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THE EFFECT OF MACROECONOMIC FACTORS ON ONLINE LABOR PLATFORM USERS: THE CASE OF TURKEY

Asst. Prof. Murat Fatih TUNA (Ph.D.) *

Assoc. Prof. Hacı Ahmet KARADAŞ (Ph.D.) *

ABSTRACT

This study examines the relationship between the online labour force and some real economic factors. Since the online labour index is one of the main determinants of the GIG economy (the economy consist of online workers and freelancers), this study also reveals which macroeconomic variables the GIG economy is based on. The aim of the study is to determine the effect of some real economic factors (unemployment, economic growth, inflation) on the count of online platform users. As a result of the econometric analysis conducted with Turkey's data set for the period of June 2017 - January 2021, it has been determined that real economic factors have a statistically significant effect on the count of online platform users. According to the results of the analysis, the increase in unemployment rate and economic growth rate will cause an increase in the count of online platform users, while increase in inflation rate cause an opposite effect.

Keywords: *GIG Economy, Online Labour Platforms, Unemployment, Growth, Inflation.*

Jel Codes: *E24, J01, J24.*

1. INTRODUCTION

The increasing number of the digital economy platforms in today's economy causes the interest in the physical labour market to shift towards the digital workforce. In other words, labour markets are experiencing a kind of digital transformation (Kässi and Lehdonvirta, 2016: 1). As a matter of fact, the opportunity to work remotely, which is seen as a way to both prevent the spread of the Covid-19 outbreak and reduce the costs of companies during the pandemic process, has been perceived as an attraction by freelancers who want to generate income in an individual sense. The digital workforce, which provides businesses with labour flexibility levels that cannot be achieved with standard paid employment forms (Fleming, Rhodes, and Yu., 2019: 489), eliminates the relative importance of physical businesses connected to place. In fact, according to Braesemann, Lehdonvirta, and Kässi (2022: 35), online workforce platforms are seen as a way to close the urban-rural divide, which means the shift of white-

* Sivas Cumhuriyet University, Faculty of Economics and Administrative Sciences, Department of Management Information Systems, Sivas / Türkiye. E-mail: mftuna@cumhuriyet.edu.tr
* Sivas Cumhuriyet University, Faculty of Economics and Administrative Sciences, Department of Economics, Sivas/ Türkiye. E-mail: hkaradas@cumhuriyet.edu.tr

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collar labour produced in plazas and physical environments to digital media. Thus, the distance of rural life from labour markets has come to an end with digital transformation. According to Kalleberg and Dunn (2016: 12), employees living in rural areas can bid on works and large projects carried out in central settlements thanks to these platforms.

Information for physical workers is meticulously collected by research companies on a relatively small sample basis. However, traditional data collection methods are insufficient to measure the dynamics of the GIG (concert) economy created by self-employed online freelancers (Kässi and Lehdonvirta, 2018: 243). According to Woodcock and Graham (2019: 37), the GIG economy is a labour market that stands out with the prevalence of self-employment and short-term contracts, unlike permanent jobs. Corujo (2017: 295) explained the reason why this market is called the GIG economy by promising minimum social security and sectoral permanence. This assumption emphasizes the fact that the workforce in the GIG economy is mobile, and that employees act on project and activity basis, far from permanence.

Employees in the traditional workforce profile prefer to work for a long time in the company they are in and often see changing jobs as a kind of disorder and disturbing situation (ILO and UN, 2021: 2). As a matter of fact, job change requires a new working environment and a process of getting used to the organizational climate, which is one of the most important reasons why individuals prioritize job security and show commitment to their organizations (Hur and Perry, 2019: 6). From this point of view, employees who adopt corporate life and job security avoid leaving their comfort zone, and which blunts their work-related abilities. In contrast, the GIG economy requires an employee profile that does not pay close attention to job security. These employees, who do not feel Maslow's (1943: 382) need for security intensely, have to keep themselves professionally fit. As a matter of fact, the employee structure of the GIG economy consists of task-oriented and fast service-producing knowledge workers (Gandini, 2019: 2). This employee profile adopts continuous self-development rather than self-assurance, working on the basis of new projects, and a white-collar industry with high turnover (Rodriguez, Sarraju and Turakhia, 2022: 125). On the other hand, the idea of being a part of this economy and having high-level knowledge forced companies to become dynamic organizations with a more micro-task-oriented and flexible organizational structure. As a matter of fact, the old hierarchical organizational structures are not suitable for being a part of the GIG economy (Paul and Tankus, 2019: 45).

According to Kässi and Lehdonvirta (2016), online business uses supply mechanism, demand mechanism and spot market structure together to bring employees and employers together. Among these mechanisms, the supply mechanism allows the online workforce to publish the service they promise to produce in return for a certain fee, via the digital platform. After the offer is published, employers can bid to rent the time of their employees and the parties can again agree on the platform (Aleksynska, Bastrakova and Kharchenko, 2019: 50). On the other hand, the demand mechanism allows employers to share the qualifications they are looking for and the details of the micro-task units that must be

fulfilled within the platform. Finally, the markets where the online business deals are made are in the spot structure. In other words, online labour platforms are markets where fixed prices are applied for the requested task and there is no bargaining opportunity (Kässi and Lehdonvirta, 2016: 3).

Unemployment is an important problem that all developing and developed economies of the world are constantly struggling with. According to Bertani, Raberto, and Teglio (2020), digital investments and platforms have a reducing effect on unemployment in the long run. Moreover, these platforms have provided an opportunity for employee profiles that are remote but have the potential to produce quality services to participate in the economy (Braesemann et al., 2022: 36). In support of this, Malik, Heeks, Masiero, and Nicholson (2021) emphasized that the platforms that enable these profiles to participate in the economy contribute to the decreasing of unemployment and sustainable development. The 65% increase in the online workforce in the last four years (Duch-Brown, Gomez-Herrera, Mueller-Langer, and Tolan, 2022) is another phenomenon that strengthens the acceptability of the above statement.

Increasing employment opportunities with the help of digital workforce platforms have reduced output costs, allowing business revenues to increase, thus increasing the efficiency of their processes (Benson, Nat, Agozie, Edu, and Osemeahon, 2022: 59). Thanks to the qualified workforce provided by these platforms, businesses were able to focus more easily on business units and dynamic processes. Accordingly, the need for new business units and agility has provided the opportunity for new part-time and full-time employee qualifications to emerge. These platforms, in particular, have contributed to meeting the needs of developing countries by facilitating them to reach qualified employees that they had difficulty in reaching. With the effect of digital transformation on the increase of platforms, these employees have made a significant contribution to the GDP growth of countries (Tushev, Ebrahimi, and Mahmoud, 2022: 1). In addition, these platforms have also allowed the physically disabled or home-based workforce to join the economy (Rani and Furrer, 2021: 1).

The transformation of the world and its economies and the emerging new sub-economies have brought many radical changes such as technology change, new monetary systems, mobility, data revolution and climate change (Matolcsy, Nagy, Palotai, and Virág, 2020: 6). These changes necessitated the transformation of the structure of macroeconomic variables such as inflation and unemployment. While the rate of self-employment increased with the GIG economy, one of the mentioned sub-economies, the bargaining power of the workforce decreased, and there was an increase in the unemployment rate accordingly (Duca, 2018: 10). The undeniable share of digital workforce platforms and the created employment in the world economy increases the relative importance of studies on online employment.

The points mentioned above indicate that the online workforce, as a new employment method, will contribute greatly to the improvement of people's welfare and the development of economies. From this point of view, it is understood that it is of great importance to investigate the effect of economic

factors on the online workforce. Therefore, in this study, it is aimed to examine the effect of some macroeconomic variables (unemployment rate, economic growth rate, and CPI) on the online workforce.

2. THEORETICAL FRAMEWORK

In this part of the study, the online labour index, which is the main indicator of the GIG economy, and the macroeconomic factors affecting it will be examined.

2.1. The Online Labour Index (OLI)

The rise of the GIG economy accompanied by digital transformation has led to the shift of labour, which is the main dynamic in this economy, to digital platforms. With this shift, it has become imperative to adapt employee-based indices calculated for the traditional real economy to employees operating in the digital world. As a matter of fact, the workforce of the digital world has different dynamics from the traditional workforce in terms of process and performance outputs. At this point, OLI, created by Kässi and Lehdonvirta (2016), is the first index representing the online workforce in the world. The fact that a lot of information of self-employed online users is kept by digital platforms makes these platforms a reliable data source. In addition, these platforms provide an opportunity to instantly monitor the changes in the qualifications and current duties of the employees operating in them (Zheng, Zhang, and Zhu, 2021: 29). This is another indicator of the fact that the data provided from the platforms is constantly updated and has a highly representative structure.

OLI is created by scraping data on all projects and tasks in selected sample online workforce platforms (Ojanpera, 2016). Upwork, Freelancer, Guru, Peopleperhour and Mturk platforms, which account for approximately 70% of the global online workforce market, were used in the creation of the OLI (Jesnes and Braesemann, 2019: 1). OLI which is published in daily includes employee counts in five different sectors. Employees included in the index operate in five different occupational groups: (i) clerical and data entry, (ii) creativity and multimedia, (iii) sales and marketing support, (iv) software development and technology, and (v) writing and translation (Kässi and Lehdonvirta, 2018: 244). Studies on OLI entered the literature as of 2016, when the index was first published.

Examining the studies conducted with OLI, one can see that the studies generally evaluate OLI from an axiomatic perspective and show a preliminary approach towards the analysis-based studies to be conducted. However, no research has been found that examines the relationship of OLI with different macroeconomic variables with an econometric analysis. The most comprehensive study in the literature is the project called "The Future of Work in the Nordic Countries: Opportunities and Challenges for the Nordic Working Life Models", which includes more than 30 researchers from Denmark, Finland, Iceland, Norway, and Sweden (TemaNord, 2021). Within the scope of this project, research was carried out on the GIG economy of the Nordic countries, online freelancers, and OLI. In a conference held as a precursor to this project, Jesnes and Braesemann (2019: 1) presented the online workforce platforms in

the Nordic countries, the demand for these platforms, and structure of the labour market where demand occurs in detail.

In the literature, there are also studies conducted independently of the projects of the Nordic countries. In one of these studies, Stephany, Kässi, Rani, and Lehdonvirta, (2021: 1) cited OLI as the way to measure the world's remote freelance platform users. Duch-Brown et al. (2022) used OLI as a benchmarking parameter in their analysis with the data they obtained from the PPH (PeoplePerHour) platform to calculate the market power of platform users working in the field of artificial intelligence.

2.2. Unemployment

As with the employment rate, which is a measure of economic expansion, is a leading indicator that is important to policymakers, businesses, and job seekers (Borup and Schütte, 2022: 188), unemployment rate is also very important for economies. Unemployment is calculated as the ratio of people who are ready to work at the current wage level, who are 15 years old or more, but do not work in any job, to the total workforce (Sowell, 2014: 45; Karapınar and Zorlutuna, 2022: 4). It is clear that in order for an individual to be considered unemployed, he/she must not be able to find a job although he/she wants to work at the current wage level.

The crisis in the world and the subsequent Covid-19 pandemic caused changes in unemployment rates (Kawohl and Nordt, 2020: 389). In particular, those employed in sectors whose production activities were highly and medium-highly affected by the crisis faced problems such as losing their jobs, being on unpaid leave, and decreasing their weekly working hours (Kara, 2020: 270).

According to Jackman, Pissarides, and Savouri (1990), measures to reduce unemployment basically depend on the correct determination of labour market policies. On the other hand, Menger (2017) shows the flexible employment principle with high employee turnover as one of the strategies to reduce unemployment. Both propositions emphasize the role played by the GIG economy in reducing unemployment. Namely, the GIG economy is in a structure that allows employees to quickly integrate themselves by overcoming institutional barriers and to work in short intervals (Huang, Burtch, Hong, and Pavlou, 2020: 435). The policy of short-term employment of skilled employees increases the competition among the workforce of the GIG economy (Menger, 2017: 255), and this increase in competition allows employees to be replaced more rapidly by businesses for smaller tasks (Kuhn, 2016: 158).

The inclusion of workers in the workforce of the GIG economy, where they can produce services through independent platforms, increases the rate of physical unemployment (Huang et al., 2020: 437). In a study supporting this proposition, Dazzi (2019) suggested that the income generated by employees who transitioned to the GIG economy in the world exceeded 82.4 billion dollars as of 2017 and predicts that it will continue to increase. Moreover, he claimed that this amount was accompanied by an increase in the unemployment rate. Although there are opinions that the GIG economy exploits its working

stakeholders and ignores their social rights (Oranburg, 2018: 8), it is understood that the scope of digital platforms is expanding day by day due to the increase in the count of digital platforms. The reason for this is that individuals who have the desire and potential to work regardless of a place see the GIG economy as a way out (Prassl, 2018: 35). In addition, it can be said that the GIG economy is also an attraction for full-time employees in companies. As a matter of fact, difficulties such as geographical access problem and organizational dependency, which are a problem for the traditional workforce working in physical environments, are no longer a challenge for the employees of the GIG economy (Huang et al., 2020: 432).

In the light of the information above, one of the basic assumptions of this study is that the changes in the unemployment level affect the count of online workforces. Although the increase in the online workforce should reduce unemployment, it is assumed that the employee transition between economies as expressed by Dazzi (2019: 78) will increase unemployment and the online workforce together. To put it more clearly, as employees gradually shift from physical work environments to online work environments and those who cannot find a job in physical environment find work more easily in the online environment, the increase in the physical unemployment rate will lead to an increase in the online workforce.

2.3. Economic Growth

Rostow (1959) stated that the last of the economic growth stages is mass consumption and at this stage the focus of society shifts from supply to demand. In order to meet the increasing demand, production and therefore production capacity must be expanded. As a matter of fact, growth is increasing the production capacity and thus producing more goods and services (Sowell, 2014: 55). In this context, factors such as telecommunication investments (Yıldız, 2012) and technological developments (Malatyalı, 2016) affect economic growth. These factors, on the other hand, can be considered as the infrastructure of the digital transformation experienced in businesses, and they are also imperative in ensuring the continuity of businesses after the transformation (Gong, Gu, and Teng, 2019: 7).

With economic growth and technological development, the demand for technology-intensive products that entered our lives has increased over time, and accordingly, the need for qualified labour has emerged at the production stage (Murphy and Siedschlag, 2013: 1403). Technological developments and innovations have other effects besides their contributions such as production and productivity increases. For example, in the process of globalization, production and management styles change rapidly within the framework of adaptation to technological developments, labor and time savings are achieved, new job opportunities arise, but technological unemployment emerges in some business lines. Therefore, it can be stated that in the short run, different opposite results emerge between economic growth, technological development and unemployment rates (Üzümcü, 2018: 13). On the other hand, digital technologies have led to the emergence of the need for mobile and independent workers who

successfully use these technologies without being tied to a specific centre (Rani and Furrer, 2021: 10). Thus, the relative importance of the workforce equipped with information technologies, which can be employed both full-time and on project and task basis, has increased in terms of businesses. By this, one can think that the increase in the demand for skilled labour force that can use digital technologies will cause an increase in the supply of this workforce. Therefore, while economic growth (Sowell, 2014: 22), which is directly dependent on the increase in production, contributes to the development of technology, it also causes an increase in the qualified workforce that can use this technology effectively (Fumagalli, Lucarelli, Musolino, and Rocchi, 2018: 2).

The individual's willingness to work depends on the trade-off of leisure and labour time. This trade-off is related to income level. Under a certain level of income, people tent work more to earn more. However, over this certain income level, people tend to prefer leisure for paid work time (Mapira, Gerald, and Enerst, 2017: 253). According to Rahman (2013), when there is an increase in the welfare level of individuals and household income, it is possible to form a backward-bending labour supply curve. In other words, individuals, after reaching a certain income level, may prefer to focus on spending their earnings by giving up generating income or trying to generate income in more flexible working conditions. Thus, individuals prefer leisure time to generating income for reasons such as allocating time for themselves, taking care of the family more or tending to other things rather than work (Şengür, 2020: 304). At this point, online labour platforms have a function that will give meaning to the backward-bending labour supply curve.

Online labour platforms, which allow individuals to earn money by working flexibly, offer a transparent access opportunity free from business boundaries to all users who supply and demand labour (Lehdonvirta, Hjorth, Graham, and Barnard, 2015: 4). This situation is fully compatible with the structure of the free labour market, where those who demand, and supply labour freely come together. In addition, employers, who do not have to bear the legal costs of employing personnel, demand labour with the help of business units that will satisfy their employees financially (Kuek, Paradi-Guilford, Fayomi, Imaizumi, and Ipeirotis, 2015: 15). In this way, employees who can have high incomes and flexible working hours can get the time they need to devote to themselves and their families and spend their income (Şengür, 2020: 304). The employees covered in the OLI, which is the subject of this study, are white-collar information technology employees (Kässi and Lehdonvirta, 2018: 247), and thus they create employee profiles in accordance with the logic of digital transformation. In addition, since online labour platforms are decentralized networked organizations, they contain environments where employees can collaborate quickly and effectively (Vallas and Schor, 2020: 282).

2.3.The Consumer Price Index (CPI)

The Consumer Price Index (CPI) is an important social index crucial to economic and social policies and has wide-ranging implications for government, business, employee, and household

stakeholders (Verbrugge, 2012: 143). According to the definition of the Eurostat, The CPI shows the change in the prices of consumer goods and services provided to households over time. This index, called the cost of living by Boskin, Dulberger, Gordon, Griliches and Jorgenson (1998: 4), is accepted as one of the most important parameters affecting purchasing power (Chen and Hu, 2018: 730).

With the rise of online labour platforms in the economy, consumers have turned into users who buy products or consume services. On the other hand, as they work from home, they are more affected by fluctuations in the CPI. The fact that the employment opportunities of these employees are more project and task-oriented causes them to be more sensitive to changes in the costs of consumer products (Flanagan, 2019: 59). Apart from this, the fact that individuals tend to consume rather than production, especially during the Covid-19 pandemic process, has increased the prices of the products preferred by consumers and therefore the cost of individuals to maintain their lives (Martin, Markhvida, Hallegatte, and Walsh, 2020: 454).

Based on the aforementioned situations, the assumption of this study regarding CPI is that inflation will cause a decrease in the online workforce. Namely, the CPI is an index that provides information about the price changes in a country to the government, businesses, workforce, and stakeholders consisting of citizens (Konny, 2020: 47). The workforce, one of these stakeholders, is affected by the changes in prices both in terms of income and expenditure. However, while the online workforce does not bear typical corporate costs, it is directly affected by consumer prices as it contributes to the economy from its own home and is also a household (Vallas and Schor, 2020: 275). Moreover, since online jobs, which are generally project and task-based, do not promise continuity, the platform user will have difficulty in making long-term financial decisions. This will make it difficult for the user to obtain the necessary technical equipment to work from home. On the other hand, in order to do business on online platforms, it is necessary to have a high-quality computer hardware, but the fluctuations in the exchange rate added to the increase in the CPI makes it more difficult for individuals to purchase these products.

3. ECONOMETRIC APPLICATION

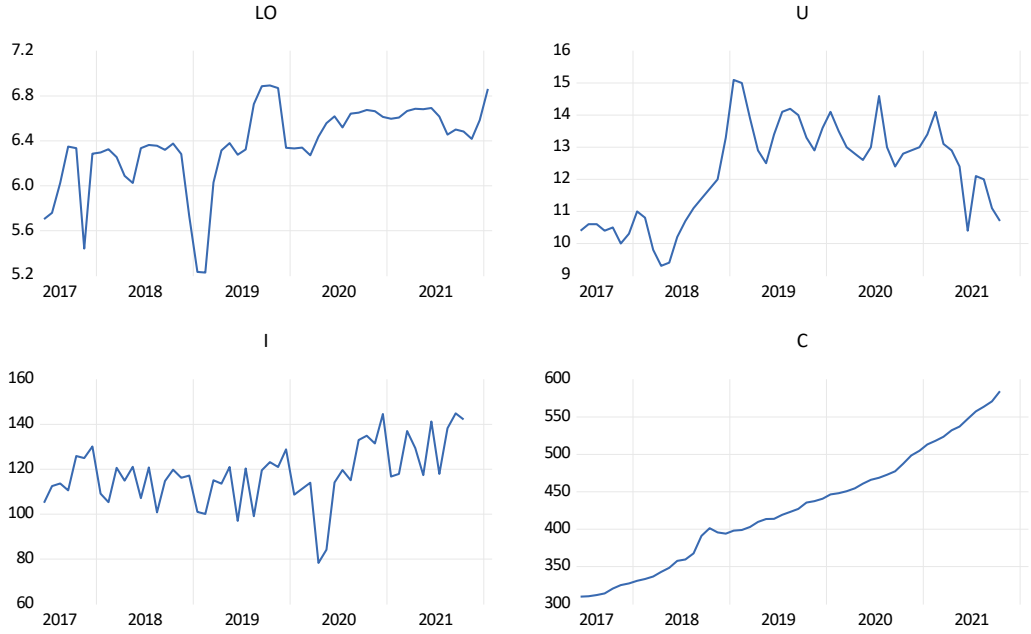
This part of the study includes econometric analysis to examine the impact of macroeconomic factors on the online workforce in Turkey. In the analysis, total count of online workers is used to represent online workforce as the dependent variable, unemployment rate, consumer price index and industrial production index are used as independent variables. Since there is no monthly frequency data for GDP, we used industrial production index to represent economic growth. The variables are in monthly frequency and belong to the period of June 2017 -January 2022. Information about the variables is given in Table 1.

Table 1. Information of the Variables

Variable	Definition	Source
O	Total count of online workers different occupation in Turkey (daily average)	OLI
LO	Natural logarithm of O	
U	Unemployment rate (% change)	CBRT
I	The industrial production index	CBRT
C	Consumer price index (2003=100)	CBRT

As stated above, the OLI, published as daily data, shows the total count of workers operating in five different occupational groups ((i) clerical and data entry, (ii) creativity and multimedia, (iii) sales and marketing support, (iv) software development and technology, and (v) writing and translation). To obtain the variable O, we first determined the total count of workers per day by adding the count of online employees in each occupation. Then, since the other variables in the analysis are in monthly frequency, we converted this variable into monthly by taking the average of the total count of workers per day. Finally, we used the natural logarithm of the O variable in order not to encounter problems due to the very high of daily average worker counts. The graphs of the variables used are given in Figure 1.

Figure 1. The Graphs of the Variables



As seen in Figure 1, the CPI variable is in an increasing trend while other variables follow a fluctuating and stable course.

Since the variables are in monthly frequency, spurious results may be obtained due to seasonal effects. Therefore, all variables were seasonally adjusted by X13 ARIMA method before the analysis.

3.1. Unit Root Tests

As known, different econometric analyses are used according to the stationarity levels of the series and if the levels are not known, spurious regression problem may be encountered in the models.

Therefore, examining the degree of stationarity of the variables before starting the study will both facilitate the selection of the model and prevent encountering the spurious regression problem. In the literature, there are many unit root tests used to examine the stationarity level of the series. Among them, the most frequently used and most trusted one is the ADF unit root test. Therefore, we decided to use the ADF unit root test in our study. Test results are given in table 2.

Table 2. ADF Unit Root Test Results

Augmented Dickey-Fuller test statistic				
	Constant		Trend and constant	
	t-Statistic	Prob.	t-Statistic	Prob.
LO	-2.493912	0.1226	-4.084075**	0.0115
D(LO)	-6.272435*	0.0000	-6.188007*	0.0000
U	-1.622420	0.4641	-1.158508	0.9084
D(U)	-8.057102*	0.0000	-6.454849*	0.0000
I	-4.250366*	0.0014	-5.070443*	0.0007
C	1.654413	0.9995	-0.636745	0.9722
D(C)	-5.535146*	0.0000	-5.912682*	0.0001

***Note*:** * and ** indicates the significance et level %1 and %5, respectively.

According to results of the unit root test (table 2), one of the variables (I) is I(0), the rest are I(1) and none of them is I(2). Since the stationarity levels of the variables is examined, we can begin to check the relation between the series.

3.2. Long-Term Relation

In the economics literature, various tests are used to examine the long-run relationship between time series. As stated above, the test selection depends on the stationarity levels of the series. Conventional OLS gives unbiased results if all the series used are stationary at level while Engle-Granger (1987) or Johansen (1991) tests give unbiased results in series that are integrated of the same order (that is, they are all I(1)). These tests may give spurious results when some of the series used are I(0) and others are I(1). As in our study, in a data set with series integrated different degrees, the long run relationships can be examined by using the Autoregressive Distributed Lag (ARDL) bounds test approach (Pesaran and Shin, 1995: 1; Pesaran, Shin, and Smith 2001: 289-290; Türkay and Demirbaş, 2012: 9-10; Atmaca and Karadaş, 2020: 10).

The unconstrained error correction model defined to detect the existence of a long-term relationship in the ARDL approach is as follows (Türkay and Demirbaş, 2012:10):

$$\Delta Y_t = \alpha_0 + \beta_1 Y_{t-1} + \sum_{i=1}^{n} \beta_{i+1} X_{i;(t-1)} + \sum_{j=1}^{p} \theta_j \Delta Y_{(t-j)} + \sum_{k=1}^{q} \delta_k \Delta X_{1;(t-k)+\cdots+\sum_{l=1}^{r} \gamma_l \Delta X_{n;(t-l)}+u_t} \quad ((1)$$

Here, Δ is the first difference operator, Y is the dependent variable, X_i's are the independent variables, β_i $(i = 1, 2, \cdots, n)$, θ_j $(\mathrm{j} = 1, 2, \cdots, p)$, δ_k $(\mathrm{k} = 1, 2, \cdots, q)$ and $\gamma_l (l = 1, 2, \cdots, r$ are the variable coefficients and u_t is the error term.

The significance of the β_i coefficients in this model is determined by evaluating the f-statistics obtained as a result of the bounds test according to the tables in Pesaran et al. (2001). The null hypothesis of the boundary test is that there is no long-term relationship between the series (Türkay and Demirbaş, 2012:10). So, it is in the form

$H_0: \beta_i = 0$ (there is no long-term relationship), for *i=1,2,3*

Therefore, if the value of the f-statistic calculated as a result of the bounds test is less than the lower limit value of a certain significance level, the null hypothesis cannot be rejected, that is, it is decided that there is no long-term relationship between the variables. If this value is between the lower and upper limit values, it is not possible to make a decision with the bounds test. If the value of the f-statistic is greater than the upper limit of the significance level, the null hypothesis is rejected at that significance level, and it is concluded that there is a long-term relationship between the variables.

The boundary test model of the series used in our study is as follows:

$$\Delta LO_t = \alpha_0 + \beta_1 LO_{t-1} + \beta_2 U_{(t-1)} + \beta_3 I_{(t-1)} + \beta_4 C_{(t-1)} + \sum_{j=1}^{p} \theta_j \Delta LO_{(t-j)} + + \sum_{k=1}^{q} \delta_k \Delta U_{(t-k)} + \sum_{l=1}^{r} \gamma_l \Delta I_{(t-l)} + \sum_{m=1}^{s} \varphi_m \Delta C_{(t-m)} + u_t \quad (2)$$

Boundary test results of this model are given in Table 3.

Table 3. Boundary Test Results

Null Hypothesis: No long-run relationships exist	
F-statistic	Degree of Freedom
7.733512*	3
Critical Value Bounds at significance level 1%	
I (0)	I (1)
4.3	5.23

***Note*:** *, indicates the significance at level 1%.

It is seen from the table 3 that the value of the f-statistic (7.73) is higher than the upper limit value of the 1% significance level (5.23). Therefore, the null hypothesis is rejected at the 1% significance level, and it is concluded that there is a long-term relationship between the series.

In linear regression models, such as the ARDL test, tests are performed on the assumption that there is no relationship between the error terms. The situation where there is a relationship between the error terms is called "autocorrelation". Autocorrelation problem may arise in a model due to reasons

such as not including some (important) explanatory variables, choosing the wrong mathematical form of the model, having a measuring error in the explained variable, and determining the error term incorrectly. As can be understood from the reasons for the emergence of the autocorrelation problem, in case of autocorrelation in the model, it can be said that the model is not efficient. The serial correlation LM (Breusch-Godfrey) test is used to determine whether there is autocorrelation between the error terms. Since the null hypothesis of this test is "no autocorrelation between the series", the null hypothesis must not be rejected in order to decide that the model is effective.

Another assumption of linear regression models is that the variance of the error terms is constant across observations and their covariances is zero. If the non-zero error covariances problem arises, the t and f statistics give biased results, and the test results lose their reliability. To check if the model has this problem, the Breusch-Pagan-Godfrey heteroscedasticity test is used. The null hypothesis of this test is "the error variances are all equal". Therefore, the null hypothesis of this test should not be rejected so that there is no problem of homoskedasticity.

Within the framework of this information, the results of ARDL (3, 4, 4, 4) model and the tests applied to examine the effectiveness of the model are given in Table 4.

Table 4. ARDL (3, 4, 4, 4) Model Results

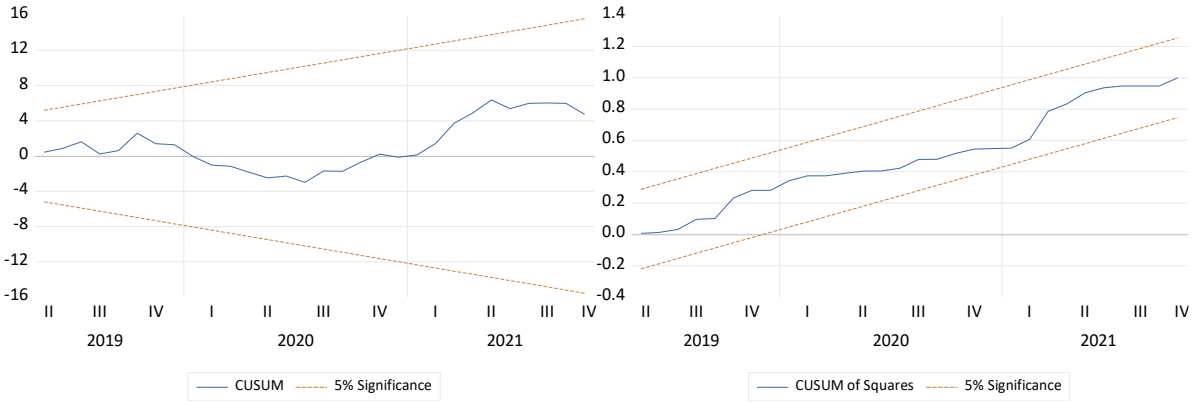
Dependent Variable: LO				
Variable	Coefficient	Std. Error	t-Statistic	Probability
ECM	-0.873826*	0.132000	-6.619912	0.0000
$\mathrm{LO} = (0.1251)\mathrm{U} + (0.0155)\mathrm{I} - (0.0260)\mathrm{C} + (0.1231)\mathrm{TREND} - 0.8738$				
Long Run Equation				
Variable	Coefficient	Std. Error	t-Statistic	Probability
U	0.125147**	0.050819	2.462611	0.0198
I	0.015476***	0.008673	1.784358	0.0845
C	-0.026033*	0.005619	-4.632700	0.0001
TREND	0.123071*	0.026490	4.645944	0.0001
$R^2 = 0.671005\ \bar{R}^2 = 0.535536\ F = 4.953206\ [0.000068]$				
$\chi^2_{BG} = 0.596356\ [0.5577]$				
$\chi^2_{BPG} = 0.842093\ [0.6424]$				

***Note*:** *, ** and *** indicates the significance et level 1%, 5% and 10%, respectively.

According to the results given in the table 4, the coefficient of the error term (ECM) is negative and significant. The coefficient value being (-0.87) means that the effect of a deviation that may occur in the model in the short term will disappear after approximately 1 (1≅1/0.87) period.

In addition, according to the results of Serial correlation LM (Breusch-Godfrey) and Heteroskedasticity (Breusch-Pagan-Godfrey) tests, autocorrelation and homoskedasticity were not found in the model. In addition to these tests, whether the coefficients obtained in the model are stable or not is examined with the CUSUM and CUSUMSQ tests. The results of these tests are presented in Figure 2.

Figure 2. The Results of CUSUM and CUSUMSQ Tests



As seen in the figure 2, the graph of the CUSUM and CUSUMSQ tests falls within the 5% significance level. This shows that the obtained long-run coefficients are stable. Since the effectiveness of the model is determined, we can now proceed to interpret the long-term coefficients.

Returning to the long-term coefficients in Table 4, it is seen that the coefficients of all independent variables are significant. Which means that the independent variables effect the dependent variable in the long term. According to these coefficients, while the count of online workers (O) is positively affected by unemployment (U) and industrial production index (I), it is negatively affected by the CPI (C). A "1-unit" increase in unemployment will cause a 12 per cent increase in count of online workers and a "1-unit" increase in the industrial production index will cause an increase of 1 per cent. Conversely, a "1-unit" increase in inflation will result in a 2 per cent reduction in the count of online workers.

The increase in unemployment causes individuals who cannot find a job in real life to create user profiles on online platforms and turn to online jobs and tasks. Especially with the effect of the pandemic and global crises, many companies had to terminate their personnel. Therefore, while these employees leaving the real economy cause an increase in the unemployment rate, they continue their lives by being included in the GIG economy. That is, employees who leave their regular jobs join the online workforce. This situation is in line with the argument expressed by Dazzi (2019) that unemployment and online workforce increase together.

With economic growth, individuals' incomes and living standards are increasing. As known, technological development can be identified as both a cause and a consequence of economic growth. The demand for technology-intensive products that entered our lives with these two (economic growth and technological development) has increased over time, this made entrepreneurs who want to make profits be interested in technology-intensive sectors. This increasing demand and interest, as expressed by Rani and Furrer (2021), has led to the emergence of the need for mobile and independent workers who can use technology effectively and work successfully without being tied to a specific centre. As a matter of fact, the GIG economy is a type of economy which is based on these employees. On the other

hand, according to Rahman (2013), after individuals reach a certain income level with the effect of growth, they may prefer to focus on spending their earnings by giving up generating income or trying to generate income in more flexible working conditions. Therefore, economic growth will lead individuals to online platforms that promise flexible working hours and satisfactory wages that are worth the time given. In addition, these employees must be equipped with technology and be suitable for the structure of the GIG economy. As supported by the findings in this study, with the increase in economic growth, an increase is observed in the number of users who produce services in online workforce platforms, namely qualified knowledge workers.

Since the online worker does not work in a particular company or institution, he/she is the owner of its own business and therefore all expenses belong to himself/herself. On the other hand, according to Rani and Furrer (2021), the concept of consumer is now largely replaced by the concept of user, and users can both produce and consume the product or service, unlike conventional consumers. The increase in CPI, that is, inflation, also causes an increase in the costs of individuals to use the platform and thus the cost of producing products, services, or content online. In this sense, CPI will make an individual, who is essentially a computer user and works from home, more price sensitive than individuals who produce services under the roof of a certain institution. For this reason, increases in CPI will cause a decrease in the online workforce and the findings obtained in this study confirm the inverse relationship between CPI and online workforce.

4. CONCLUSION

Technological development, which is both the cause and the result of economic growth, has led to the start of a digital transformation. With the digital transformation, hierarchical classical organizational structures have been replaced by task and business unit-oriented dynamic organization structures. These organizational structures have ensured the continuity of employment of knowledge workers whose institutional commitment and job security expectations are low compared to the traditional workforce. These knowledge workers, who are beyond the scope of the classical workforce with these features, produce services on the basis of micro business units. The mentioned situations have increased the relative importance of the GIG economy.

The online workforce has begun to replace the traditional workforce with the GIG economy occupying an important place in our lives. The inability to calculate the online workforce with the classical workforce indicators necessitated the invention of a new indicator. The OLI, which was first published in 2016, is the only indicator used to close this gap. The realization of the potential of online platform users on the economy increases the importance of studies on the OLI. Studies about the OLI generally evaluate OLI from an axiomatic perspective and show a preliminary approach towards analysis-based studies. However, there are no studies investigating the relationship of OLI with different macroeconomic variables with econometric analysis. At this point, since this study reveals the effect of

macroeconomic factors on OLI by econometric analysis, it is obvious that it is a study that makes a clear contribution to the literature.

In this study, the effect of selected macroeconomic factors on the online workforce was investigated. As a result of the research, it has been determined that unemployment, economic growth, and inflation have a statistically significant effect on the online workforce. According to the coefficients obtained from the econometric analysis, a "1-unit" increase in unemployment will cause a 12% increase and a "1-unit" increase in the industrial production index will cause 1% increase in count of online workers. Conversely, a "1-unit" increase in inflation will result in a 2% reduction in the in count of online workers.

It is expected that this study will guide policy makers and decision makers in their decisions by revealing the effects of macroeconomic factors on workforce transformation. These decisions will help the country's economy to adapt more easily to the dynamics of the GIG economy. In this way, it is expected that the country's economy will take a big step towards sustainable growth by keeping up with the new economic order. In addition, it will enable policy makers understand the contribution of online workers who appear as unemployed in traditional labour force indicators to the economy and help them make more efficient decisions involving platform users.

The first limitation of this study is to keep macroeconomic variables limited to unemployment, economic growth, and inflation. Another limitation is that the study was only covered in a single country. Therefore, it will be possible to detect other macroeconomic factors that influence online workers by using different variables in future studies. In addition, comparative studies with different countries and country groups will help to reveal other macroeconomic factors that affect the online workforce according to the development level of the country.

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KATKI ORANI / *CONTRIBUTION RATE*	**AÇIKLAMA / *EXPLANATION***	**KATKIDA BULUNANLAR / *CONTRIBUTORS***
Fikir veya Kavram / *Idea or Notion*	Araştırma hipotezini veya fikrini oluşturmak / *Form the research hypothesis or idea*	Asst. Prof. Murat Fatih TUNA (Ph.D.) Assoc. Prof. Hacı Ahmet KARADAŞ (Ph.D.)
Tasarım / *Design*	Yöntemi, ölçeği ve deseni tasarlamak / *Designing method, scale and pattern*	Asst. Prof. Murat Fatih TUNA (Ph.D.) Assoc. Prof. Hacı Ahmet KARADAŞ (Ph.D.)
Veri Toplama ve İşleme / *Data Collecting and Processing*	Verileri toplamak, düzenlenmek ve raporlamak / *Collecting, organizing and reporting data*	Asst. Prof. Murat Fatih TUNA (Ph.D.) Assoc. Prof. Hacı Ahmet KARADAŞ (Ph.D.)
Tartışma ve Yorum / *Discussion and Interpretation*	Bulguların değerlendirilmesinde ve sonuçlandırılmasında sorumluluk almak / *Taking responsibility in evaluating and finalizing the findings*	Asst. Prof. Murat Fatih TUNA (Ph.D.) Assoc. Prof. Hacı Ahmet KARADAŞ (Ph.D.)
Literatür Taraması / *Literature Review*	Çalışma için gerekli literatürü taramak / *Review the literature required for the study*	Asst. Prof. Murat Fatih TUNA (Ph.D.) Assoc. Prof. Hacı Ahmet KARADAŞ (Ph.D.)

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