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# Wage determination, Global Value Chains and role played by wage bargaining schemes: The case of Poland<sup>1</sup>

*Dagmara Nikulin<sup>2</sup>, Joanna Wolszczak-Derlacz<sup>3</sup>*

**Abstract:** This study examines the linkages between GVC involvement and wages in Poland given different wage bargaining schemes. The analysis is based on microdata from the European Structure of Earnings Survey for Poland combined with sectoral data from the World Input-Output Database. In particular, two measures of GVC involvement were used: the share of foreign value added (FVA) to export and the measure of traditional offshoring. The institutional settings are represented by the wage bargaining scheme which reflects the level at which the collective pay is agreed. The results show that despite the lack of a significant relationship between the sectoral involvement in GVC and the level of wages in Poland, on average workers covered by the collective pay agreement receive higher wages. Moreover, the wage-GVC nexus is conditioned on the type of pay agreements: the positive wage effect from national agreements is eliminated for a certain range of GVC intensity.

**Keywords:** wages, Global Value Chains, wage bargaining.

**JEL codes:** F16, F66, J81.

## Introduction

Wage determination is a popular topic that has been tackled by many scientists over the years. Moreover, for post-communist countries the aspect of determinants of individual workers' wages is even more interesting since the wage behaviour of firms changed considerably during the transition to a market economy (evidence for the Czech Republic, Slovakia, Poland and Hungary is described in Basu, Estrin, & Svejnar, 2004). The changes which took place after

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the breakdown of communism contributed significantly to the new shape of the industrial relations. The large-scale privatisation, inflows of foreign direct investments as well as the accession to the EU which forced the modernisation of the labour law started to create new patterns of relations between labour market actors (Stockhammer & Onaran, 2009). The experience of the global financial crisis and related rapid decline in exports resulting from decreasing foreign demand accelerated the conclusion of labour agreements in order to help companies survive during the crisis and retain employees in Central and Eastern European countries (CEECs) (Bernaciak, 2015).

Nowadays the literature indicates two new important trends describing the determinants that create current labour market outcomes: involvement in the global production sharing processes on the one hand and the role played by the labour market institutions on the another.<sup>4</sup> Referring to the first trend the process of global production sharing was developed through the concept of Global Value Chain (GVC)<sup>5</sup> which is understood as “the full range of activities that firms and workers perform to bring a product from its conception to end use and beyond” (Gereffi & Fernandez-Stark, 2016, p. 7). Despite the fact that the effects of GVC on labour markets (wages, inequalities, job losses, labour productivity) are widely examined in the literature (Baumgarten, Geishecker, & Görg, 2013; Geishecker, Görg & Munch, 2010; Parteka & Wolszczak-Derlacz, 2019), the institutional factors are described less frequently. The majority of existing research focuses on the effect of globalised production on wages. Early studies on the impact of offshoring (as international trade involvement measure) on wages (Baumgarten et al., 2013; Ebenstein, Harrison, McMillan, & Phillips, 2014; Hummels, Jørgensen, Munch, & Xiang, 2014) as well as further studies based on the concept of GVC (Autor, Dorn & Hanson, 2016; Parteka & Wolszczak-Derlacz, 2020; Szymczak & Wolszczak-Derlacz, 2022) reveal divergent results (for meta-analysis see Cardoso, Neves, Afono, & Sochirca, 2021). In general for developed countries a slightly negative impact of GVC participation is confirmed as far as backward linkages are considered, whilst in the case of forward linkages the association may be ambiguous (Szymczak & Wolszczak-Derlacz, 2022).<sup>6</sup>

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<sup>4</sup> Importantly, a relevant research question concerns the role played by the technological progress and the related process automatization which is widely described in the literature (among others Acemoglu & Autor, 2011; Acemoglu & Restrepo, 2018; Goos, Manning & Salomons, 2014). Moreover, recently increasing attention is being paid to the role of new technology on the labour market (Gruetzemacher, Dorner, Bernaola-Alvarez, Giattino, & Manheim, 2021). However, as the main focus of this study is the labour market institutions and GVC additional covariates are not included. The authors are grateful to an anonymous referee for pointing this out.

<sup>5</sup> For detailed presentation of the concept and governance of GVC see the book by Milberg and Winkler (2013).

<sup>6</sup> The ambiguous results may be explained by three different forces: productivity, relative price and labour-supply effects which may affect the labour market outcomes (Grossman & Rossi-Hansberg, 2008).



On the other hand labour market institutions are claimed to be a key factor in creating the wage-setting mechanisms (Gerlach & Stephan, 2006; Aringa & Pagani, 2007; Avouyi-Dovi, Fougère & Gautier, 2013; Eurofound, 2015; and others). According to the publication *Collective bargaining in Europe: Towards an endgame* issued by the European Trade Union Institute (ETUI) which is deeply involved in the concept of collective bargaining the wages of about two-thirds of European workers are negotiated in a collective way (Müller, Vandaele, & Waddington, 2019a). However, having in mind that the story related to the industrialisation process differs fundamentally in Central and Eastern countries when compared to Western ones (Bernaciak, 2015), there are significant differences in the collective bargaining coverage across countries—from 12% in Bulgaria, 14% in Latvia, to 46% in the Czech Republic (Müller, Vandaele, & Waddington, 2019c). Regarding Poland, the collective bargaining coverage rate has declined in recent decades from 25% in 2000 to about 18% in 2017. Similarly, Poland's unionisation rate is one of the lowest in the European Union and accounts for 12% (Müller, Vandaele, & Waddington, 2019b).

In this study the two above-mentioned literature trends are analysed together namely: GVC and wage bargaining schemes and their association with wages. Past evidence shows that only a few studies describe the relationships between wage determinations, GVC and labour market institutions (Las Heras, 2018; Guschanski & Onaran, 2021; Luo & Yang, 2020). The recent study from Ndubuisi & Owusu (2022) who use sectoral data reveals that in strictly regulated labour markets the impact of GVC on wages may be positive. As regards post-communist countries there are hardly any studies in this area.<sup>7</sup> Against this background the trade-related shocks may be moderated by the institutional environment (Rodrik, Subramanian, & Trebbi, 2004). Going further if the institutional environment is taken into account the impact of trade on wages may be negligible (Rodrik et al., 2004). Therefore the simultaneous analysis of the association between wages, trade and institutional background is of great importance.

The main goal of this paper is to investigate the wage determination in Poland and to examine the role of wage bargaining level and the involvement in global production fragmentation processes. The contribution is based on providing simultaneously an analysis of wages, GVC and labour market institutions where both wages as well as wage bargaining schemes are considered on an individual level.<sup>8</sup> The study is based on a Polish case, where Poland is characterised by rather weak collective bargaining schemes: the trade unions

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<sup>7</sup> Stockhammer and Onaran (2009) examined the association between wage determination and wage bargaining schemes controlling for the trade openness and foreign direct investment stocks. Parteka and Wolszczak-Derlacz (2020) added labour market institution variables on country level in their cross-country analysis.

<sup>8</sup> Among existing studies Guschanski and Onaran (2021) examined the nexus among wages, wage bargaining and offshoring on the basis of sectoral data.



are fragmented, sectoral agreements are scarce and the bargaining is largely decentralised (Bernaciak, 2015). We argue that an analysis of the relationship between wages and involvement in international trade in a country different from Western countries (which have a much longer tradition of collective labour agreements) is interesting. In order to fulfil the aim of this study an econometric analysis based on the augmented Mincerian wage regression is employed.

This paper consists of five sections. Section 1 is a review of the literature regarding wage determination, GVC and labour market institutions. Section 2 is empirical and presents data, the model and results. Section 3 adds extensions to the baseline model. Last section contains conclusions.

## 1. Literature review

The association between trade, institutions and wage determination is not straightforward. Starting with the considerations of Milberg and Houston (2005) on the linkages between bargaining and international competitiveness the stronger institutional arrangements may be associated with better international economic performance. That is to say that the authors claim a hump-shaped relationship (following the findings from Calmfors and Driffill (1988) between the wage bargaining coverage and international competitiveness. On the other hand international trade involvement and the related increased competition may cause a downward pressure on wages while strong unions may mitigate this effect. As Schulten (2016) argues the high rate of bargaining coverage may ensure sustainable and inclusive growth. However, it has to be taken into account that GVC involvement may be associated with decreased market power and therefore the extent to which the wages may be negotiated through collective bargaining is limited (Nickell & Layard, 1999). Ramirez and Rainbird (2010) discuss a relationship between GVC and institutions one element of which is the above-mentioned pressure caused by international competition. They note that the institutions have an impact on the process of skill formation among firms participating in GVC and the skill structure determines the wage structure. Importantly, the impact of bargaining power on wages may be dependent on the level at which the bargaining is coordinated (Nunziata, 2005).

In turn the existing evidence for developing countries shows that through introducing collective pay bargaining it is possible to achieve an improvement of working conditions (e.g. a rise in pay levels) and therefore a minimalization of the negative implications of GVC participation (Selwyn, 2013). Moreover, as Selwyn (2013) argues since greater involvement in GVC may be associated with a downgrade of working conditions it may be mitigated by the proper institutional interventions such as collective bargaining. In the case of Europe the



situation regarding the collective bargaining structures is varied.<sup>9</sup> In European countries collective pay agreements are predominantly set as wage floors for different occupation groups (Card & Cardoso, 2021). Moreover, in several European countries (Portugal, Spain, Italy, Belgium, the Netherlands, France) the system of wage bargaining is based on sectoral schemes in which the wage floor is established. This results in considerable flexibility and latitude in wage determination even in the same sector. Going further a shift towards decentralisation is visible in the form of the two-tier structure of collective bargaining. The two-tier structure is based on the assumption that the negotiations which take place at the plant level have a complementary role in relation to the multi-employer wage agreements which take place at the national, industry or regional level (Boeri, 2014).

As the post-communist countries have a different institutional background from the Western countries the economic effects of the collective bargaining may also be different for the Central and Eastern economies (Stockhammer & Onaran, 2009). Following the hypothesis proposed by Calmfors and Driffill (1988) the best labour market outcomes are obtained for industrial relations which are highly organised or highly disorganised while the worst outcomes are recorded for the intermediate level of industrial organisation. As Kohl and Platzer (2007) argue in the case of Central and Eastern European countries it is possible to identify the *transitional model of industrial relations* according to which in the private sector and multinational companies “union-free” zones may be distinguished. This results in low bargaining coverage. Consequently the existing evidence assessing the linkages between wage determination, labour market institutions and trade involvement is mainly focused on the Western European countries.

Summing up the existing evidence on the wage bargaining schemes nexus from European countries gives contrasting results: on the one hand see the research of Schäfer and Gottschall (2015) who find a positive relationship between the wage bargaining centralisation degree and the wage level and on the other hand—the review by the European Commission (2015) which argues that for decentralised bargaining schemes the wages are higher. What is more once the impact of international production fragmentation is covered the existing evidence is much more scarce (Guschanski & Onaran, 2021).

Based on the literature review the following research questions are formulated:

1. What is the association between wage bargaining scheme and wages?
2. Is the relationship between GVC and wages dependent on the type of collective pay agreement?

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<sup>9</sup> An up-to-date compilation of industrial relations and wages across Europe is presented in Brandl and others (2021).





## 2. Empirical analysis

### 2.1. Data

In order to answer the research question formulated above micro-level data for the Polish economy is used. The core database is derived from Eurostat (the European Structure of Earnings Survey: SES) for the year 2014 and contains information about over 700,000 Polish representative workers. The access to this micro-level data was granted based on an individual research proposal. The SES is a cyclical survey conducted in EU Member States as well as EU candidate countries and European Free Trade Association (EFTA) countries. The cross-sectional data covers information on the level of pay and individual characteristics of employees (sex, age, occupation, length of service, highest educational level attained, etc.) and their employers (economic activity, size and location of the enterprise).<sup>10</sup> The descriptive statistics of the variables used are presented in Table A2 in the Appendix. The micro-level data are merged with the sectoral data derived from the World Input-Output Database (WIOD) (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015) based on which different measures of GVC involvement are calculated.<sup>11</sup> Table A1 in the Appendix provides information on the distribution of the collective bargaining coverage in Poland across different industries. Detailed description of the variables is presented in the next section of this paper.

### 2.2. Model

The main aim of this study is to check whether wages of individual workers are associated with GVC involvement and collective agreements. In order to verify these propositions the following form of augmented Mincerian wage regression (reviewed in Heckman, Lochner, & Todd, 2006) is proposed:

$$\ln w_{ifs} = \alpha + \beta_1 GVC_s + \beta_2 Agreement_i + \beta_3 Pers_i + \beta_4 Firm_f + \beta_5 Sec_s + \varepsilon_{ifs} \quad (1)$$

where:  $i$  – worker;  $f$  – company;  $s$  – sector of employment. The log of worker's wage<sup>12</sup> ( $\ln w$ ) on set of personal variables ( $Pers$ ) and firm's characteristics ( $Firm$ ) was regressed. Personal variables include: sex ( $sex$ ,  $male = 1$ ); age of the workers (expressed via three binary variables:  $[ageyoung]$  which takes the value 1

<sup>10</sup> A longer description of the SES database as well as the detailed description of the variables is available on the Eurostat web page <https://ec.europa.eu/eurostat/web/microdata/structure-of-earnings-survey>.

<sup>11</sup> Specifically the decomposition is done with the usage of R package *decompr* (Quast & Kummritz, 2015). See also: (Szymczak, Parteka, & Wolszczak-Derlacz, 2022).

<sup>12</sup> The hourly average wage was used.





for workers classified as under 30 years old, [*ageaverage*] with the value 1 for workers between 30–49 years old and [*ageold*] indicating workers over 50 years old); educational level (grouped into 3 categories: low education which includes less than primary, primary and lower secondary levels [*loweduc* = 1], medium education covering upper secondary and post-secondary levels [*mededuc* = 1] and higher education which denotes tertiary education up to and above 4 years [*higheduc* = 1]); skills levels (four skill categories based on occupation classification: *skill\_1* [elementary occupations], *skill\_2* [clerical support workers, service and sales workers, skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators, and assemblers], *skill\_3* [technicians and associate professionals], *skill\_4* [managers and professionals]); and type of employment (full time versus part time [*full time* = 1]). Among the set of firm characteristics (*Firm*), there is information about the duration of employee's experience working within a given unit (split into binary variables: less than 1 year [*shordur* = 1], between 1–4 years [*meddur* = 1] and more than 4 years [*longdur* = 1]), size of the company (described by the number of employees (binary variables: between 1–49 employees [*small* = 1], between 50–249 [*medium* = 1] and above 250 employees [*large* = 1]), information on the form of economic and financial control (classified into public and private [*public* = 1]) and the type of the contract (permanent versus temporal [*temp* = 1]). Moreover, the information about sector productivity calculated as value added per number of hours worked (WIOD) was included.

There are two variables of major interest. Firstly, the type of a collective pay agreement (*Agreement*) which equals 1 if a worker is covered by a collective pay agreement regardless of its level and 0 otherwise. According to the data derived from the SES it is possible to distinguish four levels at which collective bargaining takes place: (1) the national level (*Agreement\_nat*) if the negotiations take place at the national or interconfederal level, (2) the industry level<sup>13</sup> if the negotiations are held for a given industry, economic sector or individual industries in individual regions, (3) the enterprise level (*Agreement\_enter*) if the negotiations cover only the employees of the same employer and (4) no agreement (Eurostat, 2014). Secondly, the variables related to the measures of GVC involvement. For this study two measures were calculated: (1) the share of foreign value added (FVA) to export (as presented by Wang, Wei, & Zhu, 2013) which measures the backward linkages in the international production processes and (2) the measure of traditional offshoring calculated as the share of intermediate inputs to the value added (as in Feenstra & Hanson, 1999). As the impact of traditional trade and GVC may be different depending on the type of product traded (final vs. intermediate) (Szymczak & Wolszczak-Derlacz, 2022)

<sup>13</sup> In the case of Poland this level of collective bargaining is not observed and not included in the empirical analysis.



both of the measures in order to examine the possible difference in the impact are employed. These variables are represented by the term GVC in the models.

In the next step the baseline model (Equation 1) is augmented to include the interaction term between variables *Agreement* and GVC:

$$\ln w_{ifs} = \alpha + \beta_1 GVC_s + \beta_2 Agreement_i + \beta_3 Agreement_i \times GVC_s + \beta_4 Pers_i + \beta_5 Firm_f + \beta_6 Sec_s + \varepsilon_{ifs} \quad (2)$$

According to Equation (2), the association between GVC and wages varies with the type of collective pay agreement, e.g. for workers without pay agreement for whom *Agreement* = 0, the marginal effect of GVC on wages (*ceteris paribus*) corresponds to  $\beta_1$ , while in the case of workers with pay agreement (*Agreement* = 1), the marginal effect equals  $\beta_1 + \beta_3$ .

Finally, the analogous analysis is repeated but replacing the variable *Agreement* with binary variables describing the exact level of collective pay agreement: enterprise agreement (*Agreement\_enter*), national agreement (*Agreement\_nat*) or no agreement (*Agreement\_no*) which is the default/missing category.

$$\ln w_{ifs} = \alpha + \beta_1 GVC_s + \beta_2 Agreement\_enter_i + \beta_3 Agreement\_nat_i + \beta_4 Pers_i + \beta_5 Firm_f + \beta_6 Sec_s + \varepsilon_{ifs} \quad (3)$$

$$\ln w_{ifs} = \alpha + \beta_1 GVC_s + \beta_2 Agreement\_enter_i + \beta_3 Agreement\_nat_i + \beta_4 Agreement\_enter_i \times GVC_s + \beta_5 Agreement\_nat_i \times GVC_s + \beta_6 Pers_i + \beta_7 Firm_f + \beta_8 Sec_s + \varepsilon_{ifs} \quad (4)$$

The marginal effect of GVC on wages depends on the exact level of collective bargaining: for enterprise agreement:  $\delta \ln w / \delta GVC = \beta_1 + \beta_4$ , whereas for national agreement:  $\delta \ln w / \delta GVC = \beta_1 + \beta_5$ . Estimations are carried out using the OLS method, applying the weights obtained from SES corresponding to grossing-up factor for employees and with robust standard errors clustered at the level of sectors.

### 2.3. Results

Table 1 presents the results of Equation 1 (columns 1 and 2) and Equation 2 (columns 3 and 4). Based on the results presented in Table 1 the variable *Agreement* is positive and statistically significant for the first model (Equation 1). Therefore it indicates that on average workers with a collective pay agreement earn more compared to those who are not covered by any agreement. These results are in line with the view postulated that more organised industrial relations should bring better economic performance (for review, see Eurofound, 2015). However,



if the interactions between collective bargaining schemes and GVC involvement are added to the consideration (according to Equation 2), the story will change: interaction terms turn to be statistically insignificant regardless the GVC measure used.<sup>14</sup> To some extent these results are not surprising: as Rodrik and others (2004) argue if both the institutional environment and the trade-related variables are taken into account the conclusions may be diversified and even the impact of trade may be negligible.

**Table 1. Estimation of wage regression, illustrating Equations 1 and 2**

GVC measure	FVA	OFF	FVA	OFF
	(1)	(2)	(3)	(4)
GVC	-0.003	0.015	-0.009	0.007
	[0.020]	[0.012]	[0.018]	[0.013]
Agreement	0.037**	0.034**	0.016	0.011
	[0.018]	[0.016]	[0.050]	[0.027]
GVCxAgreement			0.015	0.02
			[0.027]	[0.016]
sex	0.172***	0.168***	0.172***	0.168***
	[0.029]	[0.027]	[0.029]	[0.027]
ageyoung	-0.127***	-0.127***	-0.127***	-0.126***
	[0.032]	[0.032]	[0.032]	[0.032]
ageaverage	-0.012	-0.012	-0.011	-0.011
	[0.020]	[0.020]	[0.020]	[0.020]
loweduc	-0.316***	-0.318***	-0.315***	-0.318***
	[0.032]	[0.033]	[0.032]	[0.032]
mededuc	-0.277***	-0.280***	-0.276***	-0.279***
	[0.034]	[0.034]	[0.033]	[0.033]
full time	-0.026	-0.029	-0.026	-0.028
	[0.022]	[0.022]	[0.022]	[0.021]
skill_1	-0.586***	-0.587***	-0.585***	-0.586***
	[0.071]	[0.070]	[0.071]	[0.070]

<sup>14</sup> However, one should also take into account the specific values of GVC e.g. based on the values of coefficients from column 3 of Table 1 the marginal effect of *Agreement* equals to  $0.016 + 0.015 \times \text{FVA}$  and  $0.011 + 0.02 \times \text{OFF}$  (column 4). For high values of FVA and OFF the final effect can be different from zero.



<i>skill_2</i>	-0.461***	-0.465***	-0.461***	-0.464***
	[0.050]	[0.050]	[0.050]	[0.050]
<i>skill_3</i>	-0.315***	-0.316***	-0.315***	-0.317***
	[0.055]	[0.055]	[0.055]	[0.055]
<i>shortdur</i>	-0.109***	-0.106***	-0.109***	-0.106***
	[0.017]	[0.016]	[0.017]	[0.016]
<i>meddur</i>	-0.092***	-0.091***	-0.092***	-0.090***
	[0.016]	[0.015]	[0.015]	[0.015]
<i>small</i>	-0.211***	-0.205***	-0.211***	-0.205***
	[0.062]	[0.061]	[0.062]	[0.061]
<i>medium</i>	-0.070*	-0.068	-0.070*	-0.068
	[0.041]	[0.040]	[0.041]	[0.041]
<i>public</i>	0.099	0.110*	0.098	0.109*
	[0.063]	[0.062]	[0.063]	[0.062]
<i>temp</i>	-0.154***	-0.155***	-0.154***	-0.155***
	[0.026]	[0.026]	[0.026]	[0.026]
<i>ln_prod</i>	0.053***	0.051***	0.053***	0.051***
	[0.015]	[0.016]	[0.015]	[0.016]
$R^2$	0.51	0.51	0.51	0.51
$N$	723706	723706	723706	723706

Notes: *sex* (male = 1), *full time* (full-time employed = 1), *public* (public unit = 1), *temp* (temporary contract = 1), *ln\_prod* (log of productivity: sector value added to the number of hours worked). Default/omitted categories: *ageold*, *higheduc*, *skill\_4*, *longdur* and *large*. Regression with weights and robust standard errors clustered at the sector level (in parentheses); \* $p \leq 0.10$ , \*\* $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ .

Source: Based on data from the SES and WIOD.

Additionally, it is confirmed that personal and firm characteristics are important in the wage determination of individual workers. In particular, higher average wages are recorded for men, older and better educated workers. Moreover, people performing high-skill occupations (managers and professionals) earn more compared to people in other occupations. Similarly, the seniority in individual companies is positively related to the wage: employees who work longer in a given company are usually characterised by a higher wage. Moving onto the characteristics of the company the results are in line with expectations: higher wages are observed in larger, public enterprises and for workers with indefinite contracts. Moreover, it is meaningful to consider an alternative coding of the variables related to wage bargaining: when the collective pay agree-



ment scheme is divided into specific levels (enterprise and national pay agreements) the obtained results prove to be interesting.

Table 2 presents the results of Equation 3 (columns 1 and 2) and Equation 4 (columns 3 and 4).

**Table 2. Estimation of wage regression, illustrating Equations 3 and 4**

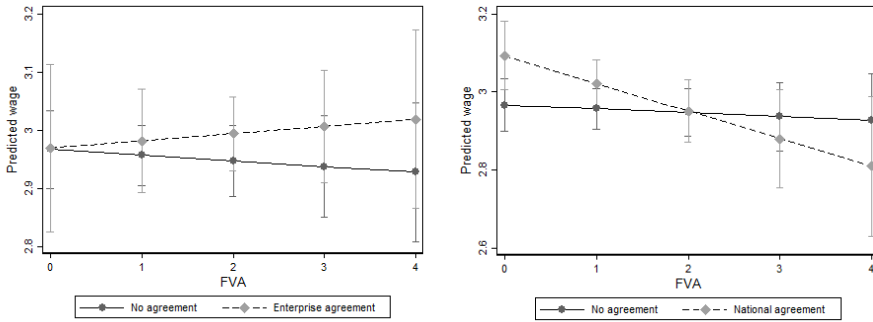
GVC measure	FVA	OFF	FVA	OFF
	(1)	(2)	(3)	(4)
GVC	-0.003	0.015	-0.01	0.006
	[0.021]	[0.012]	[0.018]	[0.013]
<i>Agreement_enter</i>	0.034*	0.031*	0.003	0.002
	[0.019]	[0.017]	[0.054]	[0.029]
<i>Agreement_nat</i>	0.058***	0.058***	0.126***	0.085***
	[0.019]	[0.018]	[0.032]	[0.021]
<i>GVCxAgreement_enter</i>			0.022	0.025
			[0.029]	[0.017]
<i>GVCxAgreement_nat</i>			-0.061***	-0.031**
			[0.022]	[0.014]
R <sup>2</sup>	0.51	0.51	0.51	0.51
N	723706	723706	723706	723706

Notes: All RHS variables (personal, firm and sector characteristics) included as in Table 1. Default (missing) category: no agreement.

Source: Based on data from the SES and WIOD.

In the case of Equation 3 the results show that agreements (of any kind) are associated with higher wages. Additionally, the effect of national agreements is both statistically more robust and larger in terms of its size effect than for enterprise-level agreements. When the interactions are added the statistical significance is sustained in the case of national agreements (positive coefficient in front of *Agreement\_nat*) but the coefficient is negative in front of its interaction with GVC (*GVCxAgreement\_nat*). The figures (Figure 1 and Figure 2) showing the association between GVC and wages depending on the level of agreement are compiled to better illustrate the results.

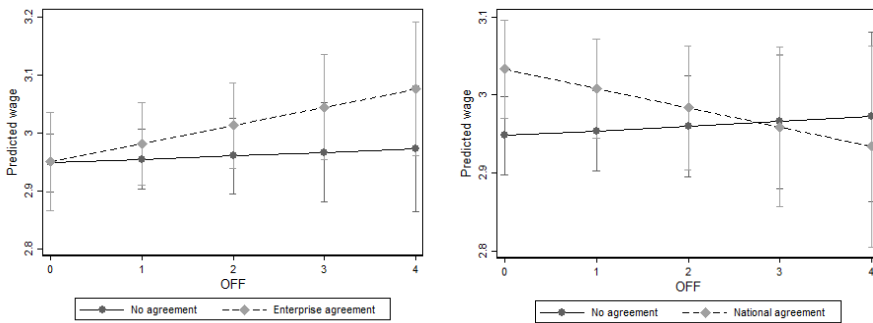
Following the relationships presented in Figures 1 and 2, in the case of enterprise agreements the association between GVC and wages is positive. This may be interpreted that when the involvement in GVC increases the wages of individual workers also increase. Conversely, in the case of national agreements wages decrease with the increase in GVC involvement. Please note that only 3.7% of workers in the sample is characterised by a national wage agree-



**Figure 1. Predicted wages due to the changes in GVC across different categories of collective pay agreements (illustrating the results from Table 2, column 3). GVC measured as FVA to export, FVA in range (0–40%), rescaled (0–4)**

Notes: predicted wage expressed as ln wages; FVA: the higher the index the greater involvement in GVC.

Source: Based on data from the SES and WIOD.



**Figure 2. Predicted wages due to the changes in GVC across different categories of collective pay agreements (illustrating the results from Table 2, column 4). GVC measured as OFF, OFF in range (0–40%), rescaled (0–4)**

Notes: predicted wage expressed as ln wages; OFF: the higher the index the greater involvement in GVC.

Source: Based on data from the SES and WIOD.

ment. This trend is common for two distinct measures of GVC: FVA to export (Figure 1) and OFF (Figure 2).

Taking into account the statistical significance of the estimations in this study (the confidence intervals intersect) the result should be interpreted with caution. The positive effect of national agreements is reduced with the level of GVC participation. In fact, the effect is such that the positive wage effect from national agreements is eliminated for a certain range of GVC intensity. It is also important to differentiate the between statistical and economical significance of the results. Although the results for national agreements are statistically significant (Table 2) their economic significance is marginal (Figures 1 and 2).



In the case of less centralised agreements (e.g. enterprise wage bargaining schemes) the workers have more power to negotiate their wages (Felbermayr, Hauptmann, & Schmerer, 2014). This is especially true for GVC-involved sectors where the integration with global links may enhance the firms' productivity and competitiveness. The wages under less centralised bargaining may be more flexible and therefore related more strongly to productivity gains. At the same time for centralised bargaining schemes the workers have less bargaining power and the wages are more dependent on the macro situation of the whole economy. As Boeri, Brugiavini and Calmfors (2001) assert for decentralised bargaining schemes the linkages between productivity gains (here induced by GVC involvement) and wages are tighter. In this way enterprise-based wage negotiations may overcome the negative impact from greater GVC participation. However, given the fact that the information about GVC involvement is only available on the sectoral level a further discussion of this relationship remains open.

One should also take into consideration the fact that when looking at Figures 1 and 2 there are no statistically significant differences between a national agreement and no agreement however, in Table 2 (column 3 and 4), national agreements and interaction between GVC and national agreement are statistically significant. Moreover, despite the lack of statistical significance of some results the diverse trends within enterprise agreement/no agreement and GVC, and national agreement/no agreement and GVC are meaningful and worth future closer investigation.

### **3. Extension**

The above analysis is based on two different measures of GVC, however, both of them are calculated on the basis of trade statistics: trade in intermediate goods and input-output tables (Timmer et al., 2015). In the next step sector specific export to value added (Export) instead of GVC is employed in order to check whether the above analysis gauges the effect of GVC involvement rather than simply the effect of openness of a given sector. The results are presented in Table 3. Based on the results presented in Table 3 and Figure 3 the following can be concluded for an enterprise agreement: firstly, the predicted wages are rather stable with the increase in export penetration secondly, there is no distinct difference in wages of the workers covered by an enterprise agreement and those without any agreement. The trend in wages of workers with a national agreement (right hand graph) is similar to the trends shown by the GVC measures, However, the wide statistical confidence intervals causes the differences between national agreement and no agreement to be less obvious. In this way the results indicate that the specific trends for wage determination and specific levels of collective pay agreements are indeed characterised for Global Value Chains (not for general trade).



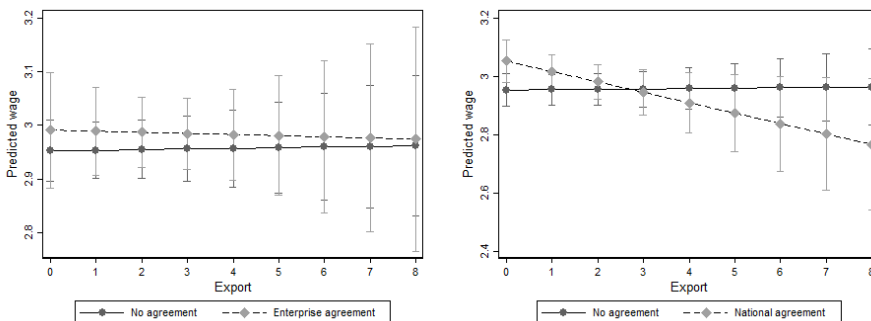


**Table 3. Estimation of wage regression, with variable *Export***

GVC measure	FVA	OFF	FVA	OFF
	(1)	(2)	(3)	(4)
<i>Export</i>	-0.001	0.002	-0.001	0.001
	[0.011]	[0.009]	[0.011]	[0.009]
<i>Agreement</i>	0.036**	0.045		
	[0.017]	[0.035]		
<i>Agreement_enter</i>			0.034*	0.039
			[0.018]	[0.038]
<i>Agreement_nat</i>			0.058***	0.099***
			[0.019]	[0.024]
<i>ExportxAgreement</i>		-0.006		
		[0.013]		
<i>ExportxAgreement_enter</i>				-0.003
				[0.014]
<i>ExportxAgreement_nat</i>				-0.037***
				[0.013]
$R^2$	0.51	0.51	0.51	0.51
$N$	723706	723706	723706	723706

Notes: All RHS variables (personal, firm and sector characteristics) included as in Table 1. Default (missing): no agreement.

Source: Based on data from the SES and WIOD.



**Figure 3. Predicted wages due to the changes in *Export* across different categories of collective pay agreements (illustrating the results from Table 3, column 4)**

Notes: Predicted wage expressed as ln wages.

Source: Based on data from the SES and WIOD.

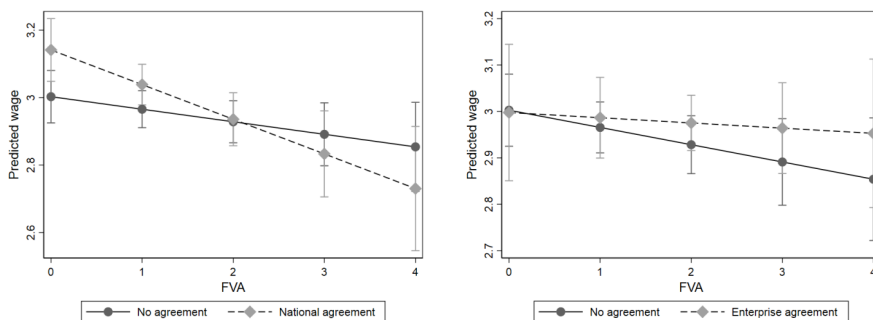
Finally, the estimations with more disaggregated classification of workers' occupation are conducted. Instead of four different skill levels, nine different occupations (ISCO 1 digit level) are introduced. In this way it is possible to better account for the occupational variation. The results are presented in Table 4 and Figure 4.

**Table 4. Estimation of wage regression, with detailed occupation classification**

GVC measure	FVA	OFF	FVA	OFF
	(1)	(2)	(3)	(4)
GVC	-0.029	0.001	-0.037*	-0.01
	[0.024]	[0.012]	[0.022]	[0.014]
Agreement_enter	0.032*	0.028*	-0.005	-0.005
	[0.018]	[0.017]	[0.051]	[0.028]
Agreement_nat	0.065***	0.065***	0.139***	0.094***
	[0.019]	[0.019]	[0.038]	[0.023]
GVCxAgreement_enter			0.026	0.029*
			[0.027]	[0.017]
GVCxAgreement_nat			-0.066**	-0.033**
			[0.025]	[0.015]
R <sup>2</sup>	0.52		0.52	0.52
N	723706	723706	723706	723706

Notes: All RHS variables (personal, firm and sector characteristics) included as in Table 1. Instead of skill levels, there are 9 different occupations. Default (missing): no agreement.

Source: Based on data from the SES and WIOD.



**Figure 4. Predicted wages due to the changes in GVC across different categories of collective pay agreements (illustrating the results from Table 4, column 3)**

Notes: Predicted wage expressed as ln wages.

Source: Based on data from the SES and WIOD.



Regardless of the level of occupational aggregation (four skill levels vs. nine occupation levels) the main conclusion considering the difference between the association between GVC and wages depending on enterprise and national collective agreements is confirmed. The overall association between collective pay agreements and wages is positive. However, the greater intensification of GVC links may contribute to weakness of the positive impact from national pay agreements.

## Conclusions

The main objective of this paper was to examine the wage determination in Poland focusing on the role played by GVC involvement and wage bargaining schemes. As the existing evidence mainly considers the role of collective bargaining in wage determination in Western Europe where the industrial relations are more developed this study is devoted to Poland a country in which industrial relations may be described as fragmented. In other words the aim of this paper was to investigate the linkages between institutions, wages and GVC in a post-communist economy which has a relatively short history of industrial relations.

The results show that controlling for a varied range of personal, company and sectoral characteristics the role played by the labour market institutions might be significant. In particular the existence of the collective bargaining schemes may have a positive impact on individual wage determination. On average workers who are covered by any type of collective pay agreement (negotiated at company or national level) earn more compared to those who are not covered by collective bargaining. This is in line with the previous empirical evidence (European Commission, 2015; Schäfer & Gottschall, 2015). However, if the interactions between the level of wage bargaining and GVC involvement are considered the association turns to be less obvious. Although the predicted wages are growing along with the GVC intensification for workers covered by enterprise agreement, this effect is rather negligible in economic terms. More large and robust is the evidence for national level agreements: the initially positive impact on wage growth is weakened by the growing involvement in GVC. However, it is claimed that workers whose pay is agreed during the negotiations at company level are less affected by the negative impact resulting from the greater links with global production fragmentation processes (due to greater negotiation power and closer links between the productivity gains and wages: Boeri et al., 2001; Felbermayr et al., 2014), was not confirmed using Polish data.

Among the limitations of this research it may be mentioned that the GVC involvement measures are available on the sectoral and not on the company level. Secondly, the focus was only on the impact of GVC and institutions on wages while other aspects of labour market performance may be also be af-



fected (Calmfors & Driffill, 1988). Thirdly, the GVC-wage nexus was observed only in the static framework while a dynamic analysis would allow for a deeper explanation of these associations. However, with the given dataset, such an exercise was impossible to implement. Fourthly, only one measure of labour market institutions related to the wage bargaining level was included. Finally, not all results are statistically significant.

As Kohl and Platzer (2007) argue various forms of government activities may be important in the determination of individual remuneration especially when taking into account the low bargaining coverage and weak unions. Therefore the wider institutional background might give more insight into the aspects of wage determination and provide a direction for further research in this context.

## Appendix

**Table A1. Collective bargaining coverage and GVC measures in Poland across different industries**

Code of industry	Name of industry	noagr	enter-pagr	na-tio-nagr	FVA	OFF
TOTAL		0.591	0.372	0.037	1.298	1.077
B	Mining and quarrying	0.203	0.762	0.034	0.718	1.113
C10-C12	Manufacture of food products, beverages and tobacco products	0.524	0.461	0.014	2.409	1.112
C13-C15	Manufacture of textiles, wearing apparel and leather products	0.628	0.354	0.018	2.993	2.972
C16_C17	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of str.; manufacture of paper and paper products	0.568	0.414	0.018	1.919	1.812
C18	Printing and reproduction of recorded media	0.679	0.303	0.018	1.828	1.818
C19_C20_C22	Manufacture of coke and refined petroleum products; manufacture of chemicals and chemical products; manufacture of rubber and plastic products	0.47	0.494	0.036	2.531	3.409
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.333	0.617	0.049	2.100	1.405
C23	Manufacture of other non-metallic mineral products	0.607	0.383	0.010	2.078	1.571
C24_C25	Manufacture of basic metals; manufacture of fabricated metal products, except machinery and equipment	0.471	0.500	0.030	1.854	2.725



C26_C27_C33	Manufacture of computer, electronic and optical products; manufacture of electrical equipment; repair and installation of machinery and equipment	0.454	0.530	0.017	3.294	3.601
C28	Manufacture of machinery and equipment n.e.c	0.389	0.583	0.028	2.511	2.726
C29_C30	Manufacture of motor vehicles, trailers and semi-trailers; manufacture of other transport equipment	0.472	0.489	0.038	2.584	2.828
C31_C32	Manufacture of furniture; other manufacturing	0.512	0.484	0.004	2.669	1.815
D35	Electricity, gas, steam and air conditioning supply	0.072	0.831	0.097	1.512	1.740
E36	Water collection, treatment and supply	0.256	0.739	0.005	0.700	0.561
E37-E39	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities	0.436	0.562	0.002	1.213	1.213
F	Construction	0.503	0.473	0.025	2.048	1.168
G45_G46	Wholesale and retail trade and repair of motor vehicles and motorcycles; wholesale trade, except of motor vehicles and motorcycles	0.709	0.278	0.014	0.822	0.564
G47	Retail trade, except of motor vehicles and motorcycles	0.695	0.243	0.062	0.772	0.473
H49_H50_H51_H52	Land transport and transport via pipelines; water transport; air transport; warehousing and support activities for transportation	0.317	0.644	0.038	1.433	0.868
H53	Postal and courier activities	0.073	0.927	0.000	0.901	0.527
I	Accommodation and food service activities	0.675	0.226	0.099	1.188	0.558
J58_J59_J60	Publishing activities; motion picture, video and television programme production, sound recording and music publishing activities	0.744	0.256	0.000	1.236	0.790
J61_J62_J63	Telecommunications; computer programming, consultancy and related activities; information service activities	0.605	0.31	0.084	1.419	1.290
K64_K65_K66	Financial service activities, except insurance and pension funding; insurance, reinsurance and pension funding except compulsory social security; activities auxiliary to financial services and insurance activities	0.609	0.359	0.031	0.924	0.531



L68	Real estate activities	0.448	0.484	0.068	0.925	0.324
M69_M70	Legal and accounting activities; activities of head offices; management consultancy activities	0.772	0.228	0.00	0.633	0.505
M69_M70_M71	Legal and accounting activities; activities of head offices; management consultancy activities; architectural and engineering activities; technical testing and analysis	0.662	0.300	0.038	0.840	0.561
M72_M73_M74_M75	Scientific research and development; advertising and market research; other professional, scientific and technical activities; veterinary activities	0.516	0.474	0.010	0.828	0.662
M74_M75	Other professional, scientific and technical activities; veterinary activities	0.592	0.308	0.100	0.655	0.568
N	Administrative and support service activities	0.672	0.269	0.059	1.120	0.773
O84	Public administration and defense; compulsory social security	0.965	0.033	0.002	0.524	0.280
P85	Education	0.745	0.184	0.071	0.485	0.232
Q	Human health and social work activities	0.567	0.403	0.030	0.861	0.621
R_S	Other service activities	0.682	0.274	0.044	1.070	0.701

Notes: Industry-level GVC indicators calculated from WIOD are matched with SES data using classification NACE Rev. 2. In some cases, however, the sectors provided in SES cover broader categories. In order to assure the correspondence between SES and WIOD we calculated an average of industry indexes (e.g. FVA) for the non-standard industry classifications e.g. C16\_C17, C26\_C27\_C33, J61\_J62\_J63.

Source: SES and WIOD.

**Table A2. Descriptive statistics**

Variable	Observations	Mean	Standard deviation	Min	Max
<i>wage</i>	723706	24.422	15.815	9.13	95.11
<i>sex</i>	723706	0.497	0.500	0	1
<i>ageyoung</i>	723706	0.16	0.367	0	1
<i>ageaverage</i>	723706	0.554	0.497	0	1
<i>loweduc</i>	723706	0.055	0.228	0	1
<i>mededuc</i>	723706	0.528	0.499	0	1
<i>FT</i>	723706	0.923	0.266	0	1
<i>skill 1</i>	723706	0.078	0.268	0	1



<i>skill 2</i>	723706	0.434	0.496	0	1
<i>skill 3</i>	723706	0.121	0.326	0	1
<i>shortdur</i>	723706	0.097	0.296	0	1
<i>meddur</i>	723706	0.268	0.443	0	1
<i>small</i>	723706	0.234	0.423	0	1
<i>medium</i>	723706	0.285	0.452	0	1
<i>nationagr</i>	723706	0.037	0.189	0	1
<i>industagr</i>	723706	0.000	0.000	0	0
<i>enterpagr</i>	723706	0.372	0.483	0	1
<i>ln Prod</i>	723706	3.135	0.874	1.242	5.133
<i>FVA</i>	723706	1.298	0.795	0.485	3.294
<i>OFF</i>	723706	1.077	0.960	0.232	3.601

Source: SES and WIOD.

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