perceive the problems concerned. Note however that it can be expected that the perceived skills shortages overestimate the actual skills shortages, since adequate anticipation of the situation by higher investments in these skills would have resulted in higher wages and lower demand. Theoretically, the actual skills shortages therefore provide the most adequate picture of the situation, although perceived skills shortages will reveal much of the underlying actual skills shortages.
Figure 1
A set of indicators for monitoring skills shortages

If firms compete for the scarce labour with the skills concerned, initially only wages will go up, without increasing supply. The combination of low supply with high wages therefore indicates a high wage skills shortage. Although in this situation perceived skills shortages will not point at any problem, such a wage competition does not solve the problem of underinvestment in education.

Finally, if employers are aware of the skills shortages, masked skills shortages indicated by policies to reduce the problem of skills shortages can be expected. It is therefore important to know whether additional adjustments took place to reduce the costs of the skills shortages. Such adjustments might be indicated by additional training of people with closely related skills, the occurrence of overtime work etc. These additional adjustments provide insight in the consequences of skills shortages, but also show employers’ creativity in solving the problems concerned.

In order to be able to monitor every type of skills shortages, and to distinguish between the forms the skills shortages might take the following set of indicators is proposed:

1. the quantitative shortage of skills
2. the quality of these skills
3. the costs at which the skills can be employed
4. the question whether employers perceive the shortages
5. the adjustment policies that employers take to reduce the costs of skills shortages.
References


