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## The self-selection of commuters

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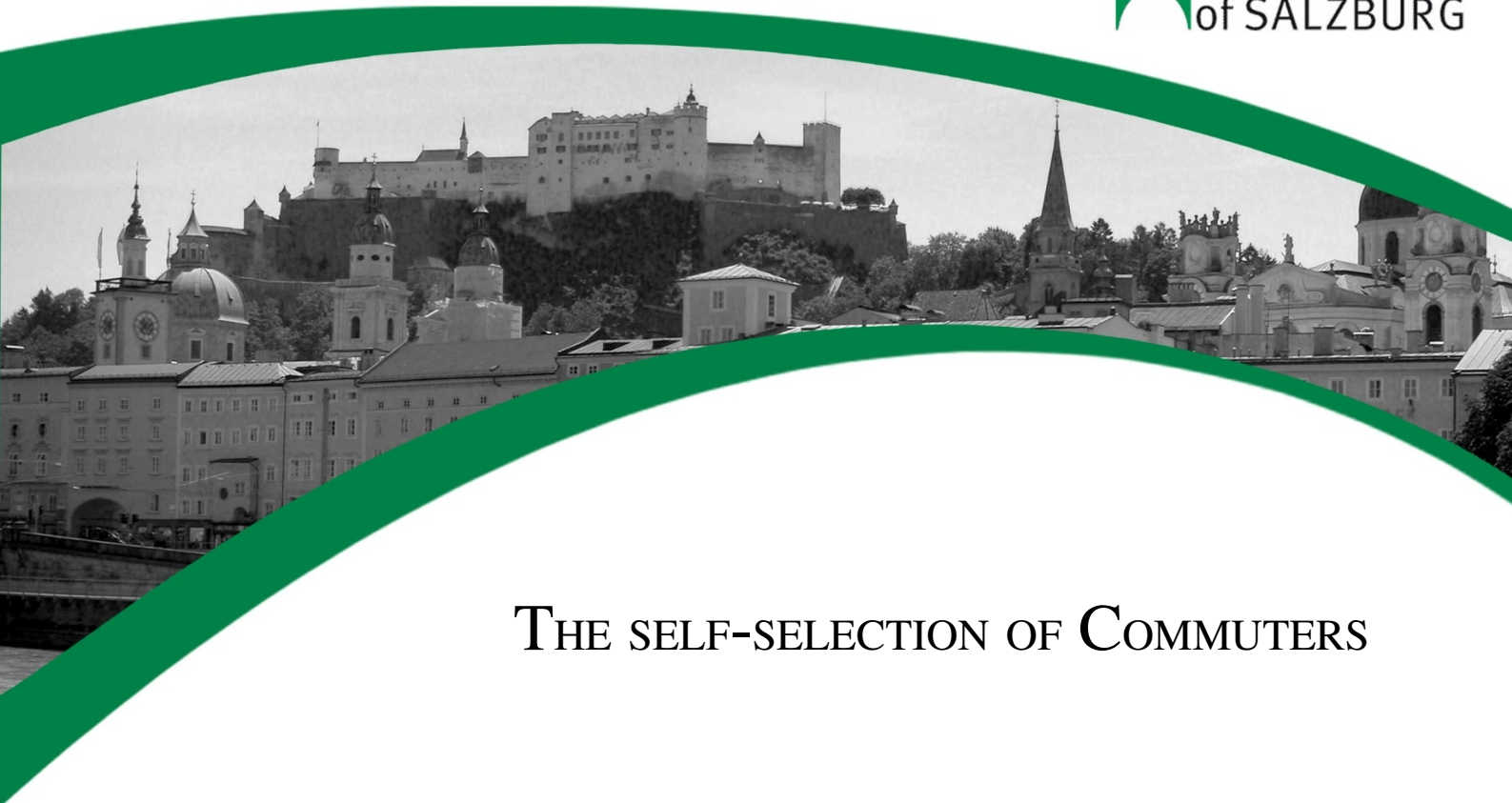
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# THE SELF-SELECTION OF COMMUTERS

PETER HUBER

WORKING PAPER No. 2011-06



**WORKING PAPERS** IN  
**ECONOMICS AND FINANCE**

# The self-selection of Commuters

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## Abstract

I analyze the skill structure of commuters in 15 EU countries. Theory suggests that higher returns to education in receiving regions and shorter commuting distances favor positive selection of commuters. Empirically all types of commuters in most EU countries are more skilled than non-commuters. Internal commuters (in particular to capital city regions) are more strongly selected than cross-border commuters, selectivity of commuters reduces with distance commuted and cross-border commuters more often than migrants have an intermediary educational attainment but less often a completed tertiary education.

**JEL Codes:** J61, R23

**Keywords:** Commuting, Selectivity, Migration

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## **Are Commuters in the EU Better Educated than Non-Commuters but Worse than Migrants?**

### **Abstract**

I analyze the skill structure of commuters in 15 EU countries. Theory suggests that higher returns to education in receiving regions and shorter commuting distances favor positive selection of commuters. Empirically all types of commuters in most EU countries are more skilled than non-commuters. Internal commuters (in particular to capital city regions) are more strongly selected than cross-border commuters, selectivity of commuters reduces with distance commuted and cross-border commuters more often than migrants have an intermediary educational attainment but less often a completed tertiary education.

**JEL Codes: J61, R23**

**Keywords:** Commuting, Selectivity, Migration

## **1. Introduction**

Increased geographical mobility of labor in the EU 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). In this literature Borjas (1987) shows that high skilled migrants move from countries with low to countries with high returns to education and low skilled migrants move in the opposite direction. Similar empirical and theoretical research with respect to the skill structure of commuters, by contrast, has been rare. Empirical results of Buch et al. (2008) suggest that cross-border workers in the German - Danish border region are often manufacturing workers in the age group of the over 25 to 35 year olds and Gottholmseder and Theurl (2007), focusing on cross-border commuters from Austria to Switzerland, find that they are most often male, 25-to 35 years old, medium skilled manufacturing workers, while a somewhat larger number of country studies (e.g. Eliason et al. 2003, VanOmmeren et al. 1999 Rouwendahl, 1999) finds that commuters within a country are more highly skilled than non-commuters.

Among the few theoretical studies on the skill structure of commuters Sorek (2009) considers a general equilibrium model of two distant, disconnected geographical zones using different technologies. Abstracting from amenities and assuming higher wages for all education levels in one of the two regions, he shows that the least highly educated live and work in the region with low returns to education, while the medium skilled commute and the most highly educated migrate to the region with high returns to education.

This paper uses data from the European Labor Force Survey (ELFS) to test this prediction. The theoretical analysis, by extending Sorek's model to allow for

amenities as well as a more general wage distribution among regions, shows that commuters can be either more or less skilled than non-commuters, but are always less skilled than migrants. Furthermore, higher returns to education in receiving regions and shorter commuting distances favor positive selection of commuters relative to stayers. The empirical part differentiates between cross-border and within country commuters as well as commuters across different distances and commuters to capital cities and other regions. It finds that all types of commuters in most of the 15 EU countries analyzed are more highly educated than region stayers. In addition - in accordance with theory - internal commuters (in particular to capital city regions) are almost always more highly educated than cross-border commuters and persons commuting larger distances are usually less strongly selected. Finally, cross-border commuters are also compared to recent migrants. According to the results - and in accordance with theory - cross-border commuters more often than migrants have an intermediary educational attainment but less often a completed tertiary education. There are, however, some deviations from these patterns in the EU member states which joined the EU after May 2004. This indicates that in these economies - which have experienced intensive structural change in the last decades - commuting follows slightly different patterns than in the "old" EU member states.

## 2. Theory

As a starting point for the analysis I consider an economy consisting of two regions (denoted by  $f$  and  $n$ , respectively) and focus on the decision of a resident of  $n$  to work and live in  $n$ , or to commute or migrate to  $f$ . Individuals differ with respect to education levels  $s$  (with  $s \in [0,1]$ ), and derive utility ( $U$ ) from consumption ( $c_i$ ) and amenities ( $\alpha_i$ ) in the region of residence ( $i$ ) according to an additively separable utility function:

$$U = \alpha_i + c_i \tag{1}$$

Each individual commands one unit of time which is split between commuting ( $\tau_{ij}$ ) and working. Individuals working in  $j$  and living in  $i$  receive an income equal to the wage rate in the region of work ( $w_j$ ) times the time spent working (i.e.  $w_j(1 - \tau_{ij})$  with  $\tau_{ij} = 0$  if  $i = j$  and  $\tau_{ij} = \tau$  if  $i \neq j$ ). Wages in region  $j$  are given by:

$$w_j = w_j + \lambda_j s \quad (2)$$

with  $\lambda_j$  a parameter measuring returns to education, which differs among regions.<sup>1</sup> In addition, when migrating individuals incur migration costs ( $k$ ).

Individuals maximize utility by choosing their region of work and residence subject to their budget constraint, ( $w_j(1 - \tau_{ij}) = c_i + k$ ). An individual with education level  $s$  residing in region  $n$  is faced with a choice between working and residing in region  $n$  (i.e. staying), which gives a utility of:

$$U^S = \alpha_n + w_n + \lambda_n s \quad (3)$$

residing in  $n$  and working in  $f$  (i.e. commuting), with utility:

$$U^C = \alpha_n + (w_f + \lambda_f s)(1 - \tau) \quad (4)$$

working and residing in  $f$  (i.e. migrating), which yields utility:

$$U^M = \alpha_f + (w_f + \lambda_f s) - k \quad (5)$$

and residing in  $f$  but working in  $n$  (i.e. return commuting), with utility

$$U^R = \alpha_f + (w_n + \lambda_n s)(1 - \tau) - k \quad (6)$$

Defining  $\tilde{\alpha} = \alpha_n - \alpha_f + k$  the critical level of education at which an individual is indifferent between migrating and commuting ( $s^{CM}$ ) is given by:

$$s^{CM} = \frac{\tilde{\alpha} - \tau w_f}{\tau \lambda_f} \quad (7)$$

with the individual preferring to commute to  $f$  if  $s^{CM} \geq s$ . In consequence if  $\tilde{\alpha} > \tau w_f > \tilde{\alpha} - \tau \lambda_f$  then  $0 < s^{CM} < 1$  and migrants are always more skilled than commuters.<sup>2</sup> Furthermore if  $\tilde{\alpha} > \tau w_f$   $U^S$  is always larger than  $U^R$  and there will be no return commuting.<sup>3</sup> Thus when people commute from  $n$  to  $f$  return

commuting does not pay off. Since our interest is with out-commuting we focus only on cases where return commuting is not feasible by assuming that  $\tilde{\alpha} > \tau w_f$  throughout. This also implies that  $s^{CM}$  is always strictly positive and reduces the choice of individuals to one between commuting, staying and migrating. Individuals are indifferent between staying and commuting at an education level ( $s^{SC}$ ) given by:

$$s^{SC} = \frac{w_n - w_f(1-\tau)}{\lambda_f(1-\tau) - \lambda_n} \quad (8)$$

with individuals preferring to stay if  $s^{SC} \geq s$  if  $\lambda_f(1-\tau) > \lambda_n$  and if  $s^{SC} \leq s$  if  $\lambda_f(1-\tau) < \lambda_n$ .<sup>4</sup> Commuters are therefore more qualified than stayers when  $\lambda_f(1-\tau) > \lambda_n$  and less qualified than stayers if  $\lambda_f(1-\tau) < \lambda_n$ .

Finally, the level of education at which an individual is indifferent between staying and migrating is given by:

$$s^{SM} = \frac{\tilde{\alpha} + w_n - w_f}{\lambda_f - \lambda_n} \quad (9)$$

with the individual preferring to stay if  $s^{SM} \geq s$  when  $\lambda_f > \lambda_n$  and if  $s^{SM} \leq s$  when  $\lambda_f < \lambda_n$ .

Three possible situations can therefore arise. The first, occurs when returns to education are larger in  $f$  than in  $n$  and commuting time is not too large (i.e.  $\lambda_f > \lambda_f(1-\tau) > \lambda_n$ ), the second when returns to education are higher in  $f$  than in  $n$  but commuting time is large (i.e.  $\lambda_f > \lambda_n > \lambda_f(1-\tau)$ ) and the third when returns to education are larger in  $n$  than in  $f$  (i.e.  $\lambda_n > \lambda_f > \lambda_f(1-\tau)$ ).

Consider first the case  $\lambda_f > \lambda_f(1-\tau) > \lambda_n$ . Here the most highly skilled residents of  $n$  emigrate (since by equations (7) and (9) migration is preferred both to commuting and staying if  $s > \max\{s^{SM}, s^{CM}\}$ ) and the least qualified stay (since by equations (8) and (9) staying is preferred both to commuting and migration if  $s \leq \min\{s^{SM}, s^{SC}\}$ ). Furthermore, if  $s^{CM} > s^{SC}$  (which after substituting equations (7) and (8) and rearranging requires that  $\tilde{\alpha} > \Delta$  with  $\Delta = \frac{\tau(w_n\lambda_f - w_f\lambda_n)}{\lambda_f(1-\tau) - \lambda_n}$ ) those with



intermediate qualification levels (i.e.  $s^{CM} \geq s > s^{SC}$ ) commute. If by contrast  $s^{SM} < s^{CM}$  no one commutes.

Figure 1 illustrates this case, by plotting the utilities of migrating, staying and commuting (i.e. equations 3 to 5) in dependence of the education level of the individual. The left hand side considers the case where  $s^{CM} > s^{SC}$ . Here utility increases most steeply for migrants and least steeply for stayers, while commuters are an intermediary case. In consequence commuting yields the highest utility among the choices in the interval  $s^{CM} > s > s^{SC}$ .<sup>5</sup>

**{Figure 1: Around here}**

The right hand side of figure 1 considers the case where  $s^{SC} > s^{CM}$ . Here too the relative slopes of the utility functions accord with those on the left hand side, but, for all education levels either migration or staying provides higher utility than commuting, so that individuals with  $s \leq s^{SM}$  stay and individuals with  $s > s^{SM}$  migrate.<sup>6</sup> In this case therefore if commuting is feasible, stayers are least educated, migrants are the best educated and commuters have intermediary education levels. If commuting is not feasible, by contrast, stayers are less educated than migrants.

When  $\lambda_f > \lambda_n > \lambda_f(1 - \tau)$ , by contrast, by equations (7) and (8) the least skilled commute (i.e. when  $s < \min\{s^{CM}, s^{SC}\}$ ) and by equations (7) and (9) the most skilled will emigrate. Staying is optimal for the medium skilled only if  $s^{SM} > s^{SC}$  (or  $\tilde{\alpha} > \Delta$ ). If this is not the case the least skilled commute, while the high skilled migrate and no one stays. This case is shown in figure 2 which on its left hand side illustrates a situation where  $s^{SM} > s^{SC}$ . Here returns to education (net of commuting costs) are highest for migrants and lowest for commuters, but intermediate for stayers so that  $s^{SM} > s^{CM} > s^{SC}$  and staying is optimal for

persons with education level  $s^{SM} > s > s^{SC}$ .<sup>7</sup> The right hand side of figure 2, by contrast, shows a situation where  $s^{SC} > s^{SM}$ . Here staying is always dominated either by commuting or migrating and the least educated (with  $s \leq s^{CM}$ ) commute while the high educated (with  $s > s^{CM}$ ) migrate.<sup>8</sup> Commuters are thus less qualified than both migrants and stayers, while migrants are more skilled than stayers.

**{Figure 2: Around here }**

Finally in case that  $\lambda_n > \lambda_f > \lambda_f(1 - \tau)$ , shown in Figure 3, the most highly skilled individuals stay, since by equations (8) and (9) staying is preferred to both commuting and migration if  $s \geq \max\{s^{SC}, s^{SM}\}$  and the least qualified commute, since by equations (7) and (8) commuting is preferred to both staying and migration when  $s < \min\{s^{CM}, s_f^{SC}\}$ . Furthermore, as can be seen from the left hand side of figure 3 by equations (7) and (9) migration is optimal for the medium skilled (i.e. those with with  $s^{SM} > s > s^{CM}$ ) if  $s^{SM} > s^{CM}$  (which requires  $\tilde{\alpha} < \Delta$ ).<sup>9</sup> If this is not the case, as illustrated on the right hand side of figure 3, those with  $s \leq s^{SC}$  commute and those with  $s^{SC} < s$  stay.<sup>10</sup> In this case therefore stayers have the highest education level, migrants have intermediary education and commuters have the lowest educational attainment.

**{Figure 3: Around here}**

In sum commuters are always less educated than migrants, and may be less educated than stayers if either returns to education are lower in the receiving region than in the sending region or if the distance between the regions is large (relative to differences in returns to education). If returns to education are higher in the receiving

region and the distance between the two regions is low commuters, however, are more skilled than stayers. Therefore higher returns to education in receiving regions and shorter commuting distances favor positive selection of commuters relative to stayers.

### **3. Data and Method**

To empirically test these predictions, I estimate logit models of the choice between residing and working in a region and commuting for different types of commuters. I differentiate cross-border and internal commuters, since traveling times and differences in returns to education between regions should (all else equal) be larger for cross border-commuters. According to theory this could lead to either stronger or weaker selection of cross-border commuters than internal commuters. In addition, among internal commuters, commuters to capital city regions and other commuters are considered separately, since the little evidence available on regional differences in returns to education (e.g. Cabral-Vieira et al 2006, Hazans, 2003a) suggests that these are higher in large urban agglomerations than elsewhere. Finally, commuters are also differentiated by distance covered in commuting, since theory suggests that selectivity should be less pronounced for longer commuting distances.

The data are taken from the ELFS for the year 2006. They contain information on both the NUTS2 region of work and residence as well as a number of demographic and workplace characteristics of persons in paid employment in 15 EU countries (Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Netherlands, Poland, Slovakia, Sweden, Spain, Romania, UK)<sup>11</sup>, that have more than one NUTS2 region. Cross-border commuters are defined as persons, who work in another country than they live in, and internal commuters as persons, who work in a different NUTS 2-region than they live in but in the same country. They

are compared to persons who live and work in the same NUTS 2-region (referred to as stayers).

According to the data in total around 0.6% of the employed commuted across borders and 7.6% of the population commuted across NUTS2 regions within their respective countries in 2006. Furthermore descriptive statistics suggest that commuters differ most significantly from stayers by a high share of males and a larger share of persons aged 20-39. Cross-border commuters often have intermediate education levels and work in manufacturing (including construction). Internal commuters are more often highly educated and are more strongly concentrated in service sector employment (see table 1).

**{Table 1: Around Here }**

**{Figure 4: Around Here}**

Furthermore as shown in Figure 4, which shows NUTS2 level commuting in the EU countries in our sample in percent of the employed at the place of residence, both internal and cross-border commuting are highly dependent on a country's geography. High rates of outbound cross-border commuting primarily occur in regions close to the border and small countries (e.g. Belgium and Austria), where most regions are located close to the border. High rates of outbound internal commuting are found primarily in the vicinity of large urban agglomerations (London, Berlin, Vienna, Prague and Stockholm) and in countries with smaller NUTS 2-regions (e.g. the Benelux countries). In addition cross-border commuting is most prevalent at borders of countries which either share a common language (e.g. France, Belgium and Switzerland or Austria, Germany and Switzerland) or have been a single country until recently (i.e. Czech Republic and Slovakia). Aside from

size and geography, however, also other factors seem to be important for the extent of commuting, since there is a large variation in outbound commuting among countries of similar size. In particular outbound commuting tends to be higher in regions with lower GDP per capita levels and lower unemployment rates (see Huber and Nowotny, 2008)

In the logit analysis I therefore include a set of dummy variables for each NUTS2 region to capture any effects of differences in size, geographic position and economic development among sending regions on commuting. In addition based on the results of the literature, which finds that commuters are often young males (e.g. Hazans, 2003, Benito and Oswald, 2000 and White, 1986), controls for gender, dummy variables for the age of respondents (measuring whether individuals are 20-29, 30-39, 40-49, 50-59 and 60 and more years old, with 15-19 year olds as a base category), and the sector of employment (agriculture, manufacturing and private or public services) are included. Finally, two dummy variables which measure whether a person has completed an intermediate (ISCED 3 or 4) or a high (ISCED 5 or 6) education, respectively, with compulsory education (ISCED 2 or less) as the excluded base group are included. These are our variables of interest, with a positive coefficient signifying that commuters are more highly qualified than stayers and a negative coefficient indicating that commuters are less qualified.

For cross-border commuters, we also test whether they are better or worse qualified than recent migrants from the same country. To do this we aggregate commuting data to the national level and consider those that live and work in the same country (irrespective whether they commute within the country or not) as stayers and merge this data with data on the number of persons born in the same country as cross-border commuters and stayers but living and working in another EU27 country since less than 10 years.<sup>12</sup> We use this data to conduct a multinomial

logit analysis of the choice between migrating, commuting and staying in a country, controlling for country dummies as well as sector of employment, gender, age and completed level of education (as defined above) as explanatory variables.

#### **4. Results**

Table 2 shows the results for all commuters, cross-border commuters, internal commuters, commuters to the capital city region and to other regions, respectively. It provides strong evidence of positive selection of commuters relative to stayers on educational attainment irrespective of the type of commuting. In all of the estimates the coefficients on both the dummy variable for intermediary as well as for high education are highly significantly positive and increase with the level of educational attainment.

#### **{Table 2: Around Here}**

There are, however, differences in selectivity among different commuter types. In particular the marginal effects reported in the bottom panel of table 2 imply that internal commuters are more positively selected than cross-border commuters: Persons with intermediary education have a 0.6 percentage points higher probability to commute to another NUTS2 region in the same country than persons with compulsory education. Their probability for commuting across borders is, however, only 0.1 percentage points higher. Similarly persons with tertiary education have a 2.7 percentage points higher probability to commute within a country but only a 0.2 percentage points higher probability to commute across borders. The longer travel times implied by cross-border commuting therefore lead to a weaker selection of cross-border commuters than of internal commuters.

Furthermore, among internal commuters those commuting to capital city regions are more strongly positively selected than those commuting elsewhere. A person with intermediary training is 0.4 percentage points more likely to commute to the capital city region than a person with at most completed compulsory education. For persons with completed tertiary education the gain is 1.6 percentage points. For internal commuters to other regions these gains are 0.1 and 0.7 percentage points, respectively. Thus - as predicted by theory - higher returns to education in urban agglomerations lead to a stronger selection commuters to capital cities.

Tables A.1 to A.2 in the appendix augment these results, by estimates on a country by country basis. They suggest that most of the patterns found apply in almost all countries of the EU. The marginal effects on the educational variables are significantly positive in all countries except for secondary educated internal commuters to the Ile de France in France, and secondary educated workers in all of the EU member states that joined the EU after May 2004 (i.e. Hungary, Poland, Romania - where also the coefficient for tertiary education is negative - and Slovakia). Thus the skill structure of commuters differs between these member states and the pre-existing member states. This may be a consequence of the substantial regional restructuring in the NMS in the past decades (see: Huber, 2007, Ferragina and Pastore 2008 for surveys). Furthermore, in all countries where positive selection prevails the marginal effects are larger for internal than cross-border commuters. The only result that is slightly less robust across countries is the stronger selection of internal commuters to capital city regions. This holds only for Austria and Belgium among countries where selection is unambiguously positive and is driven primarily by different selection mechanisms in the new member states.

Aside from providing strong evidence for positive selection of commuters on education table 2 also suggests that commuters are significantly more often male than female, with the largest gender differences existing for internal commuters (where men are by 1.6 percentage points more likely to commute than women) and for commuters to capital city regions (where the male commuting probability is by 1.1 percentage points higher than for women). Highly significant marginal effects are also found for age. For all types of commuting considered, the commuting probability attains a maximum for the 20 to 29 year olds, with marginal effects suggesting an up to 1.7 percentage points higher commuting probability than for the 15-19 year olds, for internal commuters and a 0.2 percentage points gain for the same age group for cross-border commuters. Once more these results also hold for most individual EU countries considered (see tables A.1 and A.2). Males have a higher commuting probability in all countries and the age group of the 20 to 29 year olds is often the most likely to commute, although here there are exceptions for individual types of commuters in all countries (except Spain and Sweden), with these cases interestingly indicating younger commuters in the NMS but older ones in the EU15 countries.

#### **4.1 Commuting across different distances**

Table 3 takes this analysis one step further by considering the probability to commute across different distances (i.e flows where the capital cities of the sending and receiving NUTS2 regions are less than 50 kilometers, 50 to 100 kilometers, 100 to 150 kilometers and more than 150 kilometers apart).<sup>13</sup> This is interesting, because as shown above the likelihood of a positive selection of commuters decreases with distance covered (i.e. the probability of  $\lambda_n$  being smaller than  $\lambda_f(1 - \tau)$  is lower for larger  $\tau$ ).



**{Table 3: Around Here}**

In these regressions the impact of the educational variables on the probability to commute across a certain distance falls for each consecutive category. Persons with intermediary education have a 0.7 percentage point higher probability to commute across a distance of 50 or less kilometer but an only 0.1 percentage points higher probability to commute more than 150 kilometers than persons with low education. For persons with high education this effect is 2.6 percentage points for commuting distances below 50 kilometers but only 0.6 percentage points for commuting in excess of 150 kilometers. Thus, as predicted by theory, short distance commuters are more strongly selected than long distance commuters.

Aside from this commuters commuting longer distances are also often younger (which could be attributed to lower wages and consequently lower opportunity costs of commuting for young commuters) and gender differences in commuting decrease with distance. For short distances (i.e. commuting below 50 kilometers) the highest commuting probability is attained by the 30 to 39 year olds. For all other distance categories the 20 to 29 year olds are most likely to commute and marginal effects for all age groups decrease with commuting distance. Similarly, males have a 0.8 percentage points higher commuting probability than females for moves below a distance of 100 kilometers but an only 0.4 percentage points higher probability to commute more than 150 kilometers.

**4.2 Selection of Cross-Border Commuters and Migrants**

Finally, the analysis can be extended to consider the selection of migrants relative to commuters. Table 4 reports results of multinomial logit regressions on the to migrate, commute and stay. These suggest that, in contrast to commuters, migrants are usually younger and less often male, and are more strongly drawn from

the highest but less strongly from intermediate education groups than commuters. The marginal effects reported on the right hand side of table 4 imply that a completed tertiary education increases the probability of being a migrant (relative to that of a person with completed compulsory education) by 0.2 percentage points, but having completed secondary or vocational education reduces this probability by 0.1 percentage points. For cross-border commuters marginal effects are positive for both groups, but smaller for persons with tertiary education and larger for those with a secondary or vocational education.

**{Table 4: Around Here}**

Similarly migrants are on average younger and less often male than cross-border commuters. The probability of being a migrant is largest for the age group of the 15-19 year olds for migrants but for the 20-29 year olds for the cross border commuters and being male reduces the probability of migrating by 0.2 percentage points, while it increases the probability of cross border commuting by 0.9 percentage points.

These results are, however, slightly less robust across countries (see: table A.3 in the appendix). While men are less likely to migrate in all countries, recent migrants from Germany, the Netherlands and Poland are most likely to migrate in the age group between 20 and 29, and the stronger increase in the probability to migrate than in the probability to commute for persons with tertiary education does not apply in Belgium, Germany, Hungary, Poland, Romania and Slovakia, while higher marginal effect of secondary or vocational education on commuting than on migration does not apply in Austria, Belgium, France, the Netherlands and Sweden.<sup>14</sup>

## 5. Conclusions

Increased geographical mobility of labor may have important repercussions on the skill distribution of the workforce residing and working in a region. Aside from migration, commuting is also a mechanism by which this population sorting may be encouraged. This paper analyses the skill structure of commuters in 15 EU countries. Theory implies that the selection of commuters relative to stayers and migrants depends on relative returns to skills in the sending and receiving regions and the distance commuted, with higher returns to education in receiving regions and shorter commuting distances favoring positive selection of commuters relative to stayers.

The empirical results indicate that all types of commuters in most countries are more skilled than residents of the same NUTS2 region that do not commute, but that internal commuters (in particular to capital city regions) are almost always more strongly selected than cross-border commuters, that persons commuting larger distances are usually less highly educated and that in many countries recent migrants are more often drawn from persons with completed tertiary education, while cross-border commuters are more often than both migrants and stayers drawn from the population with intermediary education. In addition commuters are often young and male, with gender differences being largest for shorter commuting flows and cross-border commuting and age differences being largest for commuting within a country and shorter commuting flows. Deviations from the above patterns often occur in the EU member states states which joined the EU after May 2004, where in particular workers with completed secondary or vocational education tend to have a lower probability of commuting, and internal commuters are often younger than in the other EU countries.

From a policy perspective this implies that measures to reduce traveling times between regions (such as investments in transport infrastructure or in the European

context integration of cross-border labor markets) aside from leading to increased commuting, will also lead to a larger share of highly educated commuting and could thus impact on population sorting. Relative to policies focusing on migration such policies are, however, also likely to disproportionately affect the medium skilled

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<sup>1</sup> As argued by (Sorek, 2009) this is equivalent to assuming exogenous differences in technology across regions which can be justified by geographical attributes, institutional or cultural differences, as well as differences in infrastructure or in the adoption of new technologies.

<sup>2</sup> If  $\tau w_f < \tilde{\alpha} - \tau \lambda_f$ ,  $s^{CM}$  is larger than one and no one migrates. If  $\tilde{\alpha} < \tau w_f$ ,  $s^{CM}$  is negative and no one commutes.

<sup>3</sup> To see this note that  $U^S > U^R$  implies that  $\tilde{\alpha} > -\tau(w_n + \lambda_n s)$  which is always true because the left hand side of this inequality is positive if  $\tilde{\alpha} > \tau w_f$ , while the right hand side is negative.

<sup>4</sup> We assume throughout that  $\lambda_f$  is always either strictly larger or smaller than  $\lambda_n$ , and that when  $U^S = U^C$  or  $U^S = U^M$  individuals stay while if  $U^C = U^M$  they commute.

<sup>5</sup> In the left hand side of Figure 1 as well as all subsequent figures we implicitly assume that  $s^{SM}$ ,  $s^{CM}$ ,  $s^{SC}$  are all positive and smaller than one. An extension to other cases is, however, simple: As is easy to see from the left hand side of figure 1 if  $0 > s^{SC}$  and  $s^{CM} > 1$  everyone commutes. If  $0 < s^{SC}$  and  $0 < s^{CM} < 1$  those with  $s \leq s^{CM}$  commute and everyone else migrates and if  $1 > s^{SC} > 0$  and  $s^{CM} > 1$  those with with  $s \leq s^{SC}$  stay while all others commute.

<sup>6</sup> Since in this case  $s^{SC} > s^{SM} > s^{CM}$  (and  $s^{CM} > 0$  by assumption),  $s^{SM}$  cannot be negative. If  $s^{SM} > 1$ , however, everyone stays.

<sup>7</sup> In this case if  $s^{SC} < 0$  and  $s^{SM} > 1$  everyone stays. If  $1 > s^{SC} > 0$  and  $s^{SM} > 1$  all with  $s < s^{SC}$  commute, while those with  $s^{SC} \leq s$  stay. If  $s^{SC} > 1$  everyone commutes and if  $s^{SC} < 0$  all with  $s^{SM} \geq s$  stay and all others migrate unless  $s^{SM} > 1$  in which case all stay.

<sup>8</sup> In addition if  $1 < s^{CM}$  everyone commutes.

<sup>9</sup> In this case  $s^{SM} > s^{SC} > s^{CM}$  so that (since  $s^{CM} > 0$ ) also  $s^{SM} > s^{SC} > 0$ . If  $s^{SM} > 1$  and  $1 > s^{CM} > 0$  residents with  $s < s^{CM}$  commute and those with  $s \geq s^{CM}$  stay, while if  $s^{CM} > 1$  everyone stays.

<sup>10</sup> If, however,  $s^{SC} < 0$  everyone stays and if  $s^{SC} > 1$  everyone commutes.

<sup>11</sup> Greek, Portuguese Italian, Slovene and Irish data are omitted due to missing data problems and/or low data reliability.

<sup>12</sup> The focus on migrants with a duration of residence of less than 10 years is dictated by data availability and a preference for considering recent migrants, to minimize problems resulting from potential selection among return migrants (see Borjas and Bratsberg, 1996).

<sup>13</sup> Since our data lack reliable information on receiving NUTS2 regions for cross-border commuters we conduct this analysis for internal commuters only. Furthermore, due to the small number of observations by distance categories, these estimates cannot be conducted on a country to country basis. I, however, checked that results reported below apply both to internal commuters to capital cities and other regions (results for these regressions are available from the author).

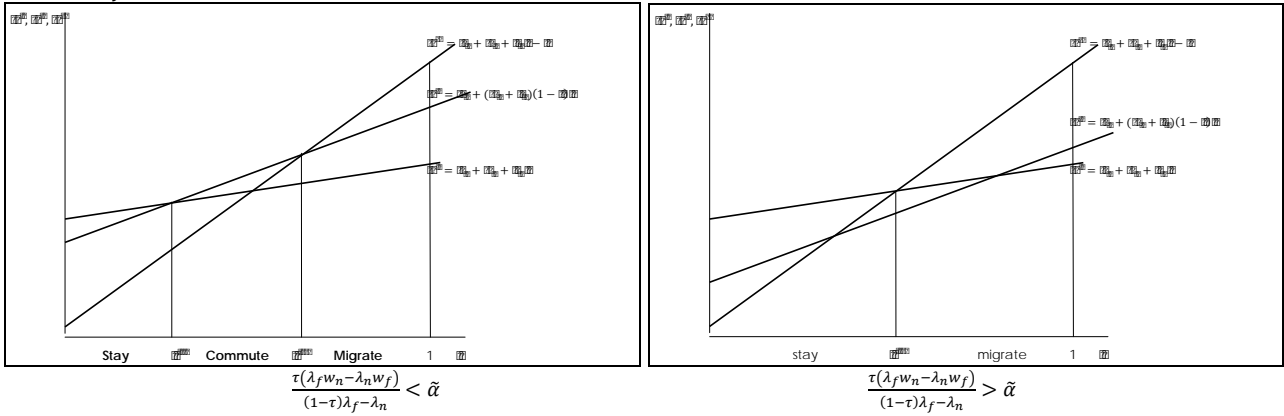
<sup>14</sup> Country results for the selection of commuters relative to stayers, however, accord with previous results. The marginal effects of the education variables change signs relative to the previous analysis only in France, Romania, Slovakia (for both variables) and Austria (for the medium education variable).

## References

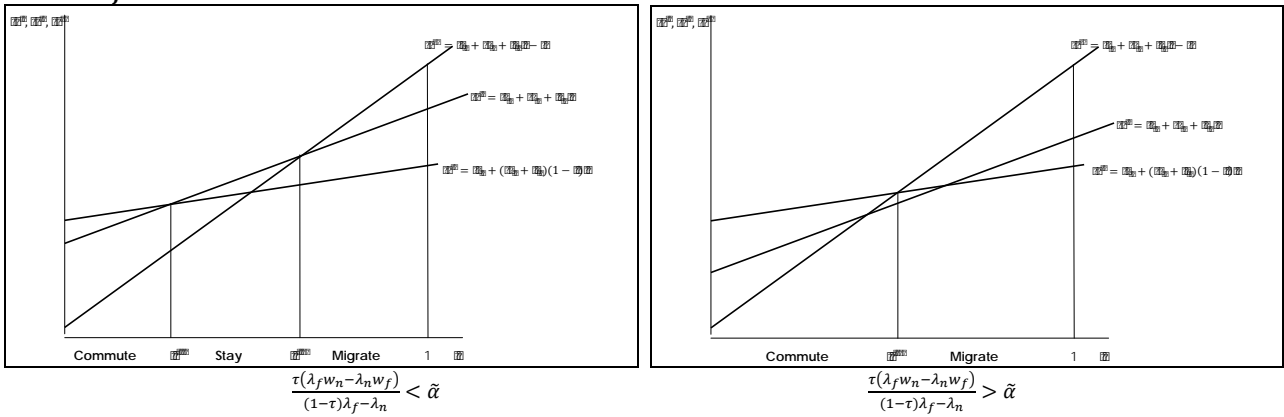
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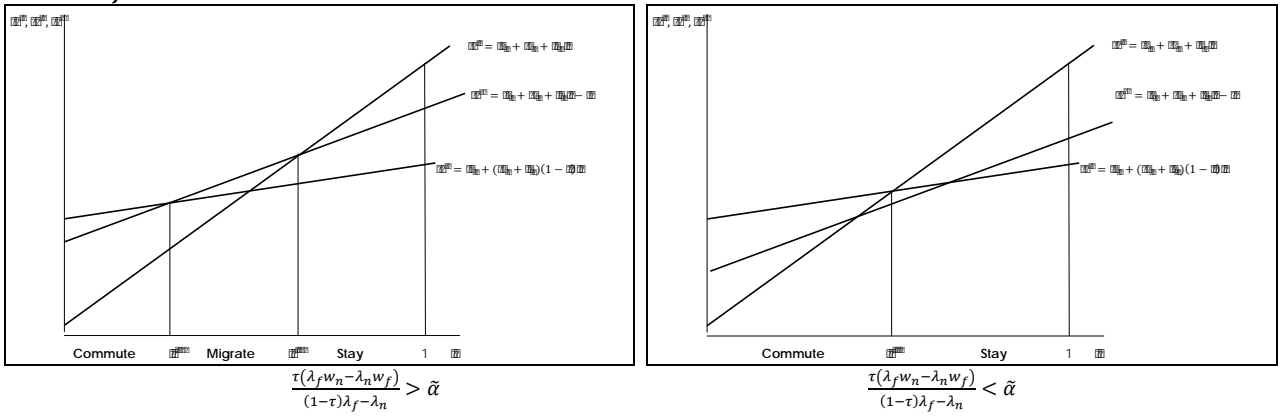
**Figure 1: Utility of staying, migrating and commuting under the assumption that  $\lambda_f > (1 - \tau)\lambda_f > \lambda_n$**



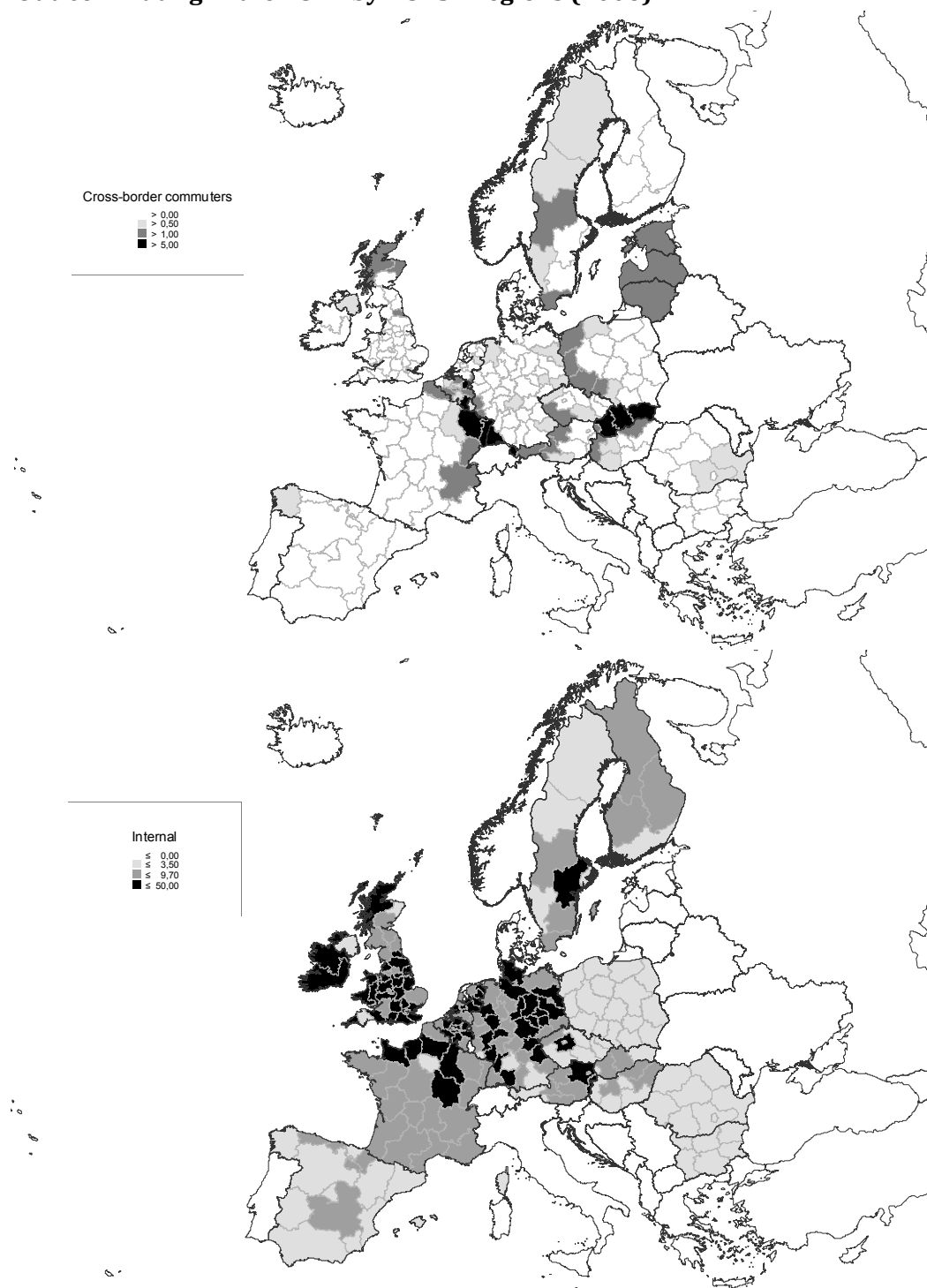
**Figure 2: Utility of staying, migrating and commuting under the assumption that  $\lambda_f > \lambda_n > (1 - \tau)\lambda_f$**



**Figure 3: Utility of staying, migrating and commuting under the assumption that  $\lambda_n > \lambda_f > (1 - \tau)\lambda_f$**





**Figure 4: 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

**Table 1: Descriptive statistics for different commuting types (in %)**

	Stayers	Overall Commuters	Cross-Border Commuters	Internal Commuters			Total
				Total	To Capital	to other regions	
Total (in % of resident population)	91.6	8.4	0.6	7.8	1.9	5.9	100.0
	Age						
age 15-19 years	2.9	2.5	1.6	2.5	1.3	2.9	2.9
age 20-29 years	19.3	21.8	26.7	21.4	22.8	21.0	19.5
age 30-39 years	26.0	27.8	26.8	27.9	29.6	27.3	26.2
age 40-49 years	26.9	26.7	26.8	26.7	27.3	26.5	26.9
age 50-59 years	19.9	18.0	15.7	18.2	16.3	18.8	19.8
age 60 or more years	4.9	3.3	2.4	3.4	2.7	3.6	4.8
	Education						
Low Education <sup>1)</sup>	22.2	16.0	14.0	16.2	13.7	16.9	21.7
Medium Education <sup>2)</sup>	51.4	48.6	59.7	47.7	44.0	48.8	51.1
High Education <sup>3)</sup>	26.4	35.4	26.3	36.2	42.3	34.2	27.2
	Gender						
Male	53.9	64.3	71.7	63.7	63.2	63.9	54.8
	Sector						
Agriculture and Mining	10.5	4.6	8.0	4.3	2.2	5.0	10.0
Manufacturing <sup>4)</sup>	22.6	25.9	38.0	24.9	17.6	27.2	22.8
Market Services	43.3	49.8	39.1	50.7	62.8	46.8	43.9
Non-Market Services	23.6	19.7	14.8	20.1	17.5	21.0	23.3

S: ELFS (2006). Notes 1) ISCED 2 or less. 2) ISCED 3-4 3) ISCED 5 or more 4) including construction

**Table 2: Regression results for different types of commuting**

	Overall Commuters	Cross-Border commuters	Internal commuters	Internal commuters	
				to capital	to other region
<b>Regression Results</b>					
age 20-29 years	0.39979*** (0.00198)	1.02250*** (0.09982)	0.38491*** (0.00204)	0.29824*** (0.00215)	0.29824*** (0.00215)
age 30-39 years	0.31254*** (0.00196)	0.95053*** (0.09970)	0.31821*** (0.00201)	0.23388*** (0.00212)	0.23388*** (0.00212)
age 40-49 years	0.20480*** (0.00196)	0.95892*** (0.09989)	0.19984*** (0.00201)	0.10833*** (0.00212)	0.10833*** (0.00212)
age 50-59 years	0.11051*** (0.00199)	0.60262*** (0.10213)	0.11730*** (0.00204)	0.06137*** (0.00216)	0.06137*** (0.00216)
age 60 or more years	-0.25851*** (0.00244)	-0.63301*** (0.12822)	-0.26312*** (0.00251)	-0.29952*** (0.00267)	-0.29952*** (0.00267)
Medium Education	0.17826*** (0.00086)	0.92813*** (0.04990)	0.16268*** (0.00089)	0.14603*** (0.00097)	0.14603*** (0.00097)
High Education	0.59078*** (0.00091)	0.53141*** (0.05422)	0.59893*** (0.00094)	0.50048*** (0.00104)	0.50048*** (0.00104)
Male	0.41942*** (0.00064)	0.59132*** (0.03859)	0.40249*** (0.00066)	0.39094*** (0.00074)	0.39094*** (0.00074)
Observations	76644	52968	73007	36800	42386
Log Likelihood	-42395194	-5221619	-39440141	-32921213	-10022265
Pseudo R2	0.14400	0.19820	0.15610	0.13700	0.31560
<b>Marginal Effects</b>					
age 20-29 years	0.02124*** (0.00012)	0.00207*** (0.00004)	0.01706*** (0.00010)	0.00962*** (0.00008)	0.00644*** (0.00005)
age 30-39 years	0.01589*** (0.00011)	0.00087*** (0.00003)	0.01356*** (0.00009)	0.00729*** (0.00007)	0.00565*** (0.00005)
age 40-49 years	0.01015*** (0.00010)	0.00092*** (0.00003)	0.00827*** (0.00009)	0.00328*** (0.00007)	0.00491*** (0.00004)
age 50-59 years	0.00540*** (0.00010)	0.00015*** (0.00003)	0.00480*** (0.00009)	0.00184*** (0.00007)	0.00347*** (0.00004)
age 60 or more years	-0.01105*** (0.00009)	-0.00043*** (0.00003)	-0.00937*** (0.00008)	-0.00781*** (0.00006)	0.00007*** (0.00004)
Medium Education	0.00845*** (0.00004)	0.00109*** (0.00001)	0.00644*** (0.00004)	0.00431*** (0.00003)	0.00125*** (0.00001)
High Education	0.03192*** (0.00006)	0.00186*** (0.00001)	0.02717*** (0.00005)	0.01661*** (0.00004)	0.00675*** (0.00002)
Male	0.01964*** (0.00003)	0.00190*** (0.00001)	0.01576*** (0.00003)	0.01142*** (0.00002)	0.00248*** (0.00001)

Notes: Top panel reports regression coefficients, bottom panel marginal effects for weighted logit regression on the probability to commute, values in brackets are heteroskedasticity robust standard errors, \*\*\*(\*\*)(\*) signify significance at 1% (5%) (10%) level, respectively. Base categories for dummy variables are 15-19 year old females with a completed compulsory education. Results for fixed effects of NUTS2 region of residence and sector of employment not reported.

**Table 3: Regression results for different commuting distances of internal commuters**

	Distance travelled			
	to 50km	50 to 100 km	100-150km	150+km
	Regression Results			
age 20-29 years	0.57771*** (0.00521)	0.66038*** (0.00363)	0,57732*** (0.00530)	0,23447*** (0.00422)
age 30-39 years	0.70816*** (0.00514)	0.65957*** (0.00359)	0,53329*** (0.00525)	-0,01522*** (0.00421)
age 40-49 years	0.59907*** (0.00514)	0.52592*** (0.00359)	0,38957*** (0.00524)	-0,12968*** (0.00422)
age 50-59 years	0.42093*** (0.00523)	0.45718*** (0.00364)	0,28705*** (0.00530)	-0,14011*** (0.00427)
age 60 or more years	0.19255*** (0.00604)	0.02470*** (0.00432)	-0,22395*** (0.00674)	-0,49633*** (0.00540)
Medium Education	0.22847*** (0.00209)	0.27990*** (0.00151)	0,06595*** (0.00209)	0,14275*** (0.00184)
High Education	0.75629*** (0.00218)	0.75064*** (0.00159)	0,41149*** (0.00229)	0,65766*** (0.00191)
Male	0.27853*** (0.00148)	0.37062*** (0.00112)	0,37900*** (0.00158)	0,59048*** (0.00140)
Observations	8837	19778	21080	28837
Log Likelihood	-8004480.6	-14855337	-8802844.9	-12096093
Pseudo R2	0.1469	0.1574	0.1539	0.1203
	Marginal Effects			
age 20-29 years	0.02020*** (0.00022)	0.01844*** (0.00012)	0.00539*** (0.00006)	0.00210*** (0.00004)
age 30-39 years	0.02479*** (0.00022)	0.01768*** (0.00011)	0.00472*** (0.00005)	-0.00013*** (0.00003)
age 40-49 years	0.02009*** (0.00020)	0.01346*** (0.00010)	0.00329*** (0.00005)	-0.00105*** (0.00003)
age 50-59 years	0.01392*** (0.00020)	0.01186*** (0.00011)	0.00241*** (0.00005)	-0.00112*** (0.00003)
age 60 or more years	0.00611*** (0.00021)	0.00056*** (0.00010)	-0.00157*** (0.00004)	-0.00334*** (0.00003)
Medium Education	0.00666*** (0.00006)	0.00629*** (0.00003)	0.00050*** (0.00002)	0,00119*** (0.00002)
High Education	0.02615*** (0.00009)	0.02039*** (0.00006)	0.00351*** (0.00002)	0.00647*** (0.00002)
Male	0.00808*** (0.00004)	0.00830*** (0.00003)	0.00290*** (0.00001)	0.00486*** (0.00001)

Notes: Top panel reports regression coefficients, bottom panel marginal effects for weighted logit regression on the probability to commute, values in brackets are heteroskedasticity robust standard errors, \*\*\*(\*\*)(\*) signify significance at 1% (5%) (10%) level, respectively. Base categories for dummy variables are 15-19 year old females with a completed compulsory education. Results for fixed effects of NUTS2 region of residence and sector of employment not reported.

**Table 4: Multinomial logit regression results for the choice of commuting, migrating and staying for cross border commuters**

	Coefficient Estimates		Marginal Effects		
	Commuting vs. Staying	Migrating vs. Staying	Staying	Commuting	Migrating
age 20-29 years	0.33476*** (0.00980)	-0.09670*** (0.00345)	-0.00013*** (0.00003)	0.00069*** (0.00002)	-0.00056*** (0.00002)
age 30-39 years	-0.16097*** (0.00989)	-0.48219*** (0.00348)	0.00285*** (0.00002)	-0.00028*** (0.00002)	-0.00257*** (0.00002)
age 40-49 years	-0.17864*** (0.00985)	-1.28500*** (0.00373)	0.00635*** (0.00002)	-0.00031*** (0.00002)	-0.00604*** (0.00001)
age 50-59 years	-0.59404*** (0.01020)	-1.63127*** (0.00403)	0.00749*** (0.00002)	-0.00093*** (0.00001)	-0.00656*** (0.00001)
age 60 or more years	-0.90605*** (0.01402)	-1.12047*** (0.00463)	0.00537*** (0.00002)	-0.00116*** (0.00001)	-0.00422*** (0.00001)
Medium Education	0.29299*** (0.00427)	-0.18480*** (0.00207)	0.00055*** (0.00001)	0.00055*** (0.00001)	-0.00110*** (0.00001)
High Education	0.35335*** (0.00470)	0.38078*** (0.00252)	-0.00317*** (0.00002)	0.00071*** (0.00001)	0.00246*** (0.00002)
Male	0.50822*** (0.00298)	-0.33614*** (0.00145)	0.00110*** (0.00001)	0.00094*** (0.00001)	-0.00203*** (0.00001)
Observations	4035				
Log Likelyhood	-13183681				
Pseudo R2	0.15580				

Notes: Left hand side panel reports regression coefficients, right hand side panel marginal effects for weighted multinomial logit regression on the probability to commute, migrate or stay, values in brackets are heteroskedasticity robust standard errors, \*\*\*(\*\*)(\*) signify significance at 1% (5%) (10%) level, respectively. Base categories for dummy variables are 15-19 year old females with a completed compulsory education. Results for fixed effects of country of residence and sector of employment not reported.

**Table A1: Marginal effects for internal and external commuting by country**

	Austria	Belgium	Czech Rep.	Germany	Spain	France	Hungary	Netherlands	Poland	Romania	Sweden	Slovakia	U.K.
Internal Commuters													
age 20-29 years	0.03799*** (0.00099)	0.10681*** (0.00315)	0.00750*** (0.00089)	0.03832*** (0.00039)	0.01407*** (0.00035)	0.00040 (0.00030)	-0.00028 (0.00066)	0.05581*** (0.00078)	0.00549*** (0.00036)	-0.00014*** (0.00002)	0.02479*** (0.00089)	-0.01829*** (0.00061)	0.02589*** (0.00039)
age 30-39 years	0.02906*** (0.00088)	0.09596*** (0.00292)	-0.00850*** (0.00069)	0.03188*** (0.00036)	0.00651*** (0.00025)	-0.00681*** (0.00028)	-0.01293*** (0.00054)	0.05962*** (0.00075)	0.00474*** (0.00034)	-0.00042*** (0.00002)	0.00654*** (0.00067)	-0.03300*** (0.00057)	0.04190*** (0.00039)
age 40-49 years	0.01575*** (0.00081)	0.09391*** (0.00288)	-0.01693*** (0.00060)	0.01721*** (0.00033)	0.00592*** (0.00025)	-0.00819*** (0.00027)	-0.01575*** (0.00048)	0.04981*** (0.00072)	0.00203*** (0.00031)	-0.00052*** (0.00002)	-0.00037 (0.00060)	-0.03788*** (0.00058)	0.02615*** (0.00037)
age 50-59 years	0.02410*** (0.00092)	0.08349*** (0.00303)	-0.01786*** (0.00058)	0.00752*** (0.00033)	0.00512*** (0.00026)	-0.00266*** (0.00029)	-0.01759*** (0.00045)	0.03585*** (0.00073)	-0.00140*** (0.00026)	-0.00068*** (0.00001)	0.00152*** (0.00062)	-0.03498*** (0.00045)	0.01171*** (0.00037)
age 60 or more years	-0.00563*** (0.00104)	-0.01880*** (0.00257)	-0.01389*** (0.00051)	-0.01191*** (0.00033)	-0.00169*** (0.00020)	-0.02968*** (0.00023)	-0.01518*** (0.00035)	-0.01121*** (0.00078)	-0.00110*** (0.00029)	-0.00114*** (0.00001)	-0.00156*** (0.00062)	-0.02876*** (0.00023)	-0.02664*** (0.00035)
Medium Education	0.02490*** (0.00036)	0.02537*** (0.00054)	-0.00256*** (0.00034)	0.01002*** (0.00014)	0.00370*** (0.00006)	0.00130*** (0.00011)	-0.00695*** (0.00020)	0.02738*** (0.00031)	0.00246*** (0.00010)	-0.00101*** (0.00002)	0.00431*** (0.00026)	-0.01104*** (0.00066)	0.02513*** (0.00017)
High Education	0.04785*** (0.00064)	0.12289*** (0.00059)	0.03715*** (0.00063)	0.03993*** (0.00019)	0.00969*** (0.00006)	0.01851*** (0.00013)	0.00737*** (0.00026)	0.08572*** (0.00040)	0.00947*** (0.00018)	-0.00054*** (0.00001)	0.02242*** (0.00036)	0.02045*** (0.00082)	0.08982*** (0.00021)
Male	0.01823*** (0.00025)	0.04784*** (0.00039)	0.01443*** (0.00015)	0.02402*** (0.00009)	0.00673*** (0.00004)	0.01889*** (0.00009)	0.01230*** (0.00014)	0.03279*** (0.00023)	0.00838*** (0.00005)	0.00086*** (0.00002)	0.01491*** (0.00018)	0.02208*** (0.00024)	0.04662*** (0.00013)
Cross Border Commuters													
age 20-29 years	0.00490*** (0.00035)	0.00674*** (0.00080)	0.00084*** (0.00029)	0.00128*** (0.00008)	0.00307*** (0.00019)	0.00307*** (0.00013)	0.00123*** (0.00042)	0.00137*** (0.00014)	0.00061*** (0.00007)	-0.00059*** (0.00004)	0.00159*** (0.00022)	-0.01570*** (0.00080)	0.00122*** (0.00008)
age 30-39 years	0.00385*** (0.00030)	0.00834*** (0.00078)	-0.00172*** (0.00021)	0.00025*** (0.00006)	0.00032*** (0.00010)	0.00443*** (0.00013)	0.00066* (0.00038)	0.00308*** (0.00017)	0.00038*** (0.00006)	-0.00099*** (0.00004)	-0.00254*** (0.00016)	-0.05197*** (0.00064)	0.00082*** (0.00006)
age 40-49 years	0.00489*** (0.00031)	0.00638*** (0.00073)	-0.00319*** (0.00018)	0.00067*** (0.00007)	0.00085*** (0.00012)	0.00423*** (0.00013)	-0.00086*** (0.00031)	0.00387*** (0.00019)	0.00022*** (0.00006)	-0.00109*** (0.00003)	-0.00296*** (0.00015)	-0.06467*** (0.00064)	0.00300*** (0.00010)
age 50-59 years	0.00362*** (0.00032)	0.00483*** (0.00075)	-0.00346*** (0.00017)	-0.00033*** (0.00006)	0.00055*** (0.00011)	0.00355*** (0.00013)	-0.00169*** (0.00027)	0.00194*** (0.00015)	0.00020*** (0.00006)	-0.00189*** (0.00003)	-0.00529*** (0.00012)	-0.05972*** (0.00048)	0.00223*** (0.00009)
age 60 or more years	0.00973*** (0.00066)	0.00755*** (0.00100)	-0.00364*** (0.00008)	-0.00082*** (0.00005)	0.00209*** (0.00020)	0.00574*** (0.00024)	-0.00031 (0.00035)	0.00130*** (0.00018)	-0.00109*** (0.00003)	-0.00197*** (0.00002)	-0.00607*** (0.00007)	-0.04486*** (0.00028)	0.00087*** (0.00008)
Medium Education	0.00216*** (0.00010)	0.00211*** (0.00015)	0.00010*** (0.00012)	0.00247*** (0.00003)	0.00215*** (0.00004)	0.00038*** (0.00002)	0.00341*** (0.00008)	0.00130*** (0.00004)	0.00044*** (0.00002)	-0.00093*** (0.00003)	0.00012 (0.00011)	-0.01325*** (0.00076)	0.00129*** (0.00002)
High Education	0.00646*** (0.00021)	0.01633*** (0.00021)	0.00067*** (0.00016)	0.00446*** (0.00006)	0.00273*** (0.00003)	0.00134*** (0.00003)	0.00503*** (0.00022)	0.00168*** (0.00006)	0.00024*** (0.00003)	-0.00164*** (0.00002)	0.00220*** (0.00014)	-0.01979*** (0.00055)	0.00208*** (0.00004)
Male	0.00207*** (0.00007)	0.00695*** (0.00011)	0.00273*** (0.00005)	0.00127*** (0.00001)	0.00099*** (0.00001)	0.00271*** (0.00002)	0.00430*** (0.00006)	0.00173*** (0.00003)	0.00191*** (0.00002)	0.00061*** (0.00002)	0.00247*** (0.00007)	0.00552*** (0.00028)	0.00300*** (0.00002)

Notes: Table reports marginal effects for weighted logit regression on the probability to commute, values in brackets are hereoskedasticity robust standard errors, \*\*\*(\*\*)(\*) signify significance at 1% (5%) (10%) level, respectively. Results for Bulgaria and Finland omitted due to low numbers of observations. Base categories for dummy variables are 15-19 year old females with a completed compulsory education. Results for fixed effects of NUTS2 region of residence and sector of employment not reported.

**Table A2: Marginal effects for internal commuting to capital and to other regions by country**

	Austria	Belgium	Czech Rep.	Germany	Spain	France	Hungary	Netherlands	Poland	Romania	Sweden	Slovakia	U.K.
Internal Commuter to capital													
age 20-29 years	0.00582*** (0.00033)	0.09820*** (0.00420)	0.00581*** (0.00055)	0.00038*** (0.00008)	0.00395*** (0.00015)	0.00463*** (0.00021)	-0.00281*** (0.00066)	0.01813*** (0.00042)	0.00156*** (0.00015)	-0.00011*** (0.00001)	0.00778*** (0.00049)	-0.00924*** (0.00074)	0.00838*** (0.00011)
age 30-39 years	0.00788*** (0.00033)	0.09084*** (0.00367)	-0.00231*** (0.00039)	0.00081*** (0.00008)	0.00137*** (0.00009)	0.00300*** (0.00019)	-0.01520*** (0.00055)	0.01990*** (0.00041)	0.00181*** (0.00015)	-0.00022*** (0.00001)	0.00380*** (0.00040)	-0.02266*** (0.00065)	0.01173*** (0.00013)
age 40-49 years	0.00490*** (0.00030)	0.10542*** (0.00374)	-0.00623*** (0.00034)	0.00042*** (0.00007)	0.00207*** (0.00011)	0.00558*** (0.00020)	-0.01852*** (0.00049)	0.01965*** (0.00039)	0.00057*** (0.00012)	-0.00028*** (0.00001)	0.00092*** (0.00035)	-0.02881*** (0.00065)	0.00859*** (0.00010)
age 50-59 years	0.00790*** (0.00036)	0.12089*** (0.00461)	-0.00674*** (0.00032)	-0.00093*** (0.00006)	0.00111*** (0.00010)	0.00302*** (0.00020)	-0.01790*** (0.00046)	0.01705*** (0.00040)	-0.00005 (0.00010)	-0.00036*** (0.00001)	-0.00034 (0.00034)	-0.02640*** (0.00050)	0.00600*** (0.00009)
age 60 or more years	-0.00061 (0.00039)	0.03148*** (0.00338)	-0.00498*** (0.00030)	-0.00112*** (0.00005)	-0.00133*** (0.00005)	-0.00310*** (0.00020)	-0.01507*** (0.00034)	0.00833*** (0.00042)	-0.00033*** (0.00010)	-0.00065*** (0.00001)	-0.00421*** (0.00027)	-0.02309*** (0.00027)	0.00204*** (0.00007)
Medium Education	0.01087*** (0.00014)	0.02052*** (0.00037)	-0.00059*** (0.00017)	0.00333*** (0.00005)	0.00080*** (0.00002)	0.00199*** (0.00006)	-0.00894*** (0.00024)	0.00557*** (0.00009)	-0.00005 (0.00003)	-0.00063*** (0.00002)	0.00090*** (0.00015)	-0.00802*** (0.00069)	0.00159*** (0.00002)
High Education	0.03189*** (0.00045)	0.07756*** (0.00048)	0.02329*** (0.00045)	0.00645*** (0.00012)	0.00321*** (0.00003)	0.01747*** (0.00010)	0.00855*** (0.00031)	0.01385*** (0.00014)	0.00166*** (0.00006)	-0.00031*** (0.00001)	0.00745*** (0.00021)	0.02481*** (0.00099)	0.00752*** (0.00005)
Male	0.00405*** (0.00009)	0.01256*** (0.00024)	0.00442*** (0.00008)	0.00101*** (0.00002)	0.00109*** (0.00002)	0.00487*** (0.00004)	0.01276*** (0.00017)	0.00499*** (0.00006)	0.00178*** (0.00002)	0.00041*** (0.00001)	0.00615*** (0.00010)	0.02029*** (0.00024)	0.00269*** (0.00002)
Internal Commuters to other regions													
age 20-29 years	0.02974*** (0.00087)	0.05854*** (0.00231)	-0.00158*** (0.00048)	0.03681*** (0.00038)	0.00821*** (0.00027)	-0.00274*** (0.00024)	0.00340*** (0.00070)	0.03889*** (0.00069)	0.00339*** (0.00031)	0.00024*** (0.00004)	0.01861*** (0.00084)	-0.00851*** (0.00020)	0.00816*** (0.00032)
age 30-39 years	0.01541*** (0.00071)	0.04797*** (0.00210)	-0.00739*** (0.00041)	0.02933*** (0.00035)	0.00418*** (0.00021)	-0.00902*** (0.00022)	-0.00170*** (0.00056)	0.04125*** (0.00066)	0.00223*** (0.00028)	-0.00007*** (0.00003)	0.00266*** (0.00058)	-0.01267*** (0.00023)	0.01592*** (0.00032)
age 40-49 years	0.00579*** (0.00065)	0.03453*** (0.00200)	-0.01066*** (0.00037)	0.01509*** (0.00032)	0.00263*** (0.00020)	-0.01255*** (0.00021)	-0.00257*** (0.00053)	0.03087*** (0.00064)	0.00116*** (0.00027)	-0.00010*** (0.00003)	-0.00168*** (0.00053)	-0.01248*** (0.00025)	0.00603*** (0.00031)
age 50-59 years	0.00898*** (0.00071)	0.01826*** (0.00198)	-0.01072*** (0.00035)	0.00766*** (0.00032)	0.00319*** (0.00022)	-0.00486*** (0.00023)	-0.00566*** (0.00045)	0.01987*** (0.00063)	-0.00145*** (0.00023)	-0.00021*** (0.00002)	0.00217 (0.00058)	-0.01145*** (0.00018)	-0.00057*** (0.00030)
age 60 or more years	-0.00690*** (0.00080)	-0.02617*** (0.00167)	-0.00877*** (0.00027)	-0.01181*** (0.00032)	-0.00062*** (0.00017)	-0.02641*** (0.00016)	-0.00513*** (0.00039)	-0.01737*** (0.00067)	-0.00085*** (0.00025)	-0.00047*** (0.00001)	0.00329*** (0.00063)	-0.00845*** (0.00010)	-0.02887*** (0.00028)
Medium Education	0.00711*** (0.00030)	0.00754*** (0.00043)	-0.00281*** (0.00027)	0.00793*** (0.00014)	0.00249*** (0.00005)	-0.00032*** (0.00009)	-0.00128*** (0.00015)	0.02050*** (0.00029)	0.00264*** (0.00009)	-0.00001 (0.00001)	0.00410*** (0.00023)	-0.00403*** (0.00033)	0.01937*** (0.00016)
High Education	0.00600*** (0.00040)	0.06434*** (0.00049)	0.01011*** (0.00038)	0.03680*** (0.00019)	0.00524*** (0.00005)	0.00317*** (0.00011)	0.00199*** (0.00019)	0.07044*** (0.00038)	0.00733*** (0.00017)	0.00009*** (0.00002)	0.01699*** (0.00032)	0.00061** (0.00029)	0.06596*** (0.00020)
Male	0.01206*** (0.00021)	0.04055*** (0.00033)	0.01018*** (0.00012)	0.02343*** (0.00009)	0.00538*** (0.00004)	0.01491*** (0.00008)	0.00443*** (0.00011)	0.02609*** (0.00022)	0.00606*** (0.00005)	0.00059*** (0.00002)	0.00950*** (0.00016)	0.00473*** (0.00014)	0.03758*** (0.00012)

Notes: Table reports marginal effects for weighted logit regression on the probability to commute, values in brackets are heteroskedasticity robust standard errors, \*\*\*(\*\*)(\*) signify significance at 1% (5%) (10%) level, respectively. Results for Bulgaria and Finland omitted due to low numbers of observations. Base categories for dummy variables are 15-19 year old females with a completed compulsory education. Results for fixed effects of NUTS2 region of residence and sector of employment not reported

**Table A3: Multinomial logit regression results for the choice of commuting, migrating and staying for cross border commuters by country**

		age 20-29 years	age 30-39 years	age 40-49 years	age 50-59 years	age 60 or more years	Medium Education	High Education	Male
Austria	Staying	-0.00357*** (0.00035)	-0.00225*** (0.00027)	-0.00070*** (0.00025)	0.00119*** (0.00022)	-0.00063* (0.00033)	-0.00219*** (0.00010)	-0.02005*** (0.00070)	-0.00035*** (0.00006)
	Commuting	0.00357*** (0.00035)	0.00217*** (0.00025)	0.00195*** (0.00024)	0.00040* (0.00021)	0.00113*** (0.00031)	-0.00029*** (0.00008)	0.00199*** (0.00013)	0.00056*** (0.00006)
	Migrating	0.00001 (0.00010)	0.00007*** (0.00010)	-0.00125*** (0.00008)	-0.00160*** (0.00006)	-0.00049*** (0.00009)	0.00249*** (0.00006)	0.01806*** (0.00069)	-0.00021*** (0.00003)
Belgium	Staying	0.00064 (0.00098)	-0.00286*** (0.00099)	0.00577*** (0.00093)	0.00516*** (0.00093)	-0.00755*** (0.00109)	-0.00563*** (0.00022)	-0.02146*** (0.00025)	-0.00477*** (0.00015)
	Commuting	0.00620*** (0.00098)	0.00918*** (0.00099)	0.00654*** (0.00092)	0.00432*** (0.00093)	0.00390*** (0.00107)	0.00278*** (0.00019)	0.01274*** (0.00021)	0.00687*** (0.00013)
	Migrating	-0.00684*** (0.00011)	-0.00632*** (0.00013)	-0.01231*** (0.00013)	-0.00948*** (0.00009)	0.00365*** (0.00027)	0.00285*** (0.00011)	0.00872*** (0.00014)	-0.00210*** (0.00008)
Germany	Staying	-0.00112*** (0.00008)	0.00085*** (0.00006)	0.00210*** (0.00006)	0.00361*** (0.00005)	0.00111*** (0.00005)	-0.00594*** (0.00003)	-0.00594*** (0.00006)	0.00056*** (0.00002)
	Commuting	0.00097*** (0.00007)	-0.00002*** (0.00005)	0.00054*** (0.00006)	-0.00076*** (0.00004)	-0.00137*** (0.00002)	0.00158*** (0.00002)	0.00306*** (0.00005)	0.00106*** (0.00001)
	Migrating	0.00015*** (0.00004)	-0.00083*** (0.00003)	-0.00264*** (0.00003)	-0.00284*** (0.00002)	0.00026*** (0.00004)	-0.00105*** (0.00002)	0.00288*** (0.00003)	-0.00162*** (0.00002)
France	Staying	-0.00260*** (0.00013)	-0.00007*** (0.00010)	0.00305*** (0.00009)	0.00440*** (0.00007)	0.00188*** (0.00009)	-0.00071*** (0.00003)	-0.00262*** (0.00005)	-0.00031*** (0.00003)
	Commuting	0.00313*** (0.00013)	0.00133*** (0.00009)	0.00112*** (0.00009)	-0.00051*** (0.00007)	-0.00101*** (0.00009)	-0.00038*** (0.00002)	-0.00079*** (0.00003)	0.00155*** (0.00002)
	Migrating	-0.00053*** (0.00003)	-0.00125*** (0.00003)	-0.00418*** (0.00003)	-0.00389*** (0.00002)	-0.00087*** (0.00003)	0.00110*** (0.00002)	0.00340*** (0.00004)	-0.00123*** (0.00002)
Hungary	Staying	0.00270*** (0.00024)	0.00372*** (0.00025)	0.00582*** (0.00022)	0.00728*** (0.00019)	0.00308*** (0.00018)	-0.00410*** (0.00011)	-0.00551*** (0.00030)	-0.00135*** (0.00007)
	Commuting	-0.00070*** (0.00024)	-0.00078*** (0.00024)	-0.00137*** (0.00021)	-0.00225*** (0.00018)	-0.00130*** (0.00018)	0.00384*** (0.00010)	0.00520*** (0.00030)	0.00311*** (0.00006)
	Migrating	-0.00200*** (0.00005)	-0.00294*** (0.00007)	-0.00445*** (0.00007)	-0.00503*** (0.00007)	-0.00178*** (0.00004)	0.00026*** (0.00005)	0.00031*** (0.00007)	-0.00176*** (0.00004)
Nether-lands	Staying	-0.00060*** (0.00016)	-0.00585*** (0.00022)	-0.00380*** (0.00019)	-0.00203*** (0.00018)	-0.01968*** (0.00060)	-0.00707*** (0.00009)	-0.01753*** (0.00016)	0.00190*** (0.00005)
	Commuting	0.00001 (0.00008)	0.00038*** (0.00008)	0.00067*** (0.00009)	0.00008*** (0.00008)	0.00006*** (0.00010)	0.00188*** (0.00005)	0.00155*** (0.00007)	0.00118*** (0.00003)
	Migrating	0.00059*** (0.00014)	0.00547*** (0.00020)	0.00313*** (0.00017)	0.00195*** (0.00016)	0.01961*** (0.00059)	0.00518*** (0.00007)	0.01598*** (0.00014)	-0.00308*** (0.00004)
Poland	Staying	-0.01519*** (0.00029)	-0.00183*** (0.00018)	0.01167*** (0.00013)	0.01427*** (0.00010)	0.01237*** (0.00006)	0.01181*** (0.00010)	0.01041*** (0.00008)	0.00409*** (0.00006)
	Commuting	-0.00003 (0.00007)	-0.00068*** (0.00006)	-0.00089*** (0.00005)	-0.00087*** (0.00004)	-0.00151*** (0.00002)	0.00093*** (0.00003)	0.00065*** (0.00005)	0.00234*** (0.00002)
	Migrating	0.01521*** (0.00028)	0.00251*** (0.00018)	-0.01078*** (0.00011)	-0.01340*** (0.00008)	-0.01086*** (0.00005)	-0.01274*** (0.00010)	-0.01105*** (0.00005)	-0.00643*** (0.00005)
Romania	Staying	0.02629*** (0.00024)	0.04304*** (0.00025)	0.06165*** (0.00020)	0.07650*** (0.00016)	0.07671*** (0.00011)	0.04340*** (0.00021)	0.03249*** (0.00018)	0.02242*** (0.00014)
	Commuting	-0.00071*** (0.00003)	-0.00096*** (0.00004)	-0.00105*** (0.00003)	-0.00177*** (0.00003)	-0.00198*** (0.00002)	-0.00062*** (0.00003)	-0.00192*** (0.00003)	0.00044*** (0.00002)
	Migrating	-0.02558*** (0.00024)	-0.04208*** (0.00025)	-0.06060*** (0.00020)	-0.07474*** (0.00015)	-0.07473*** (0.00011)	-0.04278*** (0.00021)	-0.03056*** (0.00018)	-0.02287*** (0.00014)
Sweden	Staying	0.00246*** (0.00015)	0.00545*** (0.00012)	0.00758*** (0.00011)	0.00937*** (0.00010)	0.00642*** (0.00006)	-0.00446*** (0.00014)	-0.02132*** (0.00054)	0.00170*** (0.00007)
	Commuting	-0.00015*** (0.00014)	-0.00219*** (0.00011)	-0.00317*** (0.00009)	-0.00345*** (0.00008)	-0.00356*** (0.00005)	0.00087*** (0.00010)	0.00275*** (0.00015)	0.00047*** (0.00005)
	Migrating	-0.00231*** (0.00004)	-0.00326*** (0.00005)	-0.00442*** (0.00006)	-0.00592*** (0.00006)	-0.00286*** (0.00004)	0.00359*** (0.00010)	0.01857*** (0.00053)	-0.00217*** (0.00004)
Slovakia	Staying	0.02199*** (0.00076)	0.05873*** (0.00063)	0.07719*** (0.00063)	0.07430*** (0.00046)	0.04989*** (0.00028)	0.04831*** (0.00081)	0.02953*** (0.00052)	0.00242*** (0.00029)
	Commuting	-0.01862*** (0.00071)	-0.04860*** (0.00059)	-0.05659*** (0.00058)	-0.05485*** (0.00042)	-0.04125*** (0.00026)	-0.00556*** (0.00064)	-0.02022*** (0.00051)	0.00396*** (0.00027)
	Migrating	-0.00337*** (0.00019)	-0.01013*** (0.00017)	-0.02060*** (0.00021)	-0.01945*** (0.00016)	-0.00864*** (0.00010)	-0.04275*** (0.00048)	-0.00930*** (0.00009)	-0.00638*** (0.00010)
United Kingdom	Staying	0.00118*** (0.00003)	0.00019*** (0.00004)	0.00042*** (0.00004)	0.00069*** (0.00003)	-0.00454*** (0.00011)	0.00074*** (0.00002)	-0.00300*** (0.00003)	-0.00006*** (0.00002)
	Commuting	-0.00020*** (0.00001)	-0.00026*** (0.00001)	0.00013*** (0.00001)	-0.00003*** (0.00001)	-0.00017*** (0.00001)	0.00024*** (0.00001)	0.00070*** (0.00002)	0.00040*** (0.00001)
	Migrating	-0.00098*** (0.00003)	0.00007* (0.00004)	-0.00055*** (0.00003)	-0.00065*** (0.00003)	0.00471*** (0.00011)	-0.00098*** (0.00002)	0.00230*** (0.00002)	-0.00034*** (0.00001)

Notes: Table reports marginal effects for weighted multinomial logit regression on the probability to commute, migrate and stay values in brackets are heteroskedasticity robust standard errors. \*\*\*(\*\*)(\*) signify significance at 1% (5%) (10%) level, respectively. Results for Bulgaria and Finland omitted due to low numbers of observations. Base categories for dummy variables are 15-19 year old females with a completed compulsory education. Results for fixed effects of country of residence and sector of employment not reported.

**Table A4: Multinomial logit regression results for the choice of commuting, migrating and staying by internal commuting distances and commuting types**

	Distance Travelled			
	to 50km	50 to 100 km	100-150km	150+km
	Internal Commuting to capital			



age 20-29 years	0.03230 *** (0.00084)	0.05054 *** (0.00067)	0.01262 *** (0.00033)	0.00194 *** (0.00005)
age 30-39 years	0.04995 *** (0.00088)	0.04757 *** (0.00058)	0.01232 *** (0.00031)	0.00051 *** (0.00003)
age 40-49 years	0.04914 *** (0.00085)	0.04399 *** (0.00056)	0.01191 *** (0.00030)	0.00043 *** (0.00003)
age 50-59 years	0.04114 *** (0.00088)	0.02960 *** (0.00052)	0.00654 *** (0.00027)	0.00020 *** (0.00003)
age 60 or more years	-0.00605 *** (0.00074)	0.00108 *** (0.00040)	-0.00192 *** (0.00023)	-0.00021 *** (0.00003)
Medium Education	0.03332 *** (0.00027)	0.00651 *** (0.00011)	0.00177 *** (0.00007)	0.00025 *** (0.00001)
High Education	0.08984 *** (0.00045)	0.02891 *** (0.00017)	0.01159 *** (0.00010)	0.00383 *** (0.00002)
Male	0.01910 *** (0.00017)	0.01550 *** (0.00008)	0.00869 *** (0.00005)	0.00124 *** (0.00001)
Internal Commuting to other regions				
age 20-29 years	0.01750 *** (0.00021)	0.01367 *** (0.00011)	0.00464 *** (0.00006)	0.0011669 *** (0.00003)
age 30-39 years	0.02002 *** (0.00020)	0.01317 *** (0.00010)	0.00399 *** (0.00005)	-0.000137 *** (0.00003)
age 40-49 years	0.01479 *** (0.00018)	0.00941 *** (0.00009)	0.00251 *** (0.00005)	-0.000963 *** (0.00003)
age 50-59 years	0.00928 *** (0.00018)	0.00910 *** (0.00009)	0.00210 *** (0.00005)	-0.0009036 *** (0.00003)
age 60 or more years	0.00610 *** (0.00020)	0.00047 *** (0.00009)	-0.00141 *** (0.00004)	-0.0028565 *** (0.00002)
Medium Education	0.00319 *** (0.00006)	0.00542 *** (0.00003)	0.00038 *** (0.00002)	0.0009781 *** (0.00001)
High Education	0.01751 *** (0.00008)	0.01708 *** (0.00005)	0.00262 *** (0.00002)	0.0039433 *** (0.00002)
Male	0.00642 *** (0.00004)	0.00658 *** (0.00002)	0.00223 *** (0.00001)	0.0040376 *** (0.00001)

Notes: Table reports marginal effects for weighted multinomial logit regression on the probability to commute, migrate or stay. values in brackets are heteroskedasticity robust standard errors. \*\*\*(\*\*)(\*) signify significance at 1% (5%) (10%) level, respectively. Base categories for dummy variables are 15-19 year old females with a completed compulsory education. Results for fixed effects of NUTS2 region of residence and sector of employment not reported.

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