UNDERSTANDING JOB VACANCIES IN THE BUCHAREST-ILFOV REGION BETWEEN 2020 AND 2024

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Abstract
The COVID-19 pandemic had a significant impact upon the labour markets around the globe. The EU countries were no exception. Throught the pandemic, Romania was characterised by low unemployement levels and low job vacancy rates. However, the level of job vacancy rate at regional level is determined by the developemnt level of the region. Bucharest-Ilfov is the region with highest resilience with regard to the labour market. Therefore, the aim of this paper is to analyse the Job Vacancy Rate in the Bucharest-Ilfov Region by activity of national economy at level CANE Rev. 2. More specifically, the presence of seasonality will be explored and seasonal adjustme will be performed where necessary. Using JDEMETRA 3.3.0. Particularly, the following tests are used to determine which series present seasonality: Auto-correlations at seasonal lags, Friedman, Kruskal-Wallis, Periodogram, Seasonal dummies. Next, the automatic procedure in TRAMO-SEATS and X13 packages is used in order to persome seasonal adjustment. The following two series present seasonality: Job Vacancy Rate in the Bucharest-Ilfov Region in Education; Job Vacancy Rate in the Bucharest-Ilfov Region in Financial and Insurance Activities. The automatic procedure in X13 comptuted better results in both series. For the Job Vacancy Rate in the Bucharest-Ilfov Region in Education a special correction for outliers was necessary.

Keywords: *seasonal adjustment, JDemetra+, job vacancy rate, labour market*

JEL Classification: *C01, E60, J01*

1. Introduction

In the beginning of the COVID-19 pandemic, it was very difficult to predict its impact on the Romanian economy [1], [3]. As the pandemic unfolded, many professionals in several economic areas in Romania were certain that the pandemic will be followed by a recession, as the measures taken by the government to mitigate its impact are inssuficient [15].

The impact of the COVID-19 pandemic and the sanitary measures was severe upon many aspects of the Romanian economy. First, small and medium enterprises were more severly affected by decrease in the domestic demand and the complex supply chains than large enterprises, as their resilience was already fragile even before the pandemic [14]. The impact of the contraction of supply and demand was mild in the case of companies integrated in the value chain of more advanced European countries, such as Germany and France [13]. Second, the labor market was severely affected in respect to the short-term employment [8]. Third, teleworking changed the labor market as it was adopted on a large scale, proving to be a good strategy to stay productive [17]. In this context, the IT companies became a key pillar of the economic resilience of Romania [9]. Yet, not all activities are suitable for commuting to teleworking.

In the complex economic context of Romania, the Bucharest-Ilfov region was appreciated to be one of the most resilient economic ecosystems in Europe during the COVID-19 pandemic, due to the reliance on the IT activities and scientific and professional services [21]. In order to better understand the economic ecosystem in Bucharest during the COVID-19 pandemic and its aftermath, this paper aims to analyse the Job Vacancy Rate in the Bucharest-Ilfov Region by activity of national economy at level CANE Rev. 2. More specifically, the seasonality will be explored.

2. Literature review

The COVID-19 pandemic produced great disturbances on labour markets across the world. For example, in Japan, a sharpt decline in the job vacancies occurred, due to the fact that most large companies froze hiring [11]. Also, the number of job vacancies is negatively correlated with voluntary social distancing [11]. Similarly, in Norway, the number of job vacancies declined severly on the onset of the pandemic and stabilized during the summer of 2020, thus suggesting the presence of seasonality [12]. Also, this contraction of the labour demand affected all geographical areas and economic activities [12]. In the United States of America, declines in job postings could be observed during the first year of the pandemic, doubled by increases in insurance claims [10]. Next, the governemnt's response through the Federal Unemployement Pandemic Assisstance program led to a decline in the job applications, thus increasing job vacancies [18].

In all OECD countries, the increase in the job vacancy rates during the COVID-19 pandemic is strongly correalated with the increase of quit rates [6]. In turn, the quit rate is determined by cyclical factors, such as job mobility and structural factors such as the fact that people stopped accepting low paying or hazardous jobs [6].

In the European Union, during the COVID-19 pandemic, the labour demand was negatively affected in all sectors, but especially in those where remote work is not possible [16]. Also, the European Countries can be classified in three groups based on the relationship between the unemployment rate and the job vacancy rate: tight labour markets, characterized by low unemployment rates and high vacancy rates (Austria, Belgium, Cyprus, the Czech Republic, the Netherlands); slack labour markets, characterized by high unemployement rates and low vacancy rates (Greece, Spain, Italy); balanced markets with low vacancy rates and low unemployment rates such as Romania, Poland and Bulgaria [16].

In Romania, the main drivers of labour market shortages during the COVID-19 pandemic were: the lack of skills and qualifications, the lack of mobility of the workforce and the demographic trends [23]. Also, at regional level, the number of job vacancies is determined by the development level, the amount of investments and the average wage [5]. Thus, it is not surprising that most of the job offers on the online recruitment platforms were concentrated in major cities: Bucharest, Timisoara and Cluj-Napoca [4]. Also, the Bucharest-Ilfov region registered the lowest unemployment rate and the highest job vacancy rate among all regions [22].

3. Methodology

For the purpose of this paper data on the Job Vacancy Rate in the Bucharest-Ilfov Region by activity of national economy at level CANE Rev. 2 was retrieved from the Tempo Online database provided by the National Institute of Statistics Romania on January 6, 2026. The data covers 20 quarters from 2020 to 2024, which is the standard length for the seasonal adjustment of quarterly time series [19].

In order to perform the seasonal adjustment, the automatic procedure available was used for both TRAMO-SEATS (the RSAfull specification) and X13 (the RSA5c specification) as decribed in previous studies [2]. However, as in JDemetra 3.3.0 there is no option for working days adjustment [20], a trading days adjustment was performed. In this respect, the Wald test was used in order to choose from different trading days options, as it is more robust in the presence of outliers than the F test [7].

4. Results

Table 1 presents the results of the seasonality tests the Job Vacancy Rate in the Bucharest-Ilfov Region by activity of national economy at level CANE Rev. 2. Only the rate for the Financial and Insurance Activities and Education present seasonality.

Table 1 Results of the seasonality tests for the Job Vacancy Rate in the Bucharest-Ilfov Region by activity of national economy at level CANE Rev. 2; source: designed by the author

	Auto-correlations at seasonal lags	**Friedman**	**Kruskal-Wallis**	**Periodogram**	**Seasonal dummies**
Agriculture, Forestry and Fishing	2,2447	1,5000	3,9316	0,8056	1,0168
Mining and Quarrying	0,5759	5,6154	6,6825	2,1579	1,5832
Manufacturing	1,5006	5,4000	3,2467	2,3749	1,5341
Electricity, Gas, Steam and Air Conditioning Supply	0,0000	2,1000	1,4511	1,3176	0,5660
Water Supply; Sewerage, Waste Management and Remediation Activities	3,4437	5,1000	8,2989	3,9789	3,9999
Construction	0,3567	6,9000	7,6737	1,7638	2,0637
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	0,0215	3,9000	2,1489	2,0255	1,1561
Transportation and Storage	0,0693	3,0000	1,6895	1,3710	1,6230
Accommodation and Food Service Activities	0,7301	5,1000	5,2942	2,0409	2,5096
Information and Communication	1,9425	3,6000	4,5868	1,5803	2,8742
Financial and Insurance Activities	19,2083*	8,7000	11,8646*	15,7566*	19,5247*
Real Estate Activities	1,2521	8,1000	5,6353	3,8010	4,5417
Professional, Scientific and Technical Activities	0,0000	5,7000	3,9047	0,7871	0,8709
Administrative and Support Service Activities	1,6266	5,4000	8,2500	2,5352	4,0454
Public Administration and Defence; Compulsory Social Security	3,3424	5,0000	7,6078	2,3818	3,4971
Education	29,7103*	10,8000	15,5057*	181,8780*	262,3316*
Human Health and Social Work Activities	0,0012	2,7000	1,7747	0,8620	0,9639
Arts, Entertainment and Recreation	0,0000	1,2000	3,1847	0,8559	0,9818
Other Service Activities	1,4792	3,6000	4,5079	2,2319	2,2577

*Sig. 1%

Table 2 presents the results for the seasonal adjustment using the automatic procedure on Job Vacancy Rate in the Bucharest-Ilfov Region in Financial and Insurance Activities. The X13-RSA5c specification provided better results than the TRAMO-SEATS RSA full specification.

Table 2 Seasonal adjustment using the automatic procedure on Job Vacancy Rate in the Bucharest-Ilfov Region in Financial and Insurance Activities; source: designed by the author

	X13 – RSA 5c custom specifcation	**Tramo-Seats – RSA full custom specifcation**
Summary	Good	Good
Series transformation	Series has been log-transformed	Series has been log-transformed
Trading day eff ects	None	None
Easter effects	None	None
Basic checks	definition: Good (0,000)	definition: Good (0,000)

	annual totals: Uncertain (0,026)	annual totals: Uncertain (0,021)
Regarima residuals	normality: Good (0,484) independence: Good (0,441) spectral seas peaks: Good (0,184)	normality: Good (0,741) independence: Uncertain spectral seas peaks: Good (0,687)
Outliers	number of outliers: Good (0,000)	number of outliers: Good (0,000)
Residual seasonality tests	Qs test on SA: Good (0,749) F-Test on SA (seasonal dummies): Good (0,758) Qs test on I: Good (0,570) F-Test on I (seasonal dummies): Good (0,515)	Qs test on SA: Good (0,937) F-Test on SA (seasonal dummies): Good (0,899) Qs test on I: Good (0,830) F-Test on I (seasonal dummies): Good (0,999)

Table 3 presents the results for the seasonal adjustment using the automatic procedure on Job Vacancy Rate in the Bucharest-Ilfov Region in Education. As in the case of the previous series, the X13-RSA5c specification leads to better results than the TRAMO-SEATS RSA full specification. However, the uncertain results in the Regarima residulas normality tests suggest the presence of large outliers, that need a pre-correction, in the the pre-processing phase of the seasonal adjustment.

Table 3 Seasonal adjustment using the automatic procedure on Job Vacancy Rate in the Bucharest-Ilfov Region in Education; source: designed by the author

	X13 – RSA 5c custom specifcation	**Tramo-Seats – RSA full custom specifcation**
Summary	Good	Good
Series transformation	Series has been log-transformed	Series has been log-transformed
Trading day eff ects	None	None
Easter eff ects	None	None
Basic checks	definition: Good (0,000) annual totals: Uncertain (0,048)	definition: Good (0,000) annual totals: Bad (0,059)
Regarima residuals	normality: Uncertain (0,081) independence: Uncertain spectral seas peaks: Good (0,351)	normality: Good (0,592) independence: Uncertain spectral seas peaks: Good (0,507)
Outliers	number of outliers: Good (0,000)	number of outliers: Good (0,000)
Residual seasonality tests	Qs test on SA: Good (0,927) F-Test on SA (seasonal dummies): Good (0,798) Qs test on I: Good (0,895) F-Test on I (seasonal dummies): Good (0,622)	Qs test on SA: Good (0,881) F-Test on SA (seasonal dummies): Good (0,999) Qs test on I: Good (0,849) F-Test on I (seasonal dummies): Good (0,997)

As the standard procedure suggest the presence of very large outliers in the Job Vacancy Rate in the Bucharest-Ilfov Region in Education, the specific procedure for correcting such values available in JDemetra+ 3.3.0 is applied and the results are displayed in table 4. Although both TRAMO-SEATS and X13 display overall good results, the basic checks are better for the latter. Concerning the independence of the Regarima residuals, uncertain results were obtained using both procedures. Ideally, the model should be improved until there are no uncertainties, yet, only the bad results should be promptly addressed (https://jdemetradocumentation.github.io/JDemetra-documentation/pages/reference-manual/residuals.html#:~:text=Statistics,need%20to%20improve%20the%20model accessed 6 January 2026).

Table 4 Seasonal adjustment using the automatic procedure with large outlier correction on Job Vacancy Rate in the Bucharest-Ilfov Region in Education; source: designed by the author

	X13 – RSA 5c custom specifcation	**Tramo-Seats – RSA full custom specifcation**

Summary	Good	Good
Series transformation	None	Series has been log-transformed
Trading day eff ects	None	None
Easter eff ects	None	None
Basic checks	definition: Good (0,000) annual totals: Good (0,004)	definition: Good (0,000) annual totals: Bad (0,059)
Regarima residuals	normality: Good (0,133) independence: Uncertain spectral seas peaks: Good (0,351)	normality: Good (0,592) independence: Uncertain spectral seas peaks: Good (0,507)
Outliers	number of outliers: Good (0,000)	number of outliers: Good (0,000)
Residual seasonality tests	Qs test on SA: Good (1,000) F-Test on SA (seasonal dummies): Good (1,000) Qs test on I: Good (1,000) F-Test on I (seasonal dummies): Good (0,705)	Qs test on SA: Good (0,881) F-Test on SA (seasonal dummies): Good (0,999) Qs test on I: Good (0,849) F-Test on I (seasonal dummies): Good (0,997)

5. Conclusions

The COVID-19 pandemic had disturbing effects upon the labour makerts across the European Union, Romania being no exception. The Bucharest-Ilfov region is the most developed region in the country, being a regional pole for labour demand [22]. Thus, the scope of the present study was to analyze the characteristics of job vacancy rate in this region. In this respect, JDemetra+ 3.0.0 was used.

The results showed that, the only activities where the job vacancy rate presents seasonality are education and finance and insurance. When performing seasonal adjustment, X13 proved to lead to better results.

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