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# Labour shortage and Migration: Regression Model of the Hungarian Labour Market

## SUMMARY

Humanity has always been on the move. Some people move voluntarily to learn, some for work or economic opportunities, while others migrate out of necessity, in response to climate change, natural disasters or the negative effects of environmental factors. Among the migration phenomena, labour migration plays an important role and is now a major challenge for economic actors worldwide. As a result of economic and social influences and those of globalisation, significant differences in development across Europe have been observed in recent decades, which are constantly being changed in space and time. These processes have also affected the scale of migration. In Hungary, several industrial investments are waiting to be launched, but this requires a sufficient number and quality of workers. Current data show that the domestic human resource is low and that the current labour market is no longer able to fully meet the increased labour demand. Recruiting labour from outside the country has therefore become necessary to keep the economy functioning and maintain, or even increase output. The forecasting and modelling of the labour market has long been the subject of various studies, but no model has yet been developed that can be used as a generally accepted method. The objective of my study is to model the migration processes of the Hungarian labour market using a multivariate linear regression model with different variables. In my research, I collected secondary data based on the databases of the Hungarian Central Statistical Office (KSH). A multivariate regression model was used to analyse the period 2010-2022. The employment of foreign guest workers is a politically and economically sensitive issue, therefore the study focuses exclusively on the economic context.

**Key words:** migration, labour market, human resources

**Jel-codes:** R23, O15

## INTRODUCTION

In recent decades, Europe has witnessed significant differences in development, which are constantly being changed in space and time as a result of economic and social processes and globalisation effects (Youngs – Ülgen, 2022).

One of the consequences of this process is migration, typically to more developed cities in the hope of higher incomes in the future. The migration of workers can bring not only economic and social benefits, but also significant disadvantages, which is why it is important to continuously research and analyse the causes and causal links of migration (Dabasi-Halász et al. 2017).

The main possible reasons for international migration include economic or other reasons (climate change, war). Emigration can be divided into two groups: temporary and permanent (Table 1). Among temporary migrants, there are individuals who settle in another country but plan to return, and others who continue to reside in the sending country and are members of a household there. They are called commuters. The group of permanent emigrants do not plan to return. They settle with their household in another country for a longer period. It is difficult to find reliable data on them, as sending countries do not register outward migrants, and therefore reliable, detailed or time-series information on them is not available in Hungary (Bodnár-Szabó, 2014).

The literature suggests that there are many reasons for emigration such as cyclical reasons due to unemployment rates, differences in employment potential between sending and receiving countries. Job opportunities play a key role in the emigration decision. In a recession, unemployment rises, which increases the chances of emigrating as a „push effect”, while in the receiving country, low unemployment and high job finding rates have a „pull effect”.

Table 1 Types of international migration

Migration					
Emigration			Immigration		
Permanent (no plans to return)	Temporary		Permanent (no plans to return)	Temporary	
	Involving moving	Commuting		Involving moving	Commuting

Source: authors' own editing based on Bodnár-Szabó, 2014

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The other group is made up by structural causes: unemployment rates, differences in job finding chances between sending and receiving countries. Employment potentials are of cardinal importance in the emigration decision, unemployment increases in recession, which increases the chances of emigration as a „push effect”, while low unemployment, high job finding rates in the receiving country are a „pull effect”.

Language similarity and the number of nationals of the sending nation in the receiving nation also has an effect together with the similarity of the language of the sending and receiving nations and the number of immigrants in the receiving nation increases the chances of emigration.

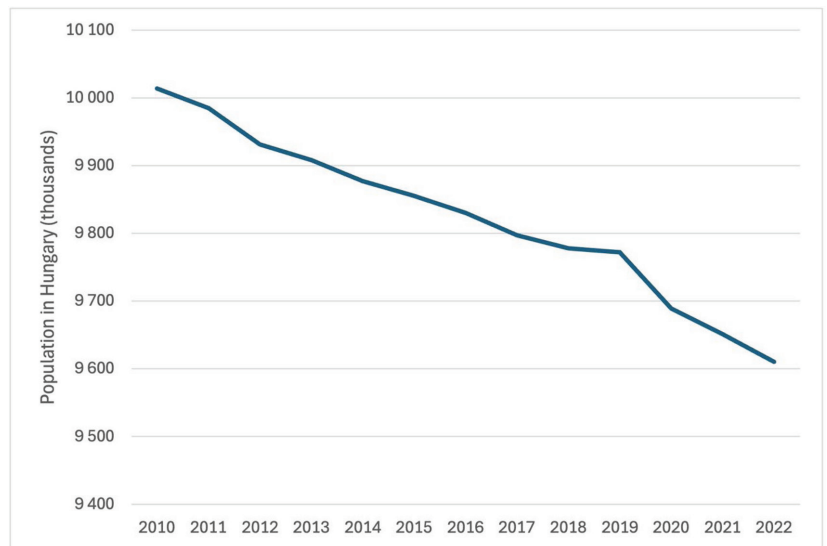
The difference in welfare expenditure between sending and receiving countries, social welfare system, education system: especially in the case of permanent emigration, the level of welfare expenditure, the equity of care, the modernity of the education system may be important factors (Bodnár-Szabó, 2014).

The growth of the European Union, the free movement of labour, the regime changes in Central and Eastern European countries, and the income differentials between nations have all induced and strengthened transnational mobility (Gödri, 2016; Ruff, 2022).

In Hungary, emigration has become a natural process and part of everyday life. We can only hypothesise about the migration of labour and the development of trends in Hungary, due to the scarce and fragmented knowledge available. We can draw on the experience of other nations on this subject and on trends in previous eras. The growing labour shortages, negative causation, and national and family deficits are self-evident. Emigrants can be “replaced” by so-called guest workers from other countries because the return of emigrants is highly doubtful (Hárs, 2020).

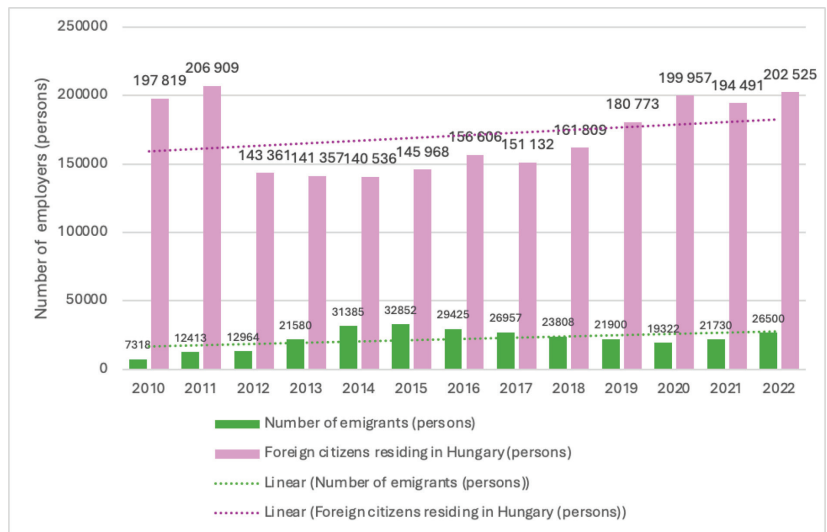
As Figure 1 shows, while there is a growing demand for workers in the domestic labour market, the workforce needed to run the economy would have to be provided by the shrinking Hungarian population. Eastern Europe, including Hungary, is characterised by an increasing number of foreign workers, while the sending character is more and more prevalent (Mélypataki-Lipták, 2020). The migration trend has been steadily increasing since 2006 and even accelerated between 2010 and 2013. The effects and consequences of emigration are controversial in the short term, and in the long term it can lead to labour shortages and a decline in the number of young people with work and skills (Hárs, 2018). Currently, the number of Hungarian citizens working abroad has risen to over 100,000, while the number of foreign guest workers has reached 92,700. In 2023, the largest number of migrants (5100) came from the Philippines (Borbély-Pecze, 2024).

Figure 2 shows the evolution of emigration and the number of foreign citizens residing in Hungary between 2010 and 2022.



**Figure 1: Population trends in Hungary 2010-2022**

Source: author's own editing based on KSH, 2024



**Figure 2: Number of emigrants and foreign nationals arriving in Hungary**

Source: author's own editing based on KSH, 2024

The number of people leaving the country almost quadrupled over the period, from 7,318 in 2010 to over 26,000 in 2022. In 2014 and 2015, more than 30,000 Hungarians looked for a life in another country. The number of emigrants fluctuates, with an increasing trend between 2010 and 2015, followed by a decreasing trend between 2016 and 2020 and an increasing trend from 2021 onwards. Looking at the number of foreign nationals residing in Hungary, it is immediately apparent that between 2012 and 2018 the number of foreign nationals residing in Hungary was approximately 150,000, a significant decrease compared to 2010-2011. No co-movement can be detected between the number of emigrants and the number of foreigners in the country.

The forecasting and modelling of the labour market has been the subject of various research projects for a long time, but no model has yet been developed that could be used as a generally accepted method for forecasting it. These models mostly range from simple extrapolations of employment without taking into account other factors to more complex, dynamic struc-

tural models that take into account a wide range of influencing factors and seek to illustrate the complexity of the labour market. One of the difficulties of forecasting in this area is therefore the complex and dynamic nature of the phenomenon, with many factors influencing its evolution. It is also volatile over time, since it is not possible to know how, for example, a change in the structure of training will affect the labour market years from now. So, this is precisely why it is crucial to build a model that describes the labour market properly. Another non-marginal area of labour market forecasting is the statistical method used for forecasting, because different models work with different errors, so the accuracy of forecasts depends to a large extent on the forecasting models used (Székelyhídi, 2016).

### MATERIAL AND METHOD

Due to the accelerating changes in the economy and the labour market, workers, the companies and legislators have to adapt to the changes in their environment. The ageing and shrinking Hungarian population, the emigrating domestic workforce, the aftermath of the Covid-19 epidemic, the energy crisis, the consequences of war in a neighbouring country, all pose serious challenges to companies and in this difficult and challenging economic environment, companies need to find the right quantity and quality of workers for their organisation, with whom they can maximise the right profits. In addition to strong emigration, there is a large influx of guest workers in high intensity, which poses a serious challenge to economic operators. My aim is to analyse and model this process. The forecasting and modelling of the labour market has been the subject of various research projects for a long time, but no model has yet been developed that could be used as a generally accepted method for forecasting it. One of the difficulties of forecasting in this area is the complex and dynamic nature of the phenomenon, with many factors influencing its evolution.

In my research, I used secondary data collected from the database of the Hungarian Central Statistical Office for the period 2010-2022. For Hungary, the following variables were analysed: the number of employed persons as the dependent variable, while the number of guest workers and the population size as explanatory variables. In this study, a multivariate linear regression model is used to model the migration process of the Hungarian labour market by including the variables presented.

The structure of the research is as follows:

1. Definition of the research problem (migration processes)
2. Research background (literature review)
3. Study objective (modelling the migration process)
4. Definition of variables, data collection (KSH)
5. Presentation of results, evaluation, conclusions

During the processing and analysis, Microsoft Excel, R and RStudio were used together with the corresponding dataset, sandwich, ggplot2 software packages.

```
> normalityTest(~Employed, test="shapiro.test", data=x)

Shapiro-Wilk normality test

data: Employed
W = 0.859, p-value = 0.03738
```

Figure 3: Shapiro-Wilk normality test result

Source: author's own editing with R, 2024

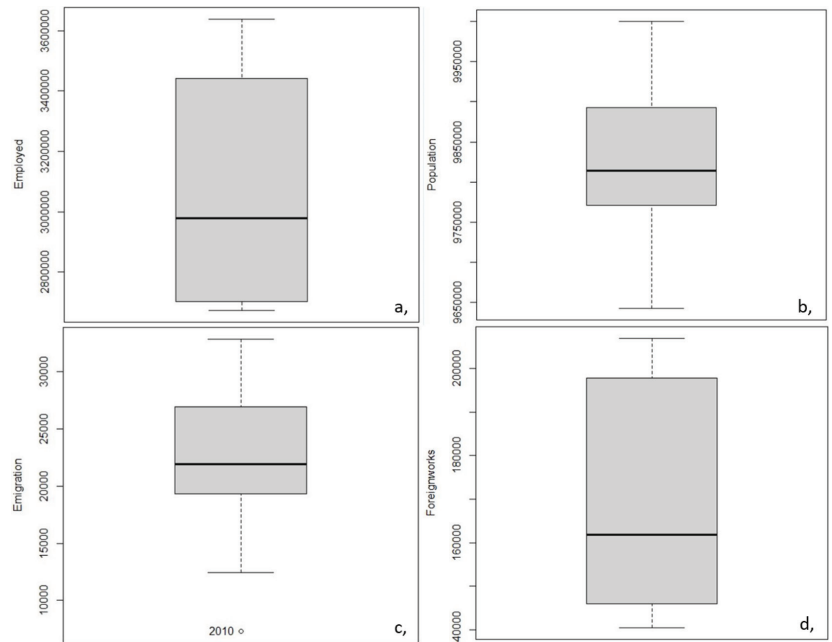


Figure 4: Outlier test

Source: author's own editing with RStudio, 2024

### RESULTS

First, I tested the normality of the dependent variable using the Shapiro-Wilk normality test (Figure 3). According to my null hypothesis H0: the variable under study is normally distributed.

( $W < 1$ ) so the variable is close to normality, ( $p < 0.05$ ) so there is insufficient evidence that normality is not met.

I then created a correlation matrix to determine how closely and in what direction each variable is related. Next, I used boxplot plots (Figure 4 a, b, d) to examine any outliers in the sample. The figure shows that emigration was the only outlier related to the 2010 data (Figure 4.c).

The linear regression model was then constructed (Figure 5). The dependent variable (Y) is the number of persons employed, while the explanatory variables (X) are the number of guest workers in Hungary and the population. H0: the coefficients of all independent variables are zero, i.e. the independent variables do not explain a significant amount of variance in the dependent variable (it does not make sense to use linear regression).

Since the p-value is very small (much less than 0.05), the null hypothesis is rejected. This means that the independent variables jointly have a significant effect on the dependent variable, i.e. the model fits the data well. A high F-statistic value indicates that the independent variables in the model together make a significant contribution to explaining the dependent variable,

```

Call:
lm(formula = Employed ~ Foreignworks + Population, data = x)

Residuals:
    Min       1Q   Median       3Q      Max
-123013  -56442  -3158   19936  297363

Coefficients:
            Estimate      Std. Error t value Pr(>|t|)
(Intercept) 31870424.8971  3222867.8861   9.889 0.00000176 ***
Foreignworks    4.6010      1.2567   3.661  0.00438 **
Population    -3.0117      0.3231  -9.321 0.00000302 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 112900 on 10 degrees of freedom
Multiple R-squared:  0.9215, Adjusted R-squared:  0.9058
F-statistic: 58.71 on 2 and 10 DF, p-value: 0.000002978
    
```

Figure 5: Linear regression model

Source: author's own editing with R, 2024

i.e. the model fits the data well and the independent variables together play an important role in explaining the variance of the dependent variable. The Multiple R-squared is 0.9215, which means that the independent variables in the model together explain 92.2% of the variance of the dependent variable. This is a high value, indicating that the model fits the data well and that the independent variables contribute significantly to explaining the dependent variable.

## CONCLUSIONS

In recent decades, Hungary has witnessed an increase in emigration and emigration, alongside population decline. In order for the economy to remain viable and for companies to remain competitive, it has become necessary to replace labour from outside the country. Economists use several methods to model economic processes, in this research a multivariate linear regression model was used to show the impact of migration on the labour market.

The model fits the data well, but it has its limitations. I assume that the model can be further extended by including different economic indicators and variables (e.g. GNP deflator, consumer price index, unemployment rate, etc.), but this requires further research. These would help to forecast labour market flows more accurately.

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