

## 2.3 LABOUR EMIGRATION AND LABOUR SHORTAGE

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The public discourse regards it as obvious that the cause of labour shortage is specialists going abroad to work and additionally in professional circles it is a prevalent view that the reason for the increasingly frequent complaints of labour shortage is growing employment abroad. Even though labour migration in itself does not explain this phenomenon, the connection is obvious. This subchapter investigates the supply side of this relationship, the extent and selectivity of outward migration, the structure and characteristics of the jobs left behind as well as the dynamics of emigration and homecoming.

Few studies have examined the impact of outward migration on the labour market of countries of origin: the ones that did so, revealed the most significant impact on the emigration of qualified professionals, wages and wage differences. (*Docquier et al*, 2013). These impacts may vary considerably, depending on economic differences between countries and migration expectations (*Massey*, 1990). Since 2004, the gradual realization of the free movement of workers has brought about an accelerated East-West labour migration in the European Union, causing sudden, unexpected changes in the labour markets of both host countries and countries of origin (*Kahanec et al*, 2016). Studies evaluating the impact of outward migration using simulation models found that the most important beneficial effects on the labour markets of countries of origin are increasing wages and decreasing unemployment along with the potential adverse effects of labour shortage, especially in certain occupations coupled with increasing labour demand (*Zaiceva*, 2014). Wage effect in response to outward migration was seen in groups that were affected by especially strong outward migration (*Dustmann et al*, 2015; *Elsner*, 2013). In the Baltic countries, *Hazans* (2016) found innovative adaptation in response to the large scale outward migration.

Labour supply has decreased since 2004 due to continuous outward migration; and the increasingly frequent reporting of shortages as well as the labour shortage seen in the new EU member states in general has emerged virtually at the same time in the growing economies of the countries of origin in Eastern Europe (*Mara*, 2016). In the following, Hungarian specificities will be discussed: the impact of employment abroad, which started to expand later than in other Eastern European countries and which has been growing strongly since 2011.

### Data, weighting and sample design

The assessment of migration and especially emigration is hindered by the lack of statistical data (*Docquier et al*, 2013), therefore we have adopted a new

method. We used the quarterly figures of the Labour Force Survey (LFS) of the Hungarian Central Statistical Office (HCSO) for the period 2006–2016. The LFS also contains the population of persons who work abroad but have a member of their household in Hungary; however, it does not contain those who moved abroad with their families.<sup>1</sup> Mirror statistics, i.e. the immigration data of other countries offer a more accurate picture of the total population of Hungarian citizens living abroad but they do not contain detailed information on activity and employment (*Hárs*, 2016). Such data are included in the 2011 census of some European host countries<sup>2</sup> – we relied on them to adjust the sample of workers exiting the Hungarian labour market in order to work abroad.

We adjusted the population working abroad, identified on the basis of LFS data, with weightings. We performed separate analyses for the three major host countries (Austria, Germany and the United Kingdom) and a joint analysis for the remaining countries. The number of workers seen in the LFS was adjusted to the total population observed in the mirror statistics (*Hárs*, 2016) by adjusting the population rate with the employment rate of the host countries estimated on the basis of the 2011 census (0.74 in the United Kingdom, 0.67 in Germany). The effect of seasonal fluctuations seen in the quarterly figures was taken into account according to the complete time series. In the case of Austria, where the number of commuters is considerable and commuters are included in the LFS data, quarterly figures from the Austrian Employment Service (AMS) were used. In the case of the remaining host countries, the mean of the weights used for the three major host countries were applied, assuming that the proportion of the “missing population” is similar in these countries. The weights obtained in this way were combined with the original weights adopted by the HCSO.

We presumed that the structure of employment abroad as well as its distribution by host countries, indicated by the LFS, is not considerably different in the total population living abroad, thus the weighted LFS statistics fairly accurately show the actual structure and proportions of the population working abroad.<sup>3</sup> *Figure 2.3.1* presents the estimated headcount of employees calculated from LFS data adjusted by mirror statistics.

The employment of the population aged 18 years or more in the period 2006–2016 was evaluated using the adjusted sample of the LFS, excluding the employment of old-age pensioners. LFS statistics contain those *working* abroad, therefore those unemployed, inactive or studying abroad are excluded (*Hárs–Simon*, 2016). When examining flows, entrants to employment abroad are defined as living in Hungary in the preceding quarter and working abroad in the next, while returnees are persons working abroad in the preceding quarter and working in Hungary in the next.<sup>4</sup>

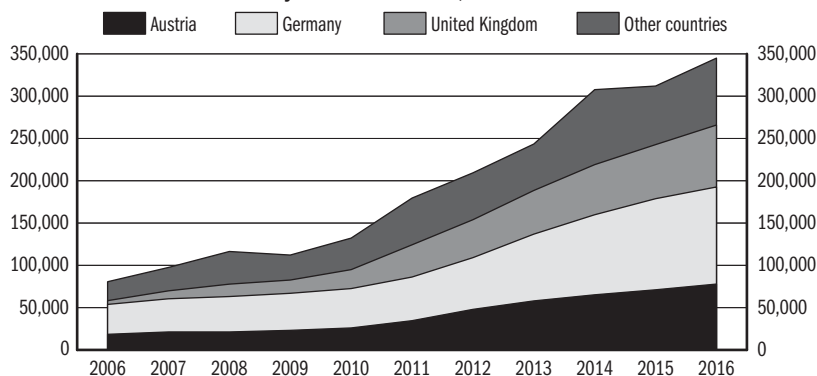
1 *Bodnár–Szabó* (2014) and *Hárs–Simon* (2016) examined both those working abroad and those commuting, while *Blaskó–Gödri* (2016) examined families that have moved.

2 See the [Census](#).

3 Selection of migration differs by host countries. The differences between the selection of working abroad and moving abroad with the family are not known – however, selection is influenced by the labour demand of the host countries. Moving usually takes place in several stages: after a family member finds employment, the entire family moves, therefore events taking place before moving may be included in the LFS in the case of families too.

4 The LFS database enable us to follow the career of an individual for six quarters but because of panel attrition, this approach would provide a less accurate result of flow, and in the case of exiters an even higher rate of panel attrition is likely.

**Figure 2.3.1: The estimated number of Hungarian citizens working abroad in major host countries, 2006–2016<sup>a</sup>**



<sup>a</sup> Applying the employment rate estimated using the LFS data adjusted by mirror statistics.

Source: Authors' calculations using LFS data.

Based on the ISCO–88 categories, we developed occupational groups, identifying expected skill shortages, to be able to examine suspected shortages. The detailed categories are presented in *Table A2.3.1* of *Annex 2.3*.

### Exit and return – the actual proportion of labour emigration

When discussing employment abroad, one usually thinks of outward migration from the Hungarian labour market; however, returnees must also be considered. (*Horváth, 2016*). A more accurate picture of labour emigration is obtained by also examining the balance of those entering and exiting employment abroad, since this balance is especially relevant for the impacts on the Hungarian labour market.<sup>5</sup>

The number of persons in employment abroad was compared to the combined headcount of those staying in Hungary in that quarter and those in employment abroad. This proportion quantifies the extent of potential labour shortage caused by employment abroad, assuming that everyone taking up employment abroad would also have a job in Hungary. *Exit rate, return rate and net rate are defined as the average proportion of those taking up employment abroad, those returning and taking up employment in Hungary and their balance respectively, relative to the combined headcount of the population concerned and those in employment in Hungary at the time of the exit, aged 18 years or more and below the retirement age.* In order to illustrate trends, the average proportions of the periods 2006–2010 and 2011–2016 were examined separately.<sup>6</sup> *Figure 2.3.2* presents the average annual proportions of the period of increasing outward migration after 2011.

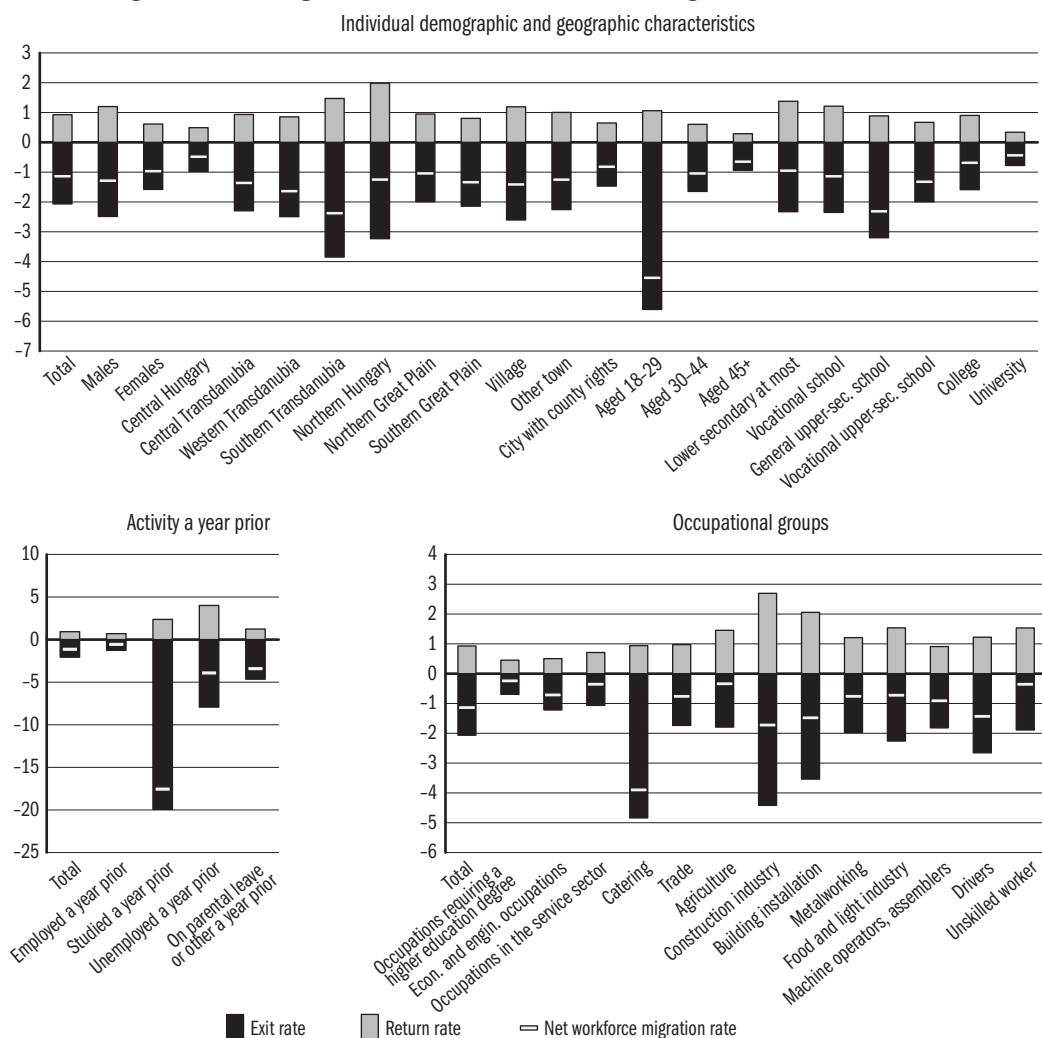
According to our estimations, slightly more than 2 per cent of workers aged 18 years or more and below the retirement age took up employment abroad annually on average between 2011 and 2016 but nearly half of these returned

<sup>5</sup> When calculating the balance of migration, we made simplifications. Exiters and returnees are regarded as similarly skilled and thus we ignore that returnees may be less successful or less competitive. Further simplifications are made concerning returnees: it is assumed that they return to the region they have left and their educational attainment does not change (the data available did not enable a more detailed analysis of differences). However, it is analysed broken down into occupations – which occupations the exiters left and the returnees returned to. It enables us to measure the impact of employment abroad on employment in Hungary, broken down into occupational groups based on ISCO–88 (*Table A2.3.1*).

<sup>6</sup> The detailed quarterly figures are presented in *Table A2.3.2*.

home and found employment in Hungary. Thus the net proportion of those absent due to employment abroad is estimated at more than 1 per cent. Between 2006 and 2010 the average proportion did not reach 0.6 per cent.

Figure 2.3.2: Average annual exit, return and net labour migration rates, 2011–2016



Note: Annual average values are calculated from quarterly average values of change. Standard errors are calculated from the sample; the net proportion of labour migration is not significant in the case of university and college graduates as well as in the service, trade, agricultural and construction industries, building installation, metalworking, food and light industry as well as unskilled jobs. *Exit rate*: the average proportion of those taking up employment abroad relative to the combined headcount of the exiters and those in employment in Hungary at the time of the exit, aged 18 years or more and below the retirement age.

*Return rate*: the average proportion of those returning home and taking up employment relative to the combined headcount of the returnees and those in employment in Hungary at the time of the exit, aged 18 years or more and below the retirement age.

*Net rate*: the average proportion of the balance of exiters and returnees relative to the combined headcount of exiters and returnees and those in employment in Hungary at the time of the exit, aged 18 years or more and below the retirement age.

Southern Transdanubia and Northern Hungary are the *regions* with the highest proportion of exiters – well above the average. In Northern Hungary the proportion of returnees is also high, which reveals short-term, seasonal employment. In Western Transdanubia, with a lower exit and return rate, the proportion of net labour migration substantially exceeds the average, while Central Hungary is characterised by the lowest exit and net labour migration rates.

An especially high proportion of young people below 30 and secondary school graduates take up employment abroad, with a low proportion of returnees. Nevertheless, the exit and return rates of higher education graduates, especially university graduates, are estimated to be below the average.

Workers who had also been *in employment in the preceding year*, were less likely than the average to take up employment abroad, while those studying or unemployed in the preceding year moved abroad to work in higher proportions. Those unemployed in the preceding year also constitute a high proportion of returnees, which indicates that for them both employment abroad and in Hungary consists of short-term, precarious work.

Finally, it was also estimated how labour migration affects the members of different *occupational groups*. The last occupation in Hungary was included in the case of exit and the occupation taken up in Hungary in the case of return. The highest proportion of exit was seen in catering (cooks, waiters): the exit rate between 2011 and 2016 was 5 per cent on average annually, coupled with a relatively low return rate, thus net labour migration reduces the potential headcount by 4 per cent on average annually. The annual average exit rate is nearly 4.5 per cent in the construction industry and 3.5 per cent in building installation occupations, coupled with a relatively high return rate. The return rate is also relatively high in other industry-related occupations. A high share of drivers also find employment abroad and along with a relatively low return rate the annual average net labour migration results in a potential workforce reduction of nearly 1.5 per cent. In spite of frequent reporting of labour shortage in trade, the proportion of those leaving trade jobs behind turned out to be below average. However, this sector showed the highest increase in the exit rate compared to the period of 2006–2010.

### **The independent effects of demographic and labour market factors on employment abroad**

Based on the migration patterns observed in the descriptive statistics, we examined how individual factors influence the probability of employment abroad, controlling for other factors. The average marginal effect and the changes over time of factors affecting the probability of exit and return were analysed using

logistic regression. The description of the model is included in *Table A2.3.2* of *Annex 2.3*. The findings, for five dates, about employment abroad and returning home are presented in *Table 2.3.1* and *Table 2.3.2* respectively.

**Table 2.3.1: The marginal effect of individual factors on employment abroad**

	Q1 2006	Q3 2008	Q1 2011	Q3 2013	Q1 2016
Female	-0.000968***	-0.001015***	-0.001049***	-0.001023***	-0.000833
Age					
Aged 18	0.000102***	0.000111***	0.000119***	0.000121***	0.000104
Aged 38	-0.000097***	-0.000112***	-0.000134***	-0.000168***	-0.000219***
Aged 48	-0.000079***	-0.000093***	-0.000113***	-0.000141***	-0.000183***
Aged 58	-0.000024***	-0.000032***	-0.000044***	-0.000062***	-0.000090***
Region					
Central Transdanubia	0.000463**	0.000625***	0.000878***	0.001282***	0.001944**
Western Transdanubia	0.001001***	0.001204***	0.001491***	0.001894***	0.002450***
Southern Transdanubia	0.001999***	0.002274***	0.002663***	0.003198***	0.003899***
Northern Hungary	0.001510***	0.001660***	0.001864***	0.002113***	0.002369***
Northern Great Plain	0.000848***	0.000862***	0.000860***	0.000797***	0.000567
Southern Great Plain	0.000797***	0.000899***	0.001027***	0.001172***	0.001293*
Type of municipality					
Other town	-0.000406*	-0.000304	-0.000141	0.000149	0.000689
City with county rights, capital city	-0.000723***	-0.000704***	-0.000665***	-0.000570**	-0.000337
Educational attainment					
Vocational school	0.000491**	0.000703***	0.001047***	0.001626***	0.002643***
General upper-secondary school	0.000898**	0.001056***	0.001307***	0.001704***	0.002344***
Vocational upper-secondary school	0.000882***	0.001127***	0.001514***	0.002143***	0.003195***
College	0.001543**	0.001873***	0.002392***	0.003220***	0.004569***
University	0.003434**	0.002848***	0.002405***	0.002033**	0.001648
Activity a year prior					
Studied a year prior	-0.000804**	-0.000639**	-0.000270	0.000548	0.002360
Unemployed a year prior	0.000488	0.001029***	0.001903***	0.003371***	0.005924***
On parental leave or other a year prior	-0.000782***	-0.000796***	-0.000811***	-0.000812***	-0.000767
Occupation					
Economic and engineering	0.000248	0.000334*	0.000472**	0.000698*	0.001085
Services	0.000520	0.000580	0.000655	0.000736	0.000784
Catering	0.003998***	0.004111***	0.004381***	0.004819***	0.005420***
Trade	0.000241	0.000396	0.000681	0.001227	0.002316
Agriculture	0.000182	0.000310	0.000549*	0.001013*	0.001954
Construction industry	0.002119***	0.002526***	0.003142***	0.004080***	0.005520***
Building installation	0.002336***	0.002654***	0.003136***	0.003849***	0.004890*
Skilled metalworking	0.001602***	0.001736***	0.001939***	0.002213***	0.002543
Food and light industry	0.003258***	0.002870***	0.002555***	0.002223***	0.001720
Machine operators, assemblers	0.000691**	0.000860***	0.001115***	0.001503***	0.002104*
Drivers	0.001527**	0.001898***	0.002467***	0.003352***	0.004760**
Unskilled work	0.000667**	0.000839***	0.001099***	0.001501***	0.002134*

Note: We used the Delta method to compute the 95 per cent confidence interval for the average marginal effect. Dependent variable: entering employment abroad.

Reference category: male, Central Hungary, village, a lower secondary qualification at most, was in employment in the preceding year, occupations requiring a higher education degree.

\*\*\* Significant at a 1 per cent level, \*\* significant at a 5 per cent level, \* significant at a 10 per cent level. Coefficients relating to those aged 28 were not significant at any of the dates and therefore are not included in the table.

**Table 2.3.2: The marginal effect of individual factors on the return to the Hungarian labour market**

	Q1 2006	Q3 2008	Q1 2011	Q3 2013	Q1 2016
Female	-0.000492***	-0.000502***	-0.000527***	-0.000534***	-0.000420
Age					
Aged 38	-0.000019***	-0.000026***	-0.000039***	-0.000062***	-0.000106***
Aged 48	-0.000023***	-0.000028***	-0.000038***	-0.000055***	-0.000087***
Aged 58	-0.000014***	-0.000016***	-0.000021***	-0.000030***	-0.000046***
Region					
Central Transdanubia	0.000231**	0.000305**	0.000415***	0.0005563**	0.0006743
Western Transdanubia	0.000483	0.000505	0.000521***	0.000462*	0.000128
Southern Transdanubia	0.000643	0.000734	0.000864***	0.000998***	0.0009996
Northern Hungary	0.001078***	0.001169***	0.001316***	0.001477***	0.0015007*
Northern Great Plain	0.000412***	0.000453***	0.000495***	0.0004815**	0.0002345
Southern Great Plain	0.000207**	0.000256**	0.0003175**	0.0003617	0.0002747
Type of municipality					
Other town	0.000338**	0.000297**	0.000235**	0.000102	-0.000214
Activity a year prior					
Unemployed a year prior	0.000344*	0.000498*	0.000776***	0.001305***	0.002362**
On parental leave or other a year prior	-0.000033	-0.000134	-0.000285**	-0.000543***	-0.001030***
Occupation					
Catering	0.002424**	0.001810**	0.001364***	0.001006*	0.000665
Construction industry	0.000316	0.000700	0.001397***	0.002751**	0.005550*
Building installation	0.000189	0.000529	0.001161**	0.002420***	0.005090**
Skilled metalworking	-0.000025	0.000161	0.000497*	0.001156***	0.002538**
Food and light industry	-0.000078	0.000141	0.000577	0.001504*	0.003605
Machine operators, assemblers	-0.000037	0.000072	0.000251	0.000573*	0.001202
Drivers	-0.000065	0.000159	0.000601	0.001536**	0.003641
Unskilled work	-0.000083	0.000077	0.000369	0.000950**	0.002185*

Note: We used the Delta method to compute the 95 per cent confidence interval for the average marginal effect. Dependent variable: entering employment abroad.

Reference category: male, Central Hungary, village, a lower secondary qualification at most, was in employment in the preceding year, occupations requiring a higher education degree

\*\*\* Significant at a 1 per cent level, \*\* significant at a 5 per cent level, \* significant at a 10 per cent level. The coefficients for the following categories were not significant at any of the dates and therefore are not included in the table: ages 18 and 28, city with county rights, capital city, educational attainment (it was only weakly significant for college graduates in 2011:0.000995\*\*), studied a year prior, economic and engineering occupations, occupations in the service sector, trade and agriculture.

The major findings indicate that the average marginal effect of being female reduces the probability of both taking up employment abroad and returning, compared to being male, and there is little change over time. As for age, the average marginal effect of being 18 years of age increases the probability of working abroad and this effect seems constant for some time but at the age of 28 the effect is no longer significant, while being 38 or older reduces the



probability of taking up employment abroad. The extremely high exit rate of the 18–29 age group seen in the descriptive statistics is only partly confirmed by the marginal estimates (only for the very young), suggesting that employment abroad may have been influenced by educational attainment level and other factors in addition to age.

*Educational attainment* has a considerable impact on taking up employment abroad; however, it has no significant impact on returning. The average marginal effect of educational attainment increases the probability of finding employment abroad in the case of all levels of educational attainment except lower-secondary qualification and the effect increases both with the qualification level and over time. Upper secondary qualification (Matura) gradually loses its stronger marginal effect compared to a vocational training certificate after 2011. Although the descriptive statistics showed an excessive outward migration of general upper-secondary school graduates, this may be influenced by other factors such as age or prior learning – the independent effect does not seem to be marked. The average marginal effect of having a higher education qualification proved to be the strongest: the effect of college education was strong throughout the entire period, while the marginal effect of university education exceeded that of college education until 2011, then started to decrease gradually and in 2016 did not show a significant effect. This finding may reflect that the opportunities available for, and the labour market attractiveness of, university graduates have changed because of the increasing employment abroad (in addition, due to proportions in the complete population, the number of higher education graduates in the sample is small, thus only substantial effects may be detected).

The *regional* effect is stronger in every region than in the region of Central Hungary. Similarly to the proportions observed in the descriptive statistics, the average marginal effect of Southern Transdanubia and Northern Hungary increases the probability of working abroad more than the other regions. The average marginal effect of Southern Transdanubia is especially strong and increases rapidly, while the effect of Northern Hungary is slightly lower. The average marginal effect of Western Transdanubia has been increasing considerably since 2011, probably due to the attraction of the Austrian labour market, which opened up completely in 2011. The marginal effect of the regions on return is substantially weaker and as opposed to the effect on exit, the most significant marginal effect on return was produced by Northern Hungary, similarly to the findings of the descriptive statistics. As for the place of residence, cities with county rights and the capital city have a weaker marginal effect on taking up employment abroad than villages, while a place of residence in other cities increases the probability of return.

Compared to being in employment a *year prior*, the average marginal effect of being unemployed increases, while being on parental leave or in other activities decreases, the probability of both taking up employment abroad and



returning to employment in Hungary. On the other hand, the marginal effect of studying in the preceding year did not seem to be significant, thus the strong impact seen in the descriptive statistics is due to other factors.

The effect of *occupations* on employment abroad is considerable. Compared to occupations requiring a higher education qualification, the average marginal effects of all other occupations on employment abroad were higher. The average marginal effects of catering, construction industry, building installation and driver occupations were substantial and increasing throughout the period and increased the probability of entering employment abroad by 0.5–0.55 per cent in 2016. The average marginal effects of machine operators, assemblers and unskilled work lagged behind but were still considerable, and increased the probability of employment abroad by around 0.25 per cent. The marginal effects of metalworking and food and light industry occupations were similar at first but then the effect was no more significant at the end of the period. The average marginal effects of trade and agricultural occupations were only significant in some years and were relatively modest. The average marginal effects of non-physical economic and engineering as well as service sector occupations were well below the level observed among manual occupations. The combined occupational groups probably hide the effects of individual occupations, such as doctors and nurses on outward migration (the sample size did not enable such detailed breakdown). The average marginal effects of individual occupations on return were smaller but return to construction industry, building installation and metalworking occupations is similar to the extent of exit, and return is similar to the findings of the descriptive statistics.

### Conclusions

Our analysis investigated how outward migration contributes to labour shortage in addition to other factors. Increasing levels of employment abroad in itself resulted in a noticeable increase in the number of workers aged 18 years or more and below the retirement age, since the net proportion of labour migration, calculated as the balance of exiters and returnees, was more than 1 per cent between 2011 and 2016 on average annually. There is also selectivity of entry to employment abroad and to a lesser extent of return. This may have an impact on labour shortage in certain sectors. Young age, educational attainment, regions and occupations have a considerable impact. Both analyses indicated that an especially high proportion of workers leave Southern and Western Transdanubia in order to find employment abroad, while the proportion of returnees is low, thus it is the most likely for labour shortage to emerge here. The proportion of workers taking up employment abroad is also high in Northern Hungary but it is coupled with a relatively high return rate.

The descriptive statistics indicate there is a high proportion of general upper-secondary, vocational upper-secondary and vocational school graduates

among exiters, who are probably young and the effect of other factors, e.g. occupations, also contribute to the proportion. After controlling for all other factors, an important effect of higher level educational attainment was identified. Occupations had an especially strong effect on employment abroad: it is mainly workers in catering, construction, building installation as well as drivers who leave their jobs to find employment abroad. This may cause major shortage in these sectors, which is reflected in observed and registered labour shortage. All manual occupations slightly increase the probability of taking up employment abroad, which also corresponds to the increasing labour shortage observed in this category. Remarkably, in trade and agricultural occupations there is no significant outward migration. In white collar occupations in general the exit rate is low; however, in the case of certain subgroups such as doctors or nurses it was not possible to confirm marginal effects.

While outward migration is substantial, half of the exiters on average returned to Hungarian jobs between 2011 and 2016. However, the selectivity of return is unclear. There is no selectivity by educational attainment; selectivity is only confirmed for a few regions. As for occupations, the return rate is high in all industrial occupations but not in white collar occupations.

## References

- BLASKÓ ZSUZSA–GÖDRI IRÉN (2016): The social and demographic composition of emigrants from Hungary In: *Blaskó Zsuzsa–Fazekas Károly* (eds.): *The Hungarian Labour Market, 2016*, IE HAS, Budapest, pp. 60–68.
- BODNÁR KATALIN–SZABÓ LAJOS TAMÁS (2014): *A kívándorlás hatása a hazai munkaerőpiacra*. (The effects of emigration on the Hungarian labour market) MNB-studies, p 114.
- DOCQUIER, F.–OZDEN, C.–PERI, G. (2013): The labour market effects of immigration and emigration in OECD countries. *The Economic Journal*, Vol. 124. No. 579. pp. 1106–1145.
- DUSTMANN, CH.–FRATTINI, T.–ROSSO, A. (2015): The effect of emigration from Poland on Polish wages. *The Scandinavian Journal of Economics*, Vol. 117. No. 2. pp. 522–564.
- ELSNER, B. (2013): Does emigration benefit the stayers? Evidence from EU enlargement. *Journal of Population Economics*, Vol. 26. No. 2. pp. 531–553.
- HÁRS ÁGNES (2016): *Emigration and immigration in Hungary after the regime change – by international comparison*. In: *Blaskó Zsuzsa–Fazekas Károly* (eds.): *The Hungarian Labour Market, 2016*, IE HAS, Budapest, pp. 39–54.
- HÁRS ÁGNES–SIMON DÁVID (2016): Labour migration, cross-border commuting, emigration. Factors explaining the employment-related emigration of Hungarians and changes since EU accession. In: *Blaskó Zsuzsa–Fazekas Károly* (eds.): *The Hungarian Labour Market, 2016*, IE HAS, Budapest, pp. 73–86.
- HAZANS, M. (2016): Migration experience of the Baltic countries in the context of economic crisis. In: *Kahanec, M.–Zimmermann, K. F.* (eds.): *Labor migration, EU enlargement, and the great recession*. Springer, Berlin–Heidelberg, pp. 297–344.
- HORVÁTH ÁGNES (2016): Returning emigrants. In: *Blaskó Zsuzsa–Fazekas Károly* (eds.): *The Hungarian Labour Market, 2016*, IE HAS, Budapest, pp. 110–116.
- HOSMER, D. W.–LEMESHOW, S. (2000): *Applied Logistic Regression*. 2. ed., John Wiley and Sons, New York.
- KAHANEC, M.–PYTLIKOVÁ, M.–ZIMMERMANN, K. F. (2016): The Free Movement of Workers in an Enlarged European Union: Institutional Underpinning of Economic Adjustment. In: *Kahanec M.–Zimmermann, K. F.* (eds.): *Labor migration, EU enlargement, and the great recession*. Springer, Berlin–Heidelberg, pp. 1–34.
- MARA, I. (2016): Outmigration and labour shortage in the EU-CEE, Special Section III. In: *Growth Stabilises: Investment a Major Driver, Except in Countries Plagued by Recession. Economic Analysis and Outlook for Central, East and Southeast Europe*. WIIW Forecast Report, Spring WIIW, Wien, pp. 41–45.
- MASSEY, D. S. (1990): Social structure, household strategies, and the cumulative causation of migration. *Population Index*, Vol. 56. No. 1. pp. 3–26.

- PAUL, P.–PENNELL, M. L.–LEMESHOW, S. (2013): [Standardizing the power of the Hosmer–Lemeshow goodness of fit test in large data sets](#). *Statistics in Medicine*, Vol. 32. No. 1. pp. 67–80.
- PREGIBON, D. (1980): [Goodness of Link Tests for Generalized Linear Models](#). *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, Vol. 29. No. 1. pp. 15–23.
- ZAICEVA, A. (2014): [Post-enlargement emigration and new EU members' labor markets](#). *IZA World of Labor*, Bonn, p. 40.

## Annex 2.3

**Table A2.3.1: Transcoding ISCO–88 occupational groups and dividing them into groups**

New code	Occupational groups	Description	ISCO–88 code
20	Occupations requiring a higher education degree	Management occupations, higher education graduates, occupations in the armed forces except for leaders of small organisations or departments	1, 2 & 0
31	Economic and engineering occupations requiring higher education or upper-secondary qualifications	Other economic, engineering and office occupations requiring higher education or upper-secondary qualifications + leaders of small organisations	311–321, 341–345, 4, 511
32	Occupations providing services requiring higher education or upper-secondary qualifications	Other occupations providing services requiring higher education or upper-secondary qualifications, except for catering and trade occupations + leaders of small organisations	322–334, 346–348, 512–516
34	Catering-related occupations	Catering (cook, waiter, barman)+ leaders of small organisations or departments	5122–5123
35	Trade-related occupations	Trade occupations + leaders of small organisations or departments	5210–5230
60	Agricultural skilled and unskilled work	Agricultural occupations and unskilled work + leaders of small organisations or departments	6, 92
70	Construction work	Construction industry occupations + leaders of small organisations or departments	7111–7129
71	Building installation	Building installation occupations	7131–7143
72	Skilled metalworking	Skilled metalworking occupations + leaders of small organisations or departments	7211–7311
73	Food and light industry skilled work	Food and other light industry occupations	7312–7442
81	Machine operator and assembler occupations	Machine operator and assembler (except for passenger car, taxi, van, bus, tram and heavy-duty vehicle drivers)	8
82	Drivers	Passenger car, taxi, van, bus, tram and heavy-duty vehicle drivers	8322–8324
90	Unskilled work	Unskilled work (except for agricultural work)	9

**Table A2.3.2: Average exit, return and net labour migration rate of workers aged 18 years or more and below the retirement age, according to individual characteristics, 2006–2010 and 2011–2016 (per cent)**

	2006–2010			2011–2016		
	exit rate	return rate	net labour migration rate	exit rate	return rate	net labour migration rate
Gender						
Total	0.28 (0.018)	0.11 (0.012)	0.17 (0.021)	0.52 (0.025)	0.23 (0.017)	0.28 (0.030)
Male	0.40 (0.029)	0.16 (0.019)	0.24 (0.035)	0.62 (0.037)	0.30 (0.024)	0.32 (0.044)
Female	0.14 (0.017)	0.06 (0.012)	0.09 (0.021)	0.39 (0.032)	0.15 (0.024)	0.24 (0.040)
Age						
18–29	0.64 (0.058)	0.10 (0.015)	0.55 (0.060)	1.40 (0.101)	0.27 (0.031)	1.14 (0.105)
30–44	0.26 (0.027)	0.06 (0.009)	0.20 (0.028)	0.41 (0.032)	0.15 (0.015)	0.26 (0.035)
45+	0.10 (0.017)	0.03 (0.007)	0.07 (0.018)	0.23 (0.026)	0.07 (0.010)	0.16 (0.028)
Region						
Central Hungary	0.09 (0.020)	0.02 (0.009)	0.07 (0.022)	0.24 (0.039)	0.12 (0.031)	0.12 (0.050)
Central Transdanubia	0.16 (0.032)	0.09 (0.029)	ns	0.57 (0.075)	0.23 (–0.043)	0.34 (0.086)
Western Transdanubia	0.33 (0.052)	0.10 (0.030)	0.22 (0.060)	0.62 (0.069)	0.21 (0.048)	0.41 (0.084)
South Transdanubia	0.65 (0.098)	0.19 (0.045)	0.46 (0.107)	0.96 (0.119)	0.37 (0.059)	0.59 (0.132)
Northern Hungary	0.57 (0.076)	0.31 (0.063)	0.26 (0.099)	0.81 (0.084)	0.50 (0.069)	0.31 (0.109)
Northern Great Plain	0.31 (0.050)	0.17 (0.041)	0.14 (0.064)	0.50 (0.063)	0.24 (0.045)	0.26 (0.077)
Southern Great Plain	0.30 (0.048)	0.10 (0.032)	0.20 (0.057)	0.54 (0.063)	0.20 (0.038)	0.33 (0.073)
Type of municipality						
Village	0.42 (0.034)	0.14 (0.020)	0.28 (0.039)	0.65 (0.038)	0.30 (0.026)	0.35 (0.046)
Other city	0.30 (0.034)	0.16 (0.027)	0.14 (0.044)	0.56 (0.045)	0.25 (0.031)	0.31 (0.055)
City with county rights	0.15 (0.025)	0.06 (0.015)	0.09 (0.029)	0.37 (0.044)	0.16 (0.031)	0.20 (0.054)
Lower secondary qualification at most	0.29 (0.054)	0.15 (0.039)	0.14 (0.067)	0.58 (0.066)	0.34 (0.068)	0.24 (0.095)
Vocational school	0.39 (0.037)	0.18 (0.027)	0.21 (0.046)	0.59 (0.041)	0.30 (0.032)	0.28 (0.052)
General upper-secondary school	0.29 (0.058)	0.09 (0.035)	0.20 (0.068)	0.80 (0.100)	0.22 (0.062)	0.58 (0.117)
Vocational upper-secondary school	0.27 (0.035)	0.07 (0.018)	0.20 (0.039)	0.50 (0.052)	0.17 (0.026)	0.33 (0.058)
College	0.13 (0.027)	0.08 (0.028)	ns	0.40 (0.074)	0.23 (0.047)	ns
University	0.13 (0.050)	ns	0.12 (0.050)	0.19 (0.049)	0.08 (0.037)	ns

	2006-2010			2011-2016		
	exit rate	return rate	net labour migration rate	exit rate	return rate	net labour migration rate
Activity a year prior						
In employment	0.20 (0.016)	0.09 (0.011)	0.12 (0.019)	0.31 (0.021)	0.17 (0.015)	0.14 (0.026)
Studied	1.55 (0.310)	ns	1.43 (0.316)	4.98 (0.598)	0.59 (0.272)	4.39 (0.657)
Was unemployed	1.12 (0.147)	0.62 (0.138)	0.50 (0.202)	1.98 (0.174)	1.00 (0.153)	0.98 (0.232)
On parental leave and other	0.72 (0.156)	0.23 (0.084)	0.50 (0.177)	1.16 (0.203)	0.31 (0.103)	0.85 (0.227)
Educational attainment level						
Higher education	0.06 (0.022)	0.03 (0.013)	ns	0.17 (0.039)	0.11 (0.029)	ns
Occupation						
Economic and engineering	0.10 (0.027)	0.10 (0.030)	ns	0.30 (0.053)	0.13 (0.029)	0.18 (0.060)
Services	0.18 (0.048)	0.03 (0.016)	0.14 (0.050)	0.27 (0.057)	0.18 (0.058)	ns
Catering	0.74 (0.174)	0.43 (0.132)	ns	1.21 (0.195)	0.23 (0.072)	0.97 (0.208)
Trade	0.09 (0.027)	ns	ns	0.43 (0.099)	0.24 (0.082)	ns
Agriculture	0.12 (0.045)	0.06 (0.031)	ns	0.45 (0.089)	0.36 (0.093)	ns
Construction industry	0.61 (0.152)	0.30 (0.092)	ns	1.10 (0.199)	0.67 (0.191)	ns
Building installation	0.64 (0.146)	0.29 (0.107)	ns	0.88 (0.162)	0.51 (0.133)	ns
Metalworking	0.49 (0.080)	0.14 (0.037)	0.35 (0.088)	0.49 (0.084)	0.30 (0.052)	ns
Food and light industry	0.57 (0.114)	0.10 (0.043)	0.47 (0.122)	0.57 (0.132)	0.38 (0.154)	ns
Operator and assembler	0.24 (0.052)	0.13 (0.048)	ns	0.45 (0.066)	0.23 (0.045)	0.23 (0.080)
Driver	0.39 (0.125)	0.16 (0.082)	ns	0.66 (0.127)	0.31 (0.097)	0.36 (0.160)
Unskilled work	0.23 (0.047)	0.16 (0.050)	ns	0.47 (0.078)	0.38 (0.081)	ns
N (observations)	410,069			424,932		

Note: Standard errors in bracket, ns: not significant.

*Exit rate*: the average proportion of those taking up employment abroad relative to the combined headcount of the exiters and those in employment in Hungary at the time of the exit, aged 18 years or more and below the retirement age.

*Return rate*: the average proportion of those returning home and taking up employment relative to the combined headcount of the returnees and those in employment in Hungary at the time of the exit, aged 18 years or more and below the retirement age.

*Net rate*: the average proportion of the balance of exiters and returnees relative to the combined headcount of exiters and returnees and those in employment in Hungary at the time of the exit, aged 18 years or more and below the retirement age.

The standard error is given in brackets (percentage point), ns: the proportion estimation is not significant.

### The description of the model

Two logistic regression models are used for evaluating the marginal probability outward and return migration, relative to the combined figure of exiters returnees and those remaining in employment in Hungary:

Model (1) – for the impact of individual factors on taking up employment abroad

Model (2) – for return from employment abroad.

The equation for both logistic regression model is as follows:

$$\ln \left( \frac{p}{1-p} \right) = b_0 + b_1 X_{gen} + b_2 X_{age} + b_3 X_{age}^2 + b_4 X_{edu} + b_5 X_{occup.cat} + b_7 X_{reg} + b_8 X_{municip} + b_9 X_{gen}t + b_{10} X_{age}t + b_{11} X_{age}^2t + b_{12} X_{edu}t + b_{13} X_{occup.cat}t + b_{14} X_{occ.stat.1y.prior}t + b_{15} X_{reg}t + b_{16} X_{municip}t,$$

where

$p$  is the probability of the following outcomes compared to staying in employment in Hungary:

In model (1): taking up employment abroad,

In model (2): returning from abroad.

*Demographic variables:*

$X_{gen}$  gender

$X_{age}$  age

$X_{edu}$  highest level of educational attainment

*Labour market variables:*

$X_{occup.cat}$  in model (1): combined occupational category in the earlier of the two quarters examined ( $t_0$ )

In model (2) combined occupational category in the later of the two quarters examined ( $t_1$ )

$X_{occ.stat.1y.prior}$  occupational status a year prior

*Regional variables:*

$X_{reg}$  region

$X_{municip}$  type of municipality

$t$  time (quarter)

The first model describes those leaving the Hungarian labour market, while the second model describes those returning to the Hungarian labour market. The independent variables of the two models only differ in the occupational category: the first model includes the one preceding the change, while the second includes the one following the change (in both cases it involves the occupational category of the exiters, returnees and those in the Hungarian labour market). Model parameters were estimated using heteroscedasticity-robust variance-covariance estimation.



The developers of the Hosmer–Lemeshow test also admit that a non-major divergence in fit may appear to be a significant error in the case of a large number of items (*Paul et al*, 2013), thus we did not adopt this test. The link tests (*Pregibon*, 1980) and the ROC-curve-analysis were applied instead, and the  $c$ -statistics based on this were used for evaluating the model fit. The Nagelkerke pseudo  $R^2$  values are given for both models (the parameters describing the model fit are presented in *Table A2.3.3*). In conclusion, the indices reveal that the independent variables explain the model of returnees to the labour market better than the model of exiters from the labour market.

**Table A2.3.3: The fit indices of the model**

	Model (1) Exiters from the labour market	Model (2) Returnees to the labour market
$c$ -statistics	0.837	0.835
Link test: explanatory power of the model	0.704***	0.870**
Link test: divergence in fit	-0.0261	-0.010
Nagelkerke $R^2$	0.118	0.138

The values of  $c$ -statistics according to *Hosmer–Lemeshow* (2000) are acceptable above 0.7, very good above 0.8 and excellent above 0.9.

\*\*\* Significant at a 1 per cent level, \*\* significant at a 5 per cent level, \* significant at a 10 per cent level 10.