The Impact of Vocational Education on the Value Added of Industrial and Service Sectors in the European Union and the United Kingdom

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ABSTRACT

This research aimed to analyze the impact of vocational high schools on value added in industrial and service production. In the study, the services value added and industry value added parameters from the World Bank for the EU and the UK for the period between 1970 and 2023 were taken as dependent variables. Results showed that effect of vocational school pupils per secondary school pupils were negative and significant ($B = -0.302$; $P < 0.05$) in the EU. In the UK, effect of vocational school pupils per secondary school pupils was insignificant, and educational expenditures had positive and significant contribution on service value added ($B = 2.579$; $P < 0.01$). In the EU, effect of vocational school pupils per secondary school pupils were positive and significant ($B = 0.372$; $P < 0.01$) on industry value added. In the UK, effects of vocational school pupils per secondary school pupils ($B = 0.061$; $P < 0.05$), educational expenditures ($B = -4.055$; $P < 0.01$) and unemployment ($B = 1.053$; $P < 0.01$) were significant on industry value added. The EU has traditional vocational training institutions that are unable to respond adequately to modern production and industrial facilities, or have not been modernized sufficiently. Vocational training has a significant impact on industrial and service added value, and the direction of this impact is variable.

Keywords: Vocational Education, Industrial Value Added, Service Value Added, The EU, The UK
JEL Classifications: I2, L6, H4

1. INTRODUCTION

Education is one of the most important facts in the lives of individuals and is an important indicator of the level of development and welfare in the social sense. For this reason, education is seen as a value that belongs not only to the societies it is in but also to the entire global public and is taxed as a global public good (Fongwa, 2021; Stiglitz, 2006). Education planning and expenditures are of vital importance in planning and evaluating the education that individuals receive and in their participation in the qualified workforce (Woodhall et al., 2004; Pandey, 2003). For

this reason, indicators regarding education plans and expenditures are followed in all international organizations, especially the World Bank, and are regularly shared with the whole world. Among these, vocational education plays an important role both in the selection of professions and the organization of professions, which also determine the social identities of individuals, and in the organization of the qualified workforce of the society (Hamid et al., 2024; Kovalchuk et al., 2022; Fuller, 2015; Mouzakitis, 2010).

Although different views have been put forward in studies conducted from past to present on vocational education regarding the impact

and contributions of this level of education within industrial and information societies, the common idea that emerges is that vocational high schools are of vital importance in terms of training intermediate staff, especially in the industrial and service sectors (Suhartanta et al., 2024; McGrath and Yamada, 2023; Mutohhari et al., 2021). Vocational education is provided in two basic ways. The first of these is vocational education provided in schools, at educational levels, and the second is in-service training provided within a profession. In-service training is generally a short-term type of education designed for a specific target audience and is mostly short-term. In continuing education levels, the aim is related to individuals getting to know a profession for the first time and choosing a profession. In this respect, vocational education provided through continuing education is also closely related to social structure and development (Jia and Huang, 2023; Chuan and Ibsen, 2022; Luhala and Yuting, 2021).

In vocational school education, which usually starts in middle school, children choose and direct their professions with high school education. At this stage, it is of great importance for individuals to develop their talents, choose the right professions, and direct themselves to the field they are most suitable for and most inclined to (Liu and Lai, 2023; Bunyamin et al., 2022; Kovalchuk et al., 2022). Today, in many countries, university education and vocational high school education are evaluated and planned as integrated. Although vocational high schools are associated with technical and industrial departments, the importance of vocational high schools is great in every sector, including the service sector (Li, 2024; Zhao et al., 2022; Silitonga, 2021).

One of the first concepts that come to mind in vocational education is the production added value, which is related to production, and this added value is valid for both industrial production and service production (Lund and Karlsen, 2020; Toner, 2010). Basically, added value refers to the improvement of the existing system and obtaining more effective results, including efficiency, and providing more added value and contribution in the production and presentation of an existing product or service process (Spöttl and Windelband, 2021; Timmermans et al., 2012; Armstrong and McVicar, 2000). Added value is not only studies targeting total efficiency in production or service delivery, but also aims to present new and innovative products or service delivery processes. In this respect, production added value is more related to knowledge, and knowledge is closely related to educational institutions. The most relevant educational levels that directly affect the production and service sectors in educational institutions are universities and vocational collages (Wheelahan and Moodie, 2024; Messmann and Mulder, 2011). While more advanced education and terminal staff are emphasized in universities, vocational high schools are educational levels that are more widespread in the general population and focus on more intermediate staff.

Although the effects of vocational high schools on production and added value have been theoretically presented in the context of knowledge (Wheelahan and Moodie, 2024; Spöttl and Windelband, 2021; Lund and Karlsen, 2020; Timmermans et al., 2012; Messmann and Mulder, 2011; Toner, 2010; Armstrong and McVicar, 2000), no study has been found that examines the relationship between vocational high schools and added value quantitatively. Therefore,

the aim of the research was to analyze the effects of vocational high schools on added value in industrial and service production. In this context, the effects of vocational high schools on production and service added value were examined temporally based on the comparative and relational scanning method, using the data of the EU and the UK, two regions that have become prominent in the world in terms of vocational fields in the last century.

2. METHODS

2.1. Research Model
The research was designed in a mixed model, including a descriptive screening model and a relational screening model. In a mixed model, the researcher can create a new research model by combining more than one research model. In the descriptive screening model, firstly, the vocational education data, primarily industrial and service added values, were analyzed for the EU and the UK over time. Then, using the relational screening model, the relationship between vocational education and service and industrial added values and their impact levels were analyzed.

2.2. Data Set
In the study, vocational education data and industry and service value added data from the World Bank Country Reports series for the EU and the UK were analyzed between 1970 and 2023. Due to the economic and demographic differences of the two regions, education expenditure and employment data were used as control variables. The codes and explanations of the parameters used in the study according to the World Bank reports were as follows:

2.2.1. Dependent variables
- SVA: Services, value added (% of GDP)
- IVA: Industry (including construction), value added (% of GDP).

2.2.2. Independent variables
- VOC: Secondary education, vocational pupils
- SEC: Secondary education, pupils
- VOCPERC: (VOC/SEC)*100.

2.2.3. Controlling variables
- EDEXP: Government expenditure on education, total (% of GDP)
- UNEMP: Unemployment, total (% of total labor force) (modeled ILO estimate).

In the World Bank data, data on vocational education are given at the secondary school level, and in order to prevent the effects of population differences between the two regions from being reflected in the research results, the percentage of vocational education among the entire population attending secondary school was taken. Since the oldest data in the data set is from 1970 and the most recent data is from 2023, the data between 1970 and 2023 were analyzed in the research.

2.3. Data Analysis
The change in the research data set parameters over time was given by trend analysis. Kolmogorov Smirnov test was

performed for the conformity of the data to the standard normal distribution. Independent sample t-test was performed for the differences between the regions of the parameters that fit the normal distribution, and Mann Whitney U tests were performed for the differences between the regions of the parameters that fit the normal distribution. In the relational screening analyzes, Spearman's rho correlation analysis was performed because the dependent variables did not fit the standard normal distribution. For the effect analysis, Generalized Linear Model (Logit) analysis was used due to linearization deviations (Yilmaz and Turanlı, 2023; Yilmaz and Turanlı, 2022). All analyzes were performed in SPSS 25.0 for Windows program, at a 95% confidence interval and a significance level of 0.05.

3. RESULTS

Vocational school pupils and secondary education pupils were significantly higher in the EU ($P < 0.05$). Vocational school pupil per total pupil at secondary education was also significantly higher in the EU ($P < 0.05$). Service value added was significantly higher in the UK, whereas industry value added was significantly higher in the EU ($P < 0.05$). Unemployment was significantly higher in the EU ($P < 0.05$). Education expenditures were similar in the EU and in the UK ($P > 0.05$) (Table 1).

In the EU, service value added was significantly correlated with vocational pupils ($r = -0.559$; $P < 0.01$), secondary school pupils ($r = -0.824$; $P < 0.01$) and unemployment ($r = -0.392$; $P < 0.05$). Industrial value added in the EU was significantly correlated with vocational pupils ($r = 0.525$; $P < 0.01$) and secondary school pupils ($r = 0.925$; $P < 0.01$) (Table 2).

In the UK, service value added was significantly correlated with vocational pupils ($r = 0.399$; $P < 0.05$), secondary school pupils ($r = 0.489$; $P < 0.01$), vocational school pupils per secondary school pupils ($r = 0.375$; $P < 0.05$) and education expenditures ($r = 0.771$;

$P < 0.01$). Industrial value added in the UK was significantly correlated with vocational pupils ($r = -0.658$; $P < 0.01$), secondary school pupils ($r = -0.790$; $P < 0.01$), vocational school pupils per secondary school pupils ($r = -0.609$; $P < 0.01$), education expenditures ($r = -0.813$; $P < 0.01$) and unemployment ($r = 0.646$; $P < 0.01$) (Table 2).

In the EU, effect of vocational school pupils per secondary school pupils were negative and significant ($B = -0,302$; $P < 0.05$). In the UK, effect of vocational school pupils per secondary school pupils was insignificant, and educational expenditures had positive and significant contribution on service value added ($B = 2.579$; $P < 0.01$) (Table 3).

In the EU, effect of vocational school pupils per secondary school pupils were positive and significant ($B = 0.372$; $P < 0.01$) on industry value added. In the UK, effects of vocational school pupils per secondary school pupils ($B = 0.061$; $P < 0.05$), educational expenditures ($B = -4.055$; $P < 0.01$) and unemployment ($B = 1.053$; $P < 0.01$) were significant on industry value added (Table 4).

4. DISCUSSION

This study aimed to quantitatively reveal the effects of vocational training on industrial and service added value through the EU and the UK data. In this context, the World Bank data were analyzed and the changes in the historical process and the relational screening results of the two regions were examined. According to the results obtained, vocational training had a positive effect on the service added value in both regions, while its effect on the industrial production added value for the EU was negative.

Although vocational education has been the subject of many studies from past to present, these studies mostly focus on the content, direction, impact and theoretical issues of vocational education (Wheelahan and Moodie, 2024; Spöttl and Windelband, 2021;

Table 1: Descriptive statistics of research parameters and difference analysis results

Parameters	Region				P-value
	The EU				
	Mean	SD	Min	Max	
VOC	12.222.222,22	1.401.167,53	10.200.000,00	15.000.000,00	0.000[a]
SEC	39.079.899,48	2.179.872,79	35.576.580,00	42.316.108,00	0.000[a]
VOCPERC	31.21	2.26	26.72	35.74	0.000[a]
SVA	63.61	1.91	59.14	65.94	0.000[a]
IVA	24.06	1.90	21.94	28.67	0.000[a]
EDEXP	4.90	0.24	4.54	5.52	0.314[b]
UNEMP	9.23	1.59	6.03	11.52	0.000[b]
	The UK				
	Mean	SD	Min	Max	
VOC	885.413,63	690.139,18	142.540,00	2.211.466,62	0.000[a]
SEC	5.289.277,56	632.344,02	4.149.067,00	6.556.991,50	0.000[a]
VOCPERC	15.77	10.60	3.18	36.05	0.000[a]
SVA	69.32	2.02	65.11	72.17	0.000[a]
IVA	20.86	3.22	16.73	27.42	0.000[a]
EDEXP	5.00	0.61	3.99	6.42	0.314[b]
UNEMP	6.26	1.89	3.73	10.35	0.000[b]

a. Mann Whitney U test, b. Imdependent Samples t-test, SD: Standard deviation, SVA: Services, value added, IVA: Industry value added, VOC: Secondary education, vocational pupils, SEC: Secondary education, pupils, VOCPERC: (VOC/SEC)*100, EDEXP: Government expenditure on education, UNEMP: Unemployment

Table 2: Spearman's rho correlation analysis between SVA and IVA with vocational education and controlling parameters

Parameters	SVA		IVA	
	r	P	r	P
The EU				
VOC	−0.559**	0.001	0.525**	0.002
SEC	−0.824**	0.000	0.925**	0.000
VOCPERC	−0.286	0.107	0.188	0.294
EDEXP	0.200	0.288	−0.034	0.860
UNEMP	−0.392*	0.024	0.344	0.050
The UK				
VOC	0.399*	0.021	−0.658**	0.000
SEC	0.489**	0.004	−0.790**	0.000
VOCPERC	0.375*	0.032	−0.609**	0.000
EDEXP	0.771**	0.000	−0.813**	0.000
UNEMP	−0.288	0.110	0.646**	0.000

*P<0.05, **P<0.01, SVA: Services, value added, IVA: Industry value added, VOC: Secondary education, vocational pupils, SEC: Secondary education, pupils, VOCPERC: (VOC/SEC)*100, EDEXP: Government expenditure on education, UNEMP: Unemployment

Table 3: Generalized Linear model (logit) for effect of vocational education on SVA for the EU and the UK

Parameter	B	Std. Error	95% wald confidence interval		Hypothesis test		
			Lower	Upper	Wald X^2	df	p
The EU							
(Intercept)	72.858	9.5659	54.109	91.606	58.010	1	0.000
VOCPERC	−0.302	0.1413	−0.579	−0.025	4.558	1	0.033
EDEXP	0.580	1.4671	−2.295	3.455	0.156	1	0.693
UNEMP	−0.309	0.2271	−0.754	0.136	1.853	1	0.173
(Scale)	2.562	0.6615	1.544	4.249			
The UK							
(Intercept)	57.027	2.4777	52.170	61.883	529.748	1	0.000
VOCPERC	0.009	0.0392	−0.067	0.086	0.058	1	0.809
EDEXP	2.579	0.4851	1.629	3.530	28.273	1	0.000
UNEMP	−0.104	0.1794	−0.455	0.248	0.333	1	0.564
(Scale)	1.640	0.4236	0.989	2.721			

SVA: Services, value added, IVA: Industry value added, VOC: Secondary education, vocational pupils, SEC: Secondary education, pupils, VOCPERC: (VOC/SEC)*100, EDEXP: Government expenditure on education, UNEMP: Unemployment

Table 4: Generalized Linear Model (Logit) for effect of vocational education on IVA for the EU and the UK

Parameter	B	Std. error	95% wald confidence interval		Hypothesis test		
			Lower	Upper	Wald X^2	df	P
The EU							
(Intercept)	8.234	9.6538	−10.688	27.155	0.727	1	0.394
VOCPERC	0.372	0.1426	0.093	0.652	6.812	1	0.009
EDEXP	0.396	1.4805	−2.505	3.298	0.072	1	0.789
UNEMP	0.263	0.2292	−0.187	0.712	1.313	1	0.252
(Scale)	2.609	0.6737	1.573	4.328			
The UK							
(Intercept)	32.743	1.8053	29.205	36.282	328.974	1	0.000
VOCPERC	0.061	0.0286	0.005	0.117	4.593	1	0.032
EDEXP	−4.055	0.3535	−4.748	−3.362	131.604	1	0.000
UNEMP	1.053	0.1307	0.797	1.309	64.855	1	0.000
(Scale)	0.871	0.2249	0.525	1.445			

SVA: Services, value added, IVA: Industry value added, VOC: Secondary education, vocational pupils, SEC: Secondary education, pupils, VOCPERC: (VOC/SEC)*100, EDEXP: Government expenditure on education, UNEMP: Unemployment

Lund and Karlsen, 2020; Timmermans et al., 2012; Messmann and Mulder, 2011; Toner, 2010; Armstrong and McVicar, 2000). In studies conducted on industrial production and service production, there are studies focusing especially on employment, labor force distribution and sectors and labor force planning (Coşkun et al, 2024; Wang and Wang, 2023; Mustafa et al., 2022). The basic result that emerged in these studies is that vocational education, especially vocational high schools, is directly related to sectors and is quite prominent in using human resources effectively. On the other hand, there were not enough studies on the contribution of vocational education to different sectors in terms of added value. The limited studies that existed focused more on the impact of vocational high schools on the added value within sectors in a theoretical context.

The EU and the UK are the leading regions of the industrial revolution in the world and are still effectively involved in world production today (Tavas et al., 2016). However, it is possible to say that there has been an increasing shift in the axis of production in recent years, especially in China. The EU and the UK are increasingly focusing on knowledge-intensive sectors and know-how-related studies, that is, on added value. According to the results obtained in this research, the percentage of vocational education and vocational education in secondary schools was significantly higher for the EU compared to the UK. Therefore, it is possible to say that the EU attaches significantly more importance to vocational education. The service sector added value was significantly higher for the UK, while the industrial added value was significantly higher for the EU. This situation alone is a candidate to explain why industry is more prominent for the EU and service is more prominent for the UK. However, further research and studies are needed for this.

According to the results obtained in the relational screening analysis, vocational education density made a negative and significant contribution to industrial production for the EU, while its effect was not significant for the UK. Although industrial production in the EU is higher compared to the UK, the effect of vocational high schools on the added value in industrial production is not positive. These data and findings reveal that it is necessary to modernize vocational education in vocational high schools urgently and comprehensively in order to give more place to modern productions for the EU and to provide added value to industrial production. In terms of service added value, as vocational education increased in both regions, more so for the EU, service added value also increased. This effect was greater for the EU. Especially in recent years, with the advances in capital and technology, service and finance sectors have become more prominent in terms of added value. While the UK and the EU are transitioning to an information society in the world, industrial production is concentrated in the Central Asian and Eastern Bloc countries of the world. In fact, when these findings are considered in this respect, they are candidates to explain the results of this axis shift in world production. In this respect, further studies with more variables and cross-comparisons are needed.

4.1. Limitations of the Study

Although the World Bank provides very valuable and comprehensive data, allowing us to examine and analyze vocational education worldwide, vocational education is a concept that changes and develops every day. In the research, vocational education is generally taken as a ratio of quantity and student numbers. However, there is not enough data on the quality and content of the education provided. This is one of the most important limitations of the research.

Another important limitation of the research is that there is no sufficient macro-level study in the literature on vocational education and its outcomes, and therefore, there is no study to compare the research results at a sufficient level. Although there are many studies related to the impact of vocational education on both industrial production and the service sector, these are either theoretical or regional studies. However, no macro-level study was found that compared the EU and the UK in time series.

4.2. Contributions of the Research to the Literature and the Field

The most important contribution of the research to the literature is that it is among the pioneering studies in the field and that it reveals the effect of vocational education on the added value of industry and service quantitatively and at a macro level. In this respect, the research can reveal the importance of vocational high schools, which has been put forward partially or qualitatively, in a quantitative and evidence-based way. In addition, the research is considered both as a source and a guide for further studies.

The most important contribution of the research to the field is that it emphasizes the importance of vocational education in public administration and social education by numerically revealing the value-added effect of vocational education on industry and service. In this respect, the EU and the UK examples constitute an effective field of study and it is useful to direct public education expenditures and planning accordingly.

5. CONCLUSION

The results obtained in the research directly reveal the effect of vocational education on the added value in the service sector for the EU and the UK. In addition, the results of the research also reveal that vocational education has negative results in the added value of industrial production for the EU. In other words, the EU has classical vocational education institutions from the past that cannot respond sufficiently to modern production and industrial facilities or they have not been able to modernize them sufficiently. In this respect, according to the results obtained in the research, vocational education has a significant effect on the industrial and service added value and the direction of this effect is variable. Therefore, this effect should be regularly monitored and managed.

In light of the results obtained in the research, the reasons for this difference between industrial production and service added value, the role of the change in the balance of production in global value added and vocational education issues can be analyzed in further research. Especially in the increasingly shifting axis of industrial production, the current situation in the Middle East and Asian countries can be analyzed and further studies can be conducted on how vocational education can be used more effectively and efficiently.

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