

# Do Cross-border commuters suffer from education-job mismatch?

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The migration literature shows that cross-border skill transfer is associated with a risk of increased job-education mismatch. This paper examines whether the problems of job-education mismatch often found among migrants also apply to cross-border commuters and compares cross-border commuters to within-country commuters as well as non-commuters and recent and established migrants in this respect. We find that cross-border commuters and recent migrants from EU15 countries have lower over- but higher under-education rates than non-commuters, but that for cross-border commuters and recent migrants from the NMS12 the opposite applies. Within-country commuters finally have lower over- but higher under-education rates than non-commuters in both regions.

**Key Words:** Commuting, Selection, Education-job Mismatch

**JEL Codes:** J61, I21, R12

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## **Introduction**

Increased mobility and the integration of European labor markets could have important repercussions on the skill distribution of the workforce residing and working in a region. This has long been recognized by the migration literature where the determinants of the skill structure of migrants have been a central concern of both empirical and theoretical research (e.g. Chiswick, 1999; Hunt, 2004; Borjas, 1999) and experts (e.g. Chiswick, 2005) have argued that policy should aim to attract highly skilled migrants. A related strand of this literature also argues that migrants' skills should not only be measured by their highest completed education, but also in terms of their education-job match (OECD 2007), since even the most highly educated migrants are unlikely to contribute to the receiving regions' human capital when their skills are inappropriately used. A number of recent contributions (Chiswick and Miller, 2007, Huber et al, 2008 OECD, 2007) have thus attempted to measure education-job mismatch among natives and foreign born in the US, the EU and other countries.

This literature has, however, largely ignored cross-border commuting as an alternative mode of labour mobility. To the best of my knowledge only MKW (2001 and 2009) analyze the extent, structure and motivations for cross-border commuting from a European perspective. These studies, however, focus on information from EURES officials and address neither commuters' skills nor education-job mismatch. Most of the commuting literature has either analysed commuting within a country (e.g. White, 1986, Hazans, 2003, Rouwendahl, 1999, Van Ommeren, 1999) or cross-border commuting in individual border regions (e.g. van der Velde et al, 2005, Greve and Rydbjerg, 2003a, 2003b, Bernotat and Snickars, 2002, M äthta and Wintr, 2009). These studies indicate that commuting within a country is much more dependent on distance than migration. Since this is also to be expected from cross-border commuting, this implies a regionally asymmetric impact of cross-border commuting on border regions. In addition White (1986) and Rouwendahl (1999) show that commuters are more often male than female. Rouwendahl (1999) finds a decreasing propensity to commute with age and Van Ommeren (1999), Hazans (2003) and Rouwendahl (1999) find that higher educated workers are more likely to commute than less educated workers.

Some of these "stylized facts" may also apply to cross-border commuters and recent case studies (Buch et al, 2008 and Gottholmseder and Theurl 2006, 2007) suggest that these are indeed mostly male but differ from within-country commuters with respect to education and age. The lack of more general insights for the entire EU is, however, a shortcoming not only from an analytical but also from a policy perspective, since in the context of European integration, issues of labor mobility and their effects on sending and receiving regions as well as on those mobile are becoming increasingly relevant. Influencing cross-border commuting as one component of cross-border labor mobility would, however, require a clear understanding of the motivations, structure and potential problems of cross-border commuters.

In this paper I analyse cross-border commuting in the EU27 using data from the European Labour Force Survey (ELFS). My focus in this respect is on over and under-qualification of commuters. In particular I assess whether the problems of education-job mismatch often found among migrants, also apply to cross-border commuters and compare them to migrants, internal commuters and non-commuters.

## **Data and Definitions**

The data are taken from the ELFS for the year 2006. This representative survey conducted in all EU27-countries asks persons in paid employment for at least one hour in the week preceding the interview for their place of residence as well as their place of work and a number of demographic and workplace characteristics (e.g. branch of employment, age, gender, occupation and highest completed education). From the data the extent and structure of commuting in the EU27 can be calculated and occupations can be matched to educational attainment to allow measurement of education-job mismatch. Unfortunately, however, the Greek, Portuguese and Cypriot questionnaires do not pose the question on place of work. Furthermore, data for Slovenia grossly disaccords with data provided in official EUROSTAT sources<sup>1</sup> and for Italy the share of non-respondents to the question on place of work exceeds 5%<sup>2</sup> while I miss data on cross-border commuting for Ireland. Thus I exclude these countries from the analysis. The data also contain only a sample of the households in the EU27 and are therefore subject to sampling error. To avoid misinterpretation, I follow the reporting rules of EUOSTAT<sup>3</sup> by putting all numbers with high standard errors in brackets and suppressing numbers where commuting levels are below the lower confidence bounds suggested by EUROSTAT.

I define cross-border commuters as persons, who work in another country than they live in. I, therefore, cannot differentiate between daily, weekly and monthly commuting and some commuters could be working abroad for several weeks or months in a row. This implies relatively distant commuting for some observations. I compare cross – border commuters to persons, who live in the same NUTS2-region as they work in (referred to as non-commuters), and persons, who work in a different NUTS2-region than they live in, in the same country (internal commuters). One consequence of this is that differences in size across NUTS2 regions severely limit the comparability data across both national and regional entities. Since commuting is highly distance dependent, the extent of commuting is *ceteris paribus* higher in smaller regions. In addition, I compare commuters to migrants that currently live and work in another country than they were born in. Since more established migrants are likely to differ from recent migrants in their education structure on account of return migration and in terms of education-job mismatch due to better labor market integration, I differentiate between established (having lived abroad for 10 or more years) and recent (having lived abroad for less

than 10 years) migrants. Also, to guarantee comparability I focus only on employed and exclude foreign born from outside the EU from the analysis.

To measure education-job mismatch I use two alternative approaches (table 1).<sup>4</sup> The first (and preferred one) is the link between the standard international taxonomy of educational attainment (ISCED) and the international classification of occupations (ISCO) at the 1 digit level suggested by OECD (2007) on the basis of a job analysis. The second is based on the implied skill levels suggested by the ILO (1987) when constructing the ISCO classification. According to OECD (2007) high education levels (i.e. ISCED 5 and 6) are required from legislators, senior officials and managers as well as professionals and technicians and associate professionals. I refer to these occupations as high-skilled occupations. Low education levels (ISCED 0, 1 and 2) are required for elementary occupations (referred to as low-skilled occupations) and all other occupations are associated with intermediate education levels (medium-skilled occupations). According to the ILO definition only professionals have high skilled occupations (requiring an educational attainment of ISCED 6 or more), technicians and associate professionals by contrast have medium skilled education (requiring an educational attainment of ISCED 5) and all other occupations are low skilled, requiring ISCED level 3 or less. Educational attainments on ISCED 4 level are not assigned to any occupation and are thus excluded from the sample in this method, since they can be neither over- nor under-educated.<sup>5</sup>

*Table 1: Correspondence of major occupation groups (ISCO-88) and required education levels (ISCED-97)*

ISCO- 88 Major groups	Required education level according to OECD (2007)		Required education level according to ILO (1987)	
1: Legislators, senior officials and managers	High-skilled	ISCED 5,6	No assignment	
2: Professionals		ISCED 5,6	High-skilled	ISCED 6
3: Technicians and associate professionals		ISCED 5,6	Medium-skilled	ISCED 5
4: Clerks	Medium-Skilled	ISCED 3,4	Low-skilled	ISCED 1,2,3
5: Service workers and shop and market sales workers		ISCED 3,4		ISCED 1,2,3
6: Skilled agricultural and fishery workers		ISCED 3,4		ISCED 1,2,3
7: Craft and related trades workers		ISCED 3,4		ISCED 1,2,3
8: Plant and machine operators and assemblers		ISCED 3,4		ISCED 1,2,3
9: Elementary occupations	Low-skilled	ISCED 0,1,2		ISCED 1,2,3
(0: Armed forces)	No assignment		No assignment	

Source: OECD (2007)

Based on these reference levels, education-job mismatch is measured by comparing a persons' highest completed education to that required in her/his occupation according to both definitions. A person is over-educated if educational attainment is higher and under-educated if educational attainment is lower than required for his/her occupation. Over- and under-education are thus characteristics of the employee relative to his/her occupation: Highly educated workers cannot be under-educated (as there are no occupations requiring higher educational attainment than high education) and less educated workers cannot be over-educated (since there are no

occupations requiring education lower than low education). One problem with both methods of measurement is that occupational categories are broad. This may induce measurement error if these broad categories encompass jobs requiring different educational attainment levels. My approach can, however, be justified by its focus on differences in education-job mismatch between migrants, cross-border commuters, internal commuters and non-commuters, since these differences will be less affected by measurement error.

Furthermore, the two measurement methods are likely to yield different results with respect to the extent of over- and under-education. In particular according to the ILO (1987) only persons with an educational attainment of ISCED level 5 and above can be over-educated, while according to OECD (2007) this can also be the case for persons with ISCED 3 and 4 education. Accordingly over-education rates will tend to be higher in the latter method. Similarly, since a larger share of occupations are classified as low skill occupations and the ISCED level 4 educational attainment is excluded from the analysis according to ILO (1987), the share of appropriately employed is likely to be higher in this classification than according to OECD (2007).

## **Descriptive statistics**

### **The extent of commuting**

Table 2 provides information on the extent of internal and cross-border out-commuting as a percentage of the employed at the place where commuters live. In conjunction with Figure 1 it suggests that cross-border out-commuting is rather rare in the EU27 and is of importance in a small number of regions only. In 2006 only around 0.7% of the employed commuted across borders. This is low relative to the 7.4% commuting across NUTS2-regions within their respective countries. Among the 220 NUTS2-regions in the sample the share of cross-border out-commuting in total employment at place of residence exceeds 5% only in 8 regions. These are three Slovak regions, Alsace-Lorraine in France, the Belgian Provinces of Luxemburg and Limburg, Freiburg in Germany and Vorarlberg in Austria. In another 31 regions it is between 1% and 5%. For the vast majority of NUTS2-regions, less than 0.5% of the resident employed commute across borders.

Cross-border commuting is also highly dependent on geography. High rates of cross-border out-commuting occur in border regions or regions close to the border. The major areas of cross-border commuting are located in border regions of countries which share a common language (e.g. Belgium and France or Austria, Switzerland and Germany), have strong historic ties (e.g. the Czech Republic and Slovakia) or where special institutional arrangements influence cross-border commuting (as in the Austro-Hungarian case, where commuting for Hungarian commuters was substantially liberalized in 1998 - Bock-Schappelwein et al, 2010) as well as in small countries (such as Belgium, Austria and the Baltics), where most regions are located close to the border. In

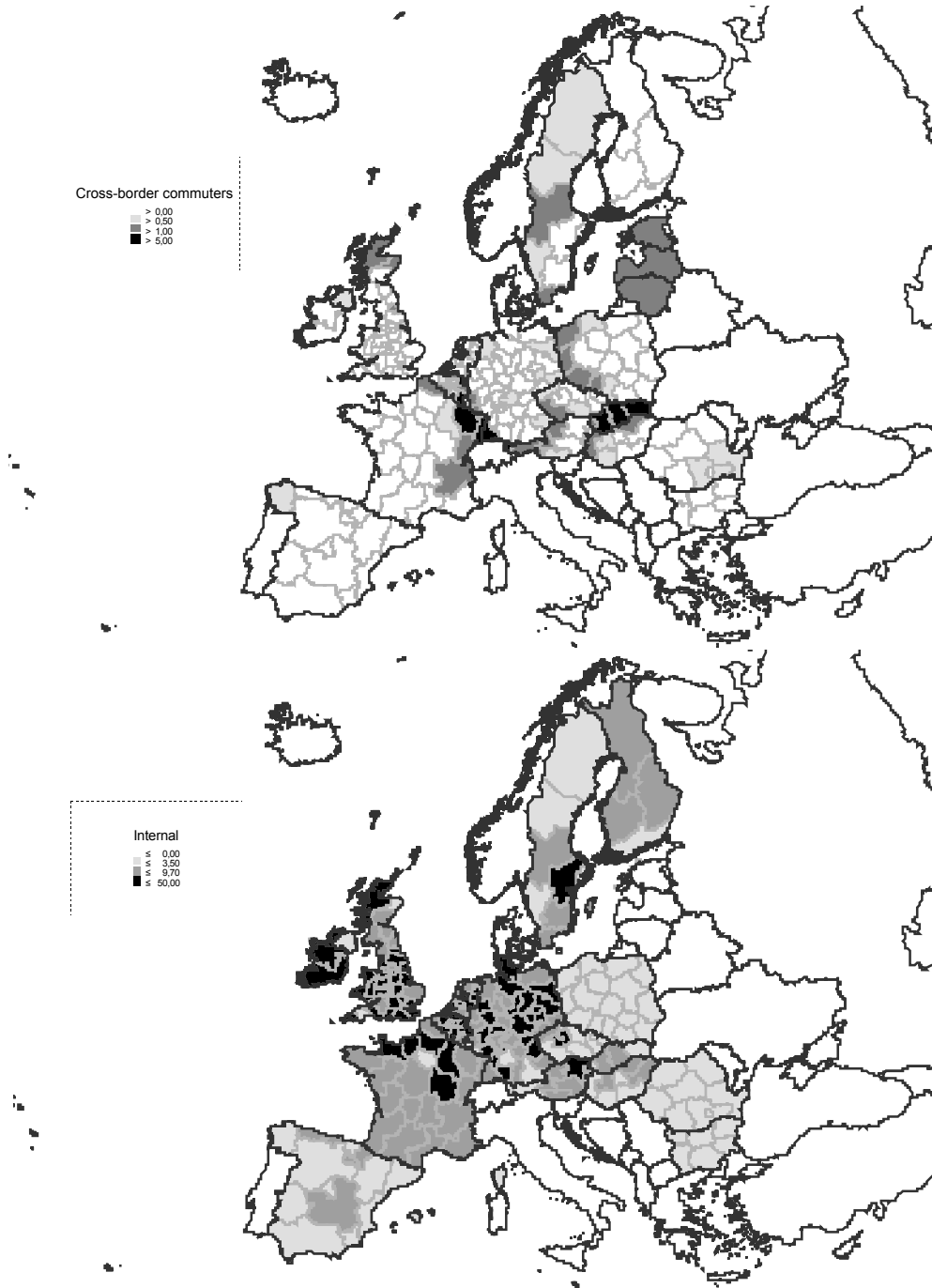
all other border regions (except those located at the German-French border), the share of cross-border out-commuters is lower than 0.5% of the resident workforce. High rates of internal out-commuting, by contrast, are found primarily near large urban agglomerations (e.g. London, Berlin, Vienna, Prague and Stockholm), and in smaller NUTS2-regions.

Table 2: Out-commuting in the EU27 by country (2006)

	Internal Commuters	Cross-border Commuters	Non-respondents	Internal Commuters	Cross-border Commuters	Non-respondents
	Absolute (thousands)			In % of employed at workplace		
Total	13369.8	1169.5	115.7	7.5	0.7	0.1
EU 15*	12580.1	792.8	113.0	9.2	0.6	0.1
Austria	397.9	39.7	-	10.1	1.0	0.0
Belgium	828.3	95.0	-	19.4	2.2	0.0
Germany	3846.5	173.2	56.1	10.3	0.5	0.2
Denmark <sup>1)</sup>	0.0	5.5	27.0	0.0	0.2	1.0
Spain	382.7	55.6	0.0	1.9	0.3	0.0
Finnland	66.9	<b>3.0</b>	0.0	2.7	0.1	0.0
France	1468.9	279.0	19.9	5.9	1.1	0.1
Luxemburg <sup>1)</sup>	0.0	1.7	0.0	0.0	0.9	0.0
Netherlands	1056.2	32.4	-	12.9	0.4	0.1
Sweden	195.7	38.3	3.1	4.4	0.9	0.1
U.K.	4337.0	69.4	-	15.4	0.2	0.0
NMS12**	789.7	376.7	-	1.9	0.9	0.0
Bulgaria	39.2	10.3	-	1.3	0.3	0.0
Czech Republic	230.7	25.1	-	4.8	0.5	0.0
Estonia <sup>1)</sup>	0.0	10.7	-	0.0	1.7	0.0
Hungary	147.5	24.9	0.0	3.8	0.6	0.0
Lithuania <sup>1)</sup>	0.0	26.2	-	0.0	1.7	0.0
Latvia <sup>1)</sup>	0.0	14.3	-	0.0	1.3	0.0
Malta	0.0	-	-	0.0	0.5	0.0
Poland	216.3	71.6	-	1.5	0.5	0.0
Romania	57.9	36.9	-	0.6	0.4	0.0
Slovakia	98.1	156.8	-	4.3	6.8	0.1

Source: EUROSTAT-LFS, own calculations Notes: Figures in brackets=unreliable data due to few observations, - =no data reported due to few observations \* excluding Greece, Portugal, Ireland and Italy, \*\*excluding Cyprus and Slovenia 1) Country has only 1 NUTS2 region, thus no internal commuting measured.

Figure 1: Out-commuting in the EU27 by NUTS2-regions (2006)



S: Eurostat, ELFS Figure shows out-commuting in % of employed at place of residence. Top panel = cross-border commuting, bottom panel= internal commuting

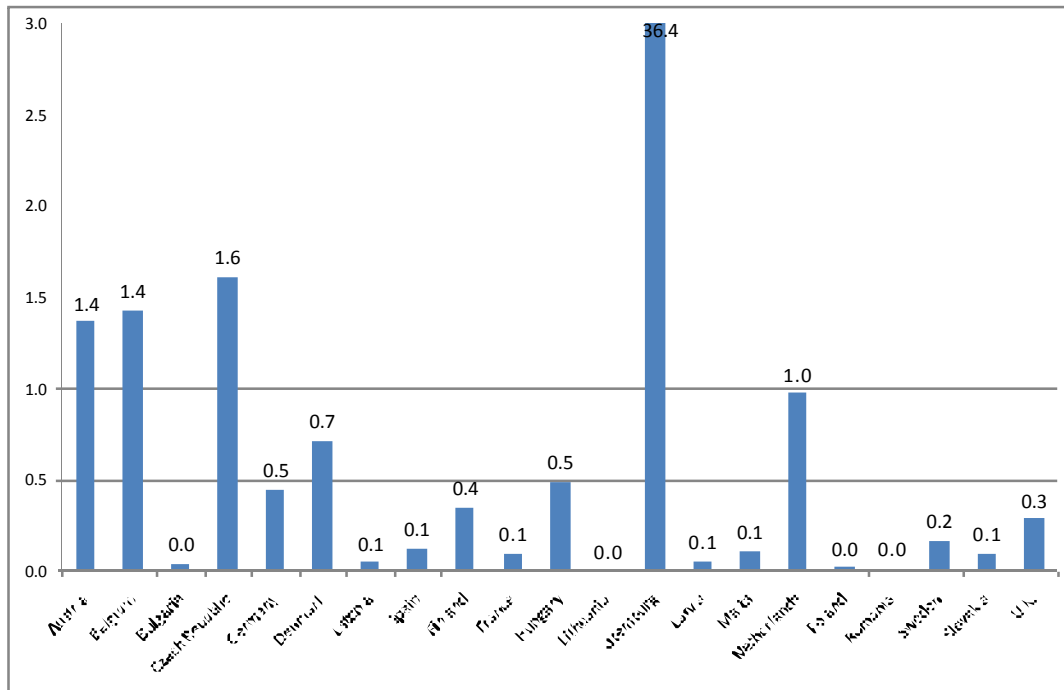
Aside from size and geography out-commuting is also higher in regions with low GDP per capita and high unemployment (Huber and Nowotny, 2008) and – although this comparison is, influenced by region size, which is larger for the peripheral regions and leads to a downward bias for commuting in these regions - there seems to be a core-

periphery pattern in both cross-border and internal commuting. Regions located more in the centre of the EU (e.g. in Austria, Belgium, Germany and the Netherlands) have higher internal and cross-border out-commuting rates. Regions located in the periphery (e.g. Spain, Bulgaria, Romania) have low commuting rates (MKW, 2009).

Finally, the share of cross-border out-commuters is higher in the NMS12 than in the EU15. I would have expected the opposite due to the shorter time span the NMS12 have integrated into the EU and institutional barriers to cross-border commuting from the NMS12 in important receiving countries of the EU15 in 2006. Cross-border commuting rates in the NMS12 are, however, increased by the high share of cross-border commuters from Slovakia to the Czech Republic and a large number of small countries among the NMS12 as well as high income differences between the NMS12 and the EU15.

From the receiving region perspective (Figure 2) the total share of cross-border in-commuters from the EU27 in the employed working in a country is also low. Apart from the outlier of Luxemburg (where over a third of the employed commute from other countries) the share of cross-border in-commuters exceeds 1% of the employed at the workplace only in Belgium, Austria and the Netherlands. For the NMS 12 cross-border in-commuting is of even lower importance. Among them the share of cross-border in-commuters in total employment at workplace exceeds 1% only in the Czech Republic (due to commuters from Slovakia), and 0.5% in Hungary.

Figure 2: Cross-border in-commuting from the EU27 by country (% of employed at workplace, 2006)



Source: Eurostat LFS, own calculations



Table 3: Place to place cross-border commuting by country groups (2006)

Sending Region	Receiving Region			Total
	EU 15	NMS12	Other countries	
	<i>Absolute (thousands)</i>			
EU 15	479.7	10.6	302.5	792.8
NMS12	243.0	105.2	29.3	377.4
	<i>Share in percent</i>			
EU 15	60.5	1.3	38.2	100.0
NMS12	64.4	27.9	7.8	100.0

Source: EUROSTAT-LFS, own calculations

Furthermore, place to place data (table 3) suggests a clear differentiation between the EU15 and the NMS12. Most of the cross-border out-commuting from the EU15 countries is directed to other EU15 countries (accounting for more than 90% of cross-border out-commuters in Belgium, Luxemburg and the Netherlands) or to other non-EU27 countries (which on account of a high share of cross-border commuters to Norway and substantial long distance commuting is particularly important for the UK, where more than 50% of the cross-border out-commuters go to non-EU countries). By contrast commuting from the NMS12 is more focused on the EU15. In all NMS12-countries except for Slovakia more than 70% of all cross-border out-commuters go to EU15 countries.

### The education structure of commuters

In terms of demographic and occupational composition cross-border commuters differ most significantly from non-commuters by a high share of males, a larger share of persons aged 25-44, and a stronger focus on intermediate (secondary level) educated workers (table 4). Cross-border commuters also often work in medium skilled occupations and construction or manufacturing. Relative to internal commuters, cross-border commuters are more often medium educated, more strongly concentrated in manufacturing employment, typically work in medium skilled occupations according to the OECD (2007) definition and have a higher share of males. This accords with previous case studies: Buch et al (2008) find that German – Danish cross-border workers are often manufacturing workers, Gottholmseder and Theurl (2006 and 2007) find that cross-border commuters from Vorarlberg to Switzerland are often male, medium skilled manufacturing workers and Huber (2011) using the same data as the current one shows that these stylised facts also pertain after controlling for other potential influences on the skill structure of cross-border migrants. One explanation for this is that the lower importance of language skills in these occupations and sectors makes it easier to find jobs across borders. Another explanation are differences in economic structure between border regions as destinations for cross-border commuters and large cities as destinations for internal commuters, since cities are more focused on the service sector.<sup>6</sup>

Relative to migrants (both established and recent) cross-border commuters are, also more often male, more often have intermediary education as well as medium-skilled occupations (at the expense of both lower shares of both high and low skilled), and compared to recent migrants are slightly older (less often aged 25-44, more often 45-60) and less often work in non-market services but substantially more often in manufacturing.

Table 4: Commuters and migrants in the EU27 by demographic and job characteristics (in %, 2006)

	Non-Commuters	Internal Commuters	Cross-border Commuters	No Response	Established Migrants	Recent Migrants
Gender						
Female	46.1	36.3	28.3	32.3	49.2	45.4
Male	53.9	63.7	71.7	67.7	50.8	54.6
Age						
Age 15-24 years	10.8	11.3	13.7	15.7	5.1	14.8
Age 24-45 years	51.3	55.0	57.0	56.3	50.4	70.4
Age 45-60 years	33.0	30.4	27.0	21.3	37.4	14.0
Age 60 or more years	5.0	3.4	2.4	6.7	7.1	0.8
Education						
Missing	0.2	0.3	-	-	0.4	0.6
Low education (ISCED 2 or less)	21.9	16.1	13.8	18.0	22.4	20.2
Medium education (ISCED 3 or 4)	51.4	47.5	60.1	48.9	45.0	52.0
High education (ISCED 5 or more)	26.6	36.1	25.9	33.0	32.1	27.2
Occupation						
High-skilled*	37.3	50.1	33.4	44.4	44.2	26.0
Medium-skilled*	51.9	41.4	56.2	41.5	44.8	47.6
Low – skilled*	10.0	6.1	9.3	7.8	10.1	26.1
Missing	0.8	2.4	1.1	6.3	0.8	0.3
Sector of Employment						
Agriculture/Mining	6.6	1.9	5.1	-	2.7	5.9
Manufacturing/Construction	26.5	27.6	41.8	31.4	23.9	32.9
Market Services	36.3	41.7	36.0	38.1	39.1	38.1
Non-Market Services	30.6	28.9	17.1	23.5	34.3	23.0

Source: EUROSTAT-LFS, own calculations Notes: - = no data reported due to few observations , column sums for individual characteristics are 100% \* according to OECD (2007) measurement

### Over- and Under-education

As, however, already pointed out, cross-border commuters' and migrants' skills should not only be measured against their highest completed education, but also by the match between their education to jobs. Aside from educational attainment over- and under-education of commuters should also be considered. A number of recent contributions show that the probability of over- and under-educated employment of both natives and migrants depends on age, gender and education. Females often have higher over- but lower under-education rates (which may be due to discrimination but has also been attributed to their lower geographical mobility - Kiker, Santos and Oliveira, 1997, Büchel and Battu, 2003). Over-education usually decreases while under-education increases with age since the limited information of younger

workers may lead to them accepting jobs below their qualification and since older workers have obtained firm or industry specific human capital. This is, however, countered by technological change and the depreciation of knowledge. If knowledge acquired recently is more relevant for an occupation, older workers may face higher over-education rates (Rubb, 2003, Groot-Maasen - van den Brink, 2000). The more educated have higher over-education rates (Sanroma, Ramos and Simon, 2009), while less educated are more often under-educated.

Previous studies also show that the probability of over-educated employment is lower among natives than among migrants and that the probability of under-educated employment is higher, but that these differences reduce with duration of stay abroad and differ substantially by country of birth of migrants (Chiswick and Miller, 2007, Sanroma, Ramos and Simon, 2009). Migrants' higher over-education rates are usually attributed to difficulties (arising from language problems or differences in educational systems) of foreigners in utilizing formal skills abroad. These typically diminish as they integrate into host societies (e.g. by learning the language). Lower under-education rates, by contrast, are interpreted as indication of problems in transferring informal skills, since under-educated employment implies that workers have acquired the skills necessary for performing this job through experience or learning on the job.

I am, however, not aware of any studies analyzing over- and under-education of commuters. Tables 5a and 5b thus report the share of cross-border, internal and non-commuters as well as (established and recent) migrants in under- and over-educated employment, stratified by some of the major correlates of the probability of over- and under-educated employment according to the two measurement concepts used in this chapter. These results are highly consistent with the literature irrespective of the measurement method used: The share of over-educated employed is substantially (15.5 percentage points according to the OECD (2007) definition and 6.4 percentage points according to the ILO (1987) method) higher and the share of under-educated employed substantially (10.3 percentage points and 4.6 percentage points, respectively) lower among recent migrants than among non-commuters. These differences almost disappear for more established migrants. Similarly, irrespective of the type of commuter or migrant considered over-education is higher among females than males, decreases with age (with the exception of the over 60 year old and recent migrants when OECD (2007) measurement is used) and education level required in the job, but increases with education, while under-education is lower for females than for males, increases with age after 25 and reduces with education and skills required in the job.

{Table 5a & 5b around here}

Internal commuters, by contrast, have rates of over- and under-education that are about comparable to those of non-commuters. According to the measurement by OECD (2007) 30.9% of both internal and non-commuters in the EU work in jobs requiring an education in excess of their actual attainment, and are thus under-educated<sup>7</sup> and 10.3% of the non-commuters and 9.1% of the internal commuters have an educational attainment higher than what is required from their job and are thus over-educated. According to ILO (1987) measurement the under-education rate among internal commuters is 26.0% (as opposed to 22.2% among non-commuters) and the over-education rate is 6.0% and only 0.1% higher than among non-commuters. Internal commuters thus seem to have only minor problems in utilizing both formally as well as informally obtained skills.

Among cross-border commuters these problems are larger. In almost all demographic groups they have higher over- and lower under-education rates than either internal or non-commuters. 13.6% of the cross-border commuters in the EU are over-educated and 24.0% are under-educated according to OECD (2007) measurement. According to ILO (1987) measurement under-education rates are 20.0% among cross-border commuters and over-education rates amount to 6.5%. These over- and under-education rates are, however, substantially lower than among recent migrants according to both measurement concepts. Once more this applies to almost all demographic groups. More established migrants, by contrast, have lower over-education rates in most demographic groups than cross-border commuters, while their under-education rates are higher in most groups.

In sum thus cross-border commuters are faced with greater problems in utilizing both their formally as well as informally acquired skills than established migrants, non-commuters and internal commuters. In comparison to recent migrants, however, they perform better. One reason for this may be that cross-border commuters will only be willing to commute if they find adequate employment opportunities abroad (or will terminate inadequate employment quickly when offered a better job back home); while migrants may have a weaker bargaining position once they have moved abroad. These results as well as all others apply to both measurement methods used although as expected over-education (and to a lesser degree also under-education rates) are substantially lower when using the ILO definition than when using the OECD definition of over- and under-education. One can therefore conclude that while measurement issues have a large impact on results with respect to the extent of over- and under-education, qualitative results with respect to differences in over- and under-education rates across groups are less strongly affected by such measurement issues.

## **Estimation Results**

These results may, however, be due to composition effects and could differ among groups of cross-border commuters. Thus I conduct multinomial logit regressions in which

I use the OECD (2007) measurement concept to form a dependent variable which takes on a value of zero if a person is appropriately qualified for their job, 1 if a person is over-educated and -1 if a person is under-educated. These regressions are run both for the overall EU27 as well as separately for the NMS12 and the EU15. As explanatory variables I include dummies for each (EU) country of residence and exclude countries that have only one NUTS2 region (the Baltic countries, Luxemburg and Malta) since they have no internal commuters. Further controls are included for sector of employment (agriculture and mining - as base category,- manufacturing, construction and private or public services), dummy variables for the age of respondents (for individuals aged 25-44, 45-59, 60 and more years, with 15-24 year olds as base category), a dummy for males, and two dummies for low (ISCED2 or less) or medium (ISCED3 or 4) education, with high education (ISCED 5 or 6) as the excluded base group. In addition – the equation includes a set of dummy variables for internal-commuters, cross-border commuters and individuals, whose commuting status is unknown, as well as for established and recent migrants (with non-commuters the base category). A positive and significant coefficient of these variables indicates that, after controlling for composition effects, the respective group has higher over- or under-education rates than non-commuters; a significantly negative value indicates lower over- and under-education rates.

Furthermore because the ease of skill transfer across borders also depends on language knowledge, I include a dummy variable for cross-border commuting and migration between countries that share a common language (France-Belgium, Netherlands-Belgium and Austria-Germany) as well as for commuting between Slovakia and the Czech Republic and among Scandinavian countries.<sup>8</sup> Since low educated worker cannot be over-educated and high educated workers cannot be under-educated I run these regressions separately for each education group.<sup>9</sup>

The marginal effects of these estimates<sup>10</sup> (table 6) in accordance with descriptive results suggest that males have lower over- but higher under-education risks than females; that the risk of over-educated employment declines, while the under-education risk increases with age (although there is some variation across education groups), and that there are more varied patterns of over- and under-education by sector of employment, which may reflect differing sectoral employment strategies with respect to education. In addition, commuting between countries that share a common language – as expected – increases under- and reduces over-education rates, with the marginal effects varying between 1.0 and 6.0 percentage points for the increase in under-education and between -2.4 to -11.7 percentage points for the reduction in over-education. Commuters between the Czech Republic and Slovakia also have higher under- and lower over-education rates. Here marginal effects suggest an increase in under-education of between 2.3 to 6.4 percentage points and a reduction of over-education between 0.5 and 8.7 percentage points. For cross-border commuters among Scandinavian countries results are more mixed. Low educated cross-border

commuters between these countries have higher under-education rates, while the medium educated have a higher one. Similarly for medium skilled cross-border commuters among Scandinavian countries over-education is by 2.5 percentage points lower, while for highly educated results are only on the margin of significance.

[Table 6 around here]

In addition in the regressions for the complete EU27 the risk of under-educated employment for cross-border out-commuters is 5.0 percentage points higher than for non-commuters among the less educated. For medium educated cross-border commuters, by contrast, the under-education risk is 3.7 percentage points lower. With respect to the over-education medium skilled cross-border commuters have a 4.2 percentage point higher risk of over-qualified employment than non-commuters, while for highly skilled cross-border commuters the risk is 3.3 percentage points higher. For all education groups, however, cross-border commuters face substantially lower over- and higher under-education rates than recent migrants. For internal commuters, by contrast, the probability of under-educated after employment controlling for other influences is actually (by 3.9 percentage points for the low skilled and 6.9 percentage points for the medium skilled) higher than for non-commuters and the risk of over-educated employment is lower (by 2.2 percentage points for the medium skilled and 5.5 percentage points for the high skilled).

The results also point to large differences between cross-border commuters from the EU15 and the NMS12. In the EU15 cross-border commuters have lower over- and higher under-education risks than non-commuters for all education groups. For workers from an EU15-country, cross-border commuting is therefore not associated with a higher risk of de-qualification when compared to non-commuters. Indeed in all cases the mobility of cross-border commuters seems to significantly improve education-job matches. For cross-border commuters from the NMS12 the opposite applies. They face significantly (between 16.0 for medium to 21.9 percentage points for high educated) higher over-education risks and also significantly (between 4.0 percentage points for low and 10.4 percentage points for medium educated) lower under-education risks than non-commuters.

Similar observations apply to both recent and established migrants from the EU15. They also have lower over- and higher under-education rates than non-commuters for all education groups. Results suggest that the probability of under-educated employment is higher among low skilled recent migrants and that the over-education risk is higher among high skilled recent migrants than for cross-border commuters from the EU15, while recent migrants from the NMS12 face substantially lower under-education as well as substantially higher over-education rates than cross-border commuters from the NMS12. Thus, problems of skill transfer among cross-border commuters and recent

migrants in the EU seem to apply primarily to migrants and cross-border commuters from the NMS12, while cross-border commuters and migrants from the EU15 actually have lower risks of de-qualification than non-commuters. This may be due to the shorter time of integration of the NMS12 and associated lower progress in the mutual recognition of skills across borders.

Table 7: Regression results for probability of over-and under-educated employment (marginal effects)

	Low Educated		Medium Educated				High Educated	
	P(Under-Educated)		P(Under-Educated)		P(Over-Educated)		P(Over-Educated)	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
<b>Sending Region: All</b>								
Internal Commuter <sup>3)</sup>	0.039***	0.0003	0.075***	0.0002	-0.023***	0.0001	-0.062***	0.0002
Cross-border Commuter <sup>3)</sup>	0.031***	0.0016	-0.037***	0.0009	0.058***	0.0007	0.016***	0.0012
Common Language	0.126***	0.0027	0.052***	0.0026	-0.051***	0.0007	-0.113***	0.0017
Slovak-Czech	0.031***	0.0062	-0.133***	0.0018	0.009***	0.0012	0.132***	0.0076
Male	0.060***	0.0002	0.018***	0.0001	-0.004***	0.0001	-0.052***	0.0001
Age 25-44 <sup>2)</sup>	-0.021***	0.0002	0.120***	0.0002	-0.019***	0.0001	-0.160***	0.0003
Age 45-59 <sup>2)</sup>	-0.006***	0.0002	0.171***	0.0002	-0.013***	0.0001	-0.162***	0.0002
Age 60 or more <sup>2)</sup>	0.013***	0.0003	0.208***	0.0004	0.010***	0.0002	-0.129***	0.0002
Manufacturing/Construction <sup>1)</sup>	-0.020***	0.0003	0.131***	0.0003	-0.026***	0.0001	-0.112***	0.0002
Market Services <sup>1)</sup>	-0.074***	0.0003	0.252***	0.0003	-0.014***	0.0001	-0.149***	0.0002
Non-Market Services <sup>1)</sup>	-0.200***	0.0004	0.352***	0.0003	0.002***	0.0001	-0.302***	0.0003
<b>Sending Region: EU15</b>								
Internal Commuter <sup>3)</sup>	0.038***	0.0003	0.080***	0.0002	-0.026***	0.0001	-0.067***	0.0002
Cross-border Commuter <sup>3)</sup>	0.057***	0.0018	0.053***	0.0015	-0.017***	0.0008	-0.008***	0.0013
Common Language	0.112***	0.0032	-0.037***	0.0024	-0.012***	0.0016	-0.113***	0.0021
Male	0.072***	0.0002	0.051***	0.0001	0.004***	0.0001	-0.060***	0.0002
Age 25-44 <sup>2)</sup>	-0.021***	0.0002	0.136***	0.0002	-0.021***	0.0001	-0.165***	0.0003
Age 45-59 <sup>2)</sup>	-0.006***	0.0002	0.187***	0.0003	-0.017***	0.0001	-0.169***	0.0002
Age 60 or more <sup>2)</sup>	-0.018***	0.0004	0.212***	0.0004	0.007***	0.0002	-0.139***	0.0002
Manufacturing/Construction <sup>1)</sup>	0.024***	0.0003	0.107***	0.0004	-0.033***	0.0001	-0.123***	0.0002
Market Services <sup>1)</sup>	-0.027***	0.0003	0.249***	0.0003	-0.014***	0.0001	-0.172***	0.0003
Non-Market Services <sup>1)</sup>	-0.129***	0.0003	0.310***	0.0004	-0.008***	0.0002	-0.326***	0.0004
<b>Sending Region: NMS12</b>								
Internal Commuter <sup>3)</sup>	0.060***	0.0012	0.031***	0.0006	-0.002***	0.0004	-0.034***	0.0005
Cross-border Commuter <sup>3)</sup>	-0.015***	0.0035	-0.086***	0.0008	0.114***	0.0012	0.128***	0.0032
Slovak-Czech	0.071***	0.0051	-0.032***	0.0023	-0.021***	0.0008	-0.016***	0.0029
Male	0.009***	0.0004	-0.062***	0.0002	-0.016***	0.0001	-0.012***	0.0002
Age 25-44 <sup>2)</sup>	-0.019***	0.0007	0.072***	0.0003	-0.014***	0.0002	-0.131***	0.0006
Age 45-59 <sup>2)</sup>	-0.005***	0.0006	0.112***	0.0004	-0.074***	0.0002	-0.123***	0.0003
Age 60 or more <sup>2)</sup>	0.103***	0.0006	0.194***	0.0009	0.017***	0.0004	-0.077***	0.0002
Manufacturing/Construction <sup>1)</sup>	-0.099***	0.0007	0.139***	0.0004	-0.011***	0.0002	-0.070***	0.0002
Market Services <sup>1)</sup>	-0.156***	0.0008	0.200***	0.0003	-0.023***	0.0001	-0.054***	0.0003
Non-Market Services <sup>1)</sup>	-0.467***	0.0009	0.448***	0.0004	0.031***	0.0002	-0.193***	0.0004

Source: ELFS Notes. Table reports marginal effects of multinomial logit regressions on the probability of over- and under-educated employment. Results for base category (appropriate employment) and for sending (NUTS2) region fixed effects are not reported, 1) base category=Agriculture and mining, 2) base category=aged 15-24, 3) base category=non-commuters. \*\*\* significant at the 1% level. SE=Standard Error.

## Robustness

One caveat with the above results may be that commuters and migrants may originate from different regions within a country. To check for robustness I therefore conduct a further multinomial logit analyses in which the same dependent and independent variable as above are included. In contrast to the previous specification this specification, however, includes dummies for each (NUTS2) region of residence but –

since we have no information on the NUTS 2 region of residence of migrants excludes migrants from the estimation. The marginal effects of the estimates (table 7) confirm descriptive results: males have lower over- but higher under-education risks than females; over-education declines, while under-education increases with age (although there is some variation across skill groups), and there are more varied patterns of over- and under-education by employment sector. This may reflect different sectoral employment strategies with respect to education.

In addition in the regressions for all countries the under-education risk for low educated cross-border commuters is 3.1 percentage points higher than for non-commuters. For medium educated cross-border commuters this is 3.7 percentage points lower. Medium educated cross-border commuters also have a 5.8 percentage point higher over-education risk than non-commuters, while for highly educated cross-border commuters it is 1.6 percentage points higher.

There are, however, large differences between cross-border commuters from the EU15 and the NMS12 countries sampled: Cross-border commuters from the EU15 have lower over- and higher under-education risks than non-commuters for all education groups. For cross-border commuters from the NMS12, however, the opposite applies. They face (between 11.4 for medium to 12.8 percentage points for highly educated) higher over-education risks and (between 1.5 percentage points for less and 8.6 percentage points for medium educated) lower under-education risks than non-commuters.

Internal commuters, by contrast, have higher under- and lower over-education risks than non-commuters in both regions. The under-education risk of internal commuters from the EU15 countries sampled is between 3.8 (less educated) and 8.0 (medium educated) percentage points higher and the over-education risk is 2.6 (medium educated) to 6.7 (high educated) percentage points lower than among non-commuters. In the NMS12 countries sampled these differences amount to a between 6.0 (less educated) to 3.1 (medium educated) percentage points higher under-education risk and a 0.2 (medium educated) to 3.4 (highly educated) lower over-education risk.

## **Conclusions**

This paper analyses over- and under-qualification of commuters in the EU27 as a little analysed mode of international labour mobility. I find that cross-border commuters as well as migrants from EU15 countries do not have higher over- and lower under-education rates than workers working and living in their region of residence. Although the available data cannot control for the duration of working abroad and also misses a number of other variables that have been found important in explaining over- and under-education among migrants (such as language knowledge) this suggests that cross-border commuting entails a lower degree of "brain waste" than migration, at least when considering European "East-West" migration. This may be because cross-



border commuters will only be willing to commute if they find adequate employment opportunities abroad, while migrants may have a weaker bargaining position once they have moved abroad.

Results, however, also show some interesting heterogeneity among cross-border commuters. In particular cross-border commuters from the NMS12 are even more often medium skilled and younger than those from the EU15 and – in contrast to commuters from the EU15 – also have a substantially higher risk of over- and lower chance of under-qualified employment than non-commuters. Substantial efforts at improving the transferability of skills from the NMS12 are therefore still needed to increase the attractiveness of cross-border commuting (and migration) for residents of these countries. In addition, as many studies before this, I find higher over-qualification risks for females and young workers. Policies focusing on these target groups may thus be needed, since they face much larger problems in skill-utilisation than others

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## Notes

<sup>1</sup> Official EUROSTAT data suggests that in the data regional codes for Slovenia may have been confused.

<sup>2</sup> In total 0.1% of the employed in the ELFS do not respond to the question on place of work. This is sizeable relative to cross-border commuting (see below) and may cause underreporting if respondents are more likely to answer questions concerning their place of work when not commuting. I thus also report non-respondents.

<sup>3</sup> see [http://circa.europa.eu/irc/dsis/employment/info/data/eu\\_ifs/index.htm](http://circa.europa.eu/irc/dsis/employment/info/data/eu_ifs/index.htm)

<sup>4</sup> See Cohn and Khan (1995), Kiker et al. (1997) Verdugo and Verdugo (1989) as well as Hartog (2000) for discussions of alternative measures of job-skill mismatch

<sup>5</sup> Unfortunately in the ELFS the lowest educational attainment measured is ISCED2 or lower, so that I cannot make use of the fact that according to ILO (1987) elementary occupations require only an ISCED 1 education.

<sup>6</sup> Some of these results may also be due to residential sorting. Since for instance more highly qualified workers may choose to live outside urban agglomerations and thus become commuters even without changing jobs.

<sup>7</sup> These under-education rates are consistent with previous studies and reflect the substantial human capital obtained among less qualified and experienced workers through "learning by doing" or training after completed education.

<sup>8</sup> In addition I was concerned that commuters to Luxemburg may be an outlier on account of the high share of in-commuting to this country. I conducted a similar analysis excluding commuters to Luxemburg (tables B1 and B2 in appendix B). These results are qualitatively similar. In earlier version of the paper I also excluded the Scandinavia dummy as well as the dummy for commuting between the Czech and Slovak Republic. Once more this leaves qualitative results unchanged.

<sup>9</sup> The low numbers of over-educated cross-border commuters with ISCED level 6 or higher education preclude estimation of a similar model for the highly educated for the ILO (1987) definition. In appendix B (tables B3 and B4) I, however, conduct a similar analyses as here for low and medium skilled commuters based on the ILO definition. Again results are qualitatively similar with respect to both measurement concepts.

<sup>10</sup> Coefficient estimates are reported in the appendix.

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Table 5a: Over and under -education rates by types of commuting, demographic and job characteristics according to OECD (2007) measurement (EU27, 2006)

	Under-education					Over-education				
	Non	Internal	Cross-border	Established	Recent	Non	Internal	Cross-border	Established	Recent
	Commuters			Migrants		Commuters			Migrants	
Total	30.9	30.9	24.0	32.6	19.6	10.3	9.1	13.6	10.5	25.8
	Gender									
Female	30.0	30.1	25.3	27.4	16.6	11.0	10.1	19.9	12.3	32.2
Male	31.8	31.3	23.4	37.6	22.1	9.7	8.5	11.1	8.8	20.5
	Age									
Age 15-24 years	35.3	34.0	15.0	39.1	26.3	10.9	11.3	19.8	10.4	25.9
Age 24-45 years	26.6	27.7	20.8	28.8	18.3	11.3	9.6	15.6	9.6	25.5
Age 45-60 years	34.5	34.6	32.6	35.2	18.5	8.7	7.4	7.4	9.9	28.2
Age 60 or more years	42.3	40.0	51.2	40.6	32.2	9.0	7.7	-	7.8	7.0
	Education									
Low education (ISCED 2 or less)	77.1	82.5	84.6	76.0	58.9					
Medium education (ISCED 3 or 4)	27.2	37.3	20.6	34.3	14.5	8.9	6.4	11.3	9.3	29.6
High education (ISCED 5 or more)						21.5	16.5	26.0	19.6	37.8
	Profession									
High-skilled*	44.4	40.6	42.8	41.9	34.9					
Medium-skilled*	27.2	23.7	16.8	30.7	22.0	10.1	13.2	11.1	12.8	16.8
Low-skilled*						49.9	55.2	77.6	46.9	68.1

Source: EUROSTAT-LFS, own calculations Notes: - = no data reported due to few observations , \* according to OECD (2007) measurement

Table 5b: Over and under -education rates by types of commuting, demographic and job characteristics according to ILO (1987) measurement (EU27, 2006)

	Under-education					Over-education				
	Non	Internal	Cross-border	Established	Recent	Non	Internal	Cross-border	Established	Recent
	Commuters			Migrants		Commuters			Migrants	
Total	22.2	27.4	20.0	26.0	15.3	5.9	6.0	6.5	6.1	10.5
	Gender									
Female	19.8	25.7	19.6	26.9	15.4	6.4	7.4	8.7	7.6	12.4
Male	25.0	30.5	21.0	25.2	15.2	5.5	5.5	5.4	5.5	8.8
	Age									
Age 15-24 years	13.3	17.9	10.2	15.1	6.1	7.5	11.2	-	-	1.8
Age 24-45 years	23.0	28.9	21.2	25.8	16.9	6.3	7.4	8.2	7.9	11.7
Age 45-60 years	24.0	28.0	21.8	27.8	14.6	4.2	4.4	3.9	5.9	11.1
Age 60 or more years	21.5	30.0	27.1	26.0	60.2	4.3	4.7	-	-	-
	Education									
Low education (ISCED 2 or less)	95.1	94.4	90.7	94.0	90.9					
Medium education (ISCED 3 or 4)	60.6	55.6	61.3	57.6	50.7	0.2	0.6	0.1	0.8	0.7
High education (ISCED 5 or more)						9.4	12.8	-	-	-
	Profession									
High-skilled*	95.1	94.4	90.7	94.0	90.9					
Medium-skilled*	60.6	55.6	61.3	57.6	50.7	0.2	0.6	-	-	-
Low-skilled*						9.4	12.8	9.7	11.7	14.1

Source: EUROSTAT-LFS, own calculations Notes: - = no data reported due to few observations , \*according to ILO (1987) measurement

Table 6: Results for probability of over-and under-educated employment (marginal effects)

	Low Educated:		Medium Educated				High Educated	
	P(Under-educated) Coefficient	S.E.	P(Under-educated) Coefficient	S.E.	P(Over-educated) Coefficient	S.E.	P(Over-educated) Coefficient	S.E.
<b>Sending Region: All</b>								
Internal commuter <sup>3)</sup>	0.039***	0.0003	0.070***	0.0002	-0.022***	0.0001	-0.055***	0.0002
Cross-border Commuter <sup>3)</sup>	0.057***	0.0012	-0.019***	0.0007	0.039***	0.0005	0.029***	0.0009
No response <sup>3)</sup>	-0.040***	0.0037	-0.053***	0.0018	0.001	0.0014	-0.106***	0.0013
Established Migrant <sup>3)</sup>	-0.007***	0.0007	0.048***	0.0006	0.008***	0.0004	0.017***	0.0006
Recent Migrants <sup>3)</sup>	-0.120***	0.0009	-0.070***	0.0005	0.202***	0.0005	0.175***	0.0008
Common Language	0.057***	0.0014	0.065***	0.0012	-0.050***	0.0004	-0.100***	0.0007
Slovak-Czech	0.025***	0.0035	-0.085***	0.0014	-0.004***	0.0009	-0.015***	0.0037
Scandinavia	0.025***	0.0030	-0.030***	0.0017	-0.025***	0.0009	0.004*	0.0026
Male	0.061***	0.0002	0.027***	0.0001	-0.007***	0.0001	-0.058***	0.0001
Age 25-44 <sup>2)</sup>	-0.026***	0.0002	0.122***	0.0002	-0.021***	0.0001	-0.163***	0.0003
Age 45-59 <sup>2)</sup>	-0.008***	0.0002	0.172***	0.0002	-0.015***	0.0001	-0.166***	0.0002
Age 60 or more <sup>2)</sup>	0.016***	0.0003	0.219***	0.0004	0.008***	0.0002	-0.133***	0.0002
Manufacturing <sup>1)</sup>	-0.022***	0.0003	0.230***	0.0004	-0.030***	0.0001	-0.165***	0.0002
Construction <sup>1)</sup>	-0.044***	0.0004	0.116***	0.0005	-0.020***	0.0001	-0.084***	0.0003
Market Services <sup>1)</sup>	-0.085***	0.0003	0.330***	0.0003	-0.020***	0.0001	-0.213***	0.0003
Non-Market Services <sup>1)</sup>	-0.216***	0.0004	0.432***	0.0004	-0.007***	0.0001	-0.372***	0.0003
<b>Sending Region: EU15</b>								
Internal Commuter <sup>3)</sup>	0.038***	0.0003	0.076***	0.0002	-0.027***	0.0001	-0.061***	0.0002
Cross-border Commuter <sup>3)</sup>	0.095***	0.0011	0.044***	0.0009	-0.037***	0.0004	-0.013***	0.0009
No response <sup>3)</sup>	-0.032***	0.0037	-0.052***	0.0021	-0.012***	0.0013	-0.123***	0.0013
Established Migrant <sup>3)</sup>	0.003***	0.0008	0.081***	0.0007	-0.031***	0.0003	-0.046***	0.0006
Recent Migrants <sup>3)</sup>	0.065***	0.0017	0.133***	0.0013	-0.038***	0.0005	-0.059***	0.0007
Common Language	0.014***	0.0018	-0.011***	0.0012	0.022***	0.0011	-0.031***	0.0012
Scandinavia	0.010***	0.0031	-0.058***	0.0018	0.024***	0.0016	0.112***	0.0036
Male	0.072***	0.0002	0.058***	0.0001	-0.001***	0.0001	-0.066***	0.0001
Age 25-44 <sup>2)</sup>	-0.025***	0.0002	0.139***	0.0002	-0.022***	0.0001	-0.166***	0.0003
Age 45-59 <sup>2)</sup>	-0.007***	0.0002	0.188***	0.0002	-0.018***	0.0001	-0.171***	0.0002
Age 60 or more <sup>2)</sup>	-0.016***	0.0004	0.223***	0.0004	0.004***	0.0002	-0.141***	0.0002
Manufacturing <sup>1)</sup>	0.046***	0.0003	0.209***	0.0006	-0.033***	0.0002	-0.184***	0.0002
Construction <sup>1)</sup>	0.041***	0.0004	0.057***	0.0006	-0.029***	0.0002	-0.090***	0.0003
Market Services <sup>1)</sup>	-0.006***	0.0003	0.317***	0.0005	-0.019***	0.0002	-0.241***	0.0003
Non-Market Service <sup>1)s</sup>	-0.104***	0.0004	0.380***	0.0005	-0.015***	0.0002	-0.401***	0.0004
<b>Sending Region: NMS12</b>								
Internal Commuter <sup>3)</sup>	0.036***	0.0014	0.023***	0.0006	0.007***	0.0005	-0.028***	0.0006
Cross-border Commuter <sup>3)</sup>	-0.027***	0.0030	-0.095***	0.0006	0.138***	0.0010	0.226***	0.0028
No response <sup>3)</sup>	0.002***	0.0005	-0.077***	0.0065	0.013**	0.0060	0.026	0.0203
Established Migrant <sup>3)</sup>	0.030***	0.0014	-0.024***	0.0007	0.074***	0.0008	0.231***	0.0015
Recent Migrants <sup>3)</sup>	-0.085***	0.0010	-0.112***	0.0003	0.251***	0.0006	0.534***	0.0014
Slovak-Czech	0.025***	0.0038	0.006***	0.0016	-0.039***	0.0005	-0.082***	0.0007
Male	0.019***	0.0004	-0.049***	0.0002	-0.021***	0.0001	-0.017***	0.0002
Age 25-44 <sup>2)</sup>	-0.020***	0.0006	0.070***	0.0003	-0.019***	0.0002	-0.141***	0.0006
Age 45-59 <sup>2)</sup>	-0.009***	0.0006	0.111***	0.0004	-0.008***	0.0002	-0.134***	0.0003
Age 60 or more <sup>2)</sup>	0.110***	0.0006	0.203***	0.0009	0.016***	0.0004	-0.089***	0.0002
Manufacturing <sup>1)</sup>	-0.067***	0.0007	0.193***	0.0005	-0.023***	0.0002	-0.092***	0.0003
Construction <sup>1)</sup>	-0.187***	0.0010	0.198***	0.0007	-0.005***	0.0002	-0.083***	0.0002
Market Services <sup>1)</sup>	-0.162***	0.0007	0.277***	0.0005	-0.031***	0.0002	-0.102***	0.0004
Non-Market Service <sup>1)s</sup>	-0.469***	0.0008	0.529***	0.0005	0.013***	0.0002	-0.258***	0.0006

S EU-LFS, Notes: Table reports marginal effects of multinomial logit regressions on the probability of over-and under-educated employment. Results for base category (appropriate employment) and for sending country fixed effects are not reported, 1) base category=Agriculture and mining 2) base category = aged 15-24, 3) base category non-commuters \*\*\* (\*\*) (\*) significant at the 1%, (5%), (10%) level respectively. S.E.= heteroscedasticity robust standard error.

## Appendix A: Regression results

Table A1: Regression results for probability of over-and under-educated employment

	Low Educated:		Medium Educated				High Educated	
	P(Under-educated)		P(Under-educated)		P(Over-educated)		P(Over-educated)	
	Coefficient	S.E.	Coefficient	S.E.	†	S.E.	†	S.E.
<b>Sending Region: All</b>								
Internal Commuter <sup>3)</sup>	0.245 ***	0.002	0.317 ***	0.001	-0.212 ***	0.002	-0.400 ***	0.001
Cross-border Commuter <sup>3)</sup>	0.379 ***	0.009	-0.048 ***	0.004	0.396 ***	0.005	0.180 ***	0.005
No response <sup>3)</sup>	-0.221 ***	0.020	-0.306 ***	0.011	-0.079 ***	0.018	-0.955 ***	0.017
Established Migrant <sup>3)</sup>	-0.043 ***	0.004	0.261 ***	0.003	0.181 ***	0.004	0.108 ***	0.004
Recent Migrants <sup>3)</sup>	-0.611 ***	0.004	-0.087 ***	0.003	1.432 ***	0.003	0.903 ***	0.004
Same Language	0.375 ***	0.011	0.246 ***	0.006	-0.834 ***	0.011	-0.874 ***	0.008
Czech Republic-Slovakia	0.158 ***	0.023	-0.523 ***	0.010	-0.168 ***	0.011	-0.105 ***	0.026
Scandinavia	0.154 ***	0.019	-0.207 ***	0.010	-0.427 ***	0.016	0.029 *	0.016
Male	0.357 ***	0.001	0.138 ***	0.001	-0.043 ***	0.001	-0.378 ***	0.001
Age 25-44 <sup>2)</sup>	-0.150 ***	0.001	0.631 ***	0.001	-0.088 ***	0.001	-1.003 ***	0.002
Age 45-59 <sup>2)</sup>	-0.048 ***	0.001	0.850 ***	0.001	0.073 ***	0.001	-1.264 ***	0.002
Age 60 or more <sup>2)</sup>	0.098 ***	0.002	1.046 ***	0.002	0.504 ***	0.002	-1.283 ***	0.002
Manufacturing <sup>1)</sup>	-0.129 ***	0.002	1.065 ***	0.002	-0.048 ***	0.002	-1.542 ***	0.003
Construction <sup>1)</sup>	-0.245 ***	0.002	0.537 ***	0.002	-0.099 ***	0.002	-0.678 ***	0.003
Market Services <sup>1)</sup>	-0.486 ***	0.002	1.663 ***	0.002	0.275 ***	0.002	-1.619 ***	0.002
Non-Market Service <sup>1)</sup>	-1.099 ***	0.002	2.093 ***	0.002	0.759 ***	0.002	-2.537 ***	0.002
Log Likelihood	-19164699		-71561501				-22141060	
<b>Sending Region: EU 15</b>								
Internal Commuter <sup>3)</sup>	0.245 ***	0.002	0.313 ***	0.001	-0.268 ***	0.002	-0.411 ***	0.001
Cross-border Commuter <sup>3)</sup>	0.706 ***	0.011	0.149 ***	0.004	-0.535 ***	0.009	-0.080 ***	0.006
No response <sup>3)</sup>	-0.184 ***	0.020	-0.291 ***	0.011	-0.246 ***	0.019	-1.059 ***	0.017
Established Migrant <sup>3)</sup>	0.019 ***	0.005	0.327 ***	0.003	-0.345 ***	0.006	-0.310 ***	0.004
Recent Migrants <sup>3)</sup>	0.444 ***	0.013	0.536 ***	0.005	-0.397 ***	0.011	-0.411 ***	0.006
Same Language	0.089 ***	0.011	-0.018 ***	0.006	0.246 ***	0.012	-0.203 ***	0.008
Scandinavia	0.064 ***	0.020	-0.269 ***	0.010	0.188 ***	0.017	0.589 ***	0.016
Male	0.427 ***	0.001	0.290 ***	0.001	0.083 ***	0.001	-0.402 ***	0.001
Age 25-44 <sup>2)</sup>	-0.151 ***	0.001	0.665 ***	0.001	-0.059 ***	0.001	-0.966 ***	0.002
Age 45-59 <sup>2)</sup>	-0.042 ***	0.001	0.868 ***	0.001	0.082 ***	0.001	-1.208 ***	0.002
Age 60 or more <sup>2)</sup>	-0.096 ***	0.002	1.025 ***	0.002	0.503 ***	0.002	-1.242 ***	0.003
Manufacturing <sup>1)</sup>	0.291 ***	0.002	0.903 ***	0.002	-0.119 ***	0.003	-1.614 ***	0.003
Construction <sup>1)</sup>	0.258 ***	0.002	0.224 ***	0.003	-0.348 ***	0.003	-0.669 ***	0.003
Market Services <sup>1)</sup>	-0.034 ***	0.002	1.525 ***	0.002	0.300 ***	0.003	-1.726 ***	0.003
Non-Market Services <sup>1)</sup>	-0.573 ***	0.002	1.766 ***	0.002	0.541 ***	0.003	-2.598 ***	0.003
Log Likelihood	-16301228		-52333308				-19406556	
<b>Sending Region: NMS 12</b>								
Internal Commuter <sup>3)</sup>	0.219 ***	0.009	0.163 ***	0.004	0.121 ***	0.006	-0.327 ***	0.008
Cross-border Commuter <sup>3)</sup>	-0.146 ***	0.016	-0.715 ***	0.008	1.046 ***	0.006	1.426 ***	0.013
No response <sup>3)</sup>	0.036 ***	0.008	-0.659 ***	0.074	0.067 ***	0.069	0.249 ***	0.174
Established Migrant <sup>3)</sup>	0.181 ***	0.009	-0.078 ***	0.006	0.711 ***	0.006	1.457 ***	0.007
Recent Migrants <sup>3)</sup>	-0.438 ***	0.005	-0.775 ***	0.005	1.634 ***	0.003	2.732 ***	0.006
Slovakia – Czech Republic	0.151 ***	0.023	-0.009	0.011	-0.676	0.011	-1.496	0.027
Male	0.111 ***	0.002	-0.369 ***	0.001	-0.347 ***	0.002	-0.180 ***	0.002
Age 25-44 <sup>2)</sup>	-0.139 ***	0.003	0.475 ***	0.002	-0.153 ***	0.002	-1.278 ***	0.005
Age 45-59 <sup>2)</sup>	-0.050 ***	0.004	0.712 ***	0.002	0.041 ***	0.003	-1.707 ***	0.005
Age 60 or more <sup>2)</sup>	0.724 ***	0.005	1.125 ***	0.004	0.527 ***	0.005	-1.586 ***	0.007
Manufacturing <sup>1)</sup>	-0.359 ***	0.003	1.140 ***	0.003	-0.054 ***	0.002	-1.384 ***	0.005
Construction <sup>1)</sup>	-0.897 ***	0.004	1.092 ***	0.003	0.235 ***	0.003	-1.386 ***	0.007
Market Services <sup>1)</sup>	-0.806 ***	0.003	1.616 ***	0.003	-0.051 ***	0.002	-1.222 ***	0.005
Non-Market Services <sup>1)</sup>	-2.110 ***	0.004	2.807 ***	0.003	1.280 ***	0.003	-2.559 ***	0.005
Log Likelihood	-2735656.6		-18626931				-18626931	

S EU-LFS, Notes: Table reports coefficients of a multinomial logit regression on the probability of over-, under-educated employment relative to appropriate employment. See table 7 for notes.

Table A2: Regression results for probability of over-and under-educated employment (coefficients)

	Low Educated		Medium Educated				High Educated	
	P(Under-Educated)		P(Under-Educated)		P(Over-Educated)		P(Over-Educated)	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
<b>Sending Region: All</b>								
Internal Commuter <sup>3)</sup>	0.253	*** 0.002	0.338	*** 0.001	-0.225	*** 0.002	-0.467	*** 0.001
Cross-border Commuter <sup>3)</sup>	0.201	*** 0.011	-0.118	*** 0.005	0.559	*** 0.006	0.106	*** 0.008
Common Language	1.069	*** 0.035	0.183	*** 0.012	-0.918	*** 0.021	-1.092	*** 0.026
Slovak-Czech	0.197	*** 0.042	-0.885	*** 0.016	-0.067	*** 0.014	0.719	*** 0.035
Male	0.358	*** 0.001	0.090	*** 0.001	-0.027	*** 0.001	-0.345	*** 0.001
Age 25-44 <sup>2)</sup>	-0.128	*** 0.001	0.619	*** 0.001	-0.074	*** 0.001	-1.003	*** 0.002
Age 45-59 <sup>2)</sup>	-0.037	*** 0.001	0.844	*** 0.001	0.086	*** 0.001	-1.255	*** 0.002
Age 60 or more <sup>2)</sup>	0.080	*** 0.002	0.999	*** 0.002	0.517	*** 0.002	-1.250	*** 0.002
Manufacturing/Construction <sup>1)</sup>	-0.119	*** 0.002	0.616	*** 0.001	-0.172	*** 0.002	-0.909	*** 0.002
Market Services <sup>1)</sup>	-0.432	*** 0.002	1.268	*** 0.001	0.216	*** 0.001	-1.109	*** 0.002
Non-Market Services <sup>1)</sup>	-1.042	*** 0.002	1.709	*** 0.001	0.682	*** 0.001	-2.077	*** 0.002
Log-Likelihood	-18461155		-69527091				-21408693	
Nobs	36591196		86194303				45985034	
<b>Sending Region: EU15</b>								
Internal Commuter <sup>3)</sup>	0.245	*** 0.002	0.332	*** 0.001	-0.266	*** 0.002	-0.464	*** 0.001
Cross-border Commuter <sup>3)</sup>	0.384	*** 0.014	0.226	*** 0.007	-0.159	*** 0.012	-0.048	*** 0.008
Common Language	0.897	*** 0.036	-0.212	*** 0.013	-0.228	*** 0.024	-0.944	*** 0.026
Male	0.426	*** 0.001	0.256	*** 0.001	0.083	*** 0.001	-0.371	*** 0.001
Age 25-44 <sup>2)</sup>	-0.128	*** 0.001	0.649	*** 0.001	-0.059	*** 0.001	-0.968	*** 0.002
Age 45-59 <sup>2)</sup>	-0.033	*** 0.001	0.867	*** 0.001	0.086	*** 0.001	-1.198	*** 0.002
Age 60 or more <sup>2)</sup>	-0.105	*** 0.002	0.982	*** 0.002	0.512	*** 0.002	-1.217	*** 0.003
Manufacturing/Construction <sup>1)</sup>	0.145	*** 0.002	0.453	*** 0.002	-0.312	*** 0.002	-0.916	*** 0.002
Market Services <sup>1)</sup>	-0.162	*** 0.002	1.194	*** 0.002	0.235	*** 0.002	-1.185	*** 0.002
Non-Market Services <sup>1)</sup>	-0.704	*** 0.002	1.445	*** 0.002	0.475	*** 0.002	-2.101	*** 0.002
Log-Likelihood	-15959980		-51203852				-18976795	
Nobs	31497241		60727781				38832295	
<b>Sending Region: NMS12</b>								
Internal Commuter <sup>3)</sup>	0.427	*** 0.010	0.203	*** 0.004	-0.074	*** 0.006	-0.472	*** 0.009
Cross-border Commuter <sup>3)</sup>	-0.089	*** 0.020	-0.599	*** 0.009	0.948	*** 0.008	1.004	*** 0.018
Slovak-Czech	0.521	*** 0.045	-0.260	*** 0.018	-0.386	*** 0.015	-0.204	*** 0.040
Male	0.056	*** 0.002	-0.444	*** 0.001	-0.313	*** 0.002	-0.136	*** 0.003
Age 25-44 <sup>2)</sup>	-0.115	*** 0.004	0.484	*** 0.002	-0.103	*** 0.003	-1.304	*** 0.005
Age 45-59 <sup>2)</sup>	-0.029	*** 0.004	0.708	*** 0.002	0.083	*** 0.003	-1.754	*** 0.005
Age 60 or more <sup>2)</sup>	0.749	*** 0.005	1.072	*** 0.004	0.536	*** 0.005	-1.495	*** 0.007
Manufacturing/Construction <sup>1)</sup>	-0.558	*** 0.004	0.844	*** 0.002	0.027	*** 0.002	-1.069	*** 0.005
Market Services <sup>1)</sup>	-0.829	*** 0.004	1.188	*** 0.002	-0.055	*** 0.002	-0.687	*** 0.004
Non-Market Services <sup>1)</sup>	-2.154	*** 0.004	2.398	*** 0.002	1.280	*** 0.002	-2.138	*** 0.004
Log-Likelihood	-2397166		-17815005				-2393532.8	
Nobs	5093955		25466522				7152739	

Source: EU-LFS Notes. Table reports coefficients of multinomial logit regressions on the probability of over- and under-educated employment. Results for base category (appropriate employment) and for sending (NUTS2) region fixed effects are not reported. 1) base category=Agriculture and mining. 2) base category=aged 15-24. 3) base category=non-commuters. \*\*\* significant at the 1%, level. SE=Standard Error, Nobs=Number of Observations.



## Appendix B: Robustness checks

### Appendix B1: Additional regression results for education-job mismatch excluding cross-border commuters to Luxemburg (OECD Definition)

	Low Educated:			Medium Educated				High Educated					
	P(Under-educated)			P(Under-educated)		P(Over-educated)		P(Over-educated)					
	Coefficient	S.E.		Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.				
	<b>Sending Region: All</b>												
Internal Commuter <sup>3)</sup>	0.245	***	0.002	0.317	***	0.001	-0.212	***	0.002	-0.400	***	0.001	
Cross-border Commuter <sup>3)</sup>	0.378	***	0.009	-0.048	***	0.004	0.396	***	0.005	0.184	***	0.005	
No response <sup>3)</sup>	-0.221	***	0.020	-0.306	***	0.011	-0.079	***	0.018	-0.955	***	0.017	
Established Migrant <sup>3)</sup>	-0.044	***	0.004	0.260	***	0.003	0.180	***	0.004	0.101	***	0.004	
Recent Migrants <sup>3)</sup>	-0.611	***	0.004	-0.087	***	0.003	1.432	***	0.003	0.909	***	0.004	
Same Language	0.375	***	0.011	0.247	***	0.006	-0.834	***	0.011	-0.875	***	0.008	
Czech Republic-Slovakia	0.159	***	0.023	-0.523	***	0.010	-0.168	***	0.011	-0.106	***	0.026	
Scandinavia	0.154	***	0.019	-0.207	***	0.010	-0.426	***	0.016	0.033	**	0.016	
Male	0.357	***	0.001	0.138	***	0.001	-0.043	***	0.001	-0.378	***	0.001	
Age 25-44 <sup>2)</sup>	-0.150	***	0.001	0.631	***	0.001	-0.088	***	0.001	-1.002	***	0.002	
Age 45-59 <sup>2)</sup>	-0.048	***	0.001	0.850	***	0.001	0.073	***	0.001	-1.263	***	0.002	
Age 60 or more <sup>2)</sup>	0.098	***	0.002	1.046	***	0.002	0.504	***	0.002	-1.283	***	0.002	
Manufacturing <sup>1)</sup>	-0.129	***	0.002	1.065	***	0.002	-0.048	***	0.002	-1.544	***	0.003	
Construction <sup>1)</sup>	-0.246	***	0.002	0.537	***	0.002	-0.099	***	0.002	-0.683	***	0.003	
Market Services <sup>1)</sup>	-0.486	***	0.002	1.663	***	0.002	0.275	***	0.002	-1.622	***	0.002	
Non-Market Services <sup>1)</sup>	-1.099	***	0.002	2.093	***	0.002	0.759	***	0.002	-2.539	***	0.002	
Log Likelihood	-19161825			-71557878				-22135874					
	<b>Sending Region EU 15</b>												
Internal Commuter <sup>3)</sup>	0.245	***	0.002	0.313	***	0.001	-0.268	***	0.002	-0.411	***	0.001	
Cross-border Commuter <sup>3)</sup>	0.705	***	0.011	0.148	***	0.004	-0.534	***	0.009	-0.074	***	0.006	
No response <sup>3)</sup>	-0.184	***	0.020	-0.291	***	0.011	-0.246	***	0.019	-1.059	***	0.017	
Established Migrant <sup>3)</sup>	0.017	***	0.005	0.326	***	0.003	-0.346	***	0.006	-0.318	***	0.004	
Recent Migrants <sup>3)</sup>	0.464	***	0.013	0.539	***	0.005	-0.395	***	0.011	-0.403	***	0.006	
Same Language	0.088	***	0.011	-0.018	***	0.006	0.245	***	0.012	-0.204	***	0.008	
Scandinavia	0.065	***	0.020	-0.268	***	0.010	0.189	***	0.017	0.595	***	0.016	
Male	0.427	***	0.001	0.290	***	0.001	0.082	***	0.001	-0.402	***	0.001	
Age 25-44 <sup>2)</sup>	-0.151	***	0.001	0.665	***	0.001	-0.059	***	0.001	-0.966	***	0.002	
Age 45-59 <sup>2)</sup>	-0.042	***	0.001	0.868	***	0.001	0.082	***	0.001	-1.208	***	0.002	
Age 60 or more <sup>2)</sup>	-0.096	***	0.002	1.025	***	0.002	0.503	***	0.002	-1.241	***	0.003	
Manufacturing <sup>1)</sup>	0.290	***	0.002	0.903	***	0.002	-0.119	***	0.003	-1.617	***	0.003	
Construction <sup>1)</sup>	0.257	***	0.002	0.224	***	0.003	-0.348	***	0.003	-0.675	***	0.003	
Market Services <sup>1)</sup>	-0.034	***	0.002	1.525	***	0.002	0.300	***	0.003	-1.729	***	0.003	
Non-Market Services <sup>1)</sup>	-0.573	***	0.002	1.766	***	0.002	0.541	***	0.003	-2.602	***	0.003	
Log Likelihood	-16298272			-52329707				-19401687					
	<b>Sending Region: NMS 12</b>												
Internal Commuter <sup>3)</sup>	0.219	***	0.009	0.163	***	0.004	0.121	***	0.006	-0.327	***	0.008	
Cross-border Commuter <sup>3)</sup>	-0.146	***	0.016	-0.715	***	0.008	1.046	***	0.006	1.426	***	0.013	
No response <sup>3)</sup>	0.025	***	0.007	-0.659	***	0.074	0.067		0.069	0.249		0.174	
Established Migrant <sup>3)</sup>	0.181	***	0.009	-0.078	***	0.006	0.711	***	0.006	1.457	***	0.007	
Recent Migrants <sup>3)</sup>	-0.438	***	0.005	-0.775	***	0.005	1.634	***	0.003	2.732	***	0.006	
Slovakia – Czech Republic	0.151	***	0.023	-0.009		0.011	-0.676		0.011	-1.496		0.027	
Male	0.111	***	0.002	-0.369	***	0.001	-0.347	***	0.002	-0.180	***	0.002	
Age 25-44 <sup>2)</sup>	-0.139	***	0.003	0.475	***	0.002	-0.153	***	0.002	-1.278	***	0.005	
Age 45-59 <sup>2)</sup>	-0.050	***	0.004	0.712	***	0.002	0.041	***	0.003	-1.707	***	0.005	
Age 60 or more <sup>2)</sup>	0.724	***	0.005	1.125	***	0.004	0.527	***	0.005	-1.586	***	0.007	
Manufacturing <sup>1)</sup>	-0.359	***	0.003	1.140	***	0.003	-0.054	***	0.002	-1.384	***	0.005	
Construction <sup>1)</sup>	-0.897	***	0.004	1.092	***	0.003	0.235	***	0.003	-1.386	***	0.007	
Market Services <sup>1)</sup>	-0.806	***	0.003	1.616	***	0.003	-0.051	***	0.002	-1.222	***	0.005	
Non-Market Services <sup>1)</sup>	-2.110	***	0.004	2.807	***	0.003	1.280	***	0.003	-2.559	***	0.005	
Log Likelihood	-2735657			-18626931				-2597088					

S EU-LFS, Notes: Table reports coefficients of a multinomial logit regression on the probability of over-, under-educated employment relative to appropriate employment. See table 7 for notes.

Appendix B2 Marginal effects for education-job mismatch excluding cross-border commuters to Luxemburg (OECD Definition)

	Low Educated: P(Under-educated)			Medium Educated				High Educated P(Over-educated)				
	Coefficient	S.E.		P(Under-educated) Coefficient	S.E.	P(Over-educated) Coefficient	S.E.	P(Over-educated) Coefficient	S.E.			
<b>Sending Region: All</b>												
Internal commuter <sup>3)</sup>	0.039	***	0.0003	0.070	***	0.0002	-0.022	***	0.0001	-0.055	***	0.0002
Cross-border Commuter <sup>3)</sup>	0.057	***	0.0012	-0.019	***	0.0007	0.039	***	0.0005	0.030	***	0.0009
No response <sup>3)</sup>	-0.040	***	0.0037	-0.053	***	0.0018	0.000		0.0014	-0.106	***	0.0013
Established Migrant <sup>3)</sup>	-0.007	***	0.0007	0.048	***	0.0006	0.008	***	0.0004	0.016	***	0.0006
Recent Migrants <sup>3)</sup>	-0.120	***	0.0009	-0.070	***	0.0005	0.202	***	0.0005	0.176	***	0.0008
Common Language	0.057	***	0.0014	0.065	***	0.0012	-0.050	***	0.0004	-0.100	***	0.0007
Slovak-Czech	0.026	***	0.0035	-0.085	***	0.0014	-0.004	***	0.0009	-0.016	***	0.0037
Scandinavia	0.025	***	0.0030	0.030	***	0.0017	0.025	***	0.0009	0.005	**	0.0026
Male	0.061	***	0.0002	0.027	***	0.0001	-0.007	***	0.0001	-0.058	***	0.0001
Age 25-44 <sup>2)</sup>	-0.026	***	0.0002	0.122	***	0.0002	-0.021	***	0.0001	-0.163	***	0.0003
Age 45-59 <sup>2)</sup>	-0.008	***	0.0002	0.172	***	0.0002	-0.015	***	0.0001	-0.166	***	0.0002
Age 60 or more <sup>2)</sup>	0.016	***	0.0003	0.219	***	0.0004	0.008	***	0.0002	-0.133	***	0.0002
Manufacturing <sup>1)</sup>	-0.022	***	0.0003	0.230	***	0.0004	-0.030	***	0.0001	-0.165	***	0.0002
Construction <sup>1)</sup>	-0.044	***	0.0004	0.116	***	0.0005	-0.020	***	0.0001	-0.085	***	0.0003
Market Services <sup>1)</sup>	-0.085	***	0.0003	0.330	***	0.0003	-0.020	***	0.0001	-0.213	***	0.0003
Non-Market Services <sup>1)</sup>	-0.216	***	0.0004	0.432	***	0.0004	-0.007	***	0.0001	-0.372	***	0.0003
<b>Sending Region: EU15</b>												
Internal Commuter <sup>3)</sup>	0.038	***	0.0003	0.076	***	0.0002	-0.027	***	0.0001	-0.061	***	0.0002
Cross-border Commuter <sup>3)</sup>	0.095	***	0.0011	0.044	***	0.0009	-0.037	***	0.0004	-0.012	***	0.0009
No response <sup>3)</sup>	-0.032	***	0.0037	-0.052	***	0.0021	-0.012	***	0.0013	-0.123	***	0.0013
Established Migrant <sup>3)</sup>	0.003	***	0.0008	0.081	***	0.0007	-0.031	***	0.0003	-0.047	***	0.0006
Recent Migrants <sup>3)</sup>	0.067	***	0.0016	0.133	***	0.0013	-0.038	***	0.0005	-0.058	***	0.0007
Common Language	0.014	***	0.0018	-0.011	***	0.0012	0.022	***	0.0011	-0.031	***	0.0012
Scandinavia	0.011	***	0.0031	-0.058	***	0.0018	0.024	***	0.0016	0.113	***	0.0036
Male	0.072	***	0.0002	0.058	***	0.0001	-0.001	***	0.0001	-0.066	***	0.0001
Age 25-44 <sup>2)</sup>	-0.025	***	0.0002	0.139	***	0.0002	-0.022	***	0.0001	-0.166	***	0.0003
Age 45-59 <sup>2)</sup>	-0.007	***	0.0002	0.188	***	0.0002	-0.018	***	0.0001	-0.171	***	0.0002
Age 60 or more <sup>2)</sup>	-0.016	***	0.0004	0.223	***	0.0004	0.004	***	0.0002	-0.141	***	0.0002
Manufacturing <sup>1)</sup>	0.046	***	0.0003	0.209	***	0.0006	-0.033	***	0.0002	-0.184	***	0.0002
Construction <sup>1)</sup>	0.040	***	0.0004	0.057	***	0.0006	-0.029	***	0.0002	-0.090	***	0.0003
Market Services <sup>1)</sup>	-0.006	***	0.0003	0.317	***	0.0005	-0.019	***	0.0002	-0.242	***	0.0003
Non-Market Services <sup>1)</sup>	-0.104	***	0.0004	0.380	***	0.0005	-0.015	***	0.0002	-0.401	***	0.0004
<b>Sending Region: NMS12</b>												
Internal Commuter <sup>3)</sup>	0.036	***	0.0014	0.023	***	0.0006	0.007	***	0.0005	-0.028	***	0.0006
Cross-border Commuter <sup>3)</sup>	-0.027	***	0.0030	-0.095	***	0.0006	0.138	***	0.0010	0.226	***	0.0028
No response <sup>3)</sup>	0.001	***	0.0003	-0.077	***	0.0065	0.013	**	0.0060	0.026		0.0203
Established Migrant <sup>3)</sup>	0.030	***	0.0014	-0.024	***	0.0007	0.074	***	0.0008	0.231	***	0.0015
Recent Migrants <sup>3)</sup>	-0.085	***	0.0010	-0.112	***	0.0003	0.251	***	0.0006	0.534	***	0.0014
Slovak-Czech	0.025	***	0.0038	0.006	***	0.0016	-0.039	***	0.0005	-0.082	***	0.0007
Male	0.019	***	0.0004	-0.049	***	0.0002	-0.021	***	0.0001	-0.017	***	0.0002
Age 25-44 <sup>2)</sup>	-0.025	***	0.0006	0.070	***	0.0003	-0.019	***	0.0002	-0.141	***	0.0006
Age 45-59 <sup>2)</sup>	-0.009	***	0.0006	0.111	***	0.0004	-0.008	***	0.0002	-0.134	***	0.0003
Age 60 or more <sup>2)</sup>	0.110	***	0.0006	0.203	***	0.0009	0.016	***	0.0004	-0.089	***	0.0002
Manufacturing <sup>1)</sup>	-0.067	***	0.0007	0.193	***	0.0005	-0.023	***	0.0002	-0.092	***	0.0003
Construction <sup>1)</sup>	-0.187	***	0.0010	0.198	***	0.0007	-0.005	***	0.0002	-0.083	***	0.0002
Market Services <sup>1)</sup>	-0.162	***	0.0007	0.277	***	0.0005	-0.031	***	0.0002	-0.102	***	0.0004
Non-Market Services <sup>1)</sup>	-0.469	***	0.0008	0.529	***	0.0005	0.013	***	0.0002	-0.258	***	0.0006

S EU-LFS, Notes: Table reports marginal effects of multinomial logit regressions on the probability of over- and under-educated employment. Results for base category (appropriate employment) and for sending country fixed effects are not reported, 1) base category=Agriculture and mining 2) base category = aged 15-24, 3) base category non-commuters \*\*\* (\*\*) (\*) significant at the 1%, (5%), (10%) level respectively. S.E.=heteroscedasticity robust standard error.

Appendix B3: Regression results for education-job mismatch according to ILO-definition

	Low Educated:			Medium Educated					
	P(Under-educated)			P(Under-educated)		P(Over-educated)			
	Coefficient	S.E.		Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
<b>Sending Region: All</b>									
Internal Commuter <sup>3)</sup>	0.380	***	0.001	0.028	***	0.001	-0.337	***	0.002
Cross-border Commuter <sup>3)</sup>	0.056	***	0.004	-0.007		0.006	0.167	***	0.007
No response <sup>3)</sup>	-0.289	***	0.012	0.324	***	0.016	-0.693	***	0.021
Established Migrant <sup>3)</sup>	0.060	***	0.003	0.072	***	0.004	0.169	***	0.005
Recent Migrants <sup>3)</sup>	-0.242	***	0.003	0.006		0.005	0.974	***	0.005
Same Language	0.244	***	0.006	0.081	***	0.008	-0.613	***	0.010
Czech Republic-Slovakia	-0.591	***	0.011	0.844	***	0.025	0.432	***	0.033
Scandinavia	-0.070	***	0.010	-0.348	***	0.015	-0.215	***	0.019
Male	0.117	***	0.001	0.351	***	0.001	-0.085	***	0.001
Age 25-44 <sup>2)</sup>	0.371	***	0.001	0.672	***	0.002	-0.480	***	0.002
Age 45-59 <sup>2)</sup>	0.440	***	0.001	0.883	***	0.002	-0.521	***	0.002
Age 60 or more <sup>2)</sup>	0.359	***	0.002	1.191	***	0.003	-0.291	***	0.003
Manufacturing <sup>1)</sup>	1.449	***	0.002	-0.185	***	0.004	-1.639	***	0.004
Construction <sup>1)</sup>	0.702	***	0.002	-0.062	***	0.005	-0.660	***	0.004
Market Services <sup>1)</sup>	1.873	***	0.002	-0.167	***	0.004	-1.678	***	0.004
Non-Market Services <sup>1)</sup>	2.498	***	0.002	0.384	***	0.004	-2.478	***	0.004
Log Likelihood	-46946382			-38087849					
<b>Sending Region: EU 15</b>									
Internal Commuter <sup>3)</sup>	0.385	***	0.001	0.040	***	0.001	-0.339	***	0.002
Cross-border Commuter <sup>3)</sup>	0.346	***	0.004	0.123	***	0.006	-0.001	***	0.007
No response <sup>3)</sup>	-0.191	***	0.012	0.387	***	0.016	-0.780	***	0.021
Established Migrant <sup>3)</sup>	0.181	***	0.003	0.376	***	0.004	-0.054	***	0.006
Recent Migrants <sup>3)</sup>	0.758	***	0.005	0.681	***	0.006	0.034	***	0.007
Same Language	-0.132	***	0.006	-0.267	***	0.009	-0.185	***	0.011
Scandinavia	-0.217	***	0.010	-0.682	***	0.015	0.140	***	0.019
Male	0.245	***	0.001	0.406	***	0.001	-0.096	***	0.001
Age 25-44 <sup>2)</sup>	0.380	***	0.001	0.658	***	0.002	-0.454	***	0.002
Age 45-59 <sup>2)</sup>	0.457	***	0.001	0.849	***	0.002	-0.495	***	0.002
Age 60 or more <sup>2)</sup>	0.374	***	0.002	1.175	***	0.003	-0.267	***	0.003
Manufacturing <sup>1)</sup>	1.372	***	0.003	-0.240	***	0.005	-1.741	***	0.005
Construction <sup>1)</sup>	0.527	***	0.003	-0.118	***	0.006	-0.698	***	0.005
Market Services <sup>1)</sup>	1.790	***	0.003	-0.195	***	0.005	-1.801	***	0.005
Non-Market Services <sup>1)</sup>	2.325	***	0.003	0.343	***	0.005	-2.583	***	0.005
Log Likelihood	-37049117			-32931025					
<b>Sending Region: NMS 12</b>									
Internal Commuter <sup>3)</sup>	0.187	***	0.004	-0.163	***	0.006	-0.429	***	0.009
Cross-border Commuter <sup>3)</sup>	-0.712	***	0.009	-0.505	***	0.016	0.937	***	0.016
No response <sup>3)</sup>	-0.623	***	0.085	0.207	***	0.166	0.178	***	0.203
Established Migrant <sup>3)</sup>	-0.438	***	0.007	-0.928	***	0.008	0.761	***	0.009
Recent Migrants <sup>3)</sup>	-1.107	***	0.005	-1.424	***	0.010	1.911	***	0.008
Slovakia – Czech Republic	0.082	***	0.012	1.712	***	0.026	-0.365	***	0.034
Male	-0.428	***	0.001	0.047	***	0.002	0.002	***	0.003
Age 25-44 <sup>2)</sup>	0.289	***	0.002	0.717	***	0.006	-0.702	***	0.006
Age 45-59 <sup>2)</sup>	0.298	***	0.002	1.068	***	0.006	-0.772	***	0.006
Age 60 or more <sup>2)</sup>	0.246	***	0.004	1.278	***	0.008	-0.466	***	0.010
Manufacturing <sup>1)</sup>	1.411	***	0.003	0.047	***	0.008	-1.347	***	0.008
Construction <sup>1)</sup>	1.085	***	0.004	0.145	***	0.010	-1.131	***	0.010
Market Services <sup>1)</sup>	1.794	***	0.003	-0.036	***	0.008	-1.219	***	0.008
Non-Market Services <sup>1)</sup>	2.907	***	0.003	0.613	***	0.008	-2.236	***	0.008
Log Likelihood	-9614933			-5000592					

S EU-LFS, Notes: Table reports coefficients of a multinomial logit regression on the probability of over-, under-educated employment relative to appropriate employment. See table 7 for notes.

Appendix B3 Marginal Effects for education-job mismatch according to ILO-definition

	Low Educated:		Medium Educated			
	P(Under-educated) Coefficient	S.E.	P(Under-educated) Coefficient	S.E.	P(Over-educated) Coefficient	S.E.
<b>Sending Region: All</b>						
Internal Commuter <sup>3)</sup>	0.051 ***	0.0002	0.043 ***	0.0003	-0.058 ***	0.0002
Cross-border Commuter <sup>3)</sup>	0.007 ***	0.0005	-0.022 ***	0.0013	0.032 ***	0.0011
No response <sup>3)</sup>	-0.031 ***	0.0012	0.142 ***	0.0032	-0.123 ***	0.0017
Established Migrant <sup>3)</sup>	0.007 ***	0.0004	-0.002 ***	0.0008	0.022 ***	0.0007
Recent Migrants <sup>3)</sup>	-0.027 ***	0.0004	-0.136 ***	0.0009	0.210 ***	0.0009
Common Language	0.032 ***	0.0008	0.079 ***	0.0018	-0.097 ***	0.0010
Slovak-Czech	-0.057 ***	0.0008	0.151 ***	0.0048	-0.032 ***	0.0043
Scandinavia	0.008 ***	0.0011	0.063 ***	0.0035	-0.001	0.0030
Male	0.014 ***	0.0001	0.097 ***	0.0002	-0.055 ***	0.0002
Age 25-44 <sup>2)</sup>	0.045 ***	0.0001	0.221 ***	0.0004	-0.167 ***	0.0003
Age 45-59 <sup>2)</sup>	0.055 ***	0.0001	0.267 ***	0.0004	-0.174 ***	0.0002
Age 60 or more <sup>2)</sup>	0.048 ***	0.0002	0.293 ***	0.0004	-0.151 ***	0.0002
Manufacturing <sup>1)</sup>	0.229 ***	0.0004	0.087 ***	0.0010	-0.193 ***	0.0002
Construction <sup>1)</sup>	0.102 ***	0.0004	0.048 ***	0.0010	-0.093 ***	0.0004
Market Services <sup>1)</sup>	0.272 ***	0.0003	0.122 ***	0.0009	-0.237 ***	0.0003
Non-Market Services <sup>1)</sup>	0.436 ***	0.0004	0.362 ***	0.0007	-0.464 ***	0.0004
<b>Sending Region: EU15</b>						
Internal Commuter <sup>3)</sup>	0.057 ***	0.0002	0.047 ***	0.0003	-0.063 ***	0.0002
Cross-border Commuter <sup>3)</sup>	0.052 ***	0.0007	0.031 ***	0.0014	-0.015 ***	0.0011
No response <sup>3)</sup>	-0.024 ***	0.0014	0.166 ***	0.0032	-0.144 ***	0.0017
Established Migrant <sup>3)</sup>	0.026 ***	0.0005	0.100 ***	0.0009	-0.053 ***	0.0007
Recent Migrants <sup>3)</sup>	0.128 ***	0.0011	0.163 ***	0.0012	-0.073 ***	0.0009
Common Language	-0.017 ***	0.0007	-0.046 ***	0.0017	-0.005 ***	0.0016
Scandinavia	0.027 ***	0.0011	0.174 ***	0.0030	0.106 ***	0.0039
Male	0.033 ***	0.0001	0.112 ***	0.0002	-0.065 ***	0.0002
Age 25-44 <sup>2)</sup>	0.051 ***	0.0001	0.213 ***	0.0004	-0.165 ***	0.0003
Age 45-59 <sup>2)</sup>	0.064 ***	0.0002	0.260 ***	0.0005	-0.174 ***	0.0003
Age 60 or more <sup>2)</sup>	0.056 ***	0.0003	0.298 ***	0.0005	-0.156 ***	0.0003
Manufacturing <sup>1)</sup>	0.237 ***	0.0006	0.082 ***	0.0012	-0.214 ***	0.0003
Construction <sup>1)</sup>	0.081 ***	0.0006	0.039 ***	0.0012	-0.100 ***	0.0005
Market Services <sup>1)</sup>	0.276 ***	0.0005	0.128 ***	0.0011	-0.267 ***	0.0004
Non-Market Services <sup>1)</sup>	0.415 ***	0.0006	0.361 ***	0.0009	-0.493 ***	0.0005
<b>Sending Region: NMS12</b>						
Internal Commuter <sup>3)</sup>	0.016 ***	0.0004	-0.002	0.0012	-0.032	0.0008
Cross-border Commuter <sup>3)</sup>	-0.043 ***	0.0004	-0.240 ***	0.0032	0.227 ***	0.0031
No response <sup>3)</sup>	-0.038 ***	0.0040	0.028	0.0297	0.002	0.0204
Established Migrant <sup>3)</sup>	-0.029 ***	0.0004	-0.315 ***	0.0016	0.246 ***	0.0017
Recent Migrants <sup>3)</sup>	-0.058 ***	0.0002	-0.547 ***	0.0010	0.578 ***	0.0014
Slovak-Czech	0.067 ***	0.0010	0.256 ***	0.0015	-0.110 ***	0.0007
Male	-0.035 ***	0.0001	0.010 ***	0.0004	-0.004 ***	0.0003
Age 25-44 <sup>2)</sup>	0.023 ***	0.0002	0.231 ***	0.0011	-0.162 ***	0.0007
Age 45-59 <sup>2)</sup>	0.025 ***	0.0002	0.262 ***	0.0008	-0.149 ***	0.0004
Age 60 or more <sup>2)</sup>	0.021 ***	0.0004	0.232 ***	0.0007	-0.107 ***	0.0003
Manufacturing <sup>1)</sup>	0.150 ***	0.0004	0.093 ***	0.0014	-0.111 ***	0.0003
Construction <sup>1)</sup>	0.125 ***	0.0006	0.096 ***	0.0016	-0.094 ***	0.0004
Market Services <sup>1)</sup>	0.202 ***	0.0004	0.086 ***	0.0013	-0.118 ***	0.0005
Non-Market Services <sup>1)</sup>	0.471 ***	0.0006	0.341 ***	0.0012	-0.332 ***	0.0007

S EU-LFS, Notes: Table reports marginal effects of multinomial logit regressions on the probability of over- and under-educated employment. Results for base category (appropriate employment) and for sending country fixed effects are not reported, 1) base category=Agriculture and mining 2) base category = aged 15-24, 3) base category non-commuters \*\*\* (\*\*) (\*) significant at the 1%, (5%), (10%) level respectively. S.E.= heteroscedasticity robust standard error.