

# Posting of workers across the EU: an empirical investigation

Lucia Dalla Pellegrina<sup>1</sup> · Margherita Saraceno<sup>2</sup>

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**Abstract** This paper investigates the effects of the intra-European posting of workers on domestic labour markets in the years 2007–2009. Instrumental variables related to neighbouring countries’ populations are used to address the endogeneity between posting and labour market features. Contrary to conventional wisdom, we find that an intensification of posting inflows is not likely to displace domestic workers, at any educational levels. Instead, an increase in posting from abroad may raise domestic labour costs. No significant effects are found on sending country labour market variables. Results point towards the development of possible synergies between domestic and posted workers, so that posting can actually improve labour efficiency and put upward pressure on labour costs.

**Keywords** Posting of Workers Directive · Employment · Displacement · Wage · Labour cost · Productivity

**JEL Classification** F2 · J8 · K31 · K33

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✉ Lucia Dalla Pellegrina  
lucia.dallapellegrina@unimib.it

Margherita Saraceno  
margherita.saraceno@unimib.it

<sup>1</sup> DEMS, University of Milano-Bicocca and “Paolo Baffi” Center, Università Bocconi, Piazza dell’Ateneo Nuovo 1, Ed. U6, 20126 Milan, Italy

<sup>2</sup> DEMS, University of Milano-Bicocca and Amsterdam Center for Law and Economics, University of Amsterdam, Piazza dell’Ateneo Nuovo 1, Ed. U6, 20126 Milan, Italy

## 1 Introduction

Every year across the European Union, around one million workers are posted by their employers to other member countries, where they provide their labour services on a temporary basis. Posted workers represent a vital factor in the development of the cross-border provision of services.

The European Directive 96/71/EC, also known as the ‘Posting of Workers Directive’, regulates this phenomenon and was introduced with the aim of clarifying the applicable legal conditions pertaining to posted workers in a context of transnational provision of services.

Although the Directive sought to enhance workers’ protection, criticism has been expressed, mainly by trade unions (ETUC 2010). In fact, this transnational legal tool is seen by its critics as a means to exert downward pressure on wages and working conditions in receiving countries and, above all, it is alleged to create adverse effects for domestic workers (Barnard 2000; Cremers 2010; Kvist 2004; Menz 2005).

In particular, social conflicts have emerged in receiving countries around the issue of competition for jobs between posted and domestic workers, such as in the well-known case of posting to the Lindsey oil refinery in the UK (Barnard 2009a, b) and other cases brought before the European Court of Justice such as the *Rush Portuguesa* (1990), *Arblade* (1999), and *Portugaia Construções* (2002).

The debate between scholars, social partners (labour unions and employers’ associations), and policy-makers on posting has raged again vividly since the European Commission has renewed efforts to frame the phenomenon with the Single Market Act of April 2011.<sup>1</sup> Furthermore, in March 2012, the European Commission publicly released a number of new proposals concerning the posting of workers at the EU level.<sup>2</sup> Understanding posting and its actual effects is particularly important since these proposals were substantially aimed at reinforcing the regulatory framework as provided by the Directive 96/71/EC.

Given the dearth of empirical contributions—especially at the cross-country level—which aim at evaluating the effects of posting on the domestic labour market of receiving countries, further investigation is needed in order to clarify whether posting actually tends to negatively affect domestic employment and working conditions or, conversely, it has a positive effect on receiving labour markets, or it has a non-significant effect.

We provide an empirical study based on data collected for the years 2007–2009 from EUROSTAT and the EC Reports on E101 certificates issued by member states. We estimate the effect of both increasing incoming posted workers from abroad on

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<sup>1</sup> On the political intention of revising the Posting of Workers Directive, the documents of the Conference on Fundamental Social Rights and the Posting of Workers in the Framework of the Single Market available in the section ‘Related Documents’ in the European Commission’s Events Archive (<http://ec.europa.eu/social/main.jsp?langId=en&catId=471&eventsId=347&furtherEvents=yes>).

<sup>2</sup> See the legislative initiatives COM (2012) 131 ‘Proposal for a Directive of the European Parliament and of the Council on the enforcement of Directive 96/71/EC concerning the posting of workers in the framework of the provision of services’ and COM (2012) 130 ‘Proposal for a Council Regulation on the exercise of the right to take collective action within the context of the freedom to provide services’.

the local employment rate, as well as on hourly labour costs. However, identification problems arise due to the presence of possible non-measurable determinants common to the inflow of posted workers and labour market variables. Such a type of endogeneity is addressed by using instrumental variables related to the relative dimension of neighbouring countries as measured by their population.

In addition, we carry out the same exercise with attention to the effects of increasing posted worker outflows on sending countries' labour market outcomes. We also disaggregate the analysis into workers attaining different educational levels and workers belonging to different sectors of the economy.

We find that workers posted from other EU member states are not associated with a decrease in employment rate of receiving countries (at any educational level), while instead posted workers are likely to increase labour cost. Further inspecting the relationship between labour productivity and incoming posted workers we interpret the upward pressure on labour costs as stemming from possible synergies between domestic and posted workers, so that incoming posting possibly has the effect of stimulating local workers' productivity.

Although the empirical outcome must be cautiously interpreted given data limitations, it suggests that the view portraying posting as a threat to domestic workers could only be a part of a more complex story. To some extent our results provide support for the continuation of policy actions facilitating intra-European posting. Finally, we do not find any significant effects on sending countries labour market variables.

The next section frames the phenomenon and its regulation. Then, descriptive evidence on posting and an overview of the dataset used for the empirical analysis are provided. The empirical section presents the econometric analysis. Final sections discuss the econometric results and conclude.

## 2 The posting of workers

A posted worker is a worker who temporarily carries out his/her work in a member state other than the one in which she normally works. Therefore, the definition of a posted worker does not include migrants. Posted workers typically provide their services to another country on a temporary basis, while being regularly employed in their home country, whereas migrants usually move to another country in order to seek a new job.

The difference between migrant workers and posted workers is that the former are permanently employed at the conditions of native workers, while the latter work temporarily in a given country, while being employed in another country. Such asymmetry makes posting a sensitive issue, because, as they provide transnational services, posted workers are in fact participating in the labour market of the receiving country, without actually 'belonging' to it.

Posting differs also from offshoring since the latter is the relocation, operated by a company, of a business process from one country to another, and is typically associated with the outsourcing of technical/administrative services. Therefore, goods and services formerly produced within a domestic firm are substituted by

goods and services produced by a foreign firm. In the case of posting, instead, domestic workers are temporarily “exported” to provide services in a foreign country. Finally, to our purposes it is important to stress that workers posted abroad are still part of the domestic labour force and are mainly subject to the domestic labour legislation. Conversely, under offshoring, workers employed in the foreign firm producing outsourced good/serviced are subject to the local working conditions of the foreign countries where the firm actually operates.

## 2.1 The Directive 1996/71/EC

On a normative ground, policy-makers were aware of the necessity of regulating intra-European posting on the basis of the ‘correct’ balance between strengthening the Single Market and protecting the rights of workers (both domestic and posted). The Posting of Workers Directive has been introduced with the explicit aim of reconciling the fundamental freedom to provide cross-border services as per Article 56 TFEU, while ensuring the adequate protection of the rights of workers who are temporarily posted abroad (van Hoek and Houwerzij 2011).

Before the introduction of the Posting of Workers Directive (1996/71/EC) in 1996, most member states required the full application of their national labour law to posted workers received. Although the territorial application of labour law ensured equality of treatment for employees working within a country, this system resulted in serious obstacles for foreign European firms operating in the transnational provision of services.

The Directive, instead, establishes a common regulatory framework which favours the transnational supply of services across the EU by allowing posting firms to apply sending countries’ national labour laws to posted workers, provided that the latter are protected by a core of minimum provisions applicable in the receiving country, as long as such rules provide better conditions than those warranted in the sending country (Art. 3.7). This was the compromise reached between the need to facilitate the transnational provision of services and the need to protect workers, so as to avoid a ‘race to the bottom’ with respect to working conditions (Davies 2002; Giese 2003; Kolehmainen 1999; Pallini and Pedersini 2010).

While the Directive establishes the ‘country of origin principle’ for firms temporarily providing cross-border services, Art. 3.1 defines a nucleus of mandatory rules for minimum protection to be observed in the host country by employers posting workers. In addition, in some specific cases, Art. 3.10 allows member states to enlarge this core of mandatory rules. However, the *Luxembourg* decision (319/06) has strongly restricted the applicability of this provision.

Although the Directive helps to identify the legal definition of posting<sup>3</sup> and protects posted workers, intra-European posting remains controversial. European

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<sup>3</sup> Posting occurs when firms established in a member state post workers to the territory of another member state under a contract signed between the posting firm and the party for whom the transnational service is provided [Art. 1.3 (a)]; an establishment or a firm which is owned by the group and is located in a member state different from the country where employees usually work [Art. 1.3(b)]; temporary employment firms or placement agencies located in a certain country hire out workers to a user firm established or operating in another member state [Art. 1.3(c)].

Court rulings<sup>4</sup> show that posting and its regulation are hotly debated issues, since it is critical to strike the right balance between the need to favour the transnational provision of services and the intention of preserving labour laws and industrial relations as established in receiving countries.

In addition, implementation and enforcement of the Directive—though supported by several actions taken by the European Commission like Communications and Recommendations<sup>5</sup>—remain wanting due to the lack of monitoring tools and sanctions in case of abuse. This can lead to practices that both undermine the rights of posted workers and create unfair competition between domestic firms and posting firms operating on the same market (Cremers 2010; van Hoek and Houwerzij 2011). These difficulties have projected exclusively a negative image of the posting of workers. Therefore, the legislative interventions recently proposed by the Commission go towards improving implementation and enforcement of the Directive.<sup>6</sup> However, the perception of posting—even when legal and ‘fair’—as undermining domestic employment and working conditions in receiving countries may well be an enduring image in the mind of the public.

## 2.2 The economics of posting

From an economic perspective, the posting of workers abroad is an important means to guarantee the transnational activity of service providers. Although there is a dearth of systematic information on posting in the EU (for example regarding workers’ skills, duration, education, gender, age, etc.), according to the European Commission every year around one million workers are posted, typically to undertake short-term projects. Normally, activities involving labour mobility at the transnational level engage posted workers. Transport and shipping, for instance, represent around 25 % of total posting in Europe (EC 2010). However, posting of workers is frequent in other sectors such as construction (26 % of total posting in Europe in 2007), financial services (10 % of posting in 2007) and in health care and social work (4 % of posting in Europe in 2007).<sup>7</sup>

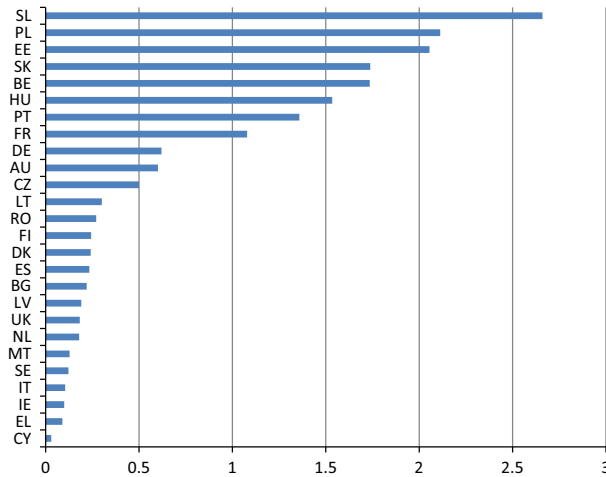
According to European Commission statistics, on average, European workers who are posted across the Union account for 2.27 % of the sending countries’ active population. Figure 1 shows the details of average postings sent in the period

<sup>4</sup> See *Laval*, *Rüffert*, and *Viking* Cases in Bucker and Wiebke (2010), *Luxembourg* Case (319/06), and, in general the European Court of Justice’s jurisprudence on the posting of workers.

<sup>5</sup> EC Communications/Recommendations on posting include ‘The implementation of Directive 96/71/EC in the member states’ (COM 458/2003), ‘Guidance on the posting of workers in the framework of the provision of services’ (COM 159/2006), ‘Benefits and potential of the posting of workers while guaranteeing the protection of workers’ (COM 304/2007), and the ‘Recommendation on enhanced administrative cooperation in the context of the posting of workers in the framework of the provision of services’ (2008).

<sup>6</sup> See the Press Release of the Commission IP/12/267 21/03/2012: ‘Commission to boost protection for posted workers’ and the legislative initiatives COM (2012) 130 and COM (2012) 131.

<sup>7</sup> Idea Consult (2011) and European Commission (2010).

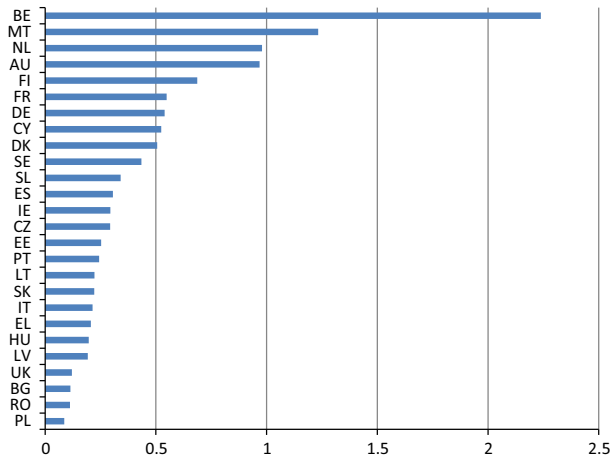


**Fig. 1** Outgoing posted workers as a share of domestic active population. *Source:* EUROSTAT; European Commission (2010) and EC (2011). Data refer to the average for years 2007–2009. Luxembourg (42.59 %) is omitted

2007–2009 from each country as a share of its active population in the in the period 2007–2009. On the one hand, there are countries, such as for example Poland, which for reasons of sheer size post a great deal of workers while receiving a few of them compared to the magnitude of their own labor markets. On the other hand, there are dynamic economies, such as France and Germany, which are relatively opened to both incoming and outgoing flows. Although on average posting represents a small share of domestic active population, data show high cross-country variability, being a relevant phenomenon for several countries (especially new EU members such as Slovenia, Poland, and Estonia). Figure 2 mirrors Fig. 1 reporting the ratio between incoming postings receiving countries' active population. In this case for small countries (Luxembourg, Belgium, Malta, The Netherlands, and Austria) the phenomenon looks rather important.

It is worth noticing, however, that the European Commission statistics are based on the compliance with obligations of communication for social security. Therefore, they only partially capture the actual size of the phenomenon. Nonetheless, the common view of the impact of posting on local labour markets is still under investigation.

On the one hand, posting can represent a solution for skill and labour shortages in receiving countries (Idea Consult 2011; Ismeri Europa 2012). Firms demanding posted workers' services may also take advantage of possibly lower labour costs and a higher degree of flexibility. At the same time, since employment creation in the European Union heavily relies on the development of the market for services, posting may effectively contribute to support job creation in such sector (Arnold and Wörgötter 2009; Bertola and Mola 2010; de Bruijna et al. 2008; El Khoury and Savvides 2006; Monti 2010).



**Fig. 2** Incoming posted workers as a share of domestic active population. *Source:* EUROSTAT; European Commission (2010) and EC (2011). Data refer to the average for years 2007–2009. Luxembourg (12.28 %) is omitted

On the other hand, when domestic workers feel that posting may cause displacement effects in recipient labour markets, the proverbial ‘fear of the Polish plumber’<sup>8</sup> becomes a real concern.

Likewise migration and offshoring, posting is a practice that raises strong objections. The latter are related to the fear that workers in the receiving countries, in case of migration and posting, and in the “sending” countries, in the case of offshoring, are somehow penalized. As for migration and offshoring the evidence on labour market outcomes is not univocal and rarely supporting common dreads.

For example, as highlighted by Friedberg and Hunt (1995) theoretical predictions concerning the impact of immigration on domestic labour markets strongly depend upon the degree of substitutability between immigrant and native workers. It turns that migrants can indeed displace domestic workers only if they are perfect substitutes, since they can put downward pressure on domestic labour standards. On the other hand, if domestic workers and migrants are imperfect substitutes, the latter may have ambiguous effects on both domestic employment and factor prices. Finally, migrants can raise domestic employment and local working conditions when they are complements to local workers. Typically, skills (including education and work experience) are the most important elements influencing the degree of substitutability among workers (Card 2001 and Borjas 2003).

Besides the wide range of evidence on the impact of migrants on labour market, this stream of literature also warns against a number of potential sources of endogeneity stemming from non-measurable characteristics which may simultaneously affect both workers’ inflows from abroad and local labour market outcomes

<sup>8</sup> During the EU enlargement in 2004, the ‘Polish plumber’ became the caricatured symbol of the widespread fear of job losses, especially in France.

(Friedberg and Hunt 1995; Borjas 2003; Card 2001; Longhi et al. 2006). Similarly, the issue of endogeneity has to be carefully considered in the case of posting.

Also the empirical literature about offshoring highlights that labour arbitrage associated to this practice does not necessarily deteriorate the labour markets of the “sending” countries. Instead, offshoring effects on working conditions are various [for a detailed review, see Harrison et al. (2011)]. Although offshoring is important in explaining the increase in the relative wages of skilled workers, the real wages of manufacturing workers are probably unaffected while the real wages of non-manufacturing workers increase (Feenstra and Gordon 1999). Liu and Tre  er (2008) find the labour market effects of inshoring and offshoring is positive, though for workers directly exposed to offshoring and for those who are less educated the effect is either less positive or even negative. Moreover, while offshoring is associated with wage reductions for routine workers in low-income locations, it is positively correlated with routine wages in high-income locations. Furthermore, Ebenstein et al. (2014) show that the net impact of offshoring on wages depends on the required skills: negative for the unskilled workers and positive for skilled ones. Finally, Hummels et al. (2010) find greater and persistent wage and earnings loss for workers who are displaced by offshoring, whereas evidence confirms that opposite general wage effects on skilled and unskilled labour wages occur.

Now, according to our previous considerations, we postulate that—besides other variables<sup>9</sup>—employment (*empl*) in the receiving country is somehow affected by posting:  $empl(posting\_inflow, \cdot)$ .

By focusing on our research question, our primary objective is to investigate the sign of  $\frac{\partial empl}{\partial posting\_inflow}$ . *Ceteris paribus*, a negative sign of the derivative would indicate that posting has the effect of inducing domestic worker displacement. Conversely, a positive coefficient would suggest that posting tends to sustain employment. Notice that when—for example—for a given *gdp*, a reduction in domestic employment is observed, then posted workers are likely to displace local ones. Conversely, a positive influence of posting on domestic employment would suggest that posting tends to sustain employment through a virtuous mechanism of synergies with domestic workers. This positive effect should be larger, the larger the increase in the output.

In addition, consider that, in the specific case of posting, where workers are subject to their home country labour legislation, labour cost can be considered a very relevant determinant of international competitiveness. Typically, labour cost (*lc*)—more than wage—is perceived as a threatening displacement element for domestic workers who fear the competition of workers posted from relatively low-labour-cost countries. For these reasons, we also investigate the relationship between posting and labour cost.<sup>10</sup> The sign of the first derivative of *lc* with respect

<sup>9</sup> Covariates are discussed in the next section.

<sup>10</sup> While employers are normally interested in labour costs, workers pay attention to wages. From the empirical perspective we separate these two components investigating the effect of posting on labour cost while controlling for taxation, which is the main non-wage component of the labour cost. In addition, labour cost data for the period 2007–2009 are more reliable than data on wage that are available from Eurostat only for few countries in the relevant period.



to *posting\_inflow* depends on how local and posted labour forces interact according to the aforementioned mechanisms.

Obviously, workers pay attention also to wages (Babecký and Dybczak 2012). From the empirical perspective, in order to separate the effects on labour cost and wage, we investigate the impact of posting on labour cost while controlling for taxation, which is the main non-wage component of the labour cost.<sup>11</sup>

Summarizing in light of the discussion above, the issue of the impact of posting on employment, labour cost, and wages rest on the possible relationship—either of displacement or of synergy—between domestic and posted workers.

### 3 Description of the dataset

The dataset consists of a panel containing yearly information on the 27 EU countries for the 2007–2009 period. The unit of observation is at country level, so that total number of observations is 81. Data have been collected from different sources, mostly EUROSTAT and the Reports of the European Commission on E101 certificates issued in 2007, 2008, and 2009.<sup>12</sup>

Concerning posting, the main statistical source of information is represented by E101 certificates. E101 forms are not directly linked to the implementation of the Posting of Workers Directive, since in principle they were conceived in order to preserve social security coordination between member states. According to the EU regulation, posted workers should normally apply for an E101. However, E101 certificates almost certainly underestimate the overall number of posted workers since many employers do not comply with the obligation of communication for social security purposes and thus do not fill in the E101. Nevertheless, we have reason to suspect that the number of certificates (postings, hereafter) is a good proxy of the actual number of posted workers, although there are no reliable evaluations regarding the exact percentage they correspond to.

Despite these limitations, E101 forms provide the only available portrait of the distribution of posting across European countries. No further data are available for comparative purposes. In fact, in only a limited number of countries,<sup>13</sup> data on postings are collected at the national level. Moreover, national data are non-comparable across countries because they are collected according to different criteria and for different purposes. Data show cross-country variability, although posting represents a small share of population, averaging 1.03 % (0.34 % excluding

<sup>11</sup> It must be noticed also that labour cost data for the period 2007–2009 are more reliable than data on wage that are available from Eurostat only for few countries in the relevant period.

<sup>12</sup> See European Commission (2010, 2011).

<sup>13</sup> Data on posting at national levels are collected in Germany (Soka-Bau system), France (French Labour Inspectorate), Belgium (LIMOSA-system), and Denmark (RUT-Register). However, national data are non-comparable across countries. For example, LIMOSA is based on a national mandatory register system and includes only employees and not self-employed workers; furthermore, according to the directorate of labour, very few enterprises in France make a declaration. Soka-Bau data is limited to the construction sector and to blue-collar workers. The RUT-register of Denmark was introduced only in May 2008 and there is the general notion that the system is still not comprehensive regarding content and coverage (Ismeri Europa 2012).

Luxembourg), and ranging from 0.01 % (Cyprus) to 1.35 % (Slovenia). The number of yearly incoming postings in the period 2007–2009 is on average 0.42 % of population (0.22 % excluding Luxembourg), ranging from 0.04 % in Poland to 0.96 % in Belgium.

A large country like Poland, records 213,989 average yearly postings in 2007–2009, while receiving only 14,471. Most large industrialised economies, instead, are characterised by substantial dynamic inflows and outflows of posted employees (for instance, France yearly posts 186,125 workers and receives 152,946 and Germany posts 157,353 and receives 222,911). Therefore, the mere fact that a country posts many workers has little to do with the extent to which received workers have an effect on domestic employment and vice versa. Finally, data show that Luxembourg is a major outlier, since it sends and receives an impressive number of workers compared to its population (18.99 and 5.49 %, respectively). Figures 1 and 2 provide a complete picture of each country's posting inflow and outflow.

In the empirical analysis that follows, we focus on the effects of received postings on domestic labour markets. In particular, we evaluate the impact of posting from other EU countries on domestic employment, as measured by the share of employed individuals on total labour force (*empl*) and on hourly labour costs in industry and services (*lc*). It is worth stressing that, for a given country, our measure of domestic employment includes foreign and migrant workers who are regularly employed in that country, whereas posted workers are not part of the hosting countries' labour force. For this reason we are particularly interested in investigating the effects of incoming posted workers, though we will also analyse the effects of posted outflows on home countries' labour market outcomes. We also inspect the effects of posted workers on labour productivity (*prod*) in order to shed light on the main outcomes of the empirical analysis.

For the sake of reliability, in the empirical analysis we need to control for other relevant elements affecting employment, in addition to the effect of the intensity of posting.<sup>14</sup>

In particular, one set of covariates is represented by measures of countries' aggregate production. We first consider real GDP index (*gdp\_real*), which takes value 100 in year 2000. Then we consider country population (*pop*) as a scale factor. We also use per capita GDP (*gdp\_pop*) as a traditional measure of a country's welfare and the inflation rate (*infl*).

Variables related to fiscal policy are also considered. On the one hand, we use the tax wedge on labour costs (*tax*) so as to isolate the role of individual countries' taxation on labour outcomes. In doing so, posting and other covariates should be interpreted as impacting on wages, rather than on the overall labour cost. Another fiscal policy variable is exploited to capture the role of institutional features. In

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<sup>14</sup> On the inclusion of specific variables as controls, see Angrist and Krueger (1999). See also Kerr and Kerr (2011), who provide an overview of the empirical literature focusing on possible displacement effects of migrant workers.

particular, the ratio of total government expenditure for unemployment policies on domestic population (*gov\_exp\_unempl\_pop*) accounts as a proxy of employment protection laws, including the presence of unions, the existence of minimum wages, and public unemployment insurance system, which are normally all positively correlated.

Another variable that is aimed at grasping both institutional features and the extent of competitiveness of a country's enterprises is a dummy reflecting the model of industrial relations drawn from the European Commission (2008). In particular, countries that have adopted a Liberal model (*ir\_liberal*) are identified with 1 (Cyprus, Ireland, Malta and the United Kingdom).

Empirical evidence points to a positive correlation between education, employment, and higher earnings. Therefore, we include an indicator of educational attainment in hosting countries. It is measured by the percentage of employed workers having attained either secondary or tertiary education (*edu\_scondary*, *edu\_tertiary*). The former corresponds to levels 3–4 of ISCED (1997), whereas the latter corresponds to levels 5–8 of ISCED (1997).

The presence of immigrants (*migr\_actpop*) and undeclared workers (*undecl\_actpop*) may also affect labour market outcomes. The literature investigating the impact of migration on labour market characteristics, in fact claims that workers select where to migrate based on destination countries' labour market conditions which they might influence in different directions depending on the degree of substitutability/complementarity with local workers (Altonji and Card 1991; Friedberg and Hunt 1995; Card 2001; Borjas 2003; Longhi et al. 2006). For similar reasons, undeclared workers, who are typically lower-skilled, may happen to displace regular workers and also drive wages down.

Finally, since we carry out our analysis considering the period where the effects of financial crisis on the real economy were at their highest, we account for the possible incidence of the recession on labour market outcomes by including a time trend (*year*). Country fixed-effects are always used.

Summary statistics concerning the variables described above are reported in Table 1. Sources and description of all variables are also reported in Table 1.

## 4 Empirical analysis

We estimate the following equation:

$$y_{it} = \alpha + \beta \text{posting\_inflow}_{it} + \gamma X_{it} + \delta_i + \varepsilon_{it} \quad (1)$$

where  $y_{it}$  corresponds—in each estimated equation—to the labour market outcomes (*empl*, *lc*) and in country  $i$  and year  $t$ . *posting\_inflow<sub>it</sub>* describes the ratio of total workers posted to country  $i$  on population of country  $i$  in year  $t$ .  $X_{it}$  is a vector of covariates portraying the economic and institutional setting of each country as described in the previous section, while  $\delta_i$  are country fixed-effects. In order to avoid having some observations relative to a few specific countries driving estimation results (e.g. Luxembourg, Belgium, the Netherlands, Sweden, and Malta) all

**Table 1** Description of the variables, summary statistics and source of data

Variable	Description	Mean	SD	Min.	Max.
<i>empl</i>	Employed people (all NACE)/domestic labour force	0.93	0.03	0.82	0.97
<i>by sector</i>					
	Construction	0.08	0.02	0.05	0.13
	Financial	0.03	0.02	0.01	0.12
	Health care	0.08	0.04	0.04	0.17
<i>by education</i>	Employees with pre-primary, primary and lower secondary education—levels 0–2 (ISCED 1997)—age 15–64 all NACE activities (%)	42.08	13.07	14.30	65.80
	Employees with upper secondary and post-secondary non-tertiary education—levels 3–4 (ISCED 1997)—age 15–64 all NACE activities (%)	69.05	5.99	59.80	81.70
	Employees with Tertiary education—levels 5–8 (ISCED 1997)—age 15–64 all NACE activities (%)	83.78	2.84	77.00	88.40
<i>lc</i>	Hourly labour cost in Industry and services (except public admin. and community services; households activ. and extra-territorial organizations)—Euro	18.08	10.95	1.89	34.98
<i>by sector</i>					
	Construction	37.43	25.37	5.59	150.66
	Financial	104.32	47.57	26.86	229.55
	Health care	37.13	21.52	10.31	95.30
<i>prod</i>	Real labour productivity per hour worked—Euro	27.14	16.83	4.30	65.00
<i>gdp_real</i>	GDP at constant prices (index 2000 = 100)	130.00	19.36	101.20	180.90
<i>gdp_mkt_pop</i>	Per-capita GDP at market current prices (th. Euro)	23.75	15.64	4.01	81.94
<i>year</i>	Linear time trend			1 (2007)	3 (2009)
<i>pop</i>	Total population (thousands)	18,428.19	23,002.68	407.81	82,314.91
<i>secondary</i>	Population with Secondary education—levels 5–6 (%)	50.82	15.51	17.60	79.60
<i>tertiary</i>	Population with Tertiary education—levels 5–8 (%)	28.13	7.909	14.00	43.10
<i>ir_liberal<sup>a</sup></i>	Model of industrial relations: liberal	0.15	0.36	0.00	1.00
<i>tax</i>	Tax wedge on labour costs	0.36	0.09	0.12	0.50

**Table 1** continued

Variable	Description	Mean	SD	Min.	Max.
<i>gov_exp_unempl_pop</i>	Total government expenditure for unemployment policies/domestic population (th Euro/th.)	0.32	0.32	0.00	1.30
<i>undecl_actpop<sup>b</sup></i>	Employees who received part or all of their income as undeclared or who refused to answer (% interviewed)	0.08	0.07	0.01	0.30
<i>migr_actpop</i>	Two-year lagged migrants/total population	0.03	0.06	0.00	0.35
<i>infl</i>	Inflation rate	2.40	1.69	-1.70	15.30
<i>neigh_pop<sup>c</sup></i>	Average EU neighbouring countries' population at given distance/domestic population (th)*km EU neighbours/total km neighbours	0.02	0.06	0.00	0.32
<i>km_neigh_eu_tot<sup>c</sup></i>	km EU neighbours/total km neighbours	0.76	0.25	0.23	1.00
<i>posting_inflow<sup>d</sup></i>	E101 certificates for workers from all other EU member states every 100 receiving country's inhabitants	0.42	1.07	0.04	5.49
<i>posting_outflow<sup>d</sup></i>	E101 certificates for workers posted to all other EU member states every 100 receiving country's inhabitants	0.61	2.08	0.00	11.77

Source: <sup>a</sup> Industrial Relation in Europe 2008—EC Chapter 2, page 51; <sup>b</sup> Undeclared Work in the European Union—Eurobarometer Survey—Report 2007; <sup>c</sup> <http://www.freemaptools.com/find-population.htm>; <sup>d</sup> European Commission (2010) and (2011); Eurostat. Data refer to years 2007–2009. Observations: 81

variables are taken in logs.<sup>15</sup> Finally, we assume that  $\varepsilon_{it}$  is an idiosyncratic error term.

We are particularly interested in the parameter  $\beta$ , which measures the labour market effects associated with posting from all other EU countries. Specifically, there might be three options. First, conditional on all available information, a positive and significant  $\beta$  would suggest that an increasing flow of posting from abroad is associated with an average increase in a given labour market outcome in country  $i$ . Second, a negative and significant  $\beta$  would suggest that an increasing flow of posting from abroad is associated with an average decrease in a given labour market outcome in country  $i$ . Third, a non-significant parameter means that there are no systematic effects of posting on local labour market.

#### 4.1 Instrumental variables

The estimation technique illustrated in the previous subsection may raise problems of identification due to the endogenous nature of posting with respect to labour market outcomes. For instance, if, for whatever reason, firms post workers to other countries according to labour market conditions, an endogenous relationship between *posting\_inflow* and  $y$  may be observed.

On the one hand, endogeneity can be partially curbed because being endowed with a panel structure of the data we can exploit country fixed-effects to control for all time-invariant characteristics which may contemporaneously affect posting and the unmeasurable components of  $y$ . Still, however, we can neither exclude the event that firms account for labour market variations nor disregard the presence of other possible specific non-measurable country characteristics that may be subject to changes in the short-run. Thus, the possible bias originating from such possibilities needs to be addressed through appropriate econometric tools.

Here, we propose possible solutions that rely on the use of instrumental variables. We use an instrument based on neighboring countries' populations *at a given distance*, relative to the domestic population (*neigh\_pop*).

In details, for each hosting country, *neigh\_pop* is constructed taking the overall population living in the area within the circle drawn taking a radius of 500 km from the centre of the country. Then, domestic population is subtracted from the overall population inside the circle to obtain neighbours' population at given distance.

Furthermore, since some EU countries share borders with non-EU member states we introduced weights to account for the actual borders shared with EU members. Weights have been constructed for each hosting country taking the ratio of kilometres of borders with other EU members to the total country's borders. Finally, since the instrumented variable *posting\_inflow* consists of the number of incoming posted workers divided by host countries' population we also divide each country's weighted distance by the domestic population to obtain the variable *neigh\_pop*.

The rationale of our choice of building an instrumental variable like *neigh\_pop* is based on the fact that it is documented that both the distance between countries and the fact of sharing common borders have an important role in posting flows (Idea

<sup>15</sup> To avoid negative peaks of the log variables we followed the standard practice of adding 1 to all ratios.

Consult 2011). Furthermore, *neigh\_pop* allows accounting for the exogenous probability of receiving foreign workers, which reflects the pressure exerted by the relative size of nearby countries. In so doing, we assume that the larger the neighbour's population compared to local population, the higher the pressure is. For instance, if a large country like France posts 5 % of its workers, it puts greater pressure on its neighbours compared to the pressure exerted by a 5 % posted by Luxembourg.

In order to be a good instrument, *neigh\_pop* should be significantly correlated with changes in each country's posted worker inflow. We (successfully) test this condition in Sect. 5. In addition, another necessary condition to obtain consistent parameters associated to *posting\_inflow* is that the instrument is uncorrelated with  $\varepsilon_{it}$  in Eq. (1) (Wooldridge 2010). In relation to this, it is reasonable that both the domestic employment rate and the domestic labour cost respond to conditions of the labour market of sending and hosting countries, regardless of their respective size. Therefore size and population should in principle be uncorrelated with the error term in Eq. (1), thus justifying the exogenous nature of the instrument with respect to the unmeasurable features included in the error term of Eq. (1).

In order to account for the presence of the instrumental variable we use a Two-Stage Fixed-Effect model. The first-stage equation is specified as follows:

$$posting\_inflow_{it} = \alpha + \varphi Z_{it} + \beta X_{it} + \delta_i + v_{it} \quad (2)$$

where  $X_{it}$  is a vector of covariates as in (1), while  $\delta_i$  are again country fixed-effects. As standard practice when using instrumental variables, the predicted value of *posting\_inflow<sub>it</sub>* replaces its actual value in (1).

## 4.2 Alternative specifications

In order to provide robustness to the empirical analysis we also perform Two-Stage Least Squares estimates on specifications different from the one reported in Eq. (1).

First, we look at whether posted workers (outflows) have some effects also on sending countries' markets. In order to investigate this possibility Eq. (1) is specified as follows:

$$y_{it} = \alpha + \beta posting\_outflow_{it} + \gamma X_{it} + \delta_i + \varepsilon_{it} \quad (3)$$

where the variables follow the previous notation. Posting outflows are now measured by the number of E101 certificates for workers posted to all other EU member states every 100 receiving country's inhabitants.

Posting outflows, however, do not easily support the same instrument as posting inflows. If, indeed, the pressure exerted by neighbouring countries' population was a good predictor for the inflow of foreign workers, it is not likely to be the same for the volume of workers sent abroad. In this case, we opted for using the ratio of kilometres of borders with EU members to the total country's borders. The rationale for justifying the relevance of such an instrument relies on the fact that countries located in the centre of the EU block are more likely to send countries to send their

workers to other EU neighbours than countries sharing borders with non-EU states who do not share the same regulation regarding worker posting.

Second, we disaggregate the local employment rate into three groups: workers with (at least) primary education, workers having (at least) secondary education, and workers attaining tertiary education. There are no similar data concerning labour cost. However, given the non-significant parameters obtained in the baseline employment regression (see next section) we are more interested in extending the analysis regarding the employment variable rather than labour cost.

Finally, we also explore the effects of posting inflows on labour market outcomes in three sectors which can be considered as those involving a relevant share of posted workers' flows (European Commission (2014)): construction, financial services, and health care.<sup>16</sup>

## 5 Results

The estimated effects of the posting of workers on the local employment rate and labour cost are reported in Tables 2 and 3 respectively. In particular, columns denoted with (a) and (b) refer to Two-Stage Least Squares (first and second-stage estimates respectively).

In columns (1a)–(1b) of each table the results of the most parsimonious (baseline) specification are displayed. This version includes posting inflow, the real GDP index (*gdp\_real*), and population (*pop*) as a scale measure. In columns (2a)–(2b) we replace the real GDP and population with per capita nominal GDP (*gdp\_mkt\_pop*), and also add the trend variable *year* so as to isolate any labour market effects which could be related to the crisis. Furthermore, according to Sect. 3, the baseline specification is augmented with the dummy *ir\_liberal* [columns (3a)–(3b)]. Columns (4a)–(4b) include countries' inflation rate (*infl*).<sup>17</sup> A variable related to fiscal policy, namely per-capita share of government expenditure allocated to unemployment policies (*gov\_exp\_unempl\_pop*), is introduced in columns (5a)–(5b). We also account for the shares of immigrants and undeclared workers on total labour force [*migr\_actpop*, *undecl\_actpop*, columns (6a)–(6b)], while variables related to education (*secondary*, *tertiary*) are included in columns (7a)–(7b). The tax wedge on labour costs (*tax*) is included only in the regressions regarding the labour cost (Table 3). This allows interpreting the parameter  $\beta$  in Eq. (3) as the effect of posting on wages, rather than on the overall labour cost.

Estimates in Table 2 report non-significant parameters associated to posting in the equation of employment. Such evidence goes against the initial indications provided by OLS<sup>18</sup> which pointed towards some positive and significant contribution of incoming posted workers on domestic employment. From the combination of

<sup>16</sup> Parallel regressions have been performed using posting outflows although estimates (available on request) do not provide any statistically significant output.

<sup>17</sup> We have also performed estimates with core inflation as a proxy of expected inflation. However, due to high correlation with actual inflation results do not provide any additional insights compared to those reported in columns (3a)–(3b).

<sup>18</sup> OLS estimates are available upon request.



**Table 2** Effect of posted worker inflow on local employment rate—Two-Stage Fixed-Effects Least Squares Estimates

	1st stage (1a)	2nd stage (1b)	1st stage (2a)	2nd stage (2b)	1st stage (3a)	2nd stage (3b)	1st stage (4a)	2nd stage (4b)	1st stage (5a)	2nd stage (5b)	1st stage (6a)	2nd stage (6b)	1st stage (7a)	2nd stage (7b)
<i>posting_inflow</i>	0.197** (0.077)	0.017 (0.011)	0.012 (0.011)	0.017 (0.011)	-0.191*** (0.119)	0.017 (0.021)	0.092 (0.114)	0.003 (0.029)	0.176** (0.083)	0.093 (0.127)	0.192** (0.075)	0.022 (0.022)	0.176** (0.080)	0.013 (0.010)
<i>gdp_real</i>	-0.974* (0.534)	0.005 (0.003)		0.005 (0.003)	-0.022* (0.012)	0.082*** (0.021)	-1.044** (0.518)	0.188*** (0.029)	-0.792 (0.699)	0.210*** (0.034)	0.192** (0.075)	0.118*** (0.022)	0.176** (0.080)	0.050** (0.022)
<i>pop</i>														
<i>gdp_mkt_pop</i>			162.391 (114.274)	-0.273 (0.844)										
<i>year</i>			-0.009** (0.004)	-0.007*** (0.002)										
<i>ir_liberal</i>					-0.129*** (0.033)	0.007 (0.016)								
<i>infl</i>							-0.722 (0.699)	0.252*** (0.054)						
<i>gov_exp_</i>									-0.041 (0.074)	-0.008 (0.029)				
<i>unempl_pop</i>											0.000 (0.000)	-0.130** (0.056)		
<i>undecl_actpop</i>											0.063** (0.032)	-0.308 (0.190)		
<i>migr_actpop</i>													0.255 (0.157)	-0.003 (0.009)
<i>secondary</i>													0.026 (0.089)	0.016* (0.009)
<i>tertiary</i>														

Table 2 continued

	1st stage (1a)	2nd stage (1b)	1st stage (2a)	2nd stage (2b)	1st stage (3a)	2nd stage (3b)	1st stage (4a)	2nd stage (4b)	1st stage (5a)	2nd stage (5b)	1st stage (6a)	2nd stage (6b)	1st stage (7a)	2nd stage (7b)
<i>constant</i>	10.336 (6.226)	0.217* (0.124)	17.479** (8.034)	14.60*** (3.927)	3.237*** (0.675)	0.153 (0.128)	9.106 (6.306)	0.256** (0.127)	3.163 (5.732)	0.094 (0.297)	3.308 (5.152)	0.023 (0.121)	3.365 (4.298)	0.455*** (0.124)
<i>neigh_pop</i>	9.93*** (2.129)	11.32*** (3.343)	11.27	6.11*** (0.177)	10.02*** (2.192)	9.24*** (2.108)	9.85*** (2.116)	11.44*** (2.798)	17.02	17.73	0.46	0.76	0.46	0.76
<i>weak identif. F-stat.<sup>a</sup></i>	16.95	11.27	0.39	0.51	0.50	0.76	0.49	0.76	0.44	0.76	0.44	0.77	0.46	0.76

Dependent variable: employment rate (*emp*) except in odd columns where it is the share of posted worker inflow on local population (*posting\_inflow*). Robust standard errors in parenthesis. All variables are in logs except *year* and dummy variables. I has been added to all variables to avoid negative logs. Country Fixed-Effects included in all regressions. (3a, b) are estimated using G2SLS Random-Effects. Observations: 81

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

<sup>a</sup> Stock-Yogo weak ID test critical values: 10 % maximal IV size 16.38; 15 % maximal IV size 8.96; 20 % maximal IV size 6.66; 25 % maximal IV size 5.53

**Table 3** Effect of posted worker inflow on local hourly labour cost—Two-Stage Fixed-Effects Least Squares Estimates

	1st stage (1a)	2nd stage (1b)	1st stage (3a)	2nd stage (3b)	1st stage (4a)	2nd stage (4b)	1st stage (5a)	2nd stage (5b)	1st stage (6a)	2nd stage (6b)	1st stage (7a)	2nd stage (7b)
<i>posting_inflow</i>	0.632*** (0.291)	1.472*** (0.436)	0.684** (0.284)	0.310* (0.182)	0.516** (0.255)	0.612* (0.361)	0.193*** (0.079)	0.178** (0.084)	0.603** (0.242)			
<i>gdp_real</i>	0.197** (0.084)	-1.273*** (0.286)	-1.283*** (0.285)	0.085 (0.112)	-0.175 (0.083)	-0.841*** (0.358)	-0.980*** (0.279)	0.178** (0.084)	-1.214*** (0.346)			
<i>pop</i>	-0.971* (0.560)	0.114 (0.083)	-0.029*** (0.014)	-1.058* (0.547)	-0.772*** (0.292)	-0.772*** (0.292)	-0.760 (0.900)	-1.054 (0.645)	0.109 (0.071)			
<i>tax</i>	0.050 (0.870)	1.124 (1.536)	0.997 (0.856)	0.163 (0.437)	1.412* (0.780)	0.169 (0.847)	0.335 (0.400)	0.096 (0.836)	0.229 (0.413)			
<i>gdp_mkt_pop</i>												
<i>year</i>												
<i>ir_liberal</i>			-0.128 (0.033)	0.913* (0.533)								
<i>infl</i>					-0.759 (0.607)	8.331*** (0.778)						
<i>gov_exp_uneempl_pop</i>					-0.044 (0.087)	-0.652 (1.372)						
<i>undecl_actpop</i>							0.001 (0.002)	-6.677*** (1.403)				
<i>migr_actpop</i>												
<i>secondary</i>									0.256 (0.160)			
										-0.380 (0.246)		

Table 3 continued

	1st stage (1a)	2nd stage (1b)	1st stage (2a)	2nd stage (2b)	1st stage (3a)	2nd stage (3b)	1st stage (4a)	2nd stage (4b)	1st stage (5a)	2nd stage (5b)	1st stage (6a)	2nd stage (6b)	1st stage (7a)	2nd stage (7b)
<i>tertiary</i>														
<i>constant</i>	4.181 (4.309)	8.133*** (1.775)	19.293** (7.245)	19.501 (73.387)	2.764*** (0.531)	7.793*** (1.793)	2.553 (4.531)	37.13*** (2.876)	3.188 (4.891)	5.628*** (2.128)	3.053 (6.091)	6.990*** (1.688)	3.308 (4.554)	7.601*** (2.466)
<i>neigh_pop</i>	9.908*** (2.063)	12.64***	12.64*** (3.581)	6.343*** (0.185)	9.286*** (2.106)	9.969*** (2.106)	9.286*** (2.106)	9.969*** (2.106)	9.969*** (2.106)	9.969*** (2.106)	9.766*** (2.005)	9.766*** (2.005)	11.44*** (2.854)	11.44*** (2.854)
<i>weak identif. F-stat.<sup>a</sup></i>	16.10	12.21	12.21	24.10	23.31	21.87	23.31	21.87	21.87	21.87	15.80	15.80	16.13	16.13
<i>R<sup>2</sup> within</i>	0.44	0.60	0.39	0.41	0.50	0.64	0.49	0.59	0.44	0.75	0.44	0.77	0.46	0.65

Dependent variable : labour cost (*lc*) except in odd columns where it is the share of posted worker inflow on local population (*posting\_inflow*). Robust standard errors in parenthesis. All variables are in logs except *year* and dummy variables. 1 has been added to all variables to avoid negative logs. Country Fixed-Effects included in all regressions. (3a,b) are estimated using G2SLS Random-Effects. Observations: 81

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

<sup>a</sup> Stock-Yogo weak ID test critical values: 10 % maximal IV size 16.38; 15 % maximal IV size 8.96; 20 % maximal IV size 6.66; 25 % maximal IV size 5.53

OLS and Two-Stage Least Squares it emerges that effect of posting inflows presented some endogenous features which might be due to the propensity of sending workers to areas where employment is higher. Such forms of endogeneity are effectively corrected by means of the neighbouring population instrument.

Summarising the results regarding the effect of posting on domestic employment, we can conclude that, contrary to what is commonly perceived, workers posted from foreign countries are not likely to displace the local labour force.

In contrast to employment, results referring to the estimation of the effects of posting on hourly labour cost in Table 3 allow to draw fairly robust conclusions regarding the role of posted workers on domestic labour market characteristics. In particular, labour cost is likely to positively respond to an increase of the inflow of workers posted from foreign countries.

In details (see Table 3), we estimate that a 1 % increase in the inflow of posted workers for every hundred inhabitants (corresponding to about 4.2 postings for every 10,000 inhabitants) increases labour cost by almost 0.69 % (from 18.08 to 18.2 on average, computed averaging all parameters associated to *posting\_inflow* in the first row of Table 3).

It is worth noticing, also, that an increase in the labour cost may be caused by both higher wage and non-wage components. As previously discussed, we isolate the contribution of the latter in explaining the labour cost through the introduction of the tax wedge (*tax*) (Table 3). In addition, it seems rather implausible that labour taxation and social security contributions can be significantly influenced by a phenomenon like posting, which is external to local institutional features, as confirmed by the non-significant parameters associated to these variables in Table 3.

As for first-stage regressions, our instrument is significant at 1 % level in predicting the share of incoming posted workers on total domestic population. In particular, estimates reported in columns (a) in Table 2 indicate that EU neighbouring countries' population at given distance to total domestic population (*neigh\_pop*) is likely to attract relatively more workers posted from abroad. The hypothesis that the instruments are not weak is supported by the F statistic reported at the bottom of Table 2.

First-stage estimates also suggest that countries receiving higher worker flows from abroad relative to local population are the richest and the smallest, as highlighted by the positive sign of the parameter associated to the real GDP index (*gdp\_real*) and the negative sign of the one associated to population (*pop*). From the negative parameter of the time trend (*year*) we can also infer that the crisis had tightening effects on posting inflows.

A significant home-country characteristic exhibiting negative correlation with posting inflows is the liberal industrial relationship model. One possible explanation for this evidence might be that the higher degree of competitiveness which normally characterizes the labour market in these systems corresponds to a reduced comparative advantage of posted workers.

Additionally, a positive and significant parameter is associated to *migr\_actpop*. Although the immigrants are more prone to establish in a host country, whereas posted workers are temporarily staying while not belonging to the local labour force, both may share the same view in terms of hosting countries' attractiveness.

No other variables, among the covariates, have significant relation with posting inflows.

Concerning the other labour market outcomes (second-stage regressions), an overview of the regression output provides additional noteworthy evidence. First, *gdp\_real* is positively correlated with employment (Table 2 columns 1 and 3–7) although being negatively correlated with the labour cost (Table 3, columns 1 and 3–7). The reason may be that *lc* is a nominal variable. Thus, although real GDP and employment monotonically decrease during the observed time interval, labour cost exhibits average constant increase at least until 2008, which may reflect nominal rigidities. The labour cost then follows different patterns in 2009 depending on the observed country. It is not by chance that when inflation is controlled for (i.e., isolating the role of nominal variables to the explanation of the nominal component of the labour cost) real GDP becomes not significant in predicting—the real component—of the labour cost [column (5), Table 2]. In addition, the contribution of inflation to the explanation of all labour market outcomes is positive.

Furthermore, the negative sign of per-capita nominal GDP in the labour cost equation [Table 3, column (2)], is possibly a mere symptom of the fact that in richer countries (i.e., those where wages are higher) GDP has dropped more sharply as a consequence of the crisis.

The positive role of the liberal model of industrial relationship on the labour cost (Table 3) may suggest that having relatively more flexible economic environment could positively affect the labour cost. Moreover, as expected, the tax wedge (*tax*) positively contributes to increasing the labour cost.

The other variables, when significant, do not provide any unexpected outcome. In particular, there is evidence of a positive role of education in explaining labour market outcomes, whereas undeclared workers seem to displace regular ones [Table 2, column (6b)] and drive down labour costs. No significant effects are associated with the presence of higher shares of immigrants on local labour force.

Finally, larger countries are associated to better labour market standards, as shown by the sign of the variable *pop* throughout Tables 2 and 3.

Turning to the analysis of the labour market effects of posted outflows in the sending countries; estimates reported in Table 4 do not exhibit any significant insights. The explanation is rather intuitive. As it has been stressed several times throughout the paper, posted workers are indeed part of the home-country labour force. As a consequence, similarities with other workers in their home-countries can be many, in terms of specialization, expertise, education, and other factors. Therefore, subtracting a small part of the labour force because of posting should not imply significant changes to home-country labour market outcomes. Similar considerations can be drawn when looking at the effects of posting on employment rates dividing population into educational classes. Again, no relevant effects are observed on either sending or hosting countries (Table 5).

Finally, when turning to the analysis of labour market outcomes in the sectors that are considered more dynamic in terms of posting inflows we observe some interesting effects compared to the general analysis. First, in the financial sector, and to a lesser extent in health care, employment considerably benefits from incoming posted workers. Such beneficial effects seem to take place in typically higher skill

**Table 4** Effect of posted worker outflow on local employment rate and hourly labour cost—Two-Stage Fixed-Effects Least Squares Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effect of posting outflow on local employment rate ( <i>empr</i> )	0.039 (0.036)	0.009 (0.014)	0.028 (0.021)	0.000 (0.014)	0.036 (0.031)	0.039 (0.078)	0.014 (0.020)
<i>km_neigh_eu_tot 1st STAGE<sup>b</sup></i>	2.816*** (0.463)	2.970*** (0.491)	1.435** (0.706)	1.120*** (0.130)	1.016*** (0.089)	1.070*** (0.1145)	1.059*** (0.256)
<i>weak identif. F-stat.<sup>b</sup></i>	14.86	9.70	14.37	15.82	13.97	8.22	9.39
Effect of posting outflow on local hourly labour cost ( <i>lc</i> )	0.839 (0.684)	1.386 (0.853)	0.696 (0.527)	-0.098 (0.131)	0.508 (0.383)	0.340 (0.603)	0.695 (0.615)
<i>km_neigh_eu_tot 1st STAGE<sup>b</sup></i>	2.235*** (0.457)	2.826*** (0.379)	1.373*** (0.538)	1.348*** (0.285)	1.457*** (0.157)	1.258*** (0.277)	1.079*** (0.294)
<i>weak identif. F-stat.<sup>b</sup></i>	12.88	15.31	13.62	13.16	13.27	11.50	12.17
Covariates (constant included)	<i>gdp_real</i> <i>pop</i> <i>tax<sup>a</sup></i>	<i>gdp_mkt_pop</i> <i>year</i> <i>tax<sup>a</sup></i>	<i>gdp_real</i> <i>pop</i> <i>ir_liberal</i> <i>tax<sup>a</sup></i>	<i>gdp_real</i> <i>pop</i> <i>Infl</i> <i>tax<sup>a</sup></i>	<i>gdp_real</i> <i>pop</i> <i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i> <i>gov_exp_unem</i> <i>undecl_actp</i> <i>migr_actpop</i> <i>tax<sup>a</sup></i>	<i>gdp_real</i> <i>pop</i> <i>secondary</i> <i>tertiary</i> <i>tax<sup>a</sup></i>

Robust standard errors in parenthesis. All variables are in logs except *year* and dummy variables. 1 has been added to all variables to avoid negative logs. Country Fixed-Effects included in all regressions. (3) is estimated using G2SLS Random-Effects. Observations: 81. First-stage and OLS estimates available upon request

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

<sup>a</sup> included in the equations for *lc*

<sup>b</sup> Stock-Yogo weak ID test critical values: 10 % maximal IV size 16.38; 15 % maximal IV size 8.96; 20 % maximal IV size 6.66; 25 % maximal IV size 5.53

**Table 5** Effect of posted worker inflow and outflow on local employment rate by education—Two-Stage Fixed-Effects Least Squares Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effect of posting inflow on local employment rate—primary education	0.078 (0.052)	0.053 (0.076)	0.078 (0.052)	0.037 (0.063)	0.082 (0.052)	0.046 (0.061)	0.035 (0.044)
Effect of posting inflow on local employment rate—secondary education	-0.013 (0.022)	-0.014 (0.030)	-0.012 (0.022)	-0.041 (0.026)	-0.016 (0.023)	0.024 (0.037)	-0.016 (0.021)
Effect of posting inflow on local employment rate—tertiary education	-0.005 (0.010)	-0.020 (0.015)	-0.005 (0.010)	-0.011 (0.012)	-0.005 (0.010)	-0.003 (0.018)	-0.006 (0.010)
Effect of posting outflow on local employment rate—primary education	0.033 (0.025)	0.021 (0.066)	0.034 (0.025)	0.007 (0.012)	0.033 (0.025)	0.051 (0.033)	0.014 (0.016)
Effect of posting outflow on local employment rate—secondary education	-0.012 (0.016)	-0.011 (0.035)	-0.012 (0.017)	-0.014 (0.015)	-0.013 (0.015)	-0.004 (0.006)	-0.010 (0.016)
Effect of posting outflow on local employment rate—tertiary education	-0.004 (0.003)	-0.017 (0.024)	-0.004 (0.006)	-0.004 (0.002)	-0.004 (0.003)	-0.005 (0.003)	-0.003 (0.003)
Covariates (constant included)	<i>gdp_real</i> <i>pop</i>	<i>gdp_mkt_pop</i> <i>year</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>
			<i>ir_liberal</i>	<i>infl</i>	<i>gov_exp_unem</i>	<i>undecl_actpop</i>	<i>secondary</i>
					<i>pl_pop</i>	<i>migr_actpop</i>	<i>tertiary</i>

Robust standard errors in parenthesis. All variables are in logs except *year* and dummy variables. I has been added to all variables to avoid negative logs. Country Fixed-Effects included in all regressions. (3) is estimated using G2SLS Random-Effects. Observations: 81. First-stage estimates available upon request

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



environments. It is worth considering, in particular, that posting in health care should not involve lower skilled labour force (i.e. caregivers who are more likely to migrate instead), but rather practical nurses, medical doctors and specialized health workers. Displacement is instead more likely to occur in a sector, like construction, where lower skilled labour is required.<sup>19</sup> In this case, posting could be exploited for competitive purposes (Table 6).

Finally, we further deepen our analysis in order to shed light on the positive relationship between posting and labour cost which is neither explained by taxation, nor accompanied by any variations in the employment rate. To this purpose, we analyse the effects of incoming posted workers on labour productivity (Table 7) finding that, parallel to labour cost, the latter increases as a consequence of an increasing posting inflow. This seems plausible given the well-known relation between labour cost and productivity.

This result looks somehow encouraging. In fact, on the one hand, it provides evidence of the existence of positive synergies between posted workers and local labour force. These effects seem to smooth any ‘race to the bottom’ concerns regarding local worker compensation. On the other hand, estimates show that, even if the effects on labour cost may appear as a threat for local enterprises, posting does not seem to reduce their earnings. Indeed, we estimate that a 1 % increase in the inflow of posted workers for every hundred inhabitants results, on average, in a 0.9 % increase in productivity (from 27.14 to 27.38 on average, computed averaging all parameters associated to *posting\_inflow* in the first row of Table 7). Recalling that the effect on labour cost was 0.66 %, such evidence suggests that the benefits of a posting inflow concerns also employers with a residual benefit amounting to 0.21.

## 6 Conclusions

In this paper, we have tested the extent to which the inflow of posted workers from other member countries can affect domestic labour market conditions in the EU. We have used country data for all 27 EU member states in the years 2007–2009.

In particular, we have estimated the effects of posting on the employment rate in order to verify whether displacement of domestic workers is likely to take place. Then, we have also investigated the influence of posting on labour cost and wage, which can be seen as measures of working conditions. In order to address potential endogeneity stemming from non-measurable characteristics common to both worker flows and labour market outcomes, we have employed instrumental variables related to neighbouring countries’ populations.

First, we find a non-significant relation between posting and the employment rate. The second important finding is that labour cost increases as a consequence of an increase in the inflow of posted workers, and this outcome is robust to the use of instrumental variables.

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<sup>19</sup> There could also be a gender bias pushing low skilled male labour in the construction sector to temporarily stay abroad, whereas low skilled female labour may prefer to migrate.

**Table 6** Effect of posted worker inflow on local employment rate, hourly labour cost, by sector—Two-Stage Fixed-Effects Least Squares Estimates (second stage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Construction</i>							
Effect of posting inflow on local employment rate ( <i>empl</i> )	-0.000 (0.010)	-0.037*** (0.011)	-0.018* (0.010)	-0.011 (0.012)	0.005 (0.010)	-0.034* (0.019)	-0.008 (0.007)
Effect of posting inflow on local hourly labour cost ( <i>lc</i> )	0.292 (0.337)	1.067** (0.497)	0.323 (0.330)	0.469* (0.257)	0.199 (0.291)	0.091 (0.416)	0.375 (0.293)
<i>Financial sector</i>							
Effect of posting inflow on local employment rate ( <i>empl</i> )	0.048*** (0.004)	0.054*** (0.007)	0.047*** (0.003)	0.048*** (0.005)	0.045*** (0.004)	0.033*** (0.008)	0.049*** (0.005)
Effect of posting inflow on local hourly labour cost ( <i>lc</i> )	0.513** (0.226)	1.415*** (0.447)	0.553** (0.224)	0.035 (0.149)	0.390* (0.203)	0.287 (0.373)	0.479** (0.187)
<i>Health care</i>							
Effect of posting inflow on local employment rate ( <i>empl</i> )	0.011 (0.019)	0.053** (0.025)	0.030** (0.014)	0.004 (0.020)	0.011 (0.016)	0.024 (0.018)	0.016 (0.018)
Effect of posting inflow on local hourly labour cost ( <i>lc</i> )	0.654** (0.280)	1.452*** (0.456)	0.702** (0.276)	0.029 (0.186)	0.526** (0.246)	0.383 (0.407)	0.639** (0.258)
Covariates (constant included)							
	<i>gdp_real</i>	<i>gdp_mkt_</i>	<i>gdp_real</i>	<i>gdp_real</i>	<i>gdp_real</i>	<i>gdp_real</i>	<i>gdp_real</i>
	<i>pop</i>	<i>year</i>	<i>pop</i>	<i>pop</i>	<i>pop</i>	<i>pop</i>	<i>pop</i>
	<i>tax<sup>a</sup></i>	<i>tax<sup>a</sup></i>	<i>ir_liberal</i>	<i>Inf</i>	<i>gov_exp_u</i>	<i>undecl_actpop</i>	<i>secondary</i>
			<i>tax<sup>a</sup></i>	<i>tax<sup>a</sup></i>	<i>nem</i>	<i>migr_actpop</i>	<i>tertiary tax<sup>a</sup></i>
					<i>pL_pop</i>		
					<i>tax<sup>a</sup></i>		

Robust standard errors in parenthesis. All variables are in logs except *year* and dummy variables. I has been added to all variables to avoid negative logs. Country Fixed-Effects included in all regressions. (3) is estimated using G2SLS Random-Effects. Observations: 81. First-stage estimates, and estimates involving posting outflow available upon request

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

<sup>a</sup> Included in the equations for *lc*

**Table 7** Effect of posted worker inflow on labour productivity—Two-Stage Fixed-Effects Least Squares Estimates (second stage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:							
Real labour productivity per hour worked in Euro ( <i>prod</i> )	0.738*** (0.270)	1.898*** (0.666)	0.778*** (0.268)	0.649*** (0.237)	0.835*** (0.258)	0.422** (0.190)	0.965*** (0.294)
Covariates (constant included)	<i>gdp_real</i> <i>pop</i>	<i>gdp_mkt_pop</i> <i>year</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>	<i>gdp_real</i> <i>pop</i>
<i>neigh_pop</i>			<i>ir_liberal</i>	<i>infl</i>	<i>gov_exp_unem</i>	<i>undecl_actp</i>	<i>secondary</i>
<i>weak_identif</i> : <i>F-stat.</i> <sup>a</sup>	9.93*** (2.129)	11.32*** (3.343)	6.11*** (0.177)	9.24*** (2.108)	10.02*** (2.192)	9.85*** (2.116)	11.44*** (2.798)
	16.95	11.27	24.11	24.01	22.26	17.02	17.73

Robust standard errors in parenthesis. All variables are in logs except *year* and dummy variables. I has been added to all variables to avoid negative logs. Country Fixed-Effects included in all regressions. (3) is estimated using G2SLS Random-Effects. Observations: 81. First-stage and OLS estimates available upon request. Estimates involving posting outflow available upon request

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

<sup>a</sup> Stock-Yogo weak ID test critical values: 10 % maximal IV size 16.38; 15 % maximal IV size 8.96; 20 % maximal IV size 6.66; 25 % maximal IV size 5.53

Therefore, our empirical results seem to be inconsistent with the general view held by some institutions—notably trade unions—regarding the possibility that posted workers undercut the labour standards of existing domestic workers. Rather, we provide evidence that labour market integration is likely to lead to higher labour costs.

The latter result, however, should not worry companies and European policy-makers unduly. Normally, higher labour costs translate into higher unemployment and lower competitive conditions for domestic firms in the near future. But in the case of posting, our estimates suggest that the increase in labour cost is likely to stem from productivity growth rather than from other non-wage components. Moreover, according to our estimates, there does not seem to be any redistributive effect as a consequence of the increase in productivity, since workers and employers share the associated benefits.

In conclusion, although the empirical investigation provides limited evidence, we believe that all the policies undertaken so far by the EU to enhance the posting of workers—along with a set of regulatory tools increasingly aimed at protecting posted workers in order to deter any form of abuse—could be welcomed.

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