OFFSHORING AND ITS IMPACT ON V4 LABOR MARKET: THE URGENT NEED FOR UPSKILLING AND COMPETENCE ADAPTATION

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Abstract: Over the past 20 years, production processes have become more fragmented, with various stages offshored to different locations, impacting international and domestic labor markets. CEE countries have become key offshoring destinations due to their skilled labor and competitive costs. This study aims to assess how shifts in international production affect labor markets in the V4 countries. We estimate a system of employment-share equations derived from a translog cost function, incorporating offshoring and domestic outsourcing, using the SUR method. Our findings suggest that offshoring negatively impacts employment for less-skilled occupations, while its effect on high-skilled jobs is insignificant. Thus, the need for continuous training and upskilling of the workforce to maintain competitiveness is highlighted by our findings.

Keywords: Offshoring, V4 countries, Labor Market, Employment shares, Translog Cost Function, SUR method

1 Introduction

The changes that have occurred in the international economy over several decades have gradually expanded. Over the past 20 years, the internationalization of production has significantly deepened, leading to quantitative and qualitative transformations. With the decline in transportation and communication costs and rapid advancements in information technologies, trade in intermediate goods and components has become even more adaptable (Milberg and Winkler, 2013). This has also influenced the dynamics of offshoring by making it easier to fragment production processes and relocate various stages of production. These developments have both positive and negative impacts on the international labor market. Offshoring can result in domestic jobs being replaced and can create downward pressure on wages in the home country. Because low-skilled jobs are more easily moved to countries with a comparative advantage in low-skilled labor-intensive production, globalization may reduce the relative demand for low-skilled workers in developed economies, contributing to rising wage inequality. However, offshoring can also lower costs for domestic firms, improve their productivity, and ultimately lead to expanded production, employment, or higher wages. Central and Eastern European countries have emerged as important destinations for offshoring activities, thanks to their skilled labor force and competitive labor costs. A group of four Central European countries known as the V4 countries are deeply integrated into the German-Central European supply chain, predominantly driven by the automotive industry (Kersan-Skabic, and Barisic, 2023). In this study, we will examine how labor markets in the V4 countries are being influenced by changes in international production, with a particular focus on the impact of offshoring on specific types of professions.

The paper is structured into five sections. Following the introduction, Section 2 provides a review of the relevant empirical literature. Section 3 presents the methodology and data used in our analysis, specifically focusing on the model employed to examine the impact of offshoring on employment shares of different professional groups. In Section 4, we discuss the results and key findings of the study. Finally, the paper concludes with some summarizing remarks and potential implications.

2 Literature Review

Despite extensive debates on offshoring, evaluating its economic effects on domestic employment remains a challenge. Offshoring is often seen as a factor driving job losses and wage cuts in developed countries. However, the literature generally suggests that these concerns may be exaggerated. Arguments that offshoring leads to job losses in developed economies often ignore the fact that it also creates many jobs in developing countries. For developed countries, offshoring can provide opportunities to improve productivity (Dvořáček and Tyll, 2010).
Measuring offshoring usually focuses on trade in intermediate goods. Feenstra and Hanson (1996, 1999) differentiate between "narrow" and "broad" definitions of offshoring. The narrow definition includes imported intermediate goods from the same industry, while the broad definition includes imports from all industries. Hijzen and Swaim (2007) explain that both narrow and broad offshoring is measured as the share of imported intermediates compared to value added, distinguishing between imports within the same industry and across different industries. Foster-McGregor et al. (2013) studied the effects of offshoring on employment in both manufacturing and services, specifically looking at how it influences labor demand. Using input-output tables, they measured offshoring from narrow and broad perspectives.

The effects of offshoring on employment differ in the short and medium term. In the short term, the impact is often negative, but in the medium term, it can be positive. The benefits of offshoring often appear later and may not directly help the workers who lost their jobs. Additionally, the positive effects of offshoring are sometimes underestimated if new jobs are seen as lower quality. Offshoring can boost productivity, support exports, and increase income, all of which can positively affect employment. These findings are also supported by Agnese's (2012) study on Japan.

In many developed countries, job losses due to offshoring account for less than 10% of total employment, such as in France, Germany, and the United Kingdom. However, in countries like Austria and Slovakia, this share is higher. Today, offshoring is not just about reducing costs; it is also about accessing new ideas and skilled labor. In recent years, research, development, and innovation - traditionally kept domestic - have increasingly been moved abroad (Görg, 2011).

Bramucci et al. (2017) analyzed the impact of offshoring on employment in five European countries and found that the effects vary depending on the industry and the type of labor. Automation tends to affect routine tasks the most, but advances in technology, including algorithms and robotics, are increasing the risk of automation for non-routine tasks as well. Nevertheless, Ottaviano (2015) argues that non-routine tasks are less likely to be moved offshore. Hummels et al. (2014) found that jobs involving routine tasks are more likely to experience wage declines.

Autor and Dorn (2013) noted that alongside the automation of routine jobs in manufacturing, there has been a structural shift in the labor market. They observe a growing demand for manual jobs in the service sector that require greater flexibility and physical adaptability.

Frey and Osborne (2017) used estimates to assess how vulnerable different jobs are to automation. They focused on the U.S. labor market and analyzed how many jobs might be affected by future automation. According to their findings, up to 47% of U.S. jobs are at high risk of being fully automated within the next decade. Jobs in logistics, transportation, and administration are particularly at risk. Surprisingly, a significant portion of jobs in the service sector, which has seen the largest growth in the U.S. over the past decades (Autor and Dorn, 2013), are also highly susceptible to automation.

Frey and Osborne (2017) also suggest that as technology continues to advance, low-skilled workers will likely move into tasks that are less prone to automation, such as those requiring

creativity and social intelligence. Concerns about offshoring have extended to research and development activities, particularly the potential loss of high-skilled jobs. However, Rassenfosse and Thomson (2019) demonstrated that offshoring in this area can boost productivity in OECD countries.

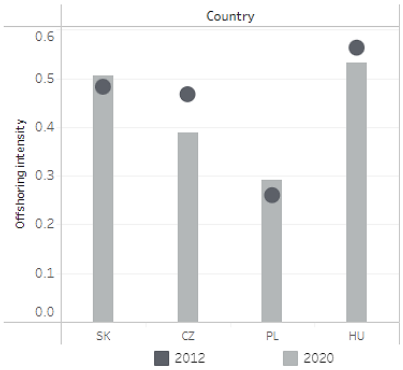

Figure 1 Offshoring intensity in V4 countries
Source: author´s elaboration based on data from the OECD TiVA database

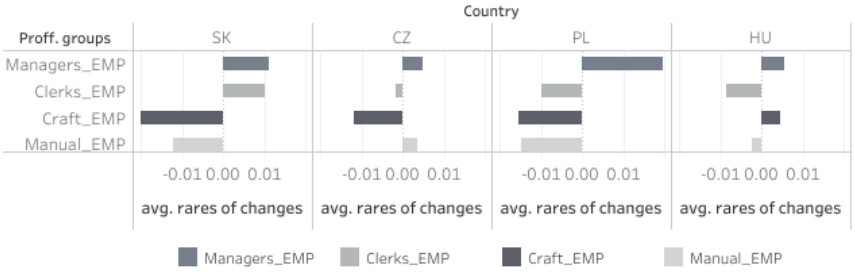

Figure 2 Employment shares dynamics by professional groups - annual average rates of change: 2012-2020
Source: author´s elaboration based on data from the ILOSTAT database

Castellani and Pieri (2013) also found that setting up research labs abroad increases productivity in the home country, enhancing competitiveness.

As mentioned above, in the next analysis we focus on the impact of offshoring on individual jobs in the V4 countries.

3 Methodology and Data

The analysis presented in this paper is based on data from the ILOSTAT database, which provides international labor statistics. The ILOSTAT database employs a categorization of employment by professional group using ISCO-08 classification as follows: (1) managers; (2) professionals; (3) technicians and associate professionals; (4) clerical support workers; (5) service and sales workers; (6) skilled agricultural, forestry and fishery workers; (7) craft and related trades workers; (8) Plant and machine operators, and assemblers, (9) elementary occupations. The professional categories have been consolidated into four main groups (Table 1), following the methodology used by Cirillo (2016) and Bramucci et al. (2017). Furthermore, the ILOSTAT database provides information on the average hourly earnings of employees in each occupation.

The OECD TiVA database was employed to construct variables measuring offshoring and domestic outsourcing. As mentioned in the previous section, according to Feenstra and Hanson's (1996, 1999) approach, offshoring can be categorized into two types: broad and narrow. Authors describe offshoring as the ratio of imported inputs to total intermediate inputs, focusing on the choice between sourcing inputs domestically or from abroad. In contrast, we define offshoring as the proportion of imported intermediate inputs relative to value-added as Hijzen and Swaim (2007), highlight the transfer of production activities that were previously performed within the domestic industry:

$$\mathrm{OFF} = \frac{\sum \mathrm{IIM_n}}{\mathrm{VA_n}}, \quad (1)$$

where IIM represents imported intermediate goods from all industries, n stands for the industry index, and VA refers to the value added.

Table 1 ISCO-08 professional groups

Professional group	ISO-08 classification
Managers	Managers
	Professionals
	Technicians and associate professionals;
Clerks	Clerical support workers
	Service and sales workers
Craft	Skilled agricultural, forestry and fishery workers
	Craft and related trades workers
Manual	Plant and machine operators, and assemblers
	Elementary occupations

Source: Cirillo (2016)

Domestic outsourcing is calculated using a similar formula:

$$\mathrm{DO} = \frac{\sum \mathrm{TIM_n} - \sum \mathrm{IIM_n}}{\mathrm{VA_n}}. \quad (2)$$

Here, $\boldsymbol{TIM}$ represents total intermediate inputs, $\boldsymbol{IIM}$ stands for imported intermediate inputs from the industry, $\boldsymbol{n}$ is the industry index, and $\boldsymbol{VA}$ refers to the value added.

Data on gross output and capital stock are sourced from the EUKLEMS & INTANPROD database. The analysis focuses on the period from 2012 to 2020, constrained by data availability. The analysis includes coverage of V4 countries, as these countries rank among the EU's most interconnected economies. Their labor markets are influenced by global economic trends, largely due to their strong dependence on international demand, particularly within the automotive sector.

Table 2 Descriptive statistics – average growth rates of variables (2012-2020)

Variable	Mean	Std. Dev.	Minimum	Maximum
$\Delta E_{managers}$	0,01025	0,01957	-0,01596	0,05887
ΔE_{clerks}	-0,00257	0,01716	-0,03865	0,03739
ΔE_{craft}	-0,01073	0,02128	-0,06408	0,03043
ΔE_{manual}	-0,00646	0,02779	-0,0796	0,04176
$\Delta W_{managers}$	0,03339	0,19384	-0,33183	0,55574
ΔW_{clerks}	0,05342	0,15182	-0,2919	0,4522
ΔW_{craft}	0,04845	0,1341	-0,24032	0,41936
ΔW_{manual}	0,04947	0,14303	-0,26613	0,41208
ΔW_{II}	0,0399	0,0394	-0,05409	0,10959
ΔOFF	-0,00163	0,04346	-0,076	0,07974
ΔDO	-0,00985	0,04747	-0,1638	0,0799
ΔY	0,04323	0,02679	-0,01301	0,0987
ΔK	0,03868	0,02578	-0,00694	0,11465

Source: author´s elaboration based on data from the ILOSTAT, OECD TiVA and EUKLEMS & INTANPROD databases

Figure 1 illustrates the intensity of offshoring across all industries in V4 countries for 2012 and 2020. Despite a slight decrease from 2012 to 2020, Hungary maintains the highest offshoring intensity (0.563). Similarly, Slovakia and the Czech Republic also show a reduction in offshoring intensity, with Slovakia's levels remaining relatively high (0.483). In contrast, Poland demonstrates the lowest offshoring intensity among the four countries (0.260). Despite the decline, offshoring levels remain significant. As expected, offshoring is particularly pronounced in smaller, open economies, such as the V4 countries.

Figure 2 reveals several key trends in employment shares across different professional groups in the V4 countries. There is a general increase in managerial positions, which reflects a growing demand for higher-level roles. Conversely, employment in clerical, craft, and manual labor positions has generally declined, indicating a contraction in these areas. This pattern suggests a shift towards more managerial roles and away from traditional labor-intensive positions across the region.

Table 2 provides descriptive statistics on the growth rates of the variables analyzed in this study. The data reveals a decline in the employment shares of clerks, craft, and manual workers over the examined period, with the craft sector experiencing the most significant reduction, decreasing by 1.07%. In contrast, the employment share of managers increased by 1.03%. Average hourly earnings show an overall rise across all professional groups, as well as in imported intermediate input. The largest increase in average hourly earnings is observed among clerical workers, with a 5.34% growth. However, the growth rates for offshoring and domestic outsourcing show a downward trend, declining by 0.163 and 0.985, respectively. On the other hand, the average growth rates for gross output and capital remain positive.

To examine how offshoring impacts employment in V4 countries, we draw on the body of research suggesting that offshoring may
contribute to skill upgrading (refer to Berman et al., 1994; Feenstra and Hanson, 1996). Foster-McGregor et al. (2013) proposed to adopt a more practical approach by estimating a system of cost-share equations derived from it. This approach implicitly assumes that the share of a specific variable factor (i.e. labor), in total variable costs can be modeled as a linear function of input prices and quasi-fixed factors (i.e. capital). The variables in the model are defined as follows:

- C - total variable costs
- w_i - wages for different skill levels and material prices for i = 1,…, M
- x_k - fixed input capital K and total output Y
- z - proxy for skill-biased technological change
- OFF - offshoring
- DO - domestic outsourcing.

The general form of the translog cost function, as proposed by Foster-McGregor et al. (2013), is expressed as:

$$\begin{aligned} \ln C = {} & \alpha_0 + \sum_{i=1}^{M} \alpha_i \ln w_i + \sum_{k=1}^{K} \beta_k \ln x_k + \sum_{y=1}^{Y} \gamma_y z_y + \\ & + \frac{1}{2}\sum_{i=1}^{M}\sum_{j=1}^{M} \gamma_{ij} \ln w_i \ln w_j + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} \delta_{kl} \ln x_k \ln x_l + \\ & + \frac{1}{2}\sum_{y=1}^{Y}\sum_{p=1}^{R} \gamma_{yp} z_y z_p + \frac{1}{2}\sum_{i=1}^{M}\sum_{k=1}^{K} \theta_{ik} \ln w_i \ln x_k + \\ & + \frac{1}{2}\sum_{i=1}^{M}\sum_{y=1}^{Y} \delta_{iy} \ln w_i z_y + \frac{1}{2}\sum_{k=1}^{K}\sum_{y=1}^{Y} \delta_{ky} \ln x_k z_y. \end{aligned} \quad (3)$$

The partial derivative of this cost function with respect to wages and material prices provides:

$$\frac{\delta \ln C}{\delta \ln w_i} = \left(\frac{\delta C}{\delta w_i}\right)\left(\frac{w_i}{C}\right). \quad (4)$$

Here, $\left(\frac{\delta C}{\delta w_i}\right)$ captures the demand for the input, resulting in the following expression for the cost share for $i = 1, \ldots, M$:

$$s_i = \alpha_i + \frac{1}{2}\sum_{j=1}^{M} \gamma_{ij} \ln w_j + \frac{1}{2}\sum_{k=1}^{K} \theta_{ik} \ln x_k + \frac{1}{2}\sum_{y=1}^{Y} \delta_{iy} \ln z_y. \quad (5)$$

To explore the changes in wage shares of labor skills and materials across different industries represented as $n = 1, \ldots, N$ the model considers the differences over time periods, leading to:

$$\triangle s_i = \alpha_0 + \sum_{j=1}^{M} \gamma_{ij} \triangle \ln w_j + \theta_K \triangle \ln K + \theta_Y \triangle \ln Y +$$

$+\delta_{OFF} \triangle \ln OFF + \delta_{DO} \triangle \ln DO + \varepsilon_i.$
(6)

In extending the conventional translog cost function, the model incorporates variables for offshoring and domestic outsourcing to capture modern economic dynamics better. We made one deviation from the model described above. Our dependent variable is expressed as shares of employment, rather than cost shares. This substitution is particularly relevant in economies with rigid labor markets, where shifts in employment structure are more pronounced than wage disparities, as highlighted by Hertveldt and Michel (2013). This adjustment also mitigates the endogeneity problem that arises when hourly wages appear on the right-hand side of the equations, potentially leading to inconsistent estimations. For each labor category, denoted by $EMPi$, the employment share equation is formulated as follows:

$$\triangle \text{EMP}_i = \alpha_0 + \sum_{j=1}^{M} \gamma_{ij} \ln w_j + \theta_K \triangle \ln K + \theta_Y \triangle \ln Y +$$
$$+\delta_{OFF} \triangle \ln OFF + \delta_{DO} \triangle \ln DO + \varepsilon_i.$$
(7)

Table 3 SUR results for the full sample of countries

	ln $E_{managers}$	ln E_{clerks}	ln E_{craft}	ln E_{manual}
ln $W_{managers}$	-0.09906	0.16219	0.07123	-0.04742
	(0.07044)	(0.06140)**	(0.06682)	(0.08309)
ln W_{clerks}	0.31816	-0.61466	-0.36787	0.37261
	(0.24143)	(0.21047)***	(0.22902)	(0.28481)
ln W_{craft}	0.34597	-0.30306	-0.26643	-0.16936
	(0.17385)*	(0.15155)*	(0.16491)	(0.20509)
ln W_{manual}	-0.43796	0.81576	0.30581	-0.25892
	(0.25889)	(0.22569)***	(0.24559)	(0.30541)
ln W_{II}	0.00134	0.33667	-0.57475	0.00221
	(0.26232)	(0.22868)	(0.24884)**	(0.30946)
ln OFF	0,10524	-0.00128	0.24676	-0.29930
	(0.11737)	(0.10232)	(0.11134)**	(0.13846)**
ln DO	-0.10836	-0.06222	-0.01778	0.14275
	(0.14165)	(0.12341)	(0.13429)	(0.16700)
ln Y	-0.32965	-0.05180	0.31026	0.66814
	(0.24899)	(0.21705)	(0.23619)	(0.29373)**
ln K	0.31791	-0.27690	0.45019	-0.80357
	(0.13786)**	(0.12018)	(0.13078)***	(0.16264)***
R-squared	0.67064	0.51960	0.76011	0.70701

The set of equations is estimated by SUR; standard errors are given in parentheses.
Reported significance levels *p <0.1, ** p < 0.05, *** p < 0.01.

The model's parameters are estimated using the Seemingly Unrelated Regressions (SUR) method, which allows for the simultaneous estimation of the entire system of equations, accounting for potential correlations between the equations.

4 Results and Discussion

A priori, offshoring should have a negative effect on the labor-intensity in an industry (the technology effect), but a positive effect on the level of output, due to the productivity gains from offshoring (the scale effect), so that the overall effect is ambiguous (Hijzen and Swaim, 2007).

The results in Table 3 display mixed set of coefficients. Starting with the own-wage coefficients, that are found to be negative and significant for clerks but insignificant for managers, craft and manual workers. The manager wage impacts positively upon the employment shares of clerks, while the craft wage impacts negatively upon the clerk's employment share.

The price of intermediates has a negative and significant impact only on the employment share of craft. The employment share of manual workers is decreasing in capital while increasing in managers and craft. The impact of output growth is significant and positive only upon the manual employment share.

The results suggest that offshoring has reduced demand only for manual workers. This would tend to suggest that only manual workers have been the most negatively affected by international offshoring. Interestingly, domestic outsourcing doesn't have any effect on any employment share.

The overall findings reveal that the employment share of clerks was primarily influenced by changes in wages. The employment share of craft workers was mainly affected by offshoring and capital (positively), and by the prices of intermediate inputs (negatively). In contrast, the employment shares of manual workers were negatively impacted by offshoring and capital, opposite to the effect on craft workers. Lastly, the employment share of managers was not negatively influenced by any of the observed factors.

Our findings indicate that offshoring and capital inputs influence labor across different skill levels in varying ways. As anticipated, lower-skilled jobs are disproportionately impacted by the globalization of production processes and technological advancements. This underscores the critical need for upskilling the less-educated workforce to remain competitive in the labor market. Furthermore, our results demonstrate a positive relationship between capital (both tangible and intangible) and higher-skilled labor, such as managerial roles. This highlights the importance of continuous training for the qualified workforce

to enhance their expertise in new technologies and adapt to the evolving business environment.

5 Conclusion

The deepening of international production networks over the past two decades – fueled by advances in transportation, communication, and information technologies – has led to significant changes in global labor markets. The rise in offshoring has transformed production processes, making them more fragmented and shifting various stages of production to different locations. The main objective of this study was to determine how shifts in international production affect labor markets in the V4 countries with a specific emphasis on the effects of offshoring on professional groups.

The descriptive evidence presented in Section 3 confirmed the presence of structural heterogeneity in employment dynamics across countries and in offshoring intensity. Although a slight decline in offshoring is observed in Slovakia and Poland when compared to the data from 2012, this could be attributed to the impact of the Coronavirus Pandemic. However, the evidence indicates that these countries still have a high level of offshoring intensity.

The econometric estimations, employing the SUR method and detailed in Section 4 (Table 3), indicate that offshoring has a negative effect on employment share for less-skilled (manual) occupations and a positive effect on craft workers. In contrast, the impact of offshoring on high-skilled occupations, such as managers or more routinized professions (clerks), is found to be statistically insignificant. The finding implies that although offshoring may enhance economic efficiency at the macro level, it presents challenges for segments of the labor market that are more likely to be affected by automation and the relocation of production tasks.

Additionally, our findings emphasize the urgent need to upskill the less-educated workforce to maintain their competitiveness in the labor market. They also reveal a strong positive correlation between capital and higher-skilled workers, particularly in managerial positions. This underscores the necessity of ongoing training for the qualified workforce to sharpen their expertise in emerging technologies and to adapt to the shifting dynamics of the business environment.

While numerous studies have focused on Western countries, it makes a significant addition to the existing empirical literature by shifting the focus to the V4 countries in Central and Eastern Europe. Additionally, our research offers a unique perspective by analyzing the effects of offshoring on distinct professional groups, rather than treating the labor market as a homogeneous entity. To effectively prepare for future shifts, policymakers must fully understand the present and anticipated labor market situation. For future research, it will be crucial to examine the relationship between offshoring in manufacturing and service industries and employment, as well as to apply this model to firm-level data.

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Primary Paper Section: A

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