

# The importance of foreign language skills in the labour markets of Central and Eastern Europe: assessment based on data from online job portals

Brian Fabo<sup>1,2,3</sup>  · Miroslav Beblavý<sup>1</sup> ·  
Karolien Lenaerts<sup>1</sup>

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**Abstract** This paper investigates the role of foreign language skills in the Visegrad Four countries' labour markets using data obtained from key online vacancy boards in these countries and from an online wage survey. Firstly, it considers the demand for language skills based on vacancies and then builds on this information by analysing the wage premium associated with foreign language skills on the occupation and individual level. The results indicate that English language knowledge is highly in demand in the Visegrad region, followed by the command of German language. Particularly, English proficiency appears to be correlated with higher wages, when controlled for common wage determinants in a regression.

**Keywords** Wage premium · Foreign language skills · Vacancy data · Web data

**JEL Classification** J2 · C8

## 1 Introduction

In a globalised world, where countries are firmly engaged in international trade, investment and migration, knowledge of foreign languages is an important skill. Especially in Europe, foreign language skills are considered a major asset—not only because of globalisation but also due to the continent's inherent linguistic diversity. Many efforts have, therefore, been done to promote foreign language acquisition

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✉ Brian Fabo  
fabob@spp.ceu.edu

<sup>1</sup> Centre for European Policy Studies (CEPS), Brussels, Belgium

<sup>2</sup> School of Public Policy, Central European University, Nádor u. 9, Budapest 1051, Hungary

<sup>3</sup> CentERdata, Tilburg, The Netherlands

and multilingualism and to better understand how this can be facilitated (Eurydice/Eurostat 2012). Initiatives such as the Erasmus + programme and the Creative Europe programme are only a few examples. This focus on foreign language skills is motivated by the role of language skills for everyday life (as a means to communicate, interact with others, bridge intercultural gaps etc.), and their significance in Europe's labour markets more specifically. Esser (2006), for example, examines the link between language and human capital. Other work has analysed the relation between language skills and employability, and reports that this relationship is positive (ET2020). Moreover, foreign language skills are crucial for labour mobility and labour market integration.

Although the importance of foreign language skills has been widely recognised, studies on the supply and demand of these skills have only started to emerge in the last two decades (Antonietti and Loi 2014). The economic literature has mostly discussed the topic of language in relation to migration and trade, from both the aggregate and individual perspective (Antonietti and Loi 2014; Isphording 2015). The *supply of foreign language skills* is typically measured on the basis of interviews and surveys. According to a Eurobarometer survey conducted in 2012, 54% of Europeans speak at least one other (foreign) language, in addition to their mother tongue, while 25% can speak at least two foreign languages and 10% at least three (Eurostat 2012). These results further show that at least half of the population cannot speak any foreign language well enough to hold a conversation.<sup>1</sup> Meanwhile, foreign language proficiency appears to be even less common in the Visegrad countries than in the EU (as reported in Table 1).

Nevertheless, even in those countries, foreign language skills are demanded on the labour market. In fact, when it comes to *labour demand*, previous research has confirmed that the demand for foreign language skills is on the rise, and that this trend is likely to continue in the future (see a.o. ET2020 2011; Antonietti and Loi 2014; Isphording 2015). This development is driven by the multilingual and multicultural environment in which firms increasingly operate, the global competition that they face and their aim to broaden their market access (ET2020 2011). It is also an important factor facilitating mobility of workers on the single EU labour market (Barslund and Busse 2016).

In our paper, we contribute to this literature and focus on the importance of foreign languages in the labour markets in Central and Eastern Europe. Specifically, we examine how common it is for employers to require foreign language skills in their job advertisements and whether proficiency in foreign languages is rewarded with a wage premium.

We discuss the case of the Visegrad Four (V4), which is composed of Czechia, Hungary, Poland and Slovakia. We selected the Visegrad Four because we are interested in the role of foreign language skills on the labour markets in countries that are open to international trade and foreign investors, but where the population's language skills may not be very well-developed. During the last two decades, the economies of the V4 countries have grown considerably, attracting substantial

<sup>1</sup> The ten countries in which over half of the population cannot speak any foreign languages are: Hungary, Italy, Portugal, the United Kingdom, Ireland, Spain, Bulgaria, Romania, Czechia and Poland.

**Table 1** Share of people able to have a conversation in English or German in the EU27 and the V4. Source Eurydice/Eurostat (2012): Special Eurobarometer Report 386

	English (%)	German (%)
EU27	38	11
Czechia	27	15
Hungary	20	18
Poland	33	19
Slovakia	26	2

amounts of foreign direct investment (FDI). The FDI-driven nature of growth resulted in a deep integration of the V4 economies in European and global capitalism. The regional bank sector is dominated by foreign-owned banks (typically Western European), multinational companies established shared service centres in all major towns of the region, and the V4 countries are very active in international trade.<sup>2</sup> The openness of the V4 economies creates demand for workers capable of communicating in foreign languages, particularly English—the *lingua franca* of international business (Sanchez et al. 2011).

In addition to English, German and Russian have historically been widely taught and used in the region. The importance of the Russian language has diminished somewhat since the end of the Cold War, but Germany remains the most important trading partner for all four V4 countries. Additionally, Germany and Austria are major sources of FDI into the region. FDI transfers from German-speaking countries (Germany, Austria) have been very visible in the field of manufacturing and, while initially outsourcing entailed mainly manual work, it now also includes outsourcing of skill-intensive activities (particularly since the 2004 EU enlargement) (Marin 2010). Given the strong mutual integration of the four Visegrad countries, languages spoken in one of the other V4 members can also be relevant (e.g. for cross-border labour mobility). Yet, out of the ten countries in which at least 50% of the population is unable to hold a conversation in a foreign language, five are located in Central and Eastern Europe and three are part of the Visegrad Four. For three of the countries, the main national language is not among the five most widely spoken languages in Europe (Polish shares the fifth position with Spanish). Our focus on the V4 countries is further motivated by the strong embeddedness of the region in the global division of labour and their position in global value chains, which allows us to gain new insights into the role of languages in the contemporary economy.

In order to examine which foreign language skills are demanded on the V4 labour markets and whether knowledge of these languages would result in a wage premium, we combine data obtained from online job portals with data from the WageIndicator survey. The WageIndicator survey (WI) is a continuous, voluntary web-based survey of wages and working conditions. For our purposes, it is

<sup>2</sup> In Slovakia, exports in goods and services as a percentage of GDP amounted to 93.5% of GDP according to Eurostat data for year 2015. For Hungary, the share was 90.7% and for Czechia it was 83%. Only Poland is a partial exemption here, due to its relatively sizable internal market. For Poland, the share of exports in goods and services represented 49.6% of GDP in 2015.

important that the wage data are available at the occupational level, coded at the 4-digit ISCO level, which makes it possible to connect data on the occupation level with the job portals data. Furthermore, since September 2015, the WageIndicator survey has been gradually enlarged by variables on language proficiency, which allows us to perform limited exploratory statistical analysis on the individual level as well.

The four job portals that we use for our analysis each have an interesting feature: each of them offers the option to select vacancies according to the demand for individual languages (e.g. the Slovak job portal also its users to select vacancies that require English language skills). This feature considerably facilitates data extraction. Most job portals, however, do not have this feature. Instead, selection is normally limited to criteria such as income bracket, region, minimum education attainment etc. Because we were able to use the information about language requirements for each vacancy, normally coded by the prospective employer, we could avoid the need to work with the entire text of the vacancies (i.e. the job description) and having to deal with identification of skill requirement, which is typically a painstaking process (Beblavý et al. 2016a; Mýtna-Kureková et al. 2015a).

The remainder of this paper is structured as follows. In the first section, we review the literature on the role of foreign language skills on the labour market. In the second section, we describe our data sources' composition and limitations and elaborate on the methodology used. Thirdly, we provide a descriptive and statistical analysis of our data. The final section presents a discussion of the results and conclusion.

## 2 Literature review

Our analysis of employers' demand of foreign language skills in the Visegrad region is embedded in the literature on the role of language in the economy, which has been surveyed fairly recently by Zhang and Grenier (2013). Their main argument is that traditional research on the relation between economics and languages can be distinguished into three strands: the first strand deals with language and economic status, the second strand covers the dynamic development of languages (from an economic perspective) and the third strand addresses language policy and planning (also from an economic perspective). Since the 1990s, these three strands have been supplemented by applications of game theory to model linguistic issues (Zhang and Grenier 2013). The game theory approach has become very popular, particularly for study of the bilingual labour markets (Armstrong 2015). Antonietti and Loi (2014) organise this literature into three subject areas: immigration, international trade and firm performance.

In our work, we are especially interested in empirical work that bridges the gap between globalisation, labour and the historical context, as all these factors come into play in the Visegrad Four. Many recent contributions are dedicated to the relationship between language skills and *trade or foreign direct investment*. Kim et al. (2015) investigate the link between language and FDI, finding a robust, significant relationship between them. Oh et al. (2011) explore the transaction costs

that exist between country pairs that do not speak the same language—with a focus on English, French, Spanish and Arabic—and compare the transaction costs related to trade and FDI for these four languages. Their results suggest that speaking a common language raises both trade and FDI, but appears to have a larger impact for the former than the latter. They also detect a common hierarchy in transaction costs for both phenomena: transaction costs are the lowest for English, followed by French, Spanish and Arabic. Another important contribution on this topic is the work of, which looks into the channels through which foreign language skill influences trade (Melitz 2008; Melitz and Toubal 2014).

The relation between language and *migration* has also received a lot of attention. Yao and van Ours (2015) examine the importance of Dutch language skills for immigrants in the Netherlands. They only find an effect on working hours for female immigrants. In another article, Budria and Swedberg (2015) assess how immigrants' Spanish language proficiency affects their earnings. The discovered effect is very high for highly educated workers, but negligible for uneducated workers. Rooth and Ekberg (2006) relate language skills to occupational mobility in Sweden. The results suggest that upward mobility accelerates among those who have invested in a Swedish academic education or destination-specific language skills. Bleakley and Chin (2004) indicate that language is a social and economic barrier that separates immigrants from natives. Migrants with poor language skills often face discrimination and social isolation. Finally, Chiswick and Miller (2010) investigate the demand for English in the United States. They find a stronger relation between proficiency in English and intra-occupational earnings differences than between proficiency in English and inter-occupational differences.

Yet another set of papers considers *historical and cultural ties* to explain why certain language skills are (still) relevant on the labour market. As an example of this work, we list two papers that cover Russian language skills in countries in Central and Eastern Europe. Lindemann and Kogan (2013) discuss the issue of language proficiency in labour market entry among young workers in Estonia and Ukraine. In Ukraine, being able to speak Russian—besides the national language—appears to be much important than in Estonia. This difference can be attributed to disparities in the immigration history of the Russian minority population and the language prevalence in both countries. In another contribution, Duncan and Mavisakalyan (2015) consider the importance of Russian language skills on the labour market in Armenia, Azerbaijan and Georgia for the period 2008–2010. In these three countries, the Russian language is still commonly used in everyday life. The authors confirm that speaking Russian is a valued skill on their labour markets.

Closer to our research is the literature that examines the importance of language skills in *specific occupations*. Maxwell (2010), for example, analyses the role of English language skills in low-skilled jobs arguing that workers with a limited knowledge of the English language have less employment opportunities and lower wages. For the case of Germany, Stöhr (2015) examines the wage premia of occupational language requirements and finds a systematic premium for English only, not for other languages. Another example is the paper by Coombs and Cebula (2009), who study the rewards for language skills for registered nurses in the United States but find mixed results. In a related study, Beblavý et al. (2016a) examine the

skill demand of U.S. employers on the basis of a sample of advertisements extracted from Burning Glass, identifying the explicit demand for language skills in 16% of the vacancies. Another interesting article is Mýtna-Kureková et al. (2012). These authors consider the demand for a range of skills for 23 low- to medium-skilled occupations in Slovakia. They find that knowledge of foreign languages is explicitly demanded in 38% of the vacancies, making it is the second-most-demanded requirement. Interestingly, this skill is important, even for low- and medium-skilled jobs performed on the domestic market.

### 3 Data and methodology

Our main data source are popular online vacancy portals in the four analysed countries. In fact, we do not analyse the content of these vacancies as such but instead work with the meta data available on the job portals. Online job portals are increasingly used as a data source for the labour market research (Carnevale et al. 2014, Kuhn 2014; Kuhn and Mansour 2014; Askitas and Zimmermann 2015; Mýtna-Kureková et al. 2015b). While analysing online vacancies is a relatively new trend, it builds upon an existing empirical literature based on an analysis of traditional, printed job advertisements (Jackson et al. 2005; Jackson 2007; Dörfler and van de Werfhorst 2009). Nonetheless, the literature warns that this web-based source may not be completely representative, given that not all job vacancies are published online and white collar jobs vacancies tend to be overrepresented on online job boards (Carnevale et al. 2014; Mýtna-Kureková et al. 2015b). For that reason, job vacancies are a good source to understand skill requirements for individual occupations, but not necessarily to estimate the number of vacancies on the market (Leithart 2013). In other words, online vacancy analysis may provide valuable insights for a specific research setting (such as skill demand for a set of occupations), yet it results cannot be generalised. While data representativeness has been put forward as a major concern in this young though rapidly developing discipline, few solutions have been put forward (Štefánik 2012; Mýtna-Kureková et al. 2015b; Beblavý et al. 2016c).

Our approach differs from the common methodology in that we focus on the meta data—the tag system that job portals use to structure the vacancies—rather than performing an analysis of the vacancies themselves. This approach is explained in more detail below. While an analysis of the text of the vacancies provides more detailed information, tags are easier and faster to collect, process and analyse than vacancies (precisely because sample sizes are smaller, yet essential information is still available). More specifically, for each of the Visegrad countries, we extracted data from a major online job portal (all are presented in Table 2). These job boards were not chosen randomly but instead selected after a careful analysis of their labour market coverage. We looked for job portals that are dominant players in their respective national labour markets and have been previously used as a source of data by local scholars (Beblavý et al. 2016d; Bohmova and Pavlicek 2015; Szabó 2011; Chmielecki 2013). For example, the Slovak portal [www.profesia.sk](http://www.profesia.sk) that we use has a market share of over 80% (Štefánik 2012). The Czech board [www.jobs.cz](http://www.jobs.cz) belongs

**Table 2** Overview of the online job portals used and the number of job advertisements available for the four countries in our sample (in July 2015)

	Online job board on which the vacancies were found	Total number of vacancies available on the job board (July 2015)	Number of vacancies available in 2015Q3 (Eurostat)
Czechia	<a href="http://www.jobs.cz">www.jobs.cz</a>	15,269	102,141
Hungary	<a href="http://www.profession.hu">www.profession.hu</a>	11,231	46,559
Poland	<a href="http://www.pracuj.pl">www.pracuj.pl</a>	36,079	73,154
Slovakia	<a href="http://www.profesia.sk">www.profesia.sk</a>	11,344	17,288

to the dominant player in the online vacancy boards sector (Management News 2016).

The four job boards that we used are listed in Table 2, together with the total number of vacancies that was available on each of them when we first extracted our data (July 2015). In total, the four portals contained approximately 74,000 vacancies. The Czech job board counted close to 15,300 advertisements, the Hungarian portal covered about 11,200 vacancies, the Polish job board published about 36,000 advertisements, and the Slovak portal had close to 11,300 vacancies. For reference, we added the number of job advertisements available in quarter three of 2015 as reported by Eurostat (the data were not seasonally adjusted, derived from national statistical offices). Apart from Czechia, for which a very large number of vacancies was reported on Eurostat, it appears that the share of vacancies available on the job portals we use is quite substantial. Note, however, that these data are not fully comparable as the Eurostat data refer to a 3-month period while the vacancy counts were obtained at a single point in time. More details on these vacancy counts, and the extent to which they may be influenced by seasonal dynamics, is provided below.

Each of the four job portals uses a system of tags to organise individual job advertisements into clusters.<sup>3</sup> Clustering facilitates the search process, as this allows users to select, for example, only those vacancies requiring specified language skills or only those for specified occupations. It is important to note here that tags are not disjunctive groups: a single job advertisement could indeed be mapped into several occupations or can, for instance, call for knowledge of multiple foreign languages (e.g. a vacancy that would call for English and German language skills would carry two foreign language-related tags: ‘English’ and ‘German’—by tracking these tags, we can obtain information about skill demand more easily than if we would have to examine the full text of the vacancy instead). We therefore considered these tags as a proxy.

Our analysis is composed of two important steps. First, we consider the total number of vacancies offered on each of the four job portals as well as the number of vacancies offered with a tag that refers to foreign language skills. For each country, we calculate the share of vacancies requiring individual language skills out of total

<sup>3</sup> See the “Appendix” for technical details about how we obtained a list of tags from the individual portals..

number of vacancies. Here, we do not focus on individual occupations but rather examine the aggregate demand for foreign language skills.

As a next step in our empirical analysis, we concentrate on the foreign language requirements for individual occupations in each of the V4 countries. Our aim is to arrive at a set of occupations that are present in all Visegrad countries and for which we could find a sufficient number of advertisements. To this end, we refine our analysis in the following way: For each Visegrad country, we remove the occupations for which fewer than 30 vacancies are published on the job portal. Thus, we no longer consider 11% of the job advertisements published on the Czech portal; for the Hungarian, the Polish and the Slovak job boards the corresponding percentages are 7, 12 and 9%. As a second step, we matched the occupations across the countries, which proved to be a rather difficult task. First, we translated the occupations (their occupational titles) to English and then compared them across the Visegrad group. Occupations that were not represented in each of the four countries were dropped from the sample immediately. Then, we mapped the occupations that were present in all countries into each other. For some occupations, this was relatively easy because there was only one suitable match in each country. For other occupations, more than one possible match was found. The reason why this can occur is that an individual occupation or tag in one country (portal) can be split up into several occupations or tags in the other countries (portals). For example, the tag ‘teacher’ -which is represented by a single tag in Czechia, Hungary, and Slovakia- is split into two tags, ‘teacher’ (Nauczyciel) and ‘instructor’ (Wykładowca), in Poland. Another example is that of programmer, for which a job portal can use multiple tags to distinguish between JAVA programmers, Python programmers and other programmers (whereas other job portals simply attach the ‘programmer’ tag to all sub-groups). In these cases, where multiple possible matches arose, a weighted average was calculated (weights equal to the number of job advertisements by occupation).

Altogether 59 occupations were identified as being sufficiently represented in all four countries (both in terms of the number of available vacancies and presence across the countries, although in some cases combining several tags). After identifying the 59 occupations, we return to the four job portals and extract the amount of vacancies available for each of these occupations as well as the amount of vacancies that demand certain foreign languages (i.e. that are tagged). From these numbers, we calculated the share of English and German languages, because only these languages we find relevant in the analysis of the entire sample of job vacancies. In the hypothetical example that the Slovak job portal would have 500 job advertisements for the ‘teacher’ occupation (i.e. 500 vacancies are tagged ‘teacher’), of which 150 would also be tagged ‘English’ (i.e. 150 carry the tags ‘teacher’ and ‘English’), the share would be 0.3.

Finally, we analyse the relationship between foreign language demand and wages. Unfortunately, there is no publically accessible representative data source that links proficiency in foreign languages to wage variables (on the occupation or individual level). While the Adult Education Survey, organised by Eurostat, has information on foreign language proficiency and wages, the wage variable contains only deciles, as opposed to specific amount, and the data are only collected in 5-year



intervals. More importantly, the occupation variable is not coded on the 4-digit level. Meanwhile, the online-based WageIndicator (WI) survey has the required variables, but out of the V4 countries it only covers Czechia and Slovakia with a sufficient sample. While this data source is not representative, it is generally deemed reliable for exploratory research and, therefore, serves our purposes (de Pedraza García et al. 2010; Tijdens and Steinmetz 2016). Our wage data are based on the median hourly gross wages, obtained from the WI web surveys collected from the beginning of 2013 until the end of the first quarter of 2016. We correlate the median wage in the occupation with the demand for foreign languages in that occupation.

From September 2015, the WI survey also contains the question “In which languages are you skilled?” with answers “Not at all”, “Barely skilled”, “Rather skilled”, “Skilled” and “Mother language”. The question is asked for the English, Spanish, Russian, Chinese and Arabic languages, thus it does not allow us to study other languages. Nevertheless, the information we can gather for English enables us to increase the robustness of our findings by analysing the relationship between knowledge of foreign languages and wages on the individual level. Unfortunately, the sample size does not allow estimating this relation for individual occupations, which is why we run our analysis for the entire labour market. We base our test on the standard Mincerian earnings function, which predicts the logarithm of earnings ( $y$ ) based on years of potential working experience and years of education (Mincer 1974). Formally, the Mincer equation is represented as follows, with  $S$  being the year of schooling and  $X$  years of potential working experience:

$$\ln y = \ln y_0 + rS + (\beta_1 X + \beta_2 X^2)$$

On top of the Mincer’s predictors, we added dummies for English proficiency (with categories ‘skilled’ and ‘native speaker’ merged due to the low number of native speakers), gender, residency in the capital city, sector of employment, supervisory position, size of the company, occupation<sup>4</sup> and whether the respondent is in Slovakia or Czechia (more details on what variables are included in what model are provided in the next section). Using the Mincer function is a technique that has been used in the context of estimating value added of language skills particularly in the research of focusing on migration and multilingual countries (see e.g. Chiswick and Miller 1999; Constant et al. 2012). To the best of our knowledge, we are not aware of any study that used this technique in the context of the foreign language skills in the Visegrad region.

## 4 Results

First, we looked at the number of vacancies that do *not* require foreign language knowledge. Of the job advertisements published on the Czech portal, 38% are tagged “does not require any foreign languages”. This share is equal to 25% for Hungary and 43% for Slovakia. Nonetheless, the relatively low number in the

<sup>4</sup> Represented by 1-digit International Classification of Occupations 2008 version occupational groups.

Hungarian case can be explained by the fact that not all vacancies are tagged for languages. If the approximately 20% of vacancies with no language tags were tagged as without language requirement, the share would be similar to the Czech and Slovak portals. As no such tag is available on the Polish job board, we do not have information on the share of job advertisements that do not require any foreign language skills in this case (note that we cannot simply calculate this number, as a single job advertisement may have multiple tags). From these percentages it is clear that there are considerable differences between the four countries that make up the Visegrad group. Foreign language skills are more demanded explicitly on the Hungarian and Czech labour markets than in Slovakia. We can only capture those job advertisements that are explicitly tagged, not those where foreign language skills are implicitly demanded. This is an important caveat that one has to be aware of in any research that is based on vacancy-based analysis. In addition, foreign language skills do appear to matter to employers, as they are explicitly requested in more than half of the vacancies. The tags, therefore, do appear to have a signalling function.

We then focus on the *individual languages, first at the regional level and then at the country level*. When we consider all job advertisements at once (for the Visegrad region as a whole), we notice that 52% of them require English language skills, 12% demand German language skills, 2% list French language skills and less than 2% request Italian, Spanish or Russian language skills. However, these aggregates likely hide differences between the countries and could certainly be affected by the number of vacancies for each country. For these reasons, we also look at the percentage of job advertisements within each country that comprises these language demands.

Interestingly, in all four countries *English* is the most frequently demanded language. Nonetheless, there is significant variation between countries. 28% of the Czech vacancies refer to English language skills, 64% of the Polish advertisements demand English language skills. For Hungary the share is 39% and for Slovakia it reaches 49%. *German* is the second most demanded language in all countries of the V4. For German, the shares seem to differ to a smaller extent. Across the four countries the share of advertisements with German language demands ranges from 10% in Czechia to 15% in Slovakia (again, this means that on the four job portals, between 10% and 15% of all advertisements published is tagged “German”). Even though French, Italian and Spanish are used extensively in the European Union, these three languages are hardly demanded in the Visegrad labour markets.

These percentages should be interpreted with some caution, as they might reflect *seasonal dynamics* (as indicated above, our data were collected in the month of July). To rule out seasonal dynamics, we contacted each of the job boards to inquire about the statistics for the entire year 2015. The Slovak job board informed us that 46% of the vacancies required English, while 14% required German. In Czechia, the 10% share of vacancies for German was confirmed, but the share for English was reported to vary between 28 and 59% depending on whether the vacancies were supplied by public employment agencies or employers. The Hungarian portal reported that 55% the vacancies demanded English or German, 10% specifically requests English and 2% specifically call for German. We could not verify whether this suggest that German can be understood as substitute for English, or not. We

unfortunately did not receive any further information from the Polish job board. Overall, these numbers are largely in line with our initial results.

We then focus our attention at the demand in *individual occupations*, for which results are presented in Tables 3 and 4 below. Table 3 shows the share of vacancies for each country that carry the tag for English language skills (ISCO codes 1-3). Table 4 depicts similar results, but for the low- and medium-skilled occupations (ISCO codes 4-9). In both tables, the five occupations in each country with the highest percentages are marked with a shaded background (i.e. we use country share rather than regional shares).

From Tables 3 and 4, we derive that it is relatively high in those occupations which ISCO codes start with 2 or 4, the professional and administrative occupations. Meanwhile, we detect low demand for positions involving manual work. Another interesting result is that particularly in Poland, some of the ISCO 7 occupations, denoting craftsmen, show a relatively high demand for English language skills. This may indicate that these workers are employed by foreign employers or that they work abroad.<sup>5</sup>

To further show the diversity of language, we split the occupations into three groups, where the first one contains occupations that most often require the job candidate to be skilled in the English language, while the third group contains occupations where such requirement is rare (see Fig. 1). More specifically, we first gather all available vacancies for each occupation (so bringing together the vacancies available in all four countries) and calculated the share of vacancies that requests English language skills. This gives us a single number for each occupation and allows us to rank occupations according to their demand for English. We rank the occupations from high to low, identifying two cut-off points (on the basis of percentiles). This enables us to distinguish between three groups, which we have labelled 'highest', 'intermediate' and 'lowest'. Note that within each group, occupations are still ranked on the basis of their share, meaning that the occupations towards the top of each bar report higher shares than the occupations towards the bottom.

Once again, we show that the demand for English language skills is the highest in managerial, professional, technical, administrative and IT-related occupations. On the lower side of the distribution, we mainly find manual labour jobs (Fig. 1).

Additionally, we calculated requirements also for the German language. We use the same strategy as for the English language skills. In this case the results are noisier, because the variance is much smaller, as no occupation in neither of the analysed countries was found to contain at least 50% of vacancies requiring German. Nonetheless, we have discovered some interesting results. Firstly, the demand for English is higher than the demand for German across countries and occupations. Only in 14 of the 236 occupation-country combinations, more advertisements request German than English. These are all artisan occupations, particularly welders and locksmith. The only exception are Slovak nurses, where the demand for German is higher by 13 percentage points than the demand for English. This largely reflects the high level of circular migration of Slovak nurses to the

<sup>5</sup> With regard to the latter option, we explored the share of vacancies that refer to positions abroad for the Slovak job portal. Overall, less than 10% of the positions advertised was a position outside of the country (with the vast majority in Czechia). For only a handful of occupations, vacancies were advertised for positions in Germany and Austria.

**Table 3** Percentage of vacancies for high-skilled occupations that require English language skills in each of the V4 countries

ISCO	Occupation	Czechia (%)	Hungary (%)	Poland (%)	Slovakia (%)
1135	HR Manager	87	42	67	67
1211	Financial Manager	63	54	62	50
1213	Operations Manager	53	48	65	59
1221	Marketing Manager	71	95	79	86
1221	Sales Director	53	45	49	51
1321	Production Director	69	50	55	74
2139	Consultant	44	64	49	66
2141	Industrial Engineer	86	81	85	83
2142	Civil Engineer	23	24	22	34
2149	Tester	88	87	76	89
2164	Architect	66	50	64	79
2211	Doctor	31	56	44	26
2221	Nurse	27	30	64	21
2330	Teacher	51	15	55	27
2411	Tax Advisor	81	50	86	98
2411	Financial Controller	83	78	72	93
2412	Financial Analyst	81	78	72	88
2431	Marketing Professional	68	85	55	71
2431	Key Account Manager	63	90	45	71
2431	Business Analyst	74	97	81	70
2433	Product Manager	83	94	74	74
2511	IT Analyst	81	87	74	88
2512	Programmer	82	84	77	85
2519	Project Manager	81	68	75	84
2519	Computer Specialist	82	83	74	80
2611	Lawyer	72	42	72	90
3112	Technician	56	35	34	46
3119	Quality Control	72	61	57	50
3122	Foreman	33	15	34	54
3323	Buyer	84	86	68	81
3341	Office Manager	76	91	58	78
3341	Team Leader	73	83	42	76
3511	IT Administrator	81	67	72	87
3512	Customer Support Worker	67	66	58	69
3538	Account Manager	53	93	48	67

The five occupations with the highest shares in each country are indicated in italics

German-speaking countries, in particular Austria (Bahna 2014). In general, the demand for German does not seem so dependent on occupation complexity, as it is in the case of demand for English. We find several ‘manual’ occupations in the group with the highest demand for language skills (Fig. 2).

**Table 4** Percentage of vacancies for low- and medium-skilled occupations that require English language skills in each of the V4 countries

	Occupation	Czechia (%)	Hungary (%)	Poland (%)	Slovakia (%)
4226	Receptionist	87	86	67	87
4232	Transport Clerk	70	69	57	65
4311	Accountant	74	51	73	79
4419	Office Worker	61	52	61	70
4419	Assistant	73	70	71	68
5120	Cook	26	10	27	12
5222	Sales Team Leader	37	36	28	46
5223	Retail assistant	25	15	29	15
5230	Cashier	36	11	10	15
5242	Regional Sales Representative	48	27	35	68
5242	Sales Representative	41	36	29	38
5242	Merchandiser	39	33	15	13
5242	Financial advisor	10	59	18	10
5244	Telesales/Call Center	29	16	23	50
7212	Welder	3	6	39	10
7231	Mechanic	20	10	32	16
7233	Locksmith	4	7	44	8
7411	Electrical Mechanic	44	3	26	32
7411	Electrician	23	6	42	16
8121	Labourer	5	8	12	5
8322	Driver	21	3	19	18
8344	Forklift Operator	9	5	7	4
9321	Packer/Auxiliary Labourer	4	14	11	11
9333	Warehouse Worker	11	7	10	13

The five occupations with the highest shares in each country are indicated in *italics*. ISCO

For two of the Visegrad countries, the Czechia, Hungary and Slovakia, we were able to find data on the hourly wages (expressed in the national currency) for some occupations. These wage data are based on the median hourly gross wages, obtained from the WageIndicator web surveys collected from 2013 through 2016. Our data cover 29 occupations for Czechia and 25 occupations for Hungary 27 and occupations for Slovakia.<sup>6</sup> There is a clear positive correlation between the shares of vacancies that require English and wages in all three countries (Fig. 3). It is the strongest in Czechia, where each additional 10 percentage points demand for English is connected with additional 50 cents of hourly income, followed by Slovakia, where the value is about 35 cents and Hungary, where more linguistically demanding occupations result in a premium of only 20 cents per additional 10% points vacancies demanding English. The correlation between the German language demand and wages is much weaker in Czechia and even negative for Slovakia. Interestingly, it is very strong for Hungary, resulting in a premium of 1.15 euro for an additional 10 percentage points of vacancies demanding German (Fig. 4).

highest	intermediate	lowest
Tester	Team Leader	Sales Representative
Industrial Engineer	Key Account Manager	Nurse
Marketing Manager	HR Manager	Foreman
IT Analyst	Account Manager	Telesales/Call Center
Programmer	Transport Clerk	Electrical Mechanic
Receptionist	Customer Support Worker	Civil Engineer
Financial Controller	Architect	Merchandiser
Product Manager	Production Director	Financial Advisor
Business Analyst	Office Worker	Electrician
Financial Analyst	Quality Control	Retail Assistant
Buyer	Financial Manager	Mechanic
Computer Specialist	Operations Manager	Cook
Tax Advisor	Consultant	Cashier
Project Manager	Sales Director	Locksmith
IT Administrator	Regional Sales Representative	Driver
Office Manager	Technician	Welder
Assistant	Doctor	Warehouse Worker
Marketing Professional	Teacher	Packer/Auxiliary Laborer
Accountant	Sales Team Leader	Labourer
Lawyer		Forklift Operator

**Fig. 1** Classification of occupations into three classes depending on the demand for English language skills across the V4

Following up on our previous line of thought that much of the demand for German speakers might be for jobs located in German-speaking countries, the lack of monetary premium associated with speaking German might be unobservable on the Slovak labour market simply because the German speakers are collecting it abroad.

Finally, with the question about English proficiency recently added to the WI survey, we examine the relationship between English proficiency, on the one hand, and wages, on the other hand, on the individual level as well. The analysis is conducted on data collected between September 2015, when the language question has been added to the survey,<sup>7</sup> and the end of 2016. An important caveat of using WageIndicator data is the potential measurement error in survey-based occupation data. This is a well-known issue that affects surveys in general. Bound et al. (2001) explain that survey responses typically are not perfectly reliable and that even

<sup>6</sup> Only occupations with at least 30 observations were taken into consideration.

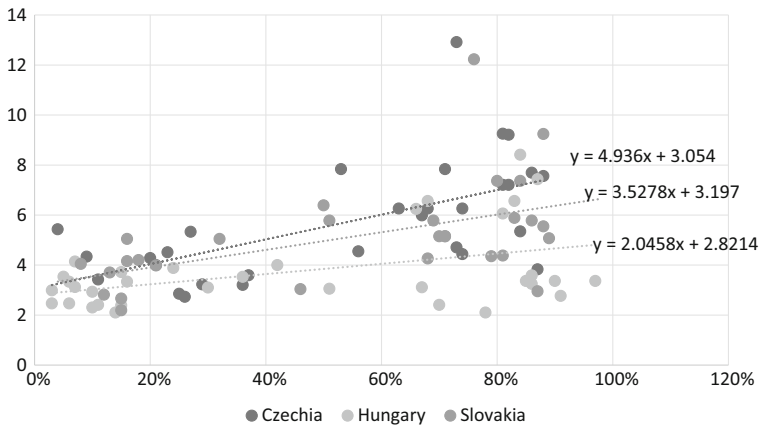


**Fig. 2** Classification of occupations into three classes depending on the demand for German language skills across the V4

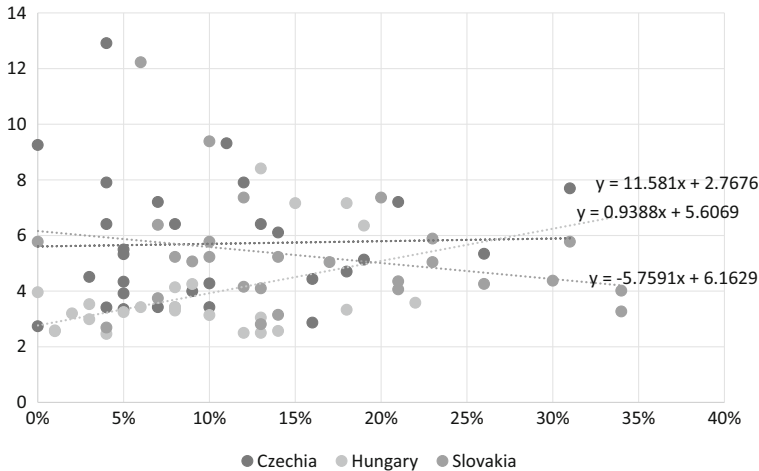
relatively common variables may not be reported without error. For the ‘occupation’ variable, for example, response errors as well as coding errors happen quite frequently, as occupational classifications can be fairly detailed (e.g. 4-digit level) or may differ across institutes. As the WageIndicator survey is widely used in several disciplines, the issue of measurement error has also been assessed (de Pedraza García et al. 2010; Guzi and de Pedraza 2015). Although it is clear that the WageIndicator survey may not be fully representative, it has been found to produce estimates of labour market outcomes determinants consistent with representative data sources.

The results of our estimation exercise are presented in Table 5. We consider three estimation models. In the simplest model (1), there is no relation between having a basic command of English and earnings (when compared to no knowledge at all,

<sup>7</sup> December 2015 for Hungary.



**Fig. 3** Correlation between the share of job advertisements that require English and the hourly log wages in the Czechia, Hungary and Slovakia



**Fig. 4** Correlation between the share of job advertisements that require German and the hourly log wages in the Czechia, Hungary and Slovakia

which is the reference category). However, being rather skilled already appears to result in a 15% earnings premium, while being highly skilled increases the salary by 37%. This model relates wages to experience and experience squared, gender, education, and English proficiency and further includes country and year dummies.

When controlling for the occupation dummies in model (2) (by adding a full set of ISCO dummies to the variables considered in model (1)), we see that the coefficient remains statistically significant, yet the size of the premium decreases to 13 and 31% respectively. Finally, when more detailed occupation variables, such as firm size, sector, supervisory position and job being located in the capital city are taken into account, the coefficient decreases to 6% for rather skilled English speakers and 20% to fluent English speakers. Model 1 explains 18.5% of variation



**Table 5** OLS analysis of the relationship between English proficiency and wages in Czechia, Slovakia and Hungary

	(1)	(2)	(3)
Years of experience	0.0295*** (0.00419)	0.0252*** (0.00416)	0.0212*** (0.00404)
Years of experience squared	−0.000582*** (0.000110)	−0.000511*** (0.000109)	−0.000397*** (0.000106)
Education	0.0444*** (0.00491)	0.0330*** (0.00508)	0.0273*** (0.00492)
Woman	−0.181*** (0.0238)	−0.191*** (0.0249)	−0.165*** (0.0241)
English skill level (reference category: no English)			
Basic	0.0313 (0.0337)	0.0214 (0.0332)	−0.0186 (0.0320)
Rather skilled	0.154*** (0.0377)	0.128*** (0.0374)	0.0618* (0.0360)
Skilled	0.364*** (0.0417)	0.306*** (0.0418)	0.197*** (0.0409)
Country and year dummies	Yes	Yes	Yes
Basic occupation dummies	No	Yes	Yes
Extended occupation dummies	No	No	Yes
Observations	1988	1988	1947
R-squared	0.185	0.217	0.300

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

in wages, model 2 22% and model 3 already 30%, which already indicates our results are somewhat robust, especially considering that the coefficients of control variables are in line with expectations.

Given the limitations of the data source used, the significance of the analysis should not be overstated. Nonetheless, the signs of the estimated coefficients are in line with our initial expectations (and that coefficients are found to be statistically significant across the three models), we can see our analysis as an additional piece of support suggesting that English language skills are important to employers in the countries examined.

## 5 Discussion and policy implications

In this paper, we used meta data associated with approximately 74,000 job advertisements published on leading online job boards in the Visegrad countries to analyse demand for foreign language skills. We found that demand is widespread, but limited to two languages: English and to a lesser extent German. The exact degree of demand varies between individual countries and occupations, though we do observe some common trends.

Most importantly, our analysis suggests that English is a language of professionals and white collar workers. For these professions it is demanded nearly universally. For working class professions, English language skills seem less needed. These results, however, do necessarily hold for the German language. We report a high demand for German in some professional occupations, but also in artisan and nursing occupations. Additionally, both individual-level and occupational-level analysis show that the English language skill comes with a wage premium. We did not find similar correlation for German.

While we found that learning German can be beneficial for some occupations (in addition to benefits unrelated to the labour market), English is by far the most in demand foreign language. Furthermore, we found evidence that English proficiency is associated with wage premium, suggesting that employers are willing to pay wage premium for the English language proficiency.

We believe that our research provides some tentative evidence for policy-makers in the V4 region to invest in English teaching. Proficiency in English in the V4 countries currently ranges from 20% in Hungary to 33% in Poland and is thus well below the EU average of 38%. Meanwhile, the knowledge of German varied between 15% in Czechia and 22% in Slovakia and was thus above the EU average of 11%. In this regard, it seems that governments are becoming aware of the importance of foreign language skills. Eurostat data on the number of foreign languages that students learn in school reveal that well over 90% of them learn at least one foreign language in upper secondary education (and in general secondary education students seem to even learn two or more foreign languages) in all four Visegrad countries. In Czechia, Poland and Slovakia over 70% of the students enrolled in primary education learn at least one foreign language.

Nonetheless, it is important to reiterate the caveats of our work. First, it is important to acknowledge that job vacancies are an incomplete measure of labour demand, for several reasons (e.g. not all job openings are advertised as recruitment may occur through internal or informal channels). Secondly, online job boards have additional limitations: not all vacancies may be advertised online and those that are published online could be biased towards specific regions, industries or applicants (Carnevale et al. 2014). Our results and conclusions, therefore, have to be weighed against these limitations. In other words, we are aware that the structure of the sample might have been biased by its limited focus on online job search and vacancies, so that an extension of our findings the ‘offline’ labour market may not be clear-cut. At the same time, the use of online vacancy data has been advocated by Kuhn and Skuterud (2004) and Askitas and Zimmermann (2009, 2015), who have pointed to its potential as a real-time data source to capture ongoing trends. For an in-depth discussion of the potential and caveats of web data, we also refer to Benfield and Szlemko (2006), Wright (2012), Leithart (2013), Carnevale et al. (2014) and Beblavý et al. (2016c).

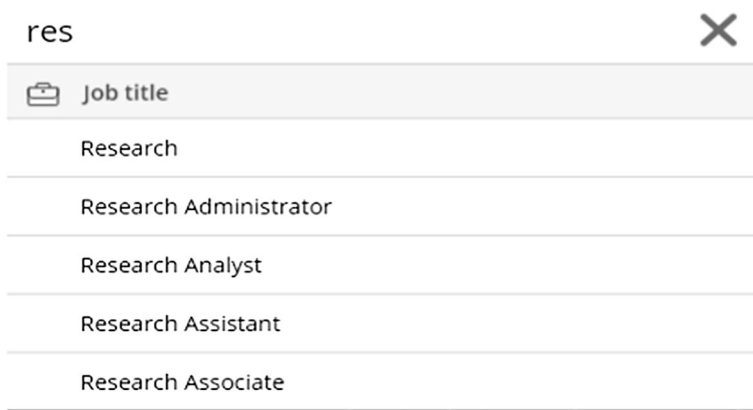
Our paper represents a first effort to exploit innovative data sources to better understand this important topic. While our results are both internally consistent and in line with the literature, we believe additional robustness checks are needed. One issue of our research is that it is based only on a cross-section of crawled data from job portals. Efforts such as the one currently spearheaded by the European Centre

for the Development of Vocational Training (Cedefop) to establish a system for continuous data collection across the EU28 are, therefore, crucial. Secondly, the newly added language questions in the WageIndicator survey will eventually result in a valuable source of data on labour market effect of language skills among job holders across the EU. Future research that strengthens the methodological framework in which a sample of vacancies published online is used as an input for labour-related analysis is needed.

**Acknowledgements** Brian Fabo acknowledges the financial support of the Eduworks Marie Curie Initial Training Network Project (PITN-GA-2013-608311) of the European Commission's 7th Framework Program. The initial data collection for this paper was performed under the framework of the InGRID—Inclusive Growth Infrastructure Diffusion—project, which has received funding from the 7th Framework Program of the European Commission [Contract no. 312691, 2013-17]. The authors are grateful to Petra Zsoldos (profession.hu), Tomáš Ervín Dombrovský (jobs.cz) and Tomáš Janotík (profesia.sk) for providing data for our research.

## Appendix: Methodology used for obtaining tags from the job portals

Of the four online job boards, only the Slovak portal publishes an information table of all tags. For the other portals, tags were extracted from the repository of terms for the autocomplete function for the vacancy search text by querying the relevant Application Programming Interface (API). Job portals generally have a search textbox, which users can utilise to look for specific vacancies. This is typically done by typing in the desired occupation. The autocomplete function of the website offers the users suggestions based on entered characters. These suggestions are normally stored in a repository, from which there are delivered by an API. This API can be often easily queried to provide a list of all possible suggestions (See Fig. 5 for an example), using Requests and BeautifulSoup packages in the Python programming language, which was then further also utilised to automatically



**Fig. 5** Tags associated with a researcher vacancy on the profesia.sk website. Tags were translated automatically via Google Translate. (Source Beblavý et al. 2016b)

download the share of vacancies with specific language requirements from the portals. This exercise was carried out on 17 July 2015.

## References

- Antonietti R, Loi M (2014) The demand for foreign languages in Italian manufacturing, AlmaLaurea working papers, no. 57, Feb 2014
- Armstrong A (2015) Equilibria and efficiency in bilingual labour markets. *J Econ Behav Organ* 112:204–220
- Askatas N, Zimmermann KF (2009) Google econometrics and unemployment forecasting. *Appl Econ Q* 55(2):107–120
- Askatas N, Zimmermann KF (2015) The internet as a data source for advancement in social sciences. *Int J Manpow* 36(1):2–12
- Bahna M (2014) Slovak care workers in Austria: how important is the context of the sending country? *J Contemp Eur Stud* 22(4):411–426
- Barslund M, Busse M (2016) How mobile is tech talent? A case study of IT professionals based on data from LinkedIn. CEPS special report no. 140, July 2016. (<https://www.ceps.eu/system/files/CEPS%20-%20LINKEDIN%20study%20FINAL.pdf>)
- Beblavý M, Fabo B, Lenaerts K (2016a) Skills requirements for the 30 most frequently advertised occupations in the United States—An analysis based on online vacancy data. (<https://www.ceps.eu/publications/skills-requirements-30-most-frequently-advertised-occupations-united-states-analysis>)
- Beblavý M, Akgüç M, Fabo B, Lenaerts K (2016b) Occupations observatory-methodological note. (<https://www.ceps.eu/publications/occupations-observatory-methodological-note>)
- Beblavý M, Akgüç M, Fabo B, Lenaerts K (2016c) What are the new occupations and the new skills? And how are they measured? State of the art report, working paper, Leuven, InGRID project, M21.6a
- Beblavý M, Mýtna Kureková L, Haita C (2016d) The surprisingly exclusive nature of medium-and low-skilled jobs: evidence from a Slovak job portal. *Pers Rev* 45(2):255–273
- Benfield JA, Szlemko WJ (2006) Internet-based data collection: promises and realities. *J Res Pract* 2(2):1
- Bleakley H, Chin A (2004) Language skills and earnings: evidence from childhood immigrants. *Rev Econ Stat* 86(2):481–496
- Bohmova L, Pavlicek A (2015) The influence of social networking sites on recruiting human resources in the Czech Republic. *Organizacija* 48(1):23–31
- Bound J, Brown C, Mathiowetz N (2001) Measurement error in survey data. In: *Handbook of econometrics*, Chapter 59, vol 5, pp 3705–3843
- Budria S, Swedberg P (2015) The impact of language proficiency on immigrants' earnings. *Rev de Econ Apl* 23(67):63–91
- Carnevale AP, Jayasundera T, Repnikov D (2014) Understanding online job ads data: a technical report, Georgetown University, McCourt School on Public Policy, Center on Education and the Workforce, April
- Chiswick BR, Miller PW (1999) Language skills and earnings among legalized aliens. *J Popul Econ* 12(1):63–89
- Chiswick B, Miller P (2010) Occupational language requirements and the value of English in the US labor market. *J Popul Econ* 23(1):353–372
- Chmielecki M (2013) Rekrutacja z wykorzystaniem mediów społecznościowych—wyniki badań. *Zeszyty Naukowe Wyższej Szkoły Bankowej we Wrocławiu* 4:37–51
- Constant AF, Kahanec M, Zimmermann KF (2012) The Russian–Ukrainian earnings divide. *Econ Transit* 20(1):1–35
- Coombs C, Cebula R (2009) Are there rewards for language skills? Evidence from the earnings of registered nurses, MPRA paper 49646. University Library of Munich, Germany
- de Pedraza García P, Tijdens K, de Bustillo Llorente RM, Steinmetz S (2010) A Spanish continuous volunteer web survey: sample bias, weighting and efficiency. *Reis Revista española de investigaciones sociológicas* 131:109–130
- Dörfler L, van de Werfhorst HG (2009) Employers' demand for qualifications and skills. *Eur Soc* 11(5):697–721

- Duncan A, Mavisakalyan A (2015) Russian language skills and employment in the Former Soviet Union. *Econ Transit* 23:625–656
- Esser H (2006) *Sprache und integration: die sozialen bedingungen und folgen des spracherwerbs von migranten*. Campus Verlag, Frankfurt
- ET2020 (2011) Languages for jobs—Providing multilingual communication skills for the labour market, Report from the thematic working group “Languages for Jobs” European Strategic Framework for Education and Training
- Eurydice/Eurostat (2012) Key data on teaching languages at school in Europe, joint Eurydice/Eurostat publication, 2012 edition
- Guzi M, de Pedraza P (2015) A web survey analysis of subjective well-being. *Int J Manpow* 36(1):48–67
- Isphording I (2015) Language and labor market success, international encyclopedia of the social and behavioral sciences (Second Edition), pp 260–265
- Jackson M (2007) How far merit selection? Social stratification and the labour market. *Br J Sociol* 58(3):367–390
- Jackson M, Goldthorpe JH, Mills C (2005) Education, employers and class mobility. *Res Soc Stratif Mobil* 23:3–33
- Kim M, Liu AH, Tuxhorn K-L, Brown DS, Leblang D (2015) Lingua mercatoria: language and foreign direct investment. *Int Stud Q* 59(2):330–343
- Kuhn P (2014) The internet as a labor matchmaker, IZA World of Labor, no. 18
- Kuhn P, Mansour H (2014) Is internet job search still ineffective? *Econ J* 124(158):1213–1233
- Kuhn P, Skuterud M (2004) Internet job search and unemployment durations. *Am Econ Rev* 94(1):218–232
- Leithart C (2013) The myth of real-time labour market data, blog post on economic modeling, 12 June 2013
- Lindemann K, Kogan I (2013) The Role of language resources in labour market entry: comparing Estonia and Ukraine. *J Ethn Migr Stud* 39(1):105–123
- Management News (2016) Online trh práce v ČR (1/2): Pár statečných a stroj na peníze. <https://www.managementnews.cz/manazer/rizeni-firmy-id-147972/online-trh-prace-v-cr-1-2-par-statecnnych-a-stroj-na-penize-id-2840641>. Accessed 21 Apr 2017
- Marin D (2010) The Opening Up of Eastern Europe at 20- Jobs, Skills and ‘Reverse Maquiladoras’ in Austria and Germany, Bruegel Working Paper 2010/02
- Maxwell NL (2010) English language and low-skilled jobs: the structure of employment. *Ind Relat* 49(3):457–465
- Melitz J (2008) Language and foreign trade. *Eur Econ Rev* 52(4):667–699
- Melitz J, Toubal F (2014) Native language, spoken language, translation and trade. *J Int Econ* 93(2):351–363
- Mincer JA (1974) Schooling, Experience, and Earnings. NBER. <http://papers.nber.org/books/minc74-1>. Accessed 21 Apr 2017
- Mýtna-Kureková L, Beblavý M, Haita C (2012) Qualifications or soft skills? Studying job advertisements for demand for low-skilled staff in Slovakia, NEUJOBS working paper D.4.3.3, August, p 32
- Mýtna-Kureková L, Beblavý M, Haita C, Thum-Thysen A (2015a) Employers’ skill preferences across europe: between cognitive and non-cognitive skills, *Journal of Education and Work*, 03/2015
- Mýtna-Kureková L, Beblavý M, Thum-Thysen A (2015b) Using online vacancies and web surveys to analyse the labour market: a methodological inquiry. *IZA J Labor Econ* 4(1):1–20
- Oh CH, Selmier WT, Lien D (2011) International trade, foreign direct investment, and transaction costs in languages. *J Socio Econ* 40(6):732–735
- Rooth D-O, Ekberg J (2006) Occupational mobility for immigrants in Sweden. *Int Migr* 44(2):57–77
- Sanchez JL, Gonzalez CS, Alayon S (2011) Evaluation of transversal competences in the final year project in engineering. In: 2011 proceedings of the 22nd EAEEIE annual conference (EAEEIE). IEEE, pp 1–5
- Štefánik M (2012) Internet job search data as a possible source of information on skills demand (with results for Slovak university graduates). In: Cedefop (ed) Building on skills forecasts—comparing methods and applications. Luxembourg: Publications Office of the European Union. [www.cedefop.europa.eu/EN/Files/5518\\_en.pdf](http://www.cedefop.europa.eu/EN/Files/5518_en.pdf)
- Stöhr T (2015) The returns to occupational foreign language use: evidence from Germany. *Labour Econ* 32:86–98

- Szabó I (2011) Comparing the competence contents of demand and supply sides on the labour market. In: Proceedings of the ITI 2011 33rd international conference on information technology interfaces (ITI). IEEE, pp 345–350
- Tijdens K, Steinmetz S (2016) Is the web a promising tool for data collection in developing countries? An analysis of the sample bias of 10 web and face-to-face surveys from Africa, Asia, and South America. *Int J Soc Res Methodol* 19(4):461–479
- Wright J (2012) Making a key distinction: real-time LMI & traditional labor market data', blog post on economic modeling, 7 Feb 2012. Retrieved from <http://www.economicmodeling.com/2012/02/07/making-a-key-distinction-real-time-lmitraditional-labormarket-data/>
- Yao Y, van Ours JC (2015) Language skills and labor market performance of immigrants in the Netherlands, *Labour Economics*, special issue, 34, pp 76–85
- Zhang WG, Grenier G (2013) How can language be linked to economics? A survey of two strands of research. *Lang Probl Lang Plan* 37(3):203–226