Gazanfarli, M. (2023). How tax reforms impact unemployment: Evidence from Azerbaijan. *Journal of International Studies, 16*(3), 238-252. doi:10.14254/2071-8330.2023/16-3/14

Journal of International Studies

Centre of Sociological Research

Scientific Papers

How tax reforms impact unemployment: Evidence from Azerbaijan

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Abstract. This study investigates the effects of tax reforms carried out by the state to maximize the economic and welfare benefits on the unemployment rate in Azerbaijan from 2000 to 2021. An Autoregressive Distributed Lag (ARDL) empirical model is developed to measure the relationship between unemployment level and major indicators characterizing tax reforms. Initial estimations consider this linkage in both the short-term and the long-run periods, however, further analysis shows that only short-run estimations are statistically significant. The empirical analysis proves that qualitative and quantitative variables that characterize tax reform significantly affect unemployment rate in the short term. Research findings suggest that higher tax burden and application of concessions (after a year) may cause increased unemployment, while implementation of numerous allowances and concessions (within the year), application of an automated tax information system, and changes in legislation can be effective in reducing unemployment in Azerbaijan.

Received: November, 2022
1st Revision: July, 2023
Accepted: September, 2023

DOI: 10.14254/2071-8330.2023/16-3/14

Keywords: unemployment rate, tax reform, ARDL cointegration approach, empirical analysis

JEL Classification: C5, H2, J6, P11

1. INTRODUCTION

The unemployment rate is one of the main macroeconomic indicators that characterizes economic development and is significantly affected by tax reforms. Reduction of tax rates and application of various concessions and exemptions (depending on the scale of business) have a considerable effect on reducing unemployment by improving the business environment in the country; this, in turn, stimulates the development of entrepreneurial activity.

The high unemployment rate in the 2000s has more than halved to 4.96 percent in 2015 due to both taxation and economic reforms carried out in Azerbaijan. The reduction continued until 2019 (4.84%), however, in 2020, due to global and local problems (COVID-19, war), the level of unemployment increased and reached 6.46 percent. This trend continued in 2021, and the unemployment rate reached 6.58 percent.

As mentioned, numerous reforms implemented in Azerbaijan played a crucial role in raising the social welfare of the population and stimulating economic development. Some of them were related to tax issues, a tool that the state constantly monitors and reforms to provide an effective tax system that significantly impacts the development of the country and its citizens (2005; 2015; 2018; 2021). Although the effect of the tax reforms on the unemployment level has been studied in many countries around the world, unfortunately, a proper investigation related to this issue has not been conducted in Azerbaijan, and its impact has not been evaluated. For this purpose, this study has focused on measuring the impact that the tax reforms carried out in 2000-2021 have had on the unemployment rate in the Republic of Azerbaijan.

This study consists of 5 sections, including the introduction. Section 2 presents the literature review, section 3 outlines the data sources and the methodology. Sections 4 and 5 are dedicated to empirical analysis, estimations, conclusions, and recommendations.

2. LITERATURE REVIEW

Taxation is an important political tool of the state, which is directly related to economic development, social welfare of the population, and improvements in the quality of life. It is no coincidence that in many countries, tax reforms comprise a significant part of the state programs and strategic documents prepared to reduce unemployment level. According to the economic literature, there are numerous valuable approaches that measured the influence of tax reforms on unemployment over the years across various countries. Some of these papers were prepared by independent researchers, others - by governmental or public institutions. One such study measured the effects of tax reforms on unemployment and wages by considering three equilibrium models (competitive, union bargaining, and efficiency wages) in Tunisia. The results and simulations therein showed that reforms changing labor tax tools could significantly reduce unemployment (Bibi, 2003). Another study analyzed employment and unemployment effects of labor tax cuts in Germany in 2004 by applying a general equilibrium modeling approach. Its estimations and simulations proved that labor tax policies can only contribute to alleviating persistent unemployment (Boehringer et al., 2004). Michaelis and Birk (2004) examined the impact of tax reform on employment and growth and considered payroll tax to be neutral. They concluded that if this tax is used to finance a cut in the capital income tax, there is an increase in both growth and employment via the capitalization effect. Finally, a paper by OECD suggested that some targeted reforms raise the level of employment (OECD, 2011).

One of the most common variations in taxation is associated with changes in tax rates. The activities of entrepreneurs and investors who have obligations in the form of various taxes and play a significant role in increasing the number of workplaces in the country are greatly affected by such changes. Considering this, investigation of the resulting effects can help determine optimal tax rates. For example, one study examining 21 OECD countries from 1998 to 2008 posited that a more progressive tax schedule reduces the unemployment rate by controlling the tax burden at the average wage (Lehmann et al., 2014). In 2017, another study measured the effects of changes in different tax types on the unemployment level in 41 countries over 11 years by utilizing a dynamic panel. The results of this study showed that international tax competition affected unemployment through its influence on international capital investment (Zirgulis & Sarapovas, 2017). Another related paper was dedicated to defining different effects of a progressive tax and transfer schedule on individual labor supply, unemployment, and savings (Pizzo, 2022).

In the literature, the effects of entire fiscal policy on the unemployment rate have also been investigated. The unemployment effects of fiscal policy were investigated in Greece based on the SVAR methodology. Their findings showed that the unemployment and growth influences could be quite sizeable in case of cuts in government purchases, especially government consumption and to a lesser extent government investment. And it was proven that tax hikes decreased output and raised the unemployment level (Tagkalakis, 2013). 17 OECD countries were analyzed for measuring how fiscal policy affects the trend of employment rate, covering the period 1980-2009 with annual data. The research proposed that a fiscal shock can modify the employment equilibrium level even without influencing potential output (Tafuro, 2015). Another related study was conducted to define the employment effects of fiscal policy innovations utilizing the narrative approach for various ethnic/racial groups and separately for expansion and recessions. The study concluded that changing tax policy causes larger adverse effects than those of defense spending on unemployment, and negative effects of tax hikes are completely driven by recessionary periods (Adnan et al., 2019).

The analysis of available literature showed that besides the tax burden, changing of tax rates, etc., the effects of digitalization in the taxation on unemployment have also been investigated and evaluated (Lyla, 2019; Bertani et al., 2020; Abdel-Sadek, 2021).

The above analysis shows that most of related investigations measured the effects of indicators separately. However, my research focuses on analyzing and defining the major characteristics of tax reform, as well as, unlike other studies, estimating the impact of the entire tax reform including quantitative and qualitative indicators, on unemployment level in Azerbaijan over the previous 22 years using ARDL cointegration approach.

3. METHODOLOGY

3.1. Data

Since this study investigates the effect of tax reform on unemployment level, characteristic factors of tax reform must be determined that were implemented initially in Azerbaijan over the previous 22 years. Analysing legislative documents and strategic plans proves that the main changes have been observed in tax burden rate, digitalization of tax system, the number of legislative changes, and the number of concessions. Therefore, the major factors that identify tax reform from 2000 to 2021 can be generalized as follows:

- Tax burden rate;
- The number of legislative changes;
- Total number of concessions and exemptions;
- Applying an Automated tax information system;

The annual data on the unemployment rate for Azerbaijan was gathered from the World Bank database. Other data related to tax reform, including tax burden rate, the number of legislative changes, total number of concessions, and exemptions were obtained from the State Tax Service under the Ministry of the Economy by appealing with the special request letter. Furthermore, there are some implemented reforms which their results are not measured quantitatively. As an example of such indicators, the application of E-Systems and e-services can be mentioned. Therefore, some reforms related digitalization of tax system such as e-application, e-declaration, one-stop-shop, online integration services with banks, etc. have been defined by generalizing as an "automated tax information system" that is considered as qualitative variable. It can be expressed depending on its application during the period of 2000 and 2021 as below:

$$D = \begin{cases} 1, & applying\ of\ automated\ tax\ information\ system \\ 0, & not\ applying\ of\ automated\ tax\ information\ system \end{cases}$$

The trends of quantitative variables (time series) and qualitative variable (dummy variable) are given Figure 1.

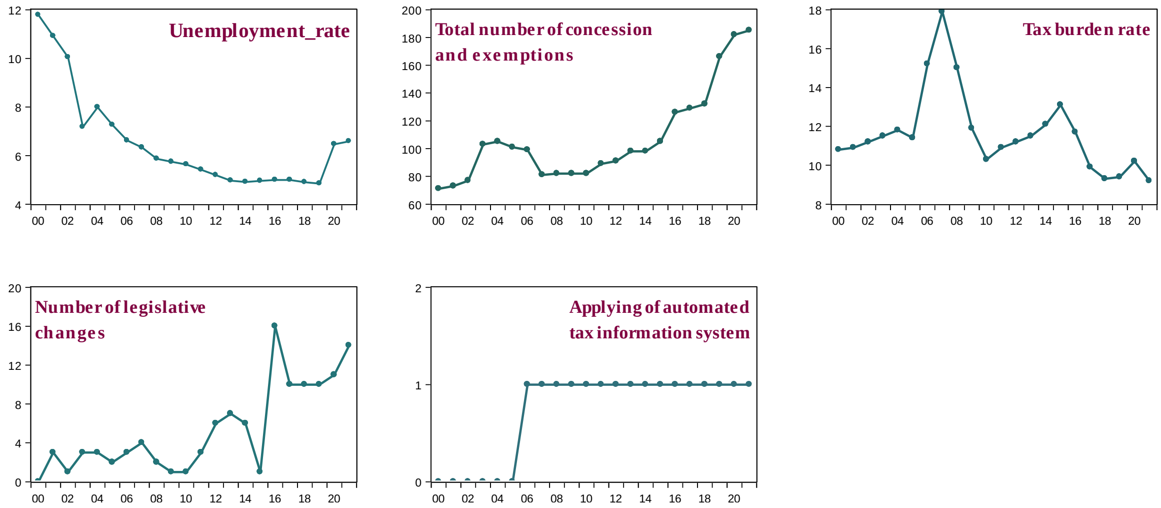


Figure 1. Qualitative and quantitative variables between 2000-2021
Source: Author's calculation, based on the World Bank database and Azerbaijan State Tax Service

3.2. Methodology

The relationship between unemployment rate and tax reforms carried out in our country can be expressed through the following function:

$$UR_t = f(LC_t, TB_t, C\&E_t, MS_t, ATIS_t,) \quad (1)$$

Where,
UR – unemployment rate, LC – The numbers of legislative changes, TB – Tax burden, C&E – Total number of concessions and exemptions, ATIS – Automated tax information system
The specifications of the model can be expressed as below:

$$UR_t = \beta_0 + \beta_1 LC_t + \beta_2 TB_t + \beta_3 C\&E_t + \beta_4 ATIS_t + \varepsilon_t \quad (2)$$

Herein,
UR_t –dependent variable; $LC_t, TB_t, C\&E_t, ATIS_t$ – explanatory variables in the t year;
ε_t – random quantity; $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ – coefficients (elasticities).
The log-linear model can be expressed by using logarithmic form of all variables and specified as:

$$Ln(UR_t) = \beta_0 + \beta_1 Ln(LC_t) + \beta_2 Ln(TB_t) + \beta_3 Ln(C\&E_t) + \beta_4 ATIS_t + \varepsilon_t \quad (3)$$

The steps of assessing this relationship is given briefly as below (Figure 2):

Autoregressive Distributed Lag (ARDL) and ECM Model Estimation

- Finding lag structure criteria
- Testing for Stationarity (unit root test):
  - If time series data is stationary, in this case, ordinary least square (OLS) or vector autoregressive (VAR) models can be utilized unbiased evaluates.
  - If all underlying variables are non-stationary, Vector Error Correction Model (VECM - Johansen Approach ECM) can be used to analyse the relationships.
  - If variables used in the analysis are of mixed type, i.e., some are stationary and others are non-stationary then Autoregressive Distributed Lag (ARDL) model is appropriate for estimating
- Applying ARDL model:
  - Long Run Form and Bounds Test
  - If there is cointegration, applying Error Correction Model (ECM)
  - If there is no cointegration, applying vector autoregressive (VAR)
- Diagnostic analysis tests (LM, JB, Engle's ARCH, etc.)
- Interpeting obtained results

Figure 2. Steps of methodology
Source: Prepared by author

ARDL model

Equation (2) can be expressed in ARDL form as below:

$$Ln(UR_t) = \beta_0 + \sum_{i=1}^{m} \gamma_i Ln(UR_{t-i}) + \sum_{j=0}^{m} \beta_{1j} Ln(LC_{t-j}) + \sum_{j=0}^{m} \beta_{2j} Ln\left(TB_{t-j}\right) + + \sum_{j=0}^{m} \beta_{3j} Ln(C\&E_{t-j}) + \sum_{j=0}^{m} \beta_{4j} ATIS_{t-j} + \varepsilon_t \quad (4)$$

Herein,
β_0 is the intercept, m is the lag order, ε_t is the error term,
UR_t is the dependent variable while $LC_t, TB_t, C\&E_t, ATIS_t$ are independent (explanatory) variables,
β_{vj}, ($v = \overline{1,4}$ express the coefficients of explanatory variables, $j = \overline{0,m}$) and γ_i, ($i = \overline{1,m}$) are the coefficients (elasticities), m is the lag order,
While considering both $I(0)$ and $I(1)$ variables in same estimation, ARDL model is more robust and suitable for small sample size of data.

ARDL model specification to cointegration test

Cointegration is a technique that provides the determination of the feasible correlation between time series processes in the long term. Literature review shows that cointegration idea was owned by Granger (Granger, 1981; Granger & Weiss, 1983). There are some cointegration tests such as Engle and Granger test (Engle & Granger, 1987), Johansen test (Johansen, 1988), Autoregressive Distributed Lag (ARDL) cointegration technique or bound cointegration testing technique (Pesaran et al., 1996; Pesaran & Shin, 1999; Pesaran et al., 2001).

ARDL Cointegration form of ARDL model (4) can be expressed as:

$$\Delta LnUR_t = \beta_0 + \sum_{i=1}^{m} \gamma_i \Delta LnTR_{t-i} + \sum_{j=1}^{m} \beta_{1j} \Delta LnLC_{t-j} + \sum_{j=1}^{m} \beta_{2j} \Delta LnTB_{t-j} + \\ + \sum_{j=1}^{m} \beta_{3j} \Delta LnC\&E_{t-j} + \sum_{j=1}^{m} \beta_{4j} \Delta ATIS_{t-j} + \delta_1 LnUR_{t-1} + \delta_2 LnLC_{t-1} + \delta_3 LnTB_{t-1} + \\ + \delta_4 LnC\&E_{t-1} + \delta_5 ATIS_{t-1} + \varepsilon_t \quad (5)$$

Where,

β_0 is the intercept, m is the maximum lag order, ε_t is the error term (white noise errors), and Δ is the first difference operator.

Expressions from δ_1 to δ_5 correspond to the long-run relationships, while β_{vj}, ($v = \overline{1,4}, j = \overline{0,m}$) and γ_i, ($i = \overline{1,m}$) depicts the short-run dynamics of model.

F-statistics is used to test the long-run equilibrium relationship between explained and explanatory variables. In accordance with the study (Pesaran et al., 2001), the calculated F-statistic is compared with the first and the second critical values, known as the lower and upper bound, respectively.

As mentioned above (Figure 2) if there is a cointegration between the variables, then the Error Correction Model (ECM) model can be utilized. This is expressed as follows:

$$\Delta LnUR_t = \beta_0 + \sum_{i=1}^{m} \theta_i \Delta LnUR_{t-i} + \sum_{j=0}^{m} \vartheta_{1j} \Delta LnLC_{t-j} + \sum_{j=0}^{m} \vartheta_{2j} \Delta LnTB_{t-j} + \\ + \sum_{j=0}^{m} \vartheta_{3j} \Delta LnC\&E_{t-j} + \sum_{j=0}^{m} \vartheta_{4j} \Delta ATIS_{t-j} + \vartheta ECM_{t-1} + \varepsilon_t \quad (6)$$

Herein, θ and ϑ are the short-run dynamic coefficients of the model and ϑ is the speed of adjustment.

4. EMPIRICAL ANALYSIS

Table 1 illustrates the descriptive analysis of all variables. The results of Jarque-Bera test and probability prove that LC, C&E and ATIS are normally distributed by accepting the null hypothesis at 5% level p value, while unemployment rate and tax burden are meet this requirement. Another crucial problem may arise when measuring the linkages, is multicollenearıty. Correlation analysis (table 2) proves that correlation between independent variables is not severe.

Table 1

Descriptive analysis of variables

	UR	C&E	TB	LC	D_ATIS
Mean	6.525909	107.1364	11.65455	5.318182	0.727273
Median	5.800000	98.50000	11.30000	3.000000	1.000000
Maximum	11.78000	185.0000	17.90000	16.00000	1.000000
Minimum	4.850000	71.00000	9.200000	0.000000	0.000000
Std. Dev.	2.009394	33.40131	2.084118	4.602136	0.455842
Skewness	1.461728	1.223915	1.490242	0.879937	-1.020621
Kurtosis	4.098426	3.473327	5.078421	2.643804	2.041667
Jarque-Bera	8.940374	5.697917	12.10286	2.955362	4.661314
Probability	0.011445	0.057905	0.002354	0.228166	0.097232

Source: Author's calculation, 2023

Table 2

Correlation analysis

Correlation					
Probability	**LUR**	**LTB**	**LLC**	**LCE**	**D_ATIS**
LUR	1.000000				

LTB	0.082310	1.000000			
	0.7228	-----			
LLC	-0.365861	-0.378490	1.000000		
	0.1029	0.0907	-----		
LCE	-0.336242	-0.548342	0.737967	1.000000	
	0.1361	0.0101	0.0001	-----	
D_ATIS	-0.824602	0.052963	0.350794	0.301173	1.000000
	0.0000	0.8196	0.1190	0.1846	-----

Included observations: 21
Source: Author's calculation, 2023

Testing stationarity

Defining the optimal lag length possess is the important role in the applying of various unit root tests. Table 3 illustrates the results of the lag order selection in order to present the association endogenous variables. As seen from the table 3, optimal lag length is 2.

Table 3

Lag length selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	5.411649	NA	6.59e-07	-0.043331	0.205205	-0.001269
1	56.97775	70.56414	4.50e-08	-2.839763	-1.348544	-2.587390
2	113.0066	47.18219*	3.48e-09*	-6.105958*	-3.372056*	-5.643273*

* indicates lag order selected by the criterion;
Endogenous variables: LUR LTB LLC LCE ATIS; Included observations: 19
Source: Author's calculation, 2023

Stationarity of the time series is the process that mean, variance and autocorrelation structure of series do not change over time. Numerous tests such as Augmented Dickey-Fuller test (ADF), Philipse-Perron (PP), Kwiatkowski Phillips Schmidt and Shin (KPSS) and others are utilized to check the stationarity of time series. In this purpose, our study used ADF and PP tests which null and alternative Hypothesis of them (Dickey & Fuller, 1981; Phillips & Perron, 1988) are below:

H_0: The process has a unit root

H_1: The process does not have a unit root

The results (table 4) show that used variables are mixed, some of them are stationary and others are non-stationary at level and 1st level, respectively.

Table 4

Unit root test results

Variables			ADF		P-P		Results
			Level	**1st level**	**Level**	**1st level**	
LnUR	t-statistic	**C**	-2.813678***	-4.280642	-3.060104**	-4.279602	I(0), I(1)
	P-value		0.0733	0.0037	0.0455	0.0037	
	t-statistic	**C&T**	-0.781351	-6.726969	0.508752	-8.561483	
	P-value		0.9515	0.0001	0.9985	0.0000	
LnTB	t-statistic	**C**	-2.447885	-3.276053**	-1.456956	-2.631266	I(1) (C&T)
	P-value		0.1423	0.0988	0.5350	0.1035	
	t-statistic	**C&T**	-4.058509	-4.323272*	-2.123302	-2.782575	
	P-value		0.0062	0.0149	0.5043	0.2186	
LnC&E	t-statistic	**C**	0.065764	-3.656505**	0.065764	-3.659889**	I(1)
	P-value		0.9548	0.0138	0.9548	0.0137	
	t-statistic	**C&T**	-0.971204	-4.114386**	-1.133504	-3.629478***	
	P-value		0.9269	0.0246	0.8983	0.0527	
LnLC	t-statistic	**C**	-2.280521	-6.481002	-2.280521	-14.31957	I(0), I(1)
	P-value		0.1871	0.0000	0.1871	0.0000	
	t-statistic	**C&T**	-4.012209*	-6.273162	-4.005688**	-14.62147	
	P-value		0.0257	0.0004	0.0261	0.0001	

Note: ***, ** and * denote statistical significance at 1%, 5%, and 10%, respectively
Source: Author's calculation, 2023

Checking stationarity proved that utilized variables are mixed, some of them are stable and others are non-stable at level and 1st difference, respectively. Therefore, ARDL model can be used to assess the influence of explanatory variables that characterize the tax reform to the unemployment level in Azerbaijan. Akaike information criterion model selection is given in Figure 3. Akaike information criterion was applied to choose the appropriate model with the specification: ARDL (2, 1, 2, 1, 2). Therefore, general ARDL output based on equation (4) is as follows:

$$LnUR = 0.278394147222 * LnUR(-1) + 0.530605296412 * LnUR(-2) + 0.441619940099 * LnTB - 0.168237321813 * LnTB(-1) - 0.0322654265829 * LnLC - 0.0717805711222 * LnLC(-1) - 0.01900681938 * LnLC(-2) - 0.383291593743 * LnCE + 1.10230748281 * LnCE(-1) - 0.212870881739 * D\_ATIS - 0.0162626322754 * D\_ATIS(-1) + 0.318176318815 * D\_ATIS(-2) - 3.56389769392$$

ARDL Bounds test to cointegration

If the camputed F-statistic goes above the upper bound:

- the null hypothesis: *no cointegration* between TB, C&E, LC, ATIS and UR is rejected;

If it goes less the lower bound:

- the null hypothesis: *no cointegration* between variables cannot be rejected.

If F-statistic is between the lower and the upper bounds:

- the null hypothesis: *no cointegration* appropriate variables become inconclusive.

The results of cointegration analysis prove that the null hypothesis is rejected and variables are cointegrated (Table 5). Therefore, both short-run as well as long-run model can be specified.

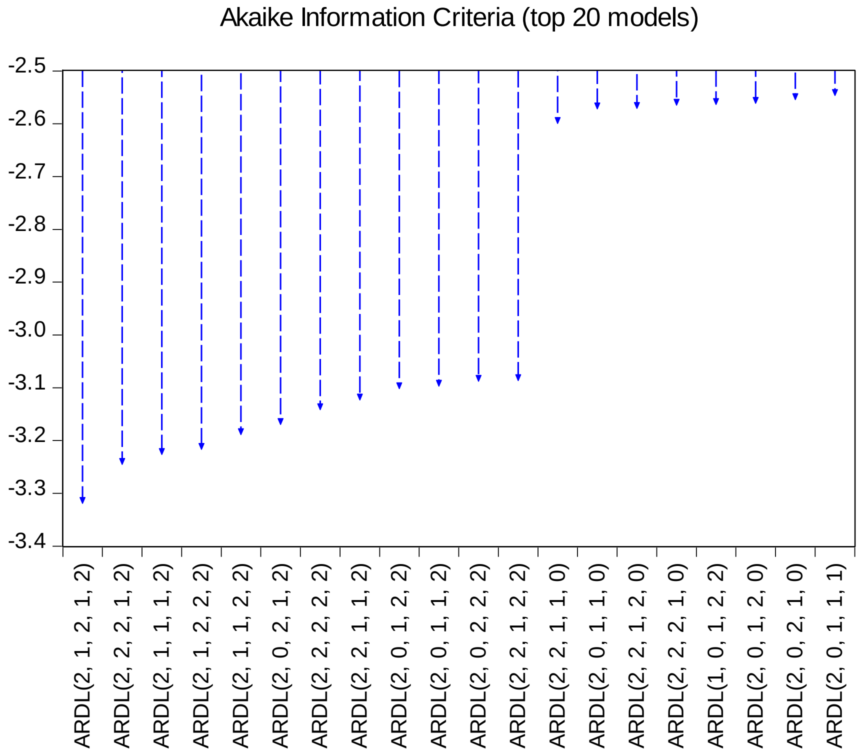


Figure 3. Akaike Information Criteria
Source: Authors' calculations, 2023

Table 5

ARDL bounds test

Null Hypothesis: No levels relationship				
Test Statistic	Value	**Significance level.**	**I(0) Bound**	**I(1) Bound**
F-statistic	17.45562	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author's calculation, 2023

ARDL cointegration test based on the equation (2) is expressed as below:

$$EC = LnUR - (1.4313 * LnTB - 0.6443 * LnLC + 3.7645 * LnCE + 0.4662 * D\_ATIS - 18.6591)$$

Coefficient of ECM define the speed adjustment of towards equilibrium. By analyzing cointegration coefficient (-0.191001) and p value (0.0000) that presented in Table 6, ECM is statistically significant and suggest that almost 19% of the discrepancy between the long-run and short run is corrected within a year.

Table 6

Long-run and short-run estimations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long run estimation				
LTB	1.431318	1.213620	1.179379	0.2829
LLC	-0.644254	0.487209	-1.322336	0.2342
LCE	3.764470	2.980408	1.263072	0.2534
D_ATIS	0.466191	0.723490	0.644365	0.5432
C	-18.65910	16.40341	-1.137513	0.2987
Short run estimation				
LUR(-1)	0.278394*	0.128699	2.163145	0.0738
LUR(-2)	0.530605***	0.142884	3.713552	0.0099
LTB	0.441620**	0.168646	2.618621	0.0397
LTB(-1)	-0.168237	0.127490	-1.319612	0.2351
LLC	-0.032265	0.018382	-1.755244	0.1297
LLC(-1)	-0.071781***	0.018474	-3.885467	0.0081
LLC(-2)	-0.019007	0.016579	-1.146409	0.2953
LCE	-0.383292*	0.168164	-2.279276	0.0629
LCE(-1)	1.102307***	0.180836	6.095630	0.0009
D_ATIS	-0.212871**	0.070905	-3.002191	0.0239
D_ATIS(-1)	-0.016263	0.068186	-0.238505	0.8194
D_ATIS(-2)	0.318176**	0.100715	3.159181	0.0196
C	-3.563898	0.752624	-4.735295	0.0032
R-squared	0.977009	Mean dependent var		1.751541
Adjusted R-squared	0.931028	S.D. dependent var		0.157851
S.E. of regression	0.041455	Akaike info criterion		-3.312653
Sum squared resid	0.010311	Schwarz criterion		-2.666458
Log likelihood	44.47020	Hannan-Quinn criter.		-3.203291
F-statistic	21.24810	Durbin-Watson stat		2.180553
Prob(F-statistic)	0.000624			

Note: ***, ** and * denote statistical significance at 1%, 5%, and 10%, respectively
Source: Author's calculation, 2023.

Long-run and short run analysis

Some required tests for the qualitative analysis of the model were checked, its adequacy for the short-term and long-term period was verified. ARDL Long Run Form and Bounds Test was used to check long-run relationships analysis (Table 6). To the Bound test result, there is a long-run relationship among variables, however all the explanatory (independent) variables are not statistically significant.

To the short-run estimations, tax burden has positive and significant (5% level) impact on unemployment level at the t year while this effect is the negative and insignificant at the $(t-1)$. LC has the negative and constructive effect on the unemployment rate at the moment of $(t-1)$. The C&E and application of ATIS also has the negative effects, however the result is significant at 10% and 5% level.
The significance of the coefficients for the short-run duration was checked by the Wald test (Table 7). To the outcomes obtained by Wald test depict that the significance of the coefficients on the application of concession and exemptions (-0.383292), legislative changes (-0.071781) was confirmed at 5% level (with 95% accuracy), as well as changing of tax burden rate (0.441620) and application of automated tax information system (-0.212871) with at 10% level (with 90% accuracy) in the short-run.

In can be noted especially, the impact of dummy variables in Log-linear regression model is defined as the percent change in depentent variable (UR) accociated with switching dummy variable (D_ATIS) from 0 to 1 is:

$$100 * (e^{-0.21} - 1) \approx -18.9\% \quad (7)$$

Table 7

Wald Test results

Test Statistic	**Value**	**df**	**Probability**
Null Hypothesis: C(1)=C(2)=0			
F-statistic	15.93412	(2, 6)	0.0040
Chi-square	31.86824	2	0.0000
Null Hypothesis: C(3)=C(4)=0			
F-statistic	3.720084	(2, 6)	0.0890
Chi-square	7.440169	2	0.0242
Null Hypothesis: C(5)=C(6)=C(7)=0			
F-statistic	6.668356	(3, 6)	0.0244
Chi-square	20.00507	3	0.0002
Null Hypothesis: C(8)=C(9)=0			
F-statistic	30.61270	(2, 6)	0.0007
Chi-square	61.22540	2	0.0000
Null Hypothesis: C(10)=C(11)=C(12)=0			
F-statistic	4.237426	(3, 6)	0.0628
Chi-square	12.71228	3	0.0053

Source: Author's calculation, 2023.

Diagnostic analysis of the ARDL model

In order to omit misleading statistical inferences, this scientific research verified the model through various important diagnostic and stability tests as follows:

- The Glejser and Breusch-Pagan-Godfrey tests were used to check homoscedasticity of residuals. Results proved that residuals are homoscedasticity (Table 8).
- The Jarque-Bera test was used to examine whether residuals distributed normally and proved by accepting H_0 (null hypothesis) at the 5% significant level. Therefore, residuals are multivariate normally distributed (Table 8);
- Durbin-Watson statistics and Correlogram of residuals – Q statistics were utilized to investigate autocorrelation. Being the value of Durbin-Watson statistics close to 2 verify the residuals are non-dependence (no autocorrelation) (Table 8), (Figure 4a).

Graph show that (Figure 4) the values obtained from the established model (4) are much closer to the actual values. To further analysis its fitness, actual and fitted values and residuals are given in the Figure 4b.

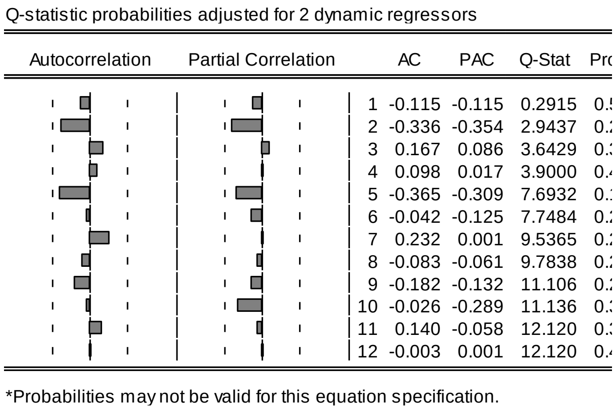
Table 8

Diagnostic analysis

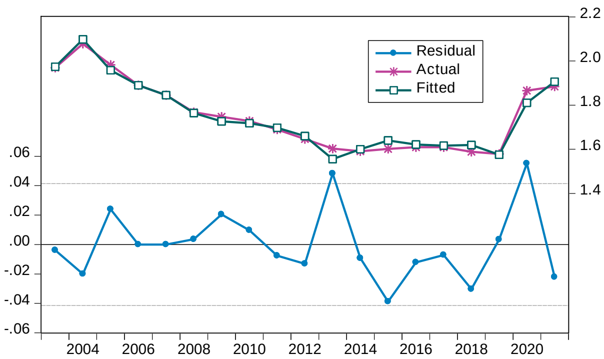
Heteroskedasticity Tests:		
	Glejser	**Breusch-Pagan-Godfrey**
F-statistic	0.580452	0.424323
Obs*R-squared	10.20738	8.722203
Scaled explained SS	3.977083	1.018754
Prob. F(17,2)	0.8011	0.9028
Prob. Chi-Square(1)	0.5978	0.7265
Prob. Chi-Square(6)	0.9838	1.0000

Jarque-Bera test	2.112750		
Prob.	0.347714		
R-squared	0.977009	Mean dependent var	1.751541
Adjusted R-squared	0.931028	S.D. dependent var	0.157851
S.E. of regression	0.041455	Akaike info criterion	-3.312653
Sum squared resid	0.010311	Schwarz criterion	-2.666458
Log likelihood	44.47020	Hannan-Quinn criter.	-3.203291
F-statistic	21.24810	Durbin-Watson stat	2.180553
Prob(F-statistic)	0.000624		

Source: Author's calculations, 2023.



a) Correlogram of residuals – Q statistics

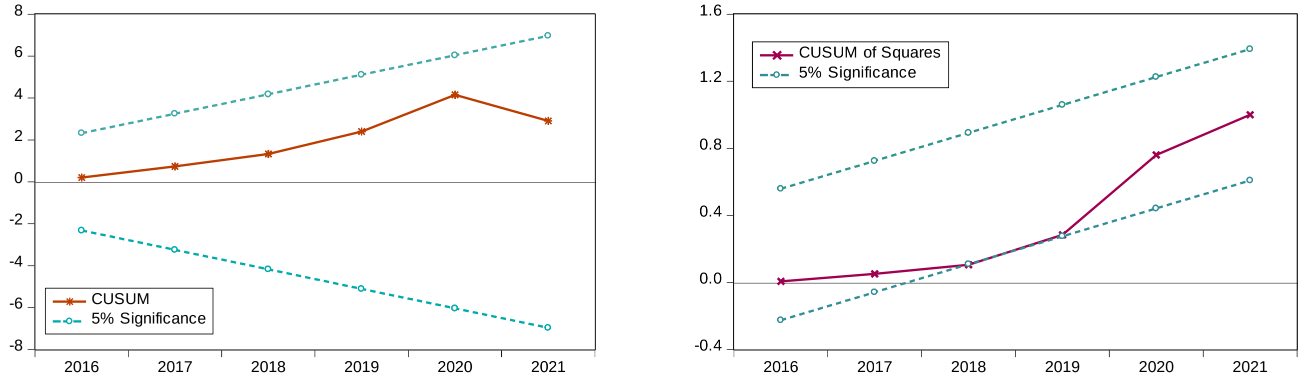


b) Actual and fitted values and residual

Figure 4. Residual analysis correlogram and plots
Source: Authors' calculations, 2023

Robustness of ARDL model

Figures present the CUSUM of Squares, CUSUM for the parameter instability from ARDL model. The tests are utilized to ascertain the parameter instability of the equation employed in the ARDL model. Since the plots in the CUSUM of Squares and CUSUM plots lie within the 5% significance level or ±2 S.E, the parameter of the equation is stable enough to evaluate the long-run and short-run causality in the study.



a) CUSUM plot b) CUSUM of squares plot

Figure 5. Plots of stability diagnostics
Source: Authors' calculations, 2023

5. CONCLUSIONS AND RECOMMENDATIONS

This study investigated the effects of tax reform to the unemployment rate in Azerbaijan during 2000-2021 analyzing short-run and long-run impacts. Autoregressive Distributed Lag (ARDL) cointegration approach was used to realize this purpose. The research outcomes are impressive and forthcoming; undoubtedly, much more tax burden may increase the unemployment level and obtained results of the empirical analysis proved this. Briefly, the conclusion that reflects the impacts of the leading indicators that characterize the tax reform on the unemployment level in Azerbaijan from 2000 to 2021 is expressed as follows:

- When the tax burden increases by 1%, the unemployment rate increases by 0.44%;
- The total number of concessions and exemptions rises by 1%, the unemployment rate falls by 0.38%, while this effect replaced with increase after a year;
- The number of legislative changes increases by 1%, unemployment rate decreases by 0.07%;
- Applying automated tax information system reduces unemployment rate approximately 19% (based on the equation (7)).

Since the unemployment level has a significant role in improving economic growth, the impacts of influential factors on unemployment must be considered and analyzed. Obviously, in developed countries, the basis of tax revenues consists of income; in developing countries, taxes are obtained from trade and consumption. This indicates that the improvement of most developing countries is seriously dependent on entrepreneurial activity. This research concluded that increasing the tax burden rate and applying too many concessions and exemptions cause an increase in unemployment. These heavy reforms led to an increase in the shadow economy rate in the country. Undoubtedly, higher tax rates and complexity in legislation frighten and move away taxpayers to fulfill their liabilities. Therefore, besides bankruptcy, false statement cases about unemployment are inevitable. However, implementing concessions and allowances to taxpayers and developing intelligent, automated systems make implementing responsibilities easier and reduce fraudulence and real unemployment. The results also prove that applying an automated tax information system significantly impacts decreasing unemployment, and numerous applied concessions may result in the rising unemployment level.

Therefore, considering those mentioned above, ensuring an effective tax burden rate, regulated allowance, fixed legislation, and application of digital transformations are recommended to policy-makers for increasing population employment and providing economic growth.

Dedication

This study is dedicated to my beloved and precious teacher professor Akif Musayev, who passed away on July 11th, 2022. I am grateful to him for growing me as a researcher and showing scientific researching is value that leads to improvement, in fact.

Declaration

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

"Declarations of interest: none"

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