



Education-occupation mismatch and its effect on unemployment in Sweden

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Abstract

Educational investments are made with the expectation that the acquired skills and knowledge will be applied on the labour market. Matching education and occupations lead to lower unemployment and vacancy rates and higher productivity and wages, but several imperfections of the labour market hinder the matching process. Education-occupation mismatch has been found to be positively linked with the structural component of unemployment. This paper explores mismatch in Sweden from a macro level perspective. A Skill Mismatch Index (SMI) is constructed from county-level educational and occupational structures, based on three education/skill levels. It appears that from 2001 to 2011 mismatch has notably declined in all counties, mostly due to a constantly increasing share of higher education. The most part of the mismatch is indeed structural; little can be attributed to lack of geographical mobility. Regressions of unemployment on the SMI indicate that around 20% of the relative changes in skills mismatch are translated into relative changes in unemployment. This result is principally similar to the few previous works of the same approach. Education-occupation mismatch has been mostly researched on micro level, and thus using a SMI is the first step towards exploring macro-level mismatch and its links to unemployment. Future research could inter alia make use of a similar index based on educational fields instead of levels.

Keywords: education-occupation mismatch, skill mismatch, SMI, skill levels, structural unemployment

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I. Introduction

Education has a number of roles in the society, from cultural and social to economic and developmental. Most often, though, it is primarily seen as an investment with some expected rate of returns—in terms of future wages as well as the chances of finding a job, career opportunities, and labour market mobility. Not only that there is a general problem of uncertainty in estimating rates of return, it is also unrealistic to expect that the returns of certain types of education will remain unchanged over time (Hejke & Borghans 1998). In any case, it is logical to assume that the rate of returns is higher when more of the skills and knowledge obtained from a chosen educational program are used on the labour market. That means that an employee's education should match their occupation.

In addition to higher returns on educational investments, better matching of workers' education and occupations are associated with lower unemployment levels, less unfilled job positions, and higher productivity (Hejke 1996). The returns should not only be seen from an individual's but also from the society's perspective. This is why governments are also interested in the right kind of schooling choices and provide extensive funding to education. However, in a market economic context, the choices regarding education and occupation are in the end made by individuals. The problem is that the labour market has numerous imperfections and is not always able to reach equilibrium of demand and supply. The failures are most often related to the asymmetry or lack of adequate information; or the inflexibility of wages, which in theory are the intermediaries in moving towards equilibrium (Hejke 1996). As a result, there might be mismatch between labour demand and supply.

The problem of education-occupation mismatch can be explored in several ways. Firstly, we can distinguish the type of mismatch: vertical, in terms of the level of education (concepts of over- or undereducation), and horizontal, in terms of the field of education. Secondly, we can talk about mismatch among the employed, and mismatch with regard to the unemployed. The literature about mismatch among the employed mainly encompasses discussing methods to evaluate education-occupation match, and the effects of mismatch on an individual's labour market outcomes, most often in terms of wages (a good overview of both is given in e.g. Hartog (2000)).

As Nordin, Persson & Rooth (2010) note, considerably more has been done in exploring vertical mismatch, compared to horizontal.

The match between the regional educational level of the working-age population and the occupational requirements of the jobs in the region is analysed in this paper. This kind of a mismatch is a part of structural unemployment. Structural unemployment in turn is supposed to constitute the most part of the *natural rate of unemployment* that the economy would settle at in the long run in the absence of shocks (Orlandi 2012).

The natural rate of unemployment is often referred to as NAIRU/NAWRU (non-accelerating inflation/wage rate of unemployment). Those are based on the principal that unemployment and inflation (or wage) rates move in opposite directions due to monetary fluctuations (as expressed by the Phillips curve) (Ball & Mankiw 2002). The trend component is removed from the cycle component in unemployment rate series, thus obtaining the supposed natural rate of unemployment (Orlandi 2012). Exploring the determinants of NAIRU/NAWRU, it has in general been found that productivity has a negative effect on the natural unemployment rate (Ball & Mankiw 2002; Orlandi 2012). And given that education-occupation mismatch decreases productivity, it can be assumed to be positively associated with the natural rate of unemployment as well as (structural) unemployment in general.

The effect of mismatch on unemployment cannot directly be estimated with micro-data, simply for the reason that there is no individual match to be evaluated for an unemployed person. However, there are a few studies of using aggregate data (with regions as units) to this end. That includes observing the educational and occupational structures in regions and calculating the so-called skill mismatch index (SMI). The index is particularly useful to observe changes over time and differences between regions, but can also be used in regressions. This has been done by the European Central Bank (ECB 2012) using Euro area country-level data, the European Commission (EC 2011) using EU country-level data, and Estevão and Tsounta (2011) using US state-level data. In all cases, a significant link between mismatch and the structural component of unemployment are found.

This paper has two aims. The first is to explore vertical skills mismatch in Sweden. It appears that the skill mismatch situation has been improving at least since 2001, on contrary to a lot of

other European countries. The second aim is to investigate the effect of education-occupation mismatch on unemployment, using aggregate data. Unemployment rates are regressed on the SMI-s calculated from the educational and occupational structures of the 21 Swedish counties for the years 2001–2010 (including a number of controls). The end result turns out to be significant and in accordance with the above-mentioned studies—a greater extent of mismatch translates into a higher level of unemployment.

It must be acknowledged that the model here is not precisely the same as the above-mentioned. First of all, the control variables are somewhat different. Secondly, a difference from ECB is that when calculating the SMI, this model uses the educational structure of the whole working-age population, whereas in their paper data on the educational structure of the labour force has been used. Arguably, this would be a more precise method, but in fact ECB's own robustness checks confirmed the results remain principally the same, regardless of the exact calculation of the SMI.

The structure of this paper is as follows. Section II presents some previous empirical research with regard to education-occupation mismatch. Section III builds a theoretical framework of mismatch and the mechanisms behind its occurrence. The data and model are explained in Section IV, along with discussing their flaws. The results are presented and discussed in Section V. Finally, section VI concludes.

II. Previous empirical work

A large literature concerning education-occupation mismatch concentrates on evaluating the effect of mismatch on income, using micro-level data. A great overview with regard to vertical mismatch is given by Hartog (2000) who has surveyed numerous empirical works conducted in five developed countries (the USA, the UK, the Netherlands, Portugal and Spain). Those use the so-called ORU (over-, required and undereducation) specification, where wages are regressed on variables showing the required years of schooling and numbers of years of excess or missing schooling (difference between attained and required education in years). Generally, the return to overeducation is smaller than that to required schooling, but the penalty for undereducation is lesser in magnitude (Hartog 2000).

Considerably less has been researched on horizontal mismatch, mostly because it is even more complicated to evaluate it. Substantial, and pioneering, work in this field has been done on US data by Robst (e.g. 2007a, 2007b, 2008), who includes dummy variables of either partial or complete mismatch into Mincer-type wage equations. The same approach has been used by Nordin, Persson & Rooth (2010) on Swedish data. It appears that horizontal mismatch is somewhat more penalised than vertical.

An interesting look at the effect of mismatch on labour market outcomes from a sociological perspective has been presented by Wolbers (2003). He examines the occupational status of school-leavers in thirteen EU countries, based on the International Socio-Economic Index (ISEI). As stated by its constructors, Ganzeboom, de Graaf & Treiman (1992, p. 9), the ISEI measures "...the attributes of occupations that convert a person's main resource (education) into a person's main reward (income)." Its calculation (by the means of regression) is based on standardised data on income, education and age, grouped by occupations, and it yields in principal an index of socio-economic status. Wolbers (2003) finds that the ISEI is on average lower in the case of a mismatched field of education. This is in accordance with the literature on the direct penalties of mismatch on income.

The effect of mismatch on (the probability of) unemployment cannot be directly estimated with micro data, as unemployed people do not have a current match status. An alternative approach is

using aggregate data to find direct relations between unemployment levels and the extent on mismatch, using sectors, municipalities, countries, etc. as units of observation in a panel. The latest comprehensive work using aggregate level skill mismatch indices¹ has been published by the European Central Bank (ECB 2012). Apparently, the extent of skill mismatch has increased in the euro area during the latest crisis (the Great Recession) and skill mismatch indicators are associated with differences in the structural component of unemployment, which has also been growing. It appears the problem is caused mainly by differences in labour demand and supply, rather than lack of geographical mobility. The policy conclusions drawn from this is that wages should be more flexible to allow for sectoral reallocation; and that higher wage differentiation between job types would contribute to proper matching workers with jobs. In addition, active labour market policies such as retraining are highly recommended (ECB 2012).

The approach of the ECB is inspired by Estevão and Tsounta (2011) who explore the effects of skill mismatch on unemployment in US states during the Great Recession. Their results suggest that mismatch is related to higher (structural) unemployment rates on state level, even after removing cyclical effects. That is because while some sectors just had to deal with a contraction of the business cycle, others were hit considerably harder (particularly the housing sector), resulting in the need for some workers to move away from the strongly depressed activities, and possibly also states. They warn that the increases in unemployment benefits granted by the government hinder job search intensity, thus making it more probable for geographic and skill mismatches to persist. Instead, they, too, suggest paying attention to active labour market policies, such as subsidies to retraining and hiring the long-term unemployed, and improving employment and job search services (Estevão and Tsounta 2011).

Another paper following the methodology of Estevão and Tsounta (2011), but using data for just Belgium, is Zimmer² (2012). The results show that job seekers do not have the qualifications required by employers. In addition, there are large differences in unemployment rates between regions, which should theoretically be alleviated by labour mobility. However, commuting between north and south regions is modest; only Brussels has a high level of commuting workers.

¹ The construction of a skill mismatch index will be explained in more detail in Section IV. The earliest instance of using such an index that the author of the herein paper was able to track down is Peters (2000).

² In fact, this has been written interrelatedly with the ECB (2012) report, but examines regions within one country, as opposed to countries/states in a union.

At the same time the skill mismatch index is highest there as well, with the majority of jobs requiring high-skilled workers, yet there being a shortage of them in Brussels. The paper concludes that the mobility problem is apparent, but qualification and skill mismatches are even more prevalent (Zimmer 2012).

Finally, a similar cross-country analysis, that includes Sweden in the data sample and thus could give some kind of a comparison background to the results of this paper, is included in the European Economic Forecast of autumn 2011 by the European Commission (EC 2011). Unfortunately the part on the effects of skills mismatch on unemployment (again using the SMI) is very brief and not very detailed. It again confirms the positive association between the two, with an especially strong effect during the Great Recession. As for specific information about Sweden, it appears to have been among the countries where the SMI increased the most during the crisis³ (although still remaining one of the lowest among the 27 EU member states) (EC 2011).

As it appears, the SMI has not been used too extensively so far. However, the results of the few studies that have are significant and suggest that there indeed is a positive link between education-occupation mismatch and unemployment. This verifies the measure's usefulness and encourages using the SMI in further research with regard to (structural) unemployment.

³ The increase reported by the EC took place between 2007 and 2010. It is to be kept in mind that the general trend in Sweden is a declining one during the period under observation in this paper, i.e. 2001–2011.

III. Theoretical background

As seen from the previous section, mismatch has a negative impact on labour market outcomes. The following theoretical framework explains in more detail the relations between education-occupation mismatch and unemployment. It gives an overview of how people start out with making decisions on educational investments and might end up in structural unemployment. There are also other problems both on the individual and the societal level. To understand the consequences and reasons of mismatch is also essential for policy-making purposes.

Neugart and Schömann (2002, p. 1) note that to have a prosperous economy, "...education, training and lifelong learning policies must respond to shifts in the demand for skills and qualifications flexibly, and in due time. ... An adequately trained and educated workforce will contribute to individual wealth, will make firms more competitive and is to the advantage of societies at large because of large spill-over effects." At the same time they state it is generally agreed that vocational training, higher education and further training are all important but it is hard to justify why one of those should be prioritised over the others (Neugart & Schömann 2002). That is because the proportions of different types of education and skill sets that are needed depend on the structure of the economy.

As education contributes not only to individual but also social welfare, it is understandable that it is often largely financed by governments. As Hejke (1996) notes, governments expect a certain social return to education, which includes that the qualifications invested in can actually be applied on the labour market. This has the purpose of, on the one hand, minimizing unemployment, and, on the other hand, fulfilling job posts with adequately qualified employees whose skills and knowledge enable the highest possible productivity (Hejke 1996).

Regardless of how much certain levels or fields of education are financially supported by the government, every student has to make individual investments as well—possibly by paying tuition fees, but definitely in terms of time. Even though enough papers have proved that more education leads to higher earnings (see e.g. the overview in Hartog (2000)), as well as better chances of re-employment and possibly a lower risk of unemployment (see e.g. Riddell & Xueda 2011), it seems unreasonable that everyone should obtain a university degree. Firstly, not all people have the abilities for that. Secondly, investments into education compete with other

government investments and that means there are not enough resources to provide a higher education to everyone. Thirdly, as noted above, the structure of the economy requires different jobs to be performed, so employing overeducated people would mean wasting educational resources.

As Heijke and Borghans (1998) explain, an educational investment traditionally constitutes a choice of an educational course. That means both the field of study and the level of education. In the end, the labour market position would be determined by both the interplay of supply and demand on a submarket, and by the extent to which an individual has acquired the skills for the occupation concerned (Hejke & Borghans 1998). This is following the so-called assignment theory. There are jobs with different tasks and potential employees with different characteristics; and matching the right workers and jobs determines the overall productivity of the economy. Workers maximise their utility by choosing jobs that suit their characteristics, while wages supposedly act as intermediaries that guide each worker towards their optimal job (Sattinger 1993).

But in practice, we often cannot observe this kind of adjustment to equilibrium, because the labour market displays a number of imperfections. The main obstacles, as listed by Heijke (1996), are inflexible wage structures, limitations in substitution between submarkets, high adjustment costs, several institutions that provide protection and security, and shortfalls in the market information available to all participants.

For instance, different wage bargaining systems may slow down the adjustment of supply and demand on the labour market, e.g. collective agreements that fix the wages for a year or two in advance. Often, there are minimum wage rates that restrict the lowering of wages in declining industries, leading to hindered mobility towards growing sectors (Neugart & Schömann 2002). Another factor that decreases mobility between sectors is the non-willingness of workers to move from a high-wage but declining sector to a growing one that currently has lower wages. In fact, they might opt for staying unemployed instead of accepting a lower paid job right away (Hall 1975). This can also be the case if workers simply are not aware of the on-going structural changes in the economy but think that the decline in demand for certain skills or education is just temporary and related to the business cycle (Neugart & Schömann 2002).

High hiring and firing costs on the employers' side and high job search costs on the workers' side may hinder the matching process. This may induce both sides to settle for a not-so-perfect match. Also, firms might keep employees with the wrong qualifications because it seems more costly to replace them, whereas in reality they lose in productivity; and job searchers might opt for staying unemployed instead of making an effort to search, especially when unemployment benefits are generous. On the other hand, it has also been argued that receiving unemployment benefits eases the situation of individuals and gives them time to find a better match (Lauringson 2012).

A very important reason for labour market mismatch is that people do not have adequate information when making their educational and/or occupational decisions. Often, the available information is retrospective, whereas information on the prospects of the labour market is considerably more difficult to obtain. However, labour market conditions might change between enrolling in a study program and graduation. For a certain type of education, finding a job might turn out to be harder or wages lower than expected (Neugart & Schömann 2002). This is because the structure of the economy and thus the demand for labour might have changed during studies, which might as well happen also during employment. As a result, the supply of labour does not correspond to the current requirements of the economy.

The situation of mismatch between the demand and supply of labour, particularly in terms of skills (but possibly also geographical location) is defined as structural unemployment. This type of unemployment indicates that a structurally unemployed person does not find a job even if the economy is expanding (Aysun, Bouvet & Hofler 2012). Simply put, it means that there is a part of the labour force which cannot put its skills into use because those skills do not match the structure of the economy. It can also occur that certain skills are in excess on one regional labour market, but in shortage on another. This kind of situation could in principal be solved with labour mobility, but if that for some reason (moving costs, personal preferences, wage rigidities, etc.) is hindered, it also contributes to structural unemployment. The mismatch part is considerably harder to solve, making it difficult to tackle structural unemployment in general. Compared to cyclical unemployment, which could be reduced by stimulating effective demand, decreasing

structural unemployment requires a change in the supply side⁴, i.e. educational investments (Black, Hashimzade & Myles 2008).

Structural unemployment is in fact considered to be the natural rate of unemployment in a general equilibrium state which embeds the real structures of both labour and commodity markets, including market imperfections, stochasticity in demands and supplies, information costs, mobility costs, etc. At the same time, this natural rate is not unchangeable but can be influenced by man-made factors (Friedman 1968). It is only natural to expect that we would prefer rather a lower than a higher natural rate of unemployment, as unemployment is mostly an unwelcome state from the perspective of an individual, and definitely unwelcome for the society. It not only means educational investments going to waste, but also increased public expenditure on social security for the unemployed; at the same time, unfilled job posts mean losses in production (Heijke 1996).

⁴ Trying to manipulate the structure of the demand side is generally ore difficult since it would require planning sectoral developments.

IV. Method

1. Model and data

The model used in this paper basically follows Estevão & Tsounta (2011), making use of the skill mismatch index (SMI) on a macro level. The idea is to regress variation in unemployment rate on variations in SMI and output growth. In addition, some demographic controls are included, as well as year and county dummies. Thus, the model takes the following shape.

$$u_{it} = b_0 + b_1 SMI_{it} + b_2 y_{it} + b_3 X_{it} + \eta_i + \gamma_t + \varepsilon_{it}$$

where i and t refer to county and year, respectively;

u_{it} is the (log of) unemployment rate;

SMI_{it} is the (log of) skill mismatch index;

y_{it} is the (log of) output (per capita);

X_{it} represents a vector of control variables;

η_i represents individual county effects;

γ_t represents year effects;

ε_{it} is the error term.

A number of different specifications of the model have been explored, and the baseline equation includes just the age and sex composition of counties in vector X_{it} . One specification excludes the productivity proxy, GDP per capita. The remaining two specifications control for educational and occupational compositions of counties, respectively.

The skill mismatch index is calculated, using the following formula.

$$SMI_{it} = \sum_{j=1}^3 (S_{ijt} - D_{ijt})^2$$

where i and t refer to county and year, and j is the skill level (primary, secondary or tertiary),

S_{ijt} is the share of the working age population with skill level j ; and

D_{ijt} is the share of workers in occupations that require skill level j .

This study makes use of data from Statistics Sweden and Arbetsförmedlingen (the National Labour Market Board). It is a panel of 21 counties over 11 years (2001 to 2011), altogether 221

observations. The original variables include unemployment rate, educational attainment in terms of the level of education of the working age population, occupational groups of the employed population, sex and age composition of the working age population, and GDP per capita (for details see Appendix A).

The variables for education (seven levels) and occupation (nine groups) have both been aggregated to three matching categories. The levels of education follow the International Standard Classification of Education (ISCED97) and the occupational groups are based on the International Standard Classification of Occupations (ISCO88). In general, workers on high-skilled positions are required to have tertiary level education; medium-skilled positions require secondary education, and low-skilled occupations suffice from primary education. The precise correspondence can be seen in Table 1.

Table 1. Correspondence of major occupational groups and educational qualifications, adjusted for Sweden

ISCO88 major group	Education required	Category
1. Legislators, senior officials and managers 2. Professionals 3. Technicians and associate professionals	Post-graduate education (ISCED97 6); Post-secondary education 3 years or more (ISCED97 5A); Post-secondary education, less than 3 years (ISCED97 4+5B)	High-skilled occupations / tertiary education
4. Clerks 5. Service workers and shop and market sales workers 6. Skilled agricultural and fishery workers 7. Craft and related workers 8. Plant and machine operators and assemblers	Upper secondary education 3 years (ISCED97 3A); Upper secondary education, 2 years or less (ISCED97 3C); Primary and secondary education 9-10 years (ISCED97 2)	Semi-skilled occupations / secondary education
9. Elementary occupations	Primary and secondary education less than 9 years (ISCED97 1)	Low-skilled occupations / primary education
10. Armed forces	No specification given ⁵	–

Source: Author's composition based on Elias (1997), ILO (*sine anno*), Halldén (2008)

⁵ As the armed forces are very difficult to match with educational levels, this group has been excluded from the sample in this paper.

Originally, ISCED level 4 should be matched with ISCO major groups 4 to 8 (medium-skilled level), but the data available from Statistics Sweden has aggregated levels 4 and 5B. However, as 5B is tertiary and 4 is a post-secondary level, the joint category has been set to match ISCO major groups 1 to 3 here. Also, it will henceforth be referred to as tertiary level education.

2. Potential problems

With regard to micro data, there are in general three ways to assess whether an employee's education matches their occupation (Hartog 2000): job analysis conducted by professional job analysts; workers' self-assessment; and realised matches, based on the mean or mode education that workers in a certain occupation usually have. One opportunity for obtaining information on aggregate level would be to sum up micro-level data, but this is rather time- and resource-consuming, because first, each individual needs to be assessed separately. Another option is to observe the job structure of the economy and the educational structure of people—it would fall into the category of job analysis, but on macro level.

In this paper, this has been done based on the ISCED-ISCO correspondence. It is possible to calculate crude differences in education types demanded and supplied, percentage-wise. It should be noted that we are actually calculating the lower bounds of the size of the gaps. For example, if we observe that the share of people holding a university/college degree is 25%, but 40% of the existing jobs would require a tertiary education, then we can assume a 15% shortage of that level of education. Therefore, at least 15% of the workers would be mismatched. However, if there is also a kind of 'switch' so that out of those 25% of highly educated people, 5% are in reality holding jobs that require only secondary education, and at the same time, 5% of jobs requiring tertiary education are held by people with a lower education level, then the overall level of mismatch would be even larger. Therefore, the real situation of mismatch might be even worse than the SMI shows. That 'hidden' part of mismatch might very well have to do with regional location—even though workers with a suitable education exist in the country, they are located in different regions than the firms that need them. Other than that, it would be reasonable to assume that employers do not hire workers with the wrong type of education if the right type was available.

Furthermore, determining the correspondence of education and occupation on formal criteria is always somewhat vague, because even if formally there is a mismatch between the completed education and the job post, the person might still be adequate to perform their tasks due to on-job or off-job trainings, experience, etc. (ILO 1990). At the same time, workers who formally seem to be matched might have work-related shortcomings because of the differences in curricula or the quality of curricula, or the specifics and developments in firms that they have not been able to adjust to. Some authors argue it is important to distinguish between skill mismatch and qualification mismatch (see e.g. Allen & van der Velden 2001), but at the most general level, qualifications should (by definition) be proxies for skills, justifying the extensive amount of research that is based on formal matches.

One issue with the herein data and model set-up is representativeness. The demand for labour is approximated by the structure of fulfilled job posts, while a more precise approach would be to include the structure of vacancies as well. However, this data is not available as a time series. For the supply side, the educational structure of the whole 16–74-year-old population is used, whereas it might be argued it is more accurate to use just those who are economically active. On the one hand, the active population constitutes the supply of labour that is readily available. On the other hand, it is subject to discussion how ready are people to transfer from the active to the inactive state and *vice versa*, and if we assume this willingness to be relatively high, then we can still see the whole working-age population as a potential labour supply. For instance, long (structural) unemployment spells might easily induce people to leave the labour force⁶. Another argument for the use of the whole population is that investments into the qualifications that they are holding have already been made, and we can then evaluate the gaps between the actual and the desirable structure of educational investments.

The ECB (2012) baseline SMI calculations use the occupational structure of the employed to represent skill demand, and the educational structure of the active population for skill supply. Due to access to very good micro level data, they were also able to perform robustness checks by altering the calculation of the SMI slightly (for instance, including just the unemployed for skill

⁶ The so-called discouraged workers are not included in official labour force statistics because they are not actively searching for a job, but they are in fact inclined and available to work, and are thus an important group with regard to the supply of jobs on the labour market (ILO 2013).

supply, and only recently created jobs for skill demand); and in the end they found the results to be quite robust to alternative definitions of the SMI. In addition, the original model by Estevão & Tsounta (2011) used the educational structure of the whole population as well. Thus, the choice between the working-age population and just the labour force should not matter much, and here the former has been used.

The dataset is relatively small as educational and occupational data were available from 2001 to 2011, so the observations on the changes in SMI cover 11 years. Apparently, before 2001 the Swedish Educational Terminology (SUN) for education levels was not yet in accordance with the ISCED97 classification. The regression to explore links between unemployment and skills mismatch uses just 10 years because county-level GDP data was available only up to 2010. Still, the different specifications of the model mostly yield significant coefficients.

Statistics Sweden notes that educational data may be incomplete for a small number of people, e.g. with degrees from abroad, private degrees, or old degrees. If the analysis was on a very detailed level, this could turn out to be a problem. But the author believes that it has hardly any effect on the proportions of educational levels used here, because only three categories are used and those are large enough to be unaffected by such minor gaps in the data.

Lastly, it would of course be great to evaluate the effect of mismatch on structural unemployment directly. But it is hard to empirically separate structural unemployment from frictional and cyclical unemployment (Aysun, Bouvet & Hofler 2012), and this ambition would go beyond the reach of this paper. However, this separation is actually not necessary if we just keep in mind the reasoning behind education-occupation mismatch leading to structural unemployment, which in turn raises the overall unemployment rate.

V. Results

1. Developments of skills mismatch

As can be seen from Figure 1, SMI⁷ has generally been decreasing in Sweden between 2001 and 2011, both on national and county level. That means the situation has considerably improved within just a decade, especially compared with e.g. the euro area, where mismatch problems have on the contrary become more extensive (ECB 2012). The decrease in mismatch can largely be attributed to the fact that the share of people with tertiary education has been increasing considerably, thus decreasing the shortage of high-skilled employees, which constitutes the largest part of the overall mismatch in Sweden⁸. There is a very apparent ‘bump’ in 2009, indicating that the crisis had a negative effect on the education-occupation match in Sweden (this is in accordance with the findings of the EC (2011)). As the supply side of the labour market reacts with a lag, it is safe to assume this had to do with shocks in the occupational rather than educational structure. However, in 2010 and 2011, the index continued its downward trend again.

Variation in the level of SMI between counties is indeed large⁹. Very roughly put, in most counties the index has steadily come down from around 250–350 in 2001 to around 150–250 in 2011. At the same time the ranking of counties based on the index has remained more or less the same.

There are two extremely distinct outliers in the sample. First, in Stockholm county the SMI in 2001 was almost twice as high as the Swedish average, and it was ‘leading’ by far compared to all other counties. It appears that compared to other counties, the share of high-skilled occupations is somewhat larger and the share of medium-skilled occupations is lower. At the same time, the decrease of mismatch has been more substantial and by 2011 the SMI had dropped to the level of the second worst county (Västernorrland). This convergence might have

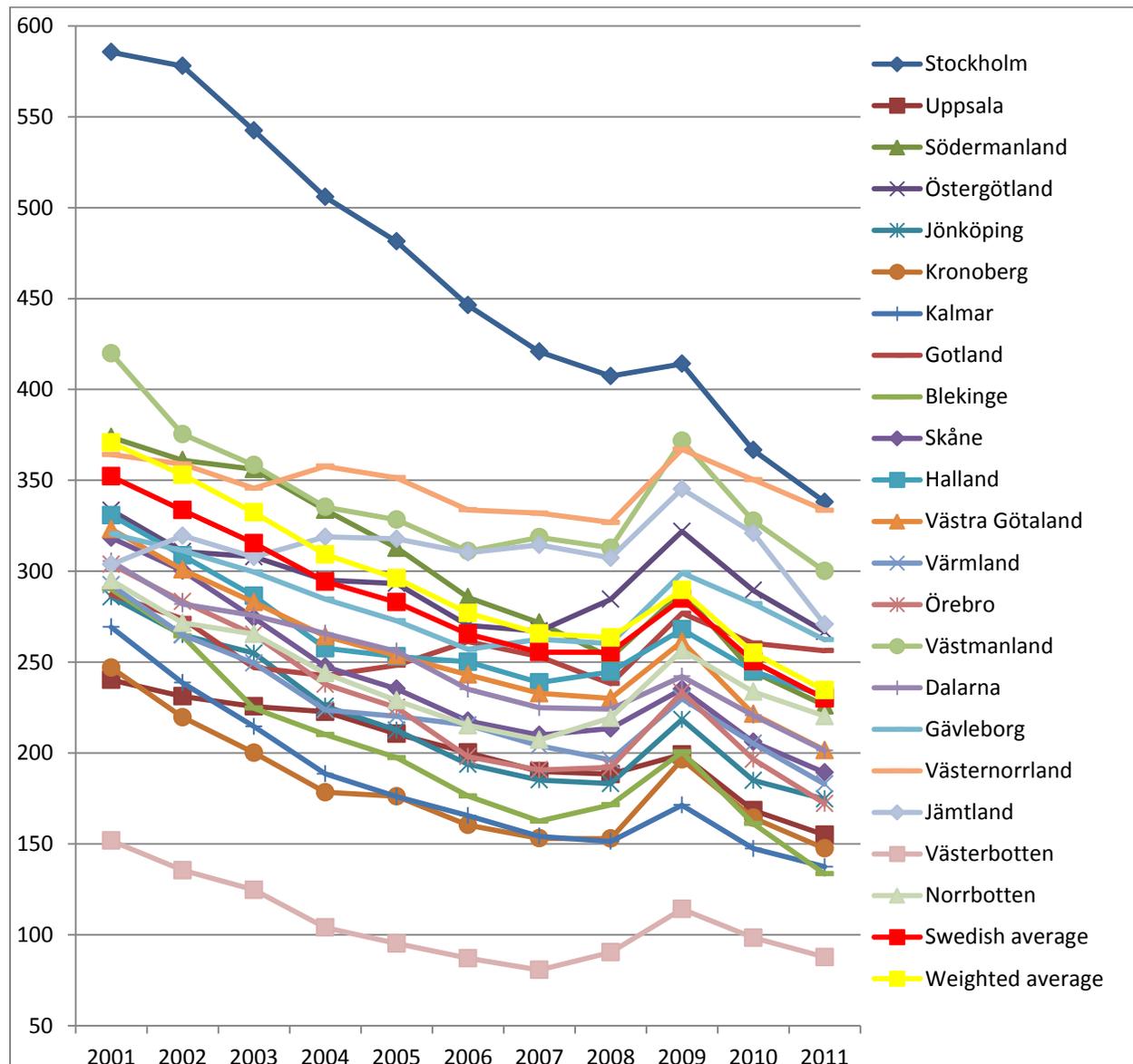
⁷ To give insight on the scale of the SMI values: in this paper the calculations are based on differences between supply and demand measured in percentage points, yielding quite large index values in the end. As the scale depends on e.g. whether the researcher chooses per cent or fractions as ‘units’, comparison of the absolute index values in different papers might not be possible.

⁸ See Appendix B for data on yearly average educational and occupational shares and gaps.

⁹ This does not affect the regression results though, as county effects are controlled for in the model.

occurred because generally in Sweden there has been an increase in tertiary education and a decrease in primary education, but in Stockholm county there has also been a notable decrease in secondary education. Thus, the gaps on each level have been closing a little, and this trend is the strongest for Stockholm county. Second, Västerbotten county has had a considerably lower index compared to any other county throughout the whole sample period. It started out at 150 in 2001, which is a level most counties could not reach even by 2011, and ended up at about 90, which is just two fifths of the average and only a quarter of the highest SMI values observed in 2011.

Figure 1. SMI trends in Sweden from 2001 to 2011



Source: Author's calculations based on data from Statistics Sweden

As for differences from the general trend, Västernorrland and Jämtland counties have been retaining a rather even (and relatively high) level of SMI, the latter actually starting out below average but ending up among the largest SMI values in 2011. On contrary, Södermanland county was the third worst in the beginning, but went through a steeper-than-average decline and reached just under the average level by the end of the observation period. Lastly, to point out some other best and worst performers, Västmanland county has constantly been among the highest SMI values as well. The lowest values, in addition to Västerbotten county, have quite steadily belonged to Kalmar, Kronoberg, Blekinge and Uppsala counties.

In the spirit of the ECB (2012), a weighted average (using the number of employed people as weights) of the SMI has been calculated as well. If this is similar to the country-level average SMI, it means that the type of mismatches is rather homogeneous across counties. However, if the country-level average is lower than the weighted SMI, we can deduce that perfect mobility between regions would solve a part of the mismatch. Thus, the difference between the two indices conveys the extent of mismatch that is arising from mobility problems (ECB 2012). It can be seen from Figure 1 that the weighted average started out being slightly higher than the country average in 2001, but came down from a 19-point difference to just a 5-point difference already by 2009, and from then on the two indices were principally the same. We can conclude that mobility was not a very big problem already in the beginning of the sample period, and has become even lesser, indicating a greater integration between regional labour markets. Therefore, the existing mismatch is much more structural than geographical.

2. Effect of skills mismatch on unemployment

Regression results of unemployment on the SMI with a number of control variables, including GDP per capita, are presented in Table 2. Different sets of control variables were included, and four settings have been presented here. The baseline model, (2), is closest to that used by the ECB (2012) (with the exception of added demographic controls). Regardless of the choice of controls, there is a significant positive association between skills mismatch and unemployment. The coefficient of SMI is relatively robust to different controls. A 1% increase in SMI brings about a 0.17–0.26% increase in unemployment. For comparison, this effect is a bit smaller than in the euro area, where according to the ECB (2012) about a third of the changes in mismatch translate into changes in the unemployment rate.

Table 2. Effect of skill mismatch on unemployment

	Dependent variable: unemployment			
	(1)	(2)	(3)	(4)
SMI	0.232*** (0.004)	0.206** (0.018)	0.167* (0.060)	0.257*** (0.009)
GDP per capita		-0.307* (0.074)	-0.387** (0.024)	-0.257 (0.120)
Tertiary education			-1.419** (0.025)	
Secondary education			-1.018 (0.101)	
Primary education			1.452*** (0.000)	
High-skilled occupations				-1.373*** (0.005)
Medium-skilled occupations				-0.747* (0.059)
Low-skilled occupations				0.411*** (0.009)
Constant	-2.908 (0.703)	4.278 (0.602)	22.774** (0.034)	22.388*** (0.010)
Observations	231	210	210	210
Adjusted R-squared	0.942	0.945	0.949	0.952

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. P-values are provided in parentheses. All variables are in log form. The education and occupations controls are logs of the number of people in the respective categories. All specifications include county and year dummies as well as controls for age and sex composition (none of which is reported here).

Regarding the links between GDP per capita (which is a proxy for productivity) and unemployment, they turn out to be significant for two out of the three specifications. The signs of the coefficients are all logical, indicating a negative relation as would be expected; and they are also quite large in size (a 1% increase in GDP means on average a 0.3–0.4% decrease in unemployment). So the findings confirm the relations between productivity and (structural) unemployment that previous empirical work has established (see Section II above). When excluding GDP from the model (1), the coefficient of SMI is somewhat larger (0.232) compared to the baseline model (0.206). This confirms that productivity plays a part in the effect of skills mismatch on unemployment.

As for demographic variables (not reported in the table), the age and sex composition¹⁰ in counties matters occasionally, with the coefficients for the share of male working-age population and the shares of age groups 55–64 and 65–74 appearing significant in some specifications. However, without including age and sex composition variables, the coefficients for the SMI were insignificant, and also yielded illogical (negative) signs for two out of the four specifications. This indicates age and gender structures in this sample affect unemployment to such an extent that without controlling for them the effects of the SMI are impossible to pin down.

Specifications (3) and (4) include the educational composition and the occupational composition as controls, respectively¹¹. Both turn out to have a significant effect on unemployment. Interestingly, both for education and occupation, an increase in the share of high or in the share of medium skill level would decrease unemployment, whereas a rise in the share of low-skilled education or occupations would increase unemployment. But what is really noteworthy is the change in the coefficient for SMI depending on which one out of the two is controlled for.

In specification (2) that includes both demographic variables and GDP as controls, the coefficient for SMI is 0.206. When also controlling for education (3), it shrinks to 0.167. This means that part of the apparent effect of SMI on unemployment can be explained by the educational structure of the working-age population (which has been shifting towards higher education levels). Not considering educational differences leads to an upward bias of the SMI effect. On the contrary, when controlling for occupations (4), the effect of SMI on unemployment increases to 0.257, indicating a downward bias in the SMI effect in specification (2). This could be attributed to opposite-signed relations with SMI. Higher education levels are negatively, but the prevalence of higher-skilled occupations is positively linked with skills mismatch (when controlling for demographic variables). Considering the two opposite biases and their extent, it might be assumed that the elasticity coefficient of SMI to unemployment is actually close to 0.2.

¹⁰ The share of foreign population was also controlled for initially, but did not have any effect in any of the specifications, and was thus excluded altogether.

¹¹ Controlling for both at the same time yielded illogical coefficient signs. This is not unexpected because the SMI is based on educational and occupational structures and we cannot keep them both constant in a specification where we expect the SMI to vary.

3. Discussion

All in all, based on the regression results, it seems that unemployment levels can be influenced by education-occupation mismatch. From the SMI analysis it appeared that the structural part of mismatch is substantial compared to the geographical part, so there is not very much room for decreasing the extent of mismatch through increased mobility. Rather the supply and demand of education should be examined.

In an international comparison, Sweden's investments into education are notably above average. Government expenditure on education constituted 7.3% of the GDP in 2012 while the OECD average was 5.8%—and this has been roughly the same level for years. All education levels up to post-secondary are publicly funded, as well as 90% of tertiary education (OECD 2012b). However, there are limited study places in each programme (in non-compulsory education), so the educational structure can be affected with targeted funding of certain programmes. This might help explain the decrease in mismatch.

Another aspect is active labour market policies (ALMP's)¹², on which Sweden has been spending almost twice as much as the OECD average (from 0.9% to 1.2% of GDP in 2003–2010, according to OECD (2012a)). Those include a very personal approach to each unemployed person with regard to assessment and counselling; work trainings and placements; and employment subsidies. Apparently, the emphasis has shifted towards individual matching and coaching activities, whereas the share of people participating in trainings has considerably decreased since 2001 (Bengtsson 2012). This is in line with a decrease in structural mismatch, suggesting that the initial educational decisions have been made quite well and it is more a matter of helping employers and workers find each other.

There is a high level of union coverage (although declining, e.g. from 81% in 2000 to 70% in 2011) and collective agreements (over 90% of workers) in Sweden. Collective bargaining happens mostly on sectoral level, but has in the recent decade started to become more decentralised, with the social partners delegating negotiation power to the company level. As most of the labour market is covered with collective agreements, there is no national minimum wage—those are negotiated between social partners at sectoral level (Eurofound 2012). As noted

¹² See e.g. Bengtsson (2012) for a good overview of the different measures that have been and are used.

earlier (see Section III), national minimum wages might hinder the lowering of wages in declining sectors, thus interfering with the adjustment of labour demand and supply, but the existence of sectoral minimum wages might have an opposite effect, provided that the social partners take a realistic approach towards the sector's future prospects. In addition, moving negotiations towards a more local level has probably made the labour market more flexible in terms of the adjustment process.

As a big part of the mismatch problem arises from inadequate information, it is useful to try to make the labour market more transparent. Labour market forecasting serves precisely that purpose. In its starting times (1960s) it was often used as a planning instrument to enforce an educational structure that would help reach a certain economic output. Nowadays it is more used for providing information about the likely developments on the labour market, thus helping to make educational decisions. It is useful for active labour market policies as well, for instance regarding retraining (Willems 1996; Heijke 1996). Forecasts help enhance occupational mobility for those already holding a job (but e.g. being mismatched) or attempting to re-enter the labour market (Neugart & Schömann 2002).

Labour market forecasts have been made in Sweden for more than 40 years, mainly by Statistics Sweden and the National Labour Market Board (Arbetsförmedlingen). As the common problem with any forecasting is that the longer the perspective, the more uncertainty it includes, Swedish institutions address this by making projections for different time periods (1–3 years, 7–8 years and 15–20 years, and the short-term forecasts are even made on county level) (Lindskog 2003). Unfortunately, the author could not find any comments on the realised accuracy of the forecasts, but with such a long-time experience their quality is supposedly rather high.

Lastly, as the comparison of country-level aggregate average and weighted average SMI-s indicated a small extent of geographical mismatch, it would be interesting to have an insight to mobility. To analyse the permanent moving patterns of people would go beyond the scope of this paper. But data on commuters reveals that commuting levels are quite low in the majority of counties (with just 3–7% of the employed working in another county, according to data from Statistics Sweden), which might support the assumption that mismatch is not so much geographical as it is structural—otherwise it would be likely that employers and workers try to solve macro level mismatch problems with extensive commuting.

VI. Conclusion

This paper examined skills mismatch in Swedish counties from 2001 to 2011, and its effect on unemployment levels. Judging by the skills mismatch index (SMI) calculated from educational and occupational structures, mismatch has been decreasing in all Swedish counties. In large part this can be attributed to the continuous increase in the share of people with tertiary education, closing the gap on the high skill level which contributes to the mismatch index the most, compared to medium and low skill levels.

The SMI can also be used to evaluate the extent of geographical mismatch in educational and occupational structures. For this, the country-level SMI and a weighted average of county-level SMIs are compared. If there is a shortage of a skill level in one county and a surplus of the same skill level in another, then the weighted SMI would be larger than the aggregate SMI, because county-level gaps would balance out in the country-level index. The two indices are very similar for Sweden though, indicating that the problem is structural rather than geographical.

Regression of unemployment on the SMI yields an elasticity of 0.21, which is a little smaller compared to what was found by the ECB for the euro area (around 0.35), but still similar in magnitude. An interesting phenomenon is that when controlling for educational structure, we seem to overestimate the mismatch effect (coefficient drops to 0.17); but when controlling for occupational structure, we underestimate it (coefficient increases to 0.26). With the two biases offsetting each other we might assume that the real effect is somewhere close to 0.2—thus, a fifth of the relative change in the SMI transfers to relative changes in the unemployment rate.

The good developments of the Swedish SMI are indeed impressive. Sweden invests a lot into education, and almost all study programmes are financed by the government. By determining the number of study places, the educational structure can be influenced through policy to match the developments in the economy. In addition, several national institutions provide thorough labour market forecasts, which facilitate informed educational choices. An aspect that should theoretically hinder the matching process is the extensive union and collective agreement coverage in Sweden, which makes wages more inflexible and thus slows down the adjustment of supply and demand. However, negotiations between social partners have been moving towards local levels, which might have enabled more flexibility. In addition, the existence of sectoral

instead of a national minimum wage could have helped signal the structural changes in the economy, thus contributing to educational decisions that match the needs of the labour market.

So far, such a macro-level method of investigating the effects of mismatch has not been used extensively. As mentioned, this method of calculating the SMI from educational and occupational structures gives the lower bounds of individual mismatch. It would be interesting to conduct a similar analysis where county-level data has been obtained from micro data, and check the robustness of results when the actual extent of mismatch is used. However, the aggregate approach used here gives a slightly different perspective. It examines the actual structural gaps, i.e. mismatch that arises from the lack of a match (in the region) and not from shortcomings in the individual matching process (so that the worker and the vacancy do not find each other). Finally, a principal development of this kind of research would be to adapt the SMI to educational fields instead of levels, and/or the combination of the two. As even simply using three skill levels is not straightforward, this can pose quite a challenge, but would reward in an immense amount of information on education-occupation mismatch and its links to (structural) unemployment.

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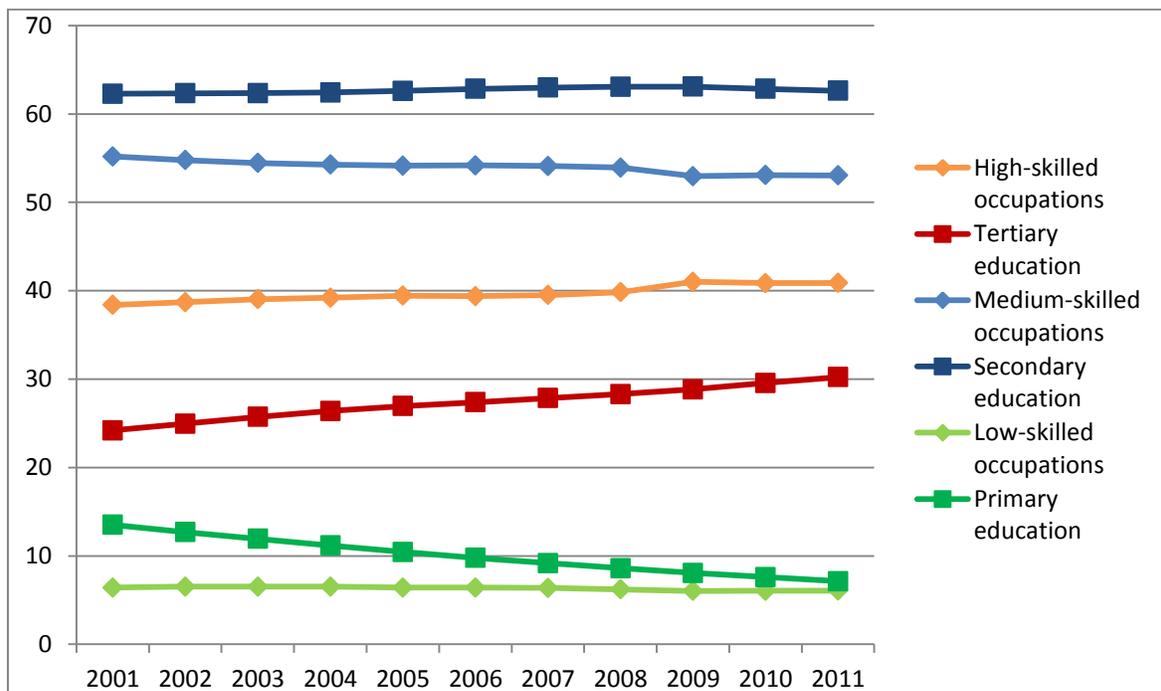
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Appendix A. Source variables

- Occupational structure obtained from Statistics Sweden database (Labour market – The Swedish Occupational Register – Employed population 16-64 years by region of residence – Employed population 16-64 years by region of residence (SSYK3)). Years 2001 to 2011, excluding occupations in the armed forces.
- Educational structure, sex and age compositions (10-year groups) obtained from Statistics Sweden database (Education and research – Educational attainment of the population – Population 16-74 years of age by region, highest level of education, age and sex). Years 2001 to 2011, excluding those whose educational attainment is unknown.
- GDP per capita (thousand SEK) obtained from Statistics Sweden database (National Accounts – Regional Accounts – Regional accounts, annual estimates – Regional Gross Domestic Product (BRP), number of employed and compensation of employees (ENS95) by region (NUTS1-3)). Years 2001 to 2010.
- Unemployment rates obtained from Arbetsförmedlingen (Om oss – Statistik och Prognoser – Tidigare statistik – Öppet arbetslösa och sökande i program med aktivitetsstöd, andelar av befolkningen). Years 2001 to 2011, total (16-64-year-olds).

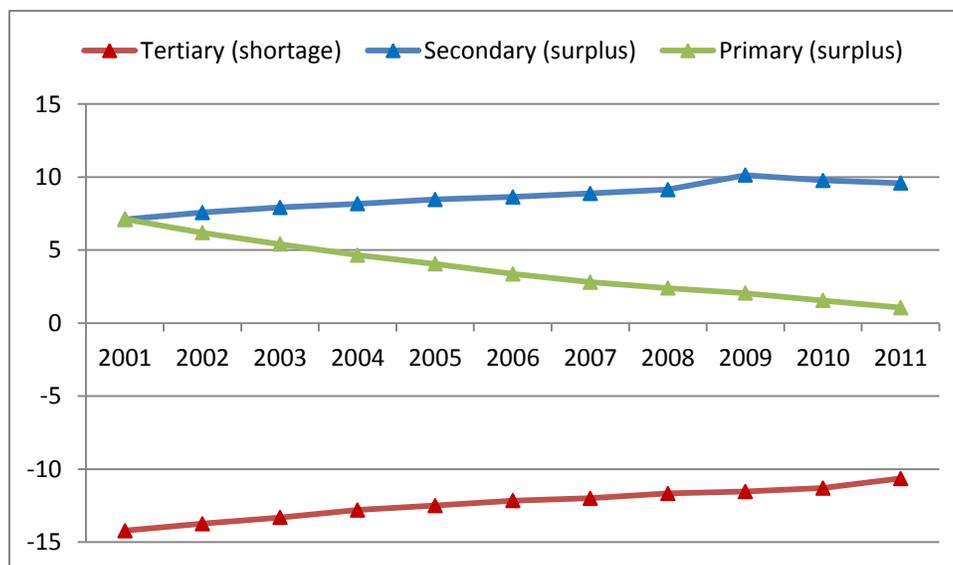
Appendix B. Educational and occupational structures

Figure B.1. Educational and occupational shares (% , mean of all counties)



Source: Author's calculations based on Statistics Sweden

Figure B.2. Education-occupation gaps (percentage points, mean of all counties)



Source: Author's calculations based on Statistics Sweden