Noble International Journal of Economics and Financial Research
ISSN(e): 2519-9730 ISSN(p): 2523-0565
Vol. 05, No. 06, pp: 63-73, 2020

Published by Noble Academic Publisher
URL: http://napublisher.org/?ic=journals&id=2

Open Access

ASSESSMENT ON THE CHANGE OF UNION DENSITY RATE BY MEANS OF MACROECONOMIC INDICATORS: A QUANTITATIVE RESEARCH

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ABSTRACT: During the last decades of the twentieth and the first two decades of the 21st century, there has been a gradual decrease in union density all over the world. Decrease in bargaining power and resources have resulted in density decrease. This article presents the results of a quantitative study conducted using multiple regressions and shows that there is a correlation between density and various macroeconomic measures or other state indicators from the 36 OECD Member States (Organization for Economic Co-operation and Development) and ILO (International Labor Organization) used in the calculation. Additionally, the survey results showed that the best predictor of the variable was the strictness of employment protection, followed by the rest of the model's variables but with continuously declining significance.

Keywords: Density; Strictness; Income; Debt; Unemployment.

1. INTRODUCTION

The period from the mid 70's to the present day has been accompanied by a decline in trade union density worldwide, including developed economies such as the United States, the United Kingdom, New Zealand and Australia (Fairbrother and Yates, 2003). However, the decline in union density was also observed in countries with lower macroeconomic outcomes such as Greece, Italy, Brazil, Poland, India, etc.

In essence, the unions are in a constant state of being unable to recruit new members in terms of the number of members they lose either from prosperous sectors of the economy or from traditional sectors of the economy.

Although there is no complete agreement among academics on the reasons that led to this decline, it is generally accepted that the macroeconomic environment and the factors that determine it, the ever-changing composition of the workforce, the policy of the states regarding workplace relationships and workplace practices are key factors that led to this decline (Mason and Bain, 1993; Metcalf, 1991).

At the same time, problems concerning the unions themselves and the way they are organized are contributing to the decline in union density. Indicative examples could be the lack of effort to create and apply for new jobs (Kelly, 1990; Voos, 1984), the failure of associations to provide substantial benefits to their members (Bryson and Gomez, 2005; Metcalf, 2005), and the inability to reform and modify operating unions to attract new members by identifying new demands of the unions with the interests of new employees (Dolvik and Waddington, 2005; Hyman, 1999).

The above raises a number of questions. What will be the course of trade unionism expressed through trade union density? Are there factors that are decisive for the evolution of trade union density through which we can calculate its future trend? Does it vary depending on the level of wages, the general economic situation and the position of one country's economy relative to the rest?

The main objective of the present research is to investigate the relationship between trade union densities and various macroeconomic sizes as well as different indicators within a state. In other words, if they are important data for predicting the number of trade union density in a country, unemployment,

industrial production, the national product deficit, and other figures will be discussed below. At the same time, the degree and magnitude of the influence of each variable on the predictability and utility of the model are examined.

The paper is structured as follows: After the introductory first part, in the second part, we made a recording of the density characteristics, in the third part we proceeded to examine what should be considered as key factors in our regression analysis. The fourth section discusses the research methodology. The fifth section presents the analysis of results and a discussion of findings. The sixth section discusses the control of admissions and finally concludes with a summary of findings and serves as a motive for further research.

2. UNIONS' DENSITY

According to International Bibliography, the acquisition of trade union membership depends mainly on the ability of the trade union to generate a sufficiently large wage gap for non-members so as to at least offset the cost of registration and membership (Steen, 2011).

In some countries and even more in Europe, individual trading is a way of personally securing rights over the collective bargaining (Kelly, 1998; Knoke, 1990; Schnabel, 2003; Schnabel and Wagner, 2007; Visser, 2002).

Some useful conclusions drawn from various surveys partly clarified the employee's demand for union membership. So this demand depends on:

a) According to (Ebbinghaus *et al.*, 2008), the existence of a collective agreement, in several countries, guarantees the employee's rights vis-à-vis the employer, irrespective of whether or not the employee is a member of a union, and thus makes the demand for unionism bigger. Of course this fact, due to differences in the legal framework, can vary in intensity and manner of implementation from country to country.

b) Checchi *et al.* (2010) argued, in a relative study, that it is the average wage earners who are most often enrolled in unions, as opposed to low wages and high wages earners. This fact can easily be justified for the high-paid, but not so easy for the low-paid because of their low bargaining power.

c) Blanchflower (2007) considered that the density of trade unions is higher in the public sector than in the private sector.

(d) The phenomenon of the positive correlation of the size of the company with the demand for trade unionism is observed internationally. The larger the number of employees, the greater the density and vice versa.

e) As Schnabel and Wagner (2007) argued, the keys determinants of demand are the employment sector and its position on the world market (strong, medium, weak).

f) The individual characteristics of the employee such as education, gender, age etc. play a key role in the will to acquire trade union membership.

According to Waddington (2006); Waddington and Whitston (1997), the safety and security of the employee as a member of a trade union and the individual protection of union employees against employment are among the main reasons for joining a trade union. According to them, if one feels safe today, that does not mean that he will be the same in the future unless he is a member of a trade union.

The fact that unions are collective bodies creates a number of problems:

a) As long as the union claims and gains some benefits for its members (increase in salaries and allowances, reduction in working time, longer rest, etc.) all these benefits are likely to apply to non-members working in the same business which makes participation in the union unnecessary for the employee (Crouch, 2004; Elster, 1989; Knoke, 1990).
b) Many times the collective bodies, and thus the trade unions, are bodies that interact with politics and the governors, public administration at every level, even with employers and their own trade unions. This fact includes the risk that employees' interests may be differentiated from the goals of the unions (Crouch, 2004; Traxler, 1998).

3. FACTORS THAT SHOULD BE CONSIDERED

Referring to international literature, there have been occasional attempts by various researchers to explain the decline in union density using macroeconomic and microeconomic data (Checchi and Visser, 2005; Ebbinghaus and Visser, 1999; Scruggs and Lange, 2002; Western, 1997).

Other research aimed at investigating the reasons for the difference in union density has also used individual, macroeconomic, and microeconomic factors (Bryson and Gomez, 2005; Bryson *et al.*, 2005; Schnabel and Wagner, 2003;2005).

Other researchers, using a combination of longitudinal and cross-sectional research based on micro and macro data, have attempted to find answers about the differentiation of trade union trends in different states (Blanchflower, 1996;2006; Schnabel and Wagner, 2005). Generally, in almost all surveys, time series and regression methods were used to quantify union density and predict its trend (upward, downward, percentages, etc.) (Steen, 2011).

A survey conducted on behalf of the ILO by Lawrence and Ishikawa (2005) on the demand for membership of trade unions comprising more than 72 countries also used various macroeconomic figures.

In another study carried out again on behalf of the ILO (2010) in an attempt to interpret the behavior of trade unions in times of crisis in different countries, some macroeconomic indicators were used:

On page 47 of the research, that deals with the Asian crisis of 1997–98: The case of the Republic of Korea, and particular in Table 1. (Macroeconomic indicators for the Republic of Korea, 1996–2008), the following indicators are included: Growth rate (%), Real GDP, Consumption, Investment, Exports, Imports, Consumer prices, Amounts Current balance, foreign reserves, won per dollar.

On page 62 dealing with the Japanese Economic Crisis of the 1990s in Figure 1, the following indicators are listed: Trends in prices, land prices, and official discount rate

On pages 65, 66 and 108 are analyzed the following indicators: Annual change in government bonds and real GDP, interest rates, loans, and Average income.

In addition to a conference organized by the ILO in an article announced by Vaughan-Whitehead (2017), various macroeconomic and microeconomic figures were analyzed again. Overall in recent years, however, these analyses have been based on data from international organizations such as the ILO, the OECD, etc. using macroeconomic data.

4. RESEARCH METHODS

The research was conducted with the help of SPSS ver. 26 statistical package using multiple linear regressions and the stepwise method. Using multiple linear regressions, given the values of the independent variables, we can predict the value of the dependent variable in each case. The dependent variables used to determine the values of the independent variable were derived from macroeconomic, microeconomic and other factors of the various Member States, included in the equation model, and obtained from the Organization for Economic Co-operation and Development (2019) site. , retrieved on 2-9-2019 as well as from the site of the International Labour Office Laborsta (2019) retrieved on 3-9-2019 and are as follows:

Table 1. Dependent variables

Description	**name in the model**
Net National Income per Capita	income
Unemployment rate	unemploy
General government fiscal balance as a % of GDP	balance
Gross Domestic Product per head US $	GDP_head
Minimum wages in US $ constant prices at 2018	min_wage
Health expenditure .Share of gross domestic product	health_exp
Long Term Interest Rate	interest
Total Central Government debt % GDP	debt
Strictness of employment protection. Individual and collective dismissals (regular contracts)	strictness

Source: International Labour Office Laborsta (2019)

The independent variable density (whose name in the reciprocal equation is again density) the value of which, in each case, we try to capture is net density as clarified by the ILO, (Lawrence and Ishikawa, 2005). Namely is the fraction that results from the division of the numerator (employees registered in a trade union) and the denominator (number of employees). The reasons for the choice, except that it serves the purposes of the multiple linear regression (Dafermos, 2005), are: a) It is of arithmetic type b) Its

uncontested measure c) c) The possible choice of Gross Density (Lawrence and Ishikawa, 2005) as a dependent variable, which takes wage and salary-earners as a denominator, is risky. That is because it carries the risk of being improperly mapped by all Member States, as the registration of unemployed(in some Member States) has a different meaning (and therefore numerical mapping) than others. d) It obtains the maximum number of cases for the regression model (756) because there is a numerical representation of the density in all cases.

This is how we created the database for statistical processing with 756 cases as shown in Table 2. These cases are for the Member States - members of the Organization for Economic Co-operation and Development (OECD) from ILO (International Labor Office) and are analyzed in each state by within 1998 through 2018, in an effort to provide 21 years of data to secure a large number of cases to be processed in regression analysis.

Table 2. Number of Cases

State	Years of reporting	Cases
Australia	1998 – 2018	21
Austria	1998 – 2018	21
Belgium	1998 – 2018	21
Canada	1998 – 2018	21
Chile	1998 – 2018	21
Czech Republic	1998 – 2018	21
Denmark	1998 – 2018	21
Estonia	1998 – 2018	21
Finland	1998 – 2018	21
France	1998 – 2018	21
Germany	1998 – 2018	21
Greece	1998 – 2018	21
Hungary	1998 – 2018	21
Iceland	1998 – 2018	21
Ireland	1998 – 2018	21
Israel	1998 – 2018	21
Italy	1998 – 2018	21
Japan	1998 – 2018	21
Korea	1998 – 2018	21
Latvia	1998 – 2018	21
Lithuania	1998 – 2018	21
Luxemburg	1998 – 2018	21
Mexico	1998 – 2018	21
Netherlands	1998 – 2018	21
New Zealand	1998 – 2018	21
Norway	1998 – 2018	21
Poland	1998 – 2018	21
Portugal	1998 – 2018	21
Slovakia	1998 – 2018	21
Slovenia	1998 – 2018	21
Spain	1998 – 2018	21
Sweden	1998 – 2018	21
Switzerland	1998 – 2018	21
Turkey	1998 – 2018	21
United Kingdom	1998 – 2018	21
USA	1998 – 2018	21
Total		**756**

Source: International Labour Office Laborsta (2019)

5. RESULTS & DISCUSSION

The number of cases (756) meets the needs of the investigation. Field (2000) argued that a reliable regression model requires 10 observations for each independent variable (9 independent variables were introduced into the model), while Coakes and Steed (1999) consider this number to be smaller (5). In our study we have 84.

Table 3. Descriptive Statistics

	Mean	Std. Deviation	N
Density	21,01024	9,886944	184
income	87,4991	28,19114	184
unemploy	7,573	3,8841	184
balance	-4,8347	3,92075	184
GDP_head	31197,75	10239,204	184
min_wage	13345,03	5870,931	184
health_exp	8,129	2,1764	184
interest	5,0268	1,63367	184
debt	49,726	34,8934	184
strictness	2,1635	,86853	184

Source: Author

In Table 3 (Descriptive Statistics) we found that of the 756 cases we introduced into the model, and according to the method used for regression analysis i.e. stepwise (Nurosis, 2002), 184 finally participated, with the mean of the independent variable being 21%.

Table 4. Correlation

Pearson Correlation density	1,000	Sig. (1-tailed) density	-
income	-,113	income	,323
unemploy	,123	unemploy	,307
balance	,097	balance	,347
GDP_head	,199	GDP_head	,207
Min_wage	,029	Min_wage	,453
Health_exp	-,325	Health_exp	,087
interest	,103	interest	,337
debt	,469	debt	,092
strictness	-,471	strictness	,091

Source: Author

In table 4 (Correlations), where the second column shows the values of the correlations of the independent predictors with the depended one (density) - with the title Pearson Correlation- we observed that the highest level of correlation with the dependent variable is shown by the predictor strictness with r = -47.1% and absolute value |0,471|, followed by the variable debt with r = 46.9%, while the lowest correlation value is noted at variable min_wage with r= 2.9%. In the fourth column (Sig. 1-tailed) is listed the correlation of the independent variables with each other. According to Dafermos (2005) a good linear regression analysis requires the independent predictors not to be highly correlated. So if we check the existence of a relationship between them with our null and alternative hypothesis we will observe the following:

Ho: There is no linear relationship between the independent variables
H1: There is a linear relationship between the independent variables

Because observed levels of statistical significance are in all cases sign (1-tailed)> 5%, with the higher value in the min_wage variable (0.453 or 45.3%) and lower in the health_exp variable (0.087 or 8.7%), our zero hypothesis is valid.

Table 5. Variables Entered/Removed [a]

Model	Variables Entered	Method
1 2 3 4	strictness min_wage balance debt	Stepwise(Criteria: Probability-of- F-to-enter<=0,50, Probability-of-F-to-remove>=0,100

a. Dependent Variable: density

Source: Author

Table 5 shows which predictors were entered and removed from the model using the Stepwise Method, at which time and by which criteria Therefore, we observed that 4 predictors from 9 were chosen with the variable strictness first introduced into the model, which also had the highest absolute value for the dependent variable | 0.471 | (from table nr. 4 correlations), while the latter manages to introduce variable debt.

Table 6. Model summary(e)

Model	R	R Square	Adjusted R Square	R Square Change	Sig. F Change	Durbin Watson
1	,471(a)	,221	,176	,221	,042	
2	,936(b)	,875	,860	,654	,000	2,225
3	,957(c)	,916	,899	,041	,017	
4	,979(d)	,959	,947	,043	,002	

(a). Predictors: (Constant), strictness
(b). Predictors: (Constant), strictness, min_wage
(c). Predictors: (Constant), strictness, min_wage, balance
(d). Predictors: (Constant), strictness, min_wage, balance, debt
(e). Dependent Variable: density
Source: Author

Table 6 provides a summary of our regression model according to the Stepwise method. We observed that the method evolved in four phases, as well as the number of the independent variables we had available and at each stage, created a new model. In this table we saw that the first model created by the introduction of the variable strictness alone, can explain 22.1% of the dispersion (R2 =, 221) while the addition of the variable min_wage to model 2, results to the explained dispersion increasing to 87.5%. Correspondingly in the 3rd model, the variable balance increases the dispersion to 91.6%, while finally in the 4th model with four predictors (strictness, min_wage, balance, debt) is able to explain 95.9% of the total dispersion of the dependent variable density and of course with the specific size of the 184 cases that were introduced into the reciprocating model. So if we analyze the results of model 4, which is the model with the largest number of predictors (4), we get the following:

- Multiple correlation coefficient R showing the correlation between observed and predicted values of the dependent variable is high and takes the value R = 97.9%

- The R2 multiplicative index, which in the case of the 4th regression model equals to 95.9%, shows the percentage of high dispersion, credited to the density-dependent variable with all the 4 independent variables (strictness, min_wage, balance, and debt). This value when it is higher than 50%- and in the context of research conducted in the field of Social Sciences- according to Stevens (2002) is fully acceptable. (Myers, 1990) considers that the value of R2 should exceed 50% to 70%.

- The Adjusted coefficient of determination (Adjusted R^2) with a value of 94.7% is essentially a correction of R2 which essentially offsets its potential bias, which also receives a high predictive value.

- According to Stevens (2002) a model has high predictive power since the value of n / k is greater than 5, where n is the sample size and k is the number of predictors. In this reciprocal model, we considered that this ratio is equal to 184/4 = 46

- Regarding the factor R2Change, we note that its initial value in model 1 was 22.1% when only the strictness variable was introduced into the model. In the second model, the introduction of the second variable min_wage added 65, 4% to the factor R2Change, in the third model, the independent variable added an additional 4.1% and finally in the fourth model, the debt variable had an additional 4.3%.

- The factor sign. F Change contains the statistical significance levels of each variable. Indeed, the introduction of the predictor's strictness min_wage, balance, and debt, is statistically significant and takes the values of, 042 /, 000 /, 017 and, 002 respectively for each model. Therefore, the insertion of the independent variables mentioned above and in the order they were introduced, is considered significant since they all receive values that are higher than the input criterion in the set model (, 0005).

Table 7. Coefficients [a]

Model		Unstandardized Coefficients			Collinearity Statistics	
		B	Std. Error	t	Tolerance	VIF
4	(Constant)	-90,044	12,023	-7,489		
	strictness	-37,990	2,470	-15,382	,247	4,054
	min_wage	,009	,001	11,540	,231	4,334
	balance	1,071	,238	4,499	,768	1,302
	debt	,168	,044	3,840	,820	1,219

a. Dependent Variable: density
Source: Author

Table 7 (coefficients) in column B contains all information on the 5 parameters of the reciprocal equation including the constant term. Thus the reciprocal equation constructed on the basis of our sample data and with the help of the Stepwise method is as follows:

Density= [(-37,990). (strictness)] +[(,009). (min_wage)] +[(-1,071). (balance)] + [(,168). (debt)] -90,044.

In the regression equation created, we observe that all the coefficients by which the variables multiply have positive signs except for the coefficient of variable strictness. This means that the 3 predicted variables min_wage, balance, debt have a positive correlation with the dependent variable density, while the strictness variable has negative. Further, we find that the greatest effect seems to be exercised by the variable strictness, which in column t has the largest absolute value (| 15,382 |) = -15,382. Thus, according to column k, the best predictor is strictness with absolute value | 15,382 |, and follow with reduced weight given their absolute values, the predictor min_wage with absolute value | 11,540 |, the predictor balance with absolute value | 4,499 | and finally debt with absolute value of |3,840|.

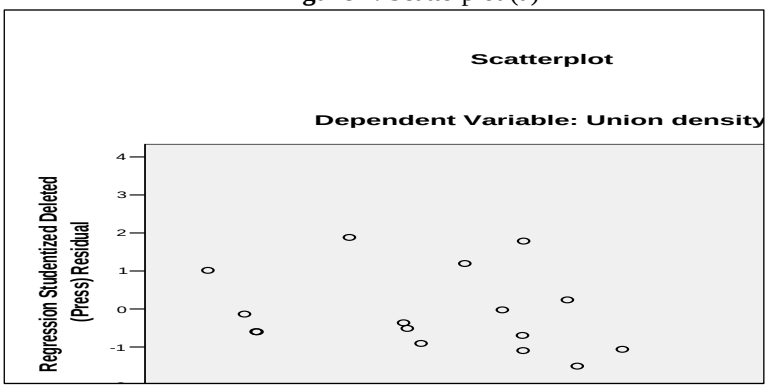
6. CONTROL OF ADMISSIONS

6.1. Independent Control Admission

The independent control admission is satisfied via three ways:

a) Using the scatterplot of studentized residuals against the sequence of observations

Figure 1. Scatterplot (a)



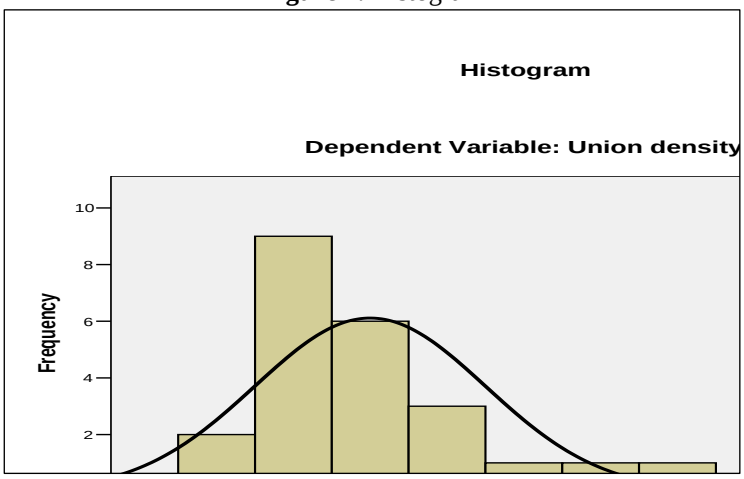
Source: Author

Figure 1 contains a random distribution of residuals above and below the imaginary horizontal line, starting at zero. There are no systematic clustering or patterns.

b) Using the Durbin-Watson statistical indicator (Table 6). As the indicator has a score between 1.5 and 2.5 (in our case 2,225) the independence observation is assured. Apart from this, the number of observations (184) is a multiple of the number of predictors.

c) According to Dafermos (2005) if the number of cases taking part in the analysis (in our case 184) is much greater than the number of coefficients in our regression model, including the fixed term (in our case 5), then the test of the assumption of independence is satisfied. This is exactly what happens in our case (184> 5).

Figure 2. Histogram

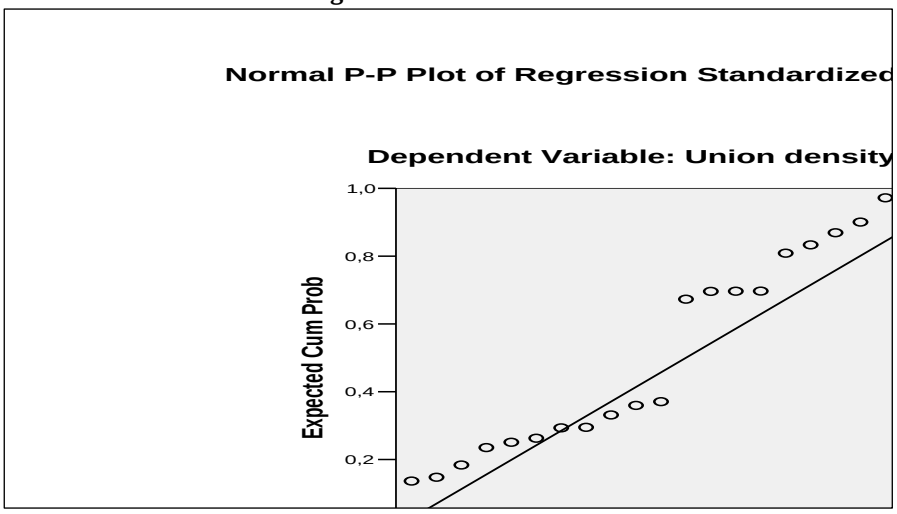


Source: Author

6.2. Control of Distribution Regularity

One of the main research concerns during the regression procedure is the possible violent interruption of regularity. Figure 2 shows that standardized Residuals follow the regular distribution with a Gauss Bell to have symmetry and normality in how values are distributed.

Figure 3. Normal P-P Plot

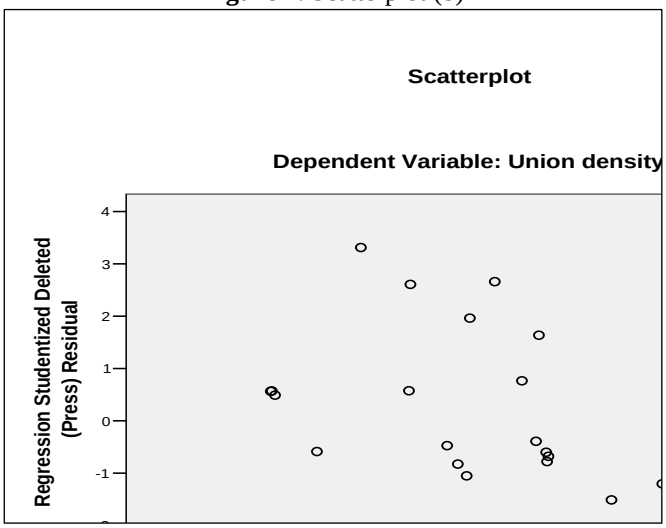


Source: Author

Moreover in figure 3, Normal P-P Plot of Regression Standardized Residual, where the vertical axis has the cumulative frequencies of the dependents' predictor expected values, and the horizontal presents the cumulative frequencies of the dependents' predictor observed values, we note that, because the figure dots are very near the line bisecting the x and y axes, we have a very clear indication of the approximate normality of our regression.

6.3. Control of Linearity and Disseminate Equality Admission

Figure 4. Scatterplot (b)



Source: Author

The Scatter Plot (Figure 4), which shows a scatter plot of Deleted Residuals against Predicted Values, satisfies the linearity and disseminates equality admissions, with patterns and systematic clustering absence.

6.4. Multi-Linear Evasion Control

Table 8. Collinearity Diagnostics

Model	Dimension	Eigenvalue	Index	Variance Proportions				
				Constant	strictness	min_wage	balance	debt
4	1	4,486	1,000	,00	,00	,00	,01	,00
	2	,389	3,398	,00	,01	,00	,59	,00
	3	,092	6,972	,00	,06	,00	,15	,66
	4	,032	11,879	,06	,29	,01	,17	,22
	5	,002	54,134	,94	,64	,99	,07	,12

Source: Author

In table 8 (Collinearity Diagnostics) and in the column of eigenvalues of covariance matrix, we observed that none of the variables is zero (0) and that only the index of the variable debt approaches dangerously (0,002).

Additionally, in Table 7 (Coefficients) where Tolerance Factor is analyzed, we observed that it has values from 0 to 1. When an independent variable has a tolerance near 1, it means that only a very small percentage of its distribution can be explained by other independent variables, which happens exactly in our case. Also in the same table (7) and for the variance inflation Factor VIF, when it does not exceed 10 there is no problem of Multi-linear evasion (Myers, 1990), which also exists in our analysis.

7. CONCLUSION AND SUGGESTIONS FOR FURTHER RESEARCH

The basic aim of this research was to investigate the relationship between union density and different macro-economic measures or other State indicators. The research aim was achieved with the creation of a retrograde equation, presented in column B of table 7 (Coefficients), showing all the data of the 5 regression parameters. All variables in the equation affect the configuration of the dependent variable "density" (Union density In the regression equation created we observed that all the coefficients by which the variables multiply have positive signs except for the coefficient of variable strictness. This means that the 3 predicted variables min_wage, balance, and debt have a positive correlation with the dependent variable density, while the strictness variable is negative. Further, we find that the greatest effect seems to be exercised by the variable strictness, which in column t represents the largest absolute value (| 15,382 |) = - 15,382.

The second objective was to verify the degree of influence of all the model's variables, in which the values of used variables were counted via extraction and interpretation of the retrograde equation. However, based on the statistical importance levels, that correspond to the t values of table 7, the best predictor variable is strictness, followed by min_wage, balance, and debt. Even if the hierarchy is considered, (Dafermos, 2005) as more representative of variable value, it would nevertheless not be wise to interpret their numerical classification in an absolute way because of the reserve of t prices theoretical approach.

The research has numerous restrictions. Findings cannot be generalized without verification. Thus, there is a need for more extensive research using another sample with the use of another kind of dependent variable and other independent variables. Also, research on the examination of each variable that influences output separately must be realized.

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