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OFFSHORING AND WAGES: EVIDENCE FROM EU MANUFACTURING INDUSTRIES

WPŁYW OFFSHORINGU NA PŁACE W PRZEMYŚLE PRZETWÓRCZYM KRAJÓW UE

Summary: Progressing globalization processes are evidenced in e.g. the relocation of production and service processes abroad, a practice referred to as offshoring. They might result in changes in local labour markets all over the world. In this context, the purpose of this study was to evaluate the impact of offshoring on the level of wages in the manufacturing industries of European Union member countries. The research was based on data from 19 industries from the WIOD database (edition 2016). In order to examine the influence of offshoring on wages, panel models with fixed effects were applied. A generalized least squares method was used for their estimation. The results obtained indicate that offshoring might have a negative impact on wages in the "old EU" member countries and a neutral influence on wages in the "new EU" countries. At the same time, it was noticed that the impact of offshoring on wages might differ significantly between industries.

Keywords: offshoring, labour market, wages.

Streszczenie: Postępujące procesy globalizacji przejawiają się m.in. w przenoszeniu procesów produkcyjnych i usługowych za granicę, co jest nazywane offshoringiem. Ich efektem mogą być zmiany obserwowane na krajowych rynkach pracy. W tym kontekście celem artykułu była ocena wpływu offshoringu na poziom płac w przemyśle krajów Unii Europejskiej. Badania oparto na danych z 19 branż przemysłu pochodzących z bazy WIOD (edycja 2016). W celu zbadania wpływu offshoringu na płace pracowników zastosowano model panelowy z efektami stałymi oszacowany z wykorzystaniem uogólnionej metody najmniejszych kwadratów. Uzyskane wyniki wskazują na negatywny wpływ offshoringu na płace w krajach „starej" UE i jego neutralny wpływ na płace w krajach „nowej" UE. Równocześnie zauważono, że wpływ offshoringu na płace może się znacznie różnić w poszczególnych branżach.

Słowa kluczowe: *offshoring*, rynek pracy, płace.

1. Introduction

Offshoring is connected with the relocation of production and service processes abroad [Oczkowska 2012]. Although offshoring is not a new phenomenon, it has recently gained new dynamics thanks to progressing globalization and regional integration which result in e.g. the reduction in the cost of transport and the radical progress in information technologies. This facilitated the further fragmentation of production processes, as well as the relocation of separate production stages to other countries. The relocation process also takes place in European Union member countries, especially the most developed ones. The inclusion of developing countries in the "global production networks" makes it possible for international companies to benefit from the generally lower costs of labour in those countries. In connection with the above, there have been concerns that offshoring can contribute to the loss of jobs in developed countries and thus to a reduction of wages in those countries [Hijzen et al. 2005]. However, the results of studies indicate that offshoring's impact on the labour market and thus wages in developed countries is ambiguous. In the short term, offshoring exerts a rather negative and direct impact on employment by reducing the number of production or service processes, a fact which leads to a reduced labour supply. However this is not the case in the mid or long term when we are often dealing with the indirect and often positive influence of offshoring on the labour market. The indirect influence can manifest by the generation of increased exports or reduction of costs which slows down the growth of the prices of consumer goods thanks to which the state can exercise a more flexible monetary policy, keeping lower interest rates which stimulate investment growth [Grossman, Rossi-Hansberg 2006].

A review of the research also indicates that offshoring often affects mainly unskilled workers, exerting pressure on decreasing their wages relative to the wages of skilled workers. Consequently, there appear increasingly higher wage inequalities. In connection with the fact that the structure of employment differs between industries, it can be presumed that offshoring has a diverse influence on employment and wages in those sectors [Parteka, Wolszczak-Derlacz 2015b].

The purpose of the study is to present the influence of offshoring on changes in the wages of those employed in the industries of European Union countries. The study used data from the World Input-Output Database (WIOD), edition 2016. Despite the fact that studies on the impact of offshoring on wages are quite popular, there are few which concern only EU member countries. Studies in that respect were based on the old classification and covered a different time scale (e.g. [Parteka, Wolszczak-Derlacz 2015a]) or focused on selected countries or industries (e.g. [Baumgarten et al. 2013]), which validates the necessity to carry out studies in that area with the use of the new WIOD database.

2. Influence of delocation on the labour market – literature review

International trade growing rapidly since the 1950s has been subject to significant changes. The initial drop in the costs of transport contributed to increased trade in the final goods, based on their comparative advantage principle. Recent progress in transport and communication technology has deeply modified international trade. Nowadays intermediate goods and components can be moved quickly and cheaply. As a consequence, companies in one country can benefit from lower prices of production factors or specific assets in another country, relocating some operations there. The first phase of globalization was marked by a geographical focus of production, while in the second phase we can see more and more separation of different stages of manufacturing [Baldwin 2006]. The relocation of production and service processes abroad, known as offshoring, impacts the labour market in the country from which certain production or service processes are being "moved out". The connection between the move of part of the production chain abroad and the change in demand for different types of labour and thus wages was analysed by Feenstra and Hanson [1996] and Hijzen et al. [2005]. The economists argued that in highly developed countries, unskilled workers or workers who do simple work have to face growing competition from abroad and thus a shrinking demand for that kind of work. However, the fact whether offshoring impacts the level of employment or wages mainly depends on the situation on the local labour market [Anderton et al. 2002]. From that point of view, the effect of offshoring is similar to the consequences brought by technological changes, and economists use similar tools to evaluate the impact of both those effects on the labour market [Feenstra, Hanson 1996]. However, in the case of offshoring there are additional concerns that the replacement of skilled workers at home with foreign workers might reduce motivation to invest in education and thus hamper the accumulation of human capital.

Meanwhile, using the Heckscher-Ohlin model in their analyses, Grossman and Rossi-Hansberg [2006], write about the fragmentation of production, arguing that over recent decades it manifested in the growth of "trade in tasks" which are the elements of production processes. Thus, countries specialize not so much in trade in specific goods but in carrying out certain tasks or processes which are elements of value added of chains within which the final product is created. Meanwhile, differences in international wages determine the extent of the international division of production since producers who maximize profits choose the location of the lowest production cost for each task. Some tasks can be performed by unskilled workers while others have to be done by more skilled workers. However, the impact of offshoring on the labour market is ambiguous. On the one hand, it leads to the increased risk of job losses as a result of the relocation of some production or service operations abroad, but on the other hand, offshoring also contributes to the creation of new jobs. There are a number of indirect mechanisms through which offshoring can have a positive impact on the labour market. Examples of the indirect impact of offshoring on employment include:

- Growth in exports due to the fact that foreign investments often supplement trade and lead to additional exports and indirectly to the creation of new jobs.
- Cost reduction which helps better control and reduce inflation. Thanks to that, it is possible to run a more flexible monetary policy and keep interest rates low. Low interest rates can indirectly boost investments which in turn might lead to the creation of new jobs.

Marin [2004], Castellani et al. [2008], Hijzen and Swaim [2007], Ando and Kimura [2007] presents a different point of view on offshoring. According to their analyses, offshoring is a broad phenomenon which covers all the sectors but its impact on employment is minor and moreover, most often positive. In particular, Marin [2004] argues that vertical foreign direct investment from Western European countries in Eastern Europe contributed to a surprisingly small reduction of jobs in the countries of origin of the investments. The fact that corporations use cheaper workforce in their industries helped Austrian and German companies remain competitive on the market. Neither was there any proof of loss of employment due to production companies' offshoring in Italy [Castellani et al. 2007]. The move of production to Eastern European countries caused a minor growth in the skills of workers in that country. In their analysis of 17 OECD countries, Hijzen and Swaim [2007] differentiate between intra-industry and inter-industry offshoring. Their results show that offshoring within the same sector (intra-industry or narrow offshoring) reduces the intensity of work but does not affect overall employment in the industry. Meanwhile, inter-industry offshoring does not affect labour intensity but might have a positive impact on the overall employment in the industry [Hijzen, Swaim 2007]. On the basis of those results, the authors argue that the growth in efficiency as a result of offshoring is sufficient to balance out the loss of jobs due to the relocation of production. The abovementioned effect concerns the offshoring of materials, not services.

Studies on the impact of offshoring on wages show that its growth leads to the increase of wages of highly skilled workers. Studying the American market, Egger [2005] concluded that in the 1980s, offshoring contributed to a 30% growth in the difference in wages in the production sector. Moreover, Geishecker and Görg [2011] pointed out that in the UK, offshoring had a negative influence on the real wages of mid and low-skilled workers and at the same time highly skilled workers could benefit from higher real wages. Baumgarten et al. [2013] also pointed out the negative impact of offshoring on the wages of low-skilled workers in Germany. However, the effect also depends on the nature of the work done by the worker. In particular, routine tasks and personal interaction play a significant role. In the case of low-skilled workers and those of low levels of personal interaction, wage cuts are higher than in the case of workers of low skills but higher level of interaction. High-skilled workers are not affected by loss of wages due to offshoring unless their work is characterized by a low level of personal interaction or many routine activities. A Swiss educational report also confirms the assumption of wage growth caused by

the offshoring of high-skilled workers who perform routine tasks. There were also indications of a small growth in the wages of workers employed in large companies but working in small international teams [Schweizerische... 2014].

In their study, Feenstra and Hanson [2001] show the consequences of offshoring on the basis of data for the US, Japan, Hong Kong and Mexico. They argue that offshoring is connected with the growing wages for non-productive (i.e. high-skilled) workers. That remains in line with their previous findings that offshoring accounts for about 15% of the relative wage growth of skilled workers, while technological changes account for about 35% [Feenstra, Hanson 1999]. In a study for the UK, Hijzen et al. [2005] stated that international outsourcing has a strong negative impact on the demand for an unskilled workforce. In a study for Germany, Geishecker and Görg [2004] prove that in the 1990s, offshoring contributed to a 1.5% decrease in real wages for workers in the three lowest skill categories while real wages for the most skilled workers increased 2.6% on that account. What is more, they show that only low-skilled workers in low-skilled sectors experience a decrease in real wages due to relocation of production. Low-skilled workers in sectors which require high skills did not suffer due to offshoring. This is similar in the case of highly skilled workers who benefit from offshoring but are employed in sectors which require high skills [Geishecker, Görg 2004].

3. Data and research methods

This study attempts to evaluate the impact of offshoring on the level of wages in the manufacturing industries of European Union member states. The research was based on data from the World Input-Output Database (WIOD), edition 2016 [Timmer et al. 2015; 2016]. It is composed of the Word Input-Output Tables (WIOT) and the Socio-Economics Accounts. WIOD 2016 differs from WIOD 2013 with the temporal and spatial range and the classification used. WIOD 2013 covers the years 1995-2011 while WIOD 2016 is devoted to 2000-2014. It must be emphasized that the structure of the WIOD 2016 edition is compliant with the latest sector and product classification, i.e. ISIC Rev. 4 (or equally NACE Rev. 2). Unfortunately, in comparison with the 2013 edition, its drawbacks include the absence of information about wages according to education and the number of hours worked by the employers. The statistical data used in this study constituted an unbalanced panel covering 19 industries in the 28 EU member states.

Empirical studies based on industry-level data use a number of model specifications which refer to various economic theories [Acemoglu, Autor 2011; Hummels et al. 2016; Wolszczak-Derlacz, Parteka 2018]. In the equations, next to the offshoring indicator, the level of wages is explained by a number of control variables, the most frequent of which include productivity and labour supply. In our case, wages in country i and industry j (W_{ij}) are a function of workforce supply (L_{ij}), intensity of capital measured by its relation to the workforce (K/L_{ij}) which determines

productivity and the offshoring intensity (OFF_{ij}). In order to study the impact of offshoring intensity on the changes in wages, the following equations were used:

$$\ln W_{ijt} = \alpha + \beta_1 \ln L_{ijt} + \beta_2 \ln K / L_{ijt} + \beta_3 \ln OFF_{ijt} + D_{ij} + D_{it} + D_{jt} + \varepsilon_{ijt}, \qquad (1)$$

$$\ln W_{ijt} = \alpha + \beta_1 \ln L_{ijt} + \beta_2 \ln K / L_{ijt} + \beta_3 \ln OFF_{ijt-1} + D_{ij} + D_{it} + D_{jt} + \varepsilon_{ijt}, \qquad (2)$$

where i denotes the country, j specifies the industry, t means time, α, β are parameters while ε_{ijt} is the random component. Wages W_{ijt} were calculated by dividing the labour compensation by the number of hours worked by employees. Supply of workforce L_{ijt} is the number of worked hours per employee, while K/L_{ijt} expresses the level of capital per the number of hours worked by the employees.

The offshoring measure OFF_{ij} expresses the share of imports of intermediate goods in the production of a given industry. The size of production is most often expressed in literature with the value-added (VA) or total output. In our case, the first one was used. In the specifications both the broad and the narrow offshoring were taken into account. The broad offshoring indicator OFF_B_{ij} reflects the share of total imports of intermediate goods from all industries and countries used in a given industry in a given country in relation to the value added. Meanwhile, the narrow offshoring indicator OFF_N_{ij} presents the share of imports of intermediate goods from all countries but only in the analysed industry relative to its added value. Due to the fact that, as pointed out in the literature, offshoring might have a delayed impact on the labour market, the model presented in equation 2 was estimated with a one-year delay in that variable.

Since the analysed data cover three dimensions (ijt), the panel models include three types of dummy variables responsible for the fixed effects which are country-industry dummies Dij, country-time dummies D_{it} and industry-time dummies D_{jt} (for more see: [Balazsi et al. 2015]). These variables account for the specific and temporal factors which are not explained in the model by the remaining explanatory variables.

Given the potential heterogeneity of separate industries, in the next step model 1 was transformed into the following form:

$$\ln W_{ijt} = \alpha + \beta_1 \ln L_{ijt} + \beta_2 \ln K / L_{ijt} + \beta_{3j} (D_j \cdot \ln OFF_{ijt}) + D_{ij} + D_{it} + D_{jt} + \varepsilon_{ijt}. \qquad (3)$$

Thus, instead of one coefficient β_3 which presents the impact of offshoring on the labour market in all the industries, we estimated j number of β_{3j} coefficients which reflect its potential impact on every industry separately.

Equations (1-3) were estimated with the use of a panel model with fixed effects. A generalized least squares method (GLS) which assumes cross-section heteroscedasticity was applied for their estimation. Thus, before the final estimation, the data were weighted according to the potential differentiation of variations between the ij data cross-sections. Moreover, in calculating the standard errors of parameters we used an estimator robust to heteroscedasticity and auto-correlation.

4. Study results

In light of the literature review, it turns out that the impact of offshoring on employment and wages can differ between countries. Hence, first, we estimated models for all European Union member states (EU 28), the so-called "old" EU member states (EU 15) and the countries which joined the EU after 2004 (EU 13). We analysed both the impact exerted by broad (OFF_B), as well as narrow offshoring (OFF_N) on wages. Given different model specifications used in the literature, the impact of offshoring was analysed without delays ($\ln OFF\_B_{ijt}$), as well as with a one-year delay ($\ln OFF\_B_{ijt-1}$) (formulas (1) and (2)). The results of the estimates of panel models with fixed effects based on the generalized least square method with heteroscedasticity and auto-correlation robust errors were included in Table 1. Due to the absence of any economic relevance, the constant term was omitted. The estimates were based on logarithmic data, thanks to which the presented coefficients are interpreted as partial elasticities.

Table 1. The impact of offshoring on wages in the European Union

Countries	EU 28			EU 15			EU 13		
Variable	Coeff.	Se	P-value	Coeff.	Se	P-value	Coeff.	Se	P-value
Broad offshoring, 1st equation									
$\ln L_{ijt}$	−0.289	0.055	0.000	−0.465	0.062	0.000	−0.201	0.075	0.008
$\ln K/L_{ijt}$	0.245	0.013	0.000	0.127	0.012	0.000	0.390	0.015	0.000
$\ln OFF\_B_{ijt}$	−0.019	0.007	0.004	−0.030	0.006	0.000	0.009	0.006	0.131
Broad offshoring, 2nd equation									
$\ln L_{ijt}$	−0.237	0.056	0.000	−0.494	0.062	0.000	−0.167	0.124	0.176
$\ln K/L_{ijt}$	0.291	0.014	0.000	0.136	0.012	0.000	0.396	0.024	0.000
$\ln OFF\_B_{ijt-1}$	−0.021	0.007	0.001	−0.031	0.006	0.000	0.005	0.014	0.697
Narrow offshoring, 1st equation									
$\ln L_{ijt}$	−0.291	0.055	0.000	−0.471	0.062	0.000	−0.198	0.075	0.008
$\ln K/L_{ijt}$	0.247	0.013	0.000	0.131	0.012	0.000	0.389	0.015	0.000
$\ln OFF\_N_{ijt}$	−0.010	0.004	0.005	−0.013	0.004	0.001	−0.009	0.003	0.004
Narrow offshoring, 2nd equation									
$\ln L_{ijt}$	−0.280	0.054	0.000	−0.501	0.063	0.000	−0.163	0.124	0.189
$\ln K/L_{ijt}$	0.253	0.013	0.000	0.139	0.012	0.000	0.397	0.024	0.000
$\ln OFF\_N_{ijt-1}$	−0.008	0.004	0.028	−0.012	0.004	0.001	−0.008	0.009	0.366

Source: own calculations based on data from the WIOD 2016.

The coefficients estimated for control variables ($\ln L_{ijt}$ and $\ln K/L_{ijt}$) have a reasonable interpretation and indicate a drop in the wages along with the increase of workforce supply and their growth along with the increase of capital to labour ratio.

However in the EU 15 countries, wages respond to changes in the labour supply stronger, while in the EU 13 countries they respond stronger to changes in the capital to labour ratio.

In light of the presented results the impact of offshoring on wages is rather small. There are also no major differences between the first specification, in which the offshoring variable is included without delays, and the second, in which a delayed impact of offshoring on wages was assumed. According to the results for the EU 28, it can be argued that a 1% growth in the broad offshoring indicator leads to a statistically significant drop in wages by about 0.02%. Meanwhile, a 1% increase in the narrow offshoring indicator leads to a drop in wages by about 0.008-0.010%.

The influence of offshoring on wages in the so-called "old" EU member states is also negative and statistically significant, a fact which not always can be said about the so-called "new" EU member states. In the case of the broad offshoring indicator, its 1% growth leads to a ca. 0.03% decrease in wages in the EU 15 member states. In the case of the EU 13, the impact proved to be positive but statistically insignificant. The impact of narrow offshoring on the level of wages in the EU 15 and EU 13 is negative and close to the levels reported for the EU 28.

The estimates presented in Table 1 are a certain generalization (averaging) and can differ significantly for separate countries and industries. Given that, in the next step, we estimated additional models according to formula 3. Next to $\ln L_{ijt}$ and $\ln K/L_{ijt}$, explanatory variables also included $j = 19$ broad offshoring indicators $D_j \cdot \ln OFF\_B_{ijt}$ in specific industries. The specification of the equation with offshoring time-lag was not studied because in the case of that variable, potential delays did not affect the results (Table 1). The models were estimated for the EU 28, EU 15 and EU 13. When it comes to the estimated coefficients next to variables $\ln L_{ijt}$ and $\ln K/L_{ijt}$, they did not differ from those presented in the first two lines of Table 1.

The estimated coefficients for j variables $\ln OFF\_B_{ijt}$ were included in Figure 1. They were ordered from the lowest to the highest according to estimates for the EU 28. Due to the increase in the number of explanatory variables, most of them were not statistically significant – only the coefficients above 0.05 and below −0.05 were significant ones. An unambiguously positive impact of broad offshoring on wages in all models was observed only for the chemical industry (C20). Meanwhile, the negative influence of offshoring on the wages in all models was visible for the following industries: pharmaceutical (C21), metal (C24), furniture (C31-C32), production of transport equipment (C30) and production of foodstuffs and beverages (C10-C12).

A large diversity among the estimates of the impact of offshoring on wages between the "old" and the "new" EU member states also can be noticed (Figure 1). Nearly half of the coefficients estimated for the EU 15 and EU 13 have opposite signs. That indicates that the results of studies presented in the literature might significantly depend on the spatial and industry scope of the given analysis. However, when analysing the study results presented in Figure 1 it is impossible to draw
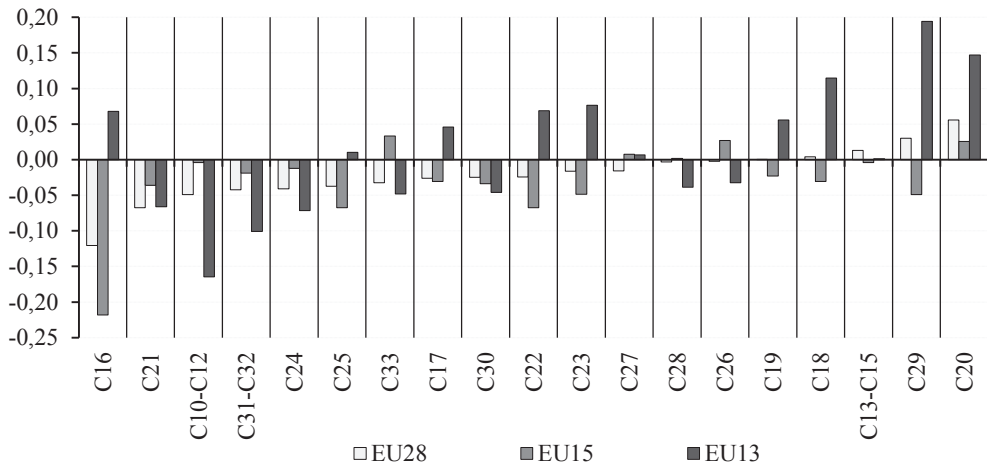
Fig. 1. Individual estimates for broad offshoring in 19 industries of the EU (β_{3j} in equation (3))

Source: own calculations based on data from the WIOD 2016.

unambiguous conclusions that in high technology industries, the impact of offshoring on wages is more positive or less negative than in other ones. Most likely, the way how offshoring impacts the level of wages depends on the internal characteristics of the industries in separate countries. The evaluation of the impact of offshoring on wages in specific industries is subject to a number of challenges. This is connected with that fact that particular industries are not homogeneous with respect to the size of the companies, their efficiency, the use of production factors and share in global markets (both with respect to exports as well as imports).

It also seems that in the "new" EU member countries there is still a great potential for increasing productivity and wages. In the case of those countries, the positive effects of offshoring such as possible exports' growth or boosted investments thanks to lower inflation pressure and low interest rates might offset any losses connected with the relocation of production to other countries. Consequently, in some industries in those countries offshoring contributes to increased wages. As shown in the results of studies by Egger [2005], Geishecker and Görg [2011], offshoring contributes to increased wages for highly skilled workers. To some extent, that might explain the differences in the impact of offshoring on wages in individual industries and countries.

5. Conclusion

The purpose of this study was to evaluate the impact of offshoring on wages in 19 manufacturing industries in the European Union member states. The study confirmed the negative impact of imports of intermediate goods on the level of wages

in the EU 28 and EU 15 countries. At the same time, the insignificant impact of offshoring on wages in the EU 13 countries was noted. This might confirm the differentiation of the impact depending on the level of economic development of the countries being studied. At the same time, it was noted that the impact of broad offshoring on wages is much stronger than the influence of narrow offshoring. The estimated coefficients indicate that the influence is much lower than that often presented in literature (e.g. [Parteka, Wolszczak-Derlacz 2015b; Kraciuk 2018]). This might be due to the application of different estimation methods, the use of dissimilar databases or a different temporal and spatial scope of the analysis.

The research indicates the potential discriminated impact of offshoring on wages in specific manufacturing industries in the EU. Thus, it might suggest that aggregated estimates of the impact of offshoring will be significantly conditioned by the scope of the industries and countries included in the analysis. It seems that the large aggregation of data used does not allow for a comprehensive investigation of this phenomenon in cross-industry terms. Therefore, further studies should be more concentrated on individual data from companies operating in different industries and looking for the causes of this state of affairs with the use of meta-analysis.

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