Integrated Approach to the International Aspects of Online Dispute Resolution Formation

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Abstract

The article presents an in-depth analysis of the International Aspects of Online Dispute Resolution (ODR) formation, focusing on the influence of economic, social, and technological factors on the effectiveness of ODR across various countries. By employing factor and regression analyses, the study identifies key determinants of ODR's success, such as GDP, population, consumer price index, unemployment rate, and others. It explores the significant impact of a country's economic development on ODR effectiveness and offers insights for policymakers on enhancing ODR systems through economic incentives, technological advancements, and legal education. The research highlights the need for a comprehensive approach to improve access to justice via online platforms, suggesting future directions to expand the study's parameters for a deeper understanding of ODR's dynamics. This work contributes significantly to the legal research field, particularly in the context of digitization and information technologies, offering a foundation for improving online dispute resolution mechanisms globally..

Keywords

Artificial intelligence, online dispute resolution, alternative dispute resolution, extrajudicial dispute resolution, civil cases, consumers, merchants, factor analysis

1. Introduction

In the modern world of rapid development of digital technologies and the information society, new challenges and opportunities arise in the field of legal research, particularly in the context of dispute resolution. Online Dispute Resolution (ODR) is becoming an increasingly important tool in resolving legal conflicts, providing efficient, accessible, and fast methods of resolution. This is particularly relevant in the conditions of globalization and internationalization of economic relations, where traditional mechanisms of legal regulation often cannot provide a quick and effective response to the challenges of the present day.

The increasing significance of ODR requires a profound understanding of the factors influencing its effectiveness and adoption. In this context, analyzing the impact of economic, social, and technological parameters on the success and adoption of ODR in different countries becomes particularly relevant. Considering the complexity and multidimensionality of these factors, the application of quantitative research methods, including factorial and regression analysis, opens up new perspectives for identifying key determinants of ODR effectiveness.

This article aims to investigate the relationship between various legal, economic, social, and technological parameters and the effectiveness of ODR in different countries. Special attention is given to factorial analysis as a method for reducing data dimensionality and identifying latent variables that influence ODR, as well as further development of regression models to assess the

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impact of these factors on the adoption and success of ODR. The use of advanced statistical analysis methods not only deepens the theoretical understanding of the mechanisms of ODR functioning but also allows for the development of practical recommendations to improve policies and strategies in the field of online dispute resolution.

The research is based on data analysis from various sources, including statistical databases of the European Union, which provides a reliable foundation for assessing and comparing the effectiveness of ODR in different jurisdictions. Therefore, this scientific work makes a significant contribution to the development of legal research in the context of digitization and information technologies, opening up new horizons for understanding and improving mechanisms of online dispute resolution.

The object of the research is the effectiveness and adoption of ODR, while the subject is the influence of various parameters on ODR outcomes, particularly within different national contexts. This issue becomes increasingly relevant in the context of rapid digitalization of society and growing globalization, where traditional mechanisms of legal regulation may not always provide a quick and effective response to contemporary challenges.

This work is structured as follows: in Chapter 2, an analysis of related doctrinal studies and works by scholars is discussed; Chapter 3 presents the methodologies of factorial analysis research to uncover latent variables influencing ODR in the context of different countries; Chapter 4 outlines the implementation of the approach proposed by the authors; and Chapter 5 provides the conclusions drawn from the research.

2. Related work

The discussion on Online Dispute Resolution (ODR) highlights its significance in managing cross-border online transactions, particularly in e-commerce. It encompasses both narrow interpretations, such as online arbitrators, and broader mechanisms including Alternative Dispute Resolution (ADR) methods and online courts. For example, the EU has developed a robust ODR platform, which includes a multilingual register of ADR bodies and has been enhanced to improve user experience and functionality [1, 2].

In terms of promoting ODR, the EU Commission launched campaigns aimed at increasing consumer and trader engagement, significantly boosting visits to the platform [2]. The scholarly focus on ODR underscores its role in addressing the inadequacies of the traditional judicial system, particularly in the U.S., and includes the use of advanced technologies like blockchain for mediation and arbitration [3, 4].

The article also delves into the practical applications of ODR, examining its effectiveness compared to traditional court proceedings and its integration within different national systems, such as those in Italy, Canada, and the UK. It discusses specific platforms like RisolviOnline in Italy and eResolution in Canada, focusing on their roles in ensuring mediator impartiality and effective dispute resolution [5].

Furthermore, the study explores the psychological and behavioral aspects of ODR, emphasizing the importance of understanding emotional reactions and decision-making processes to enhance the effectiveness of ODR platforms [6-8]. The application of factor and regression analysis provides a deeper understanding of the structural relationships among various factors influencing ODR's effectiveness and adoption across different countries [9-15].

This comprehensive examination of ODR not only outlines its diverse applications and benefits but also highlights the essential conditions necessary for its development and role in self-regulation, making it a crucial tool in the evolving landscape of global e-commerce and legal systems.

3. Methodology

3.1. Data Collection and Analysis Procedures

The European ODR platform, initiated by the European Commission, serves as a vital resource for consumers across the EU, Norway, Iceland, and Liechtenstein, facilitating the resolution of online purchase disputes through accessible and multilingual tools. By offering direct communication channels between consumers and traders, it streamlines the process of reaching fair solutions, often involving approved dispute resolution bodies, which are impartial entities proficient in resolving conflicts efficiently and economically. The platform's independence from any trader ensures a neutral ground for negotiations, promoting transparency and fairness in resolving complaints. Through its functionality, it addresses both national and cross-border grievances, with data analysis further revealing insights into sectors receiving the highest volume of complaints, guided by parameters such as Gross National Income (GNI) per capita and Gross Domestic Product (GDP), which illuminate economic factors shaping consumer behavior and dispute patterns, aiding policymakers in enhancing consumer protection measures.

Table 1

Dataset Parameters [16]

Parameter	Explanation	Data type
Population	Population size	int64
HICP	The Harmonised Index of Consumer Prices	float64
Unemployment	Information on the number of unemployed people	float64
GNI	Gross National Income per capita in PPS	float64
GDP	Gross domestic product	float64
Tax rate	Tax rate	float64
National complaints	Data on the number of national complaints	int64

3.2. Description of Methods

In this study, we employ factor analysis to uncover latent variables influencing ODR across different countries, analyzing comprehensive information that includes economic, social, and technological parameters such as GDP, population, consumer price index, unemployment rate, and others. The choice of factor analysis is motivated by its ability to reduce the dimensionality of data and identify key factors from a large number of variables, thereby enabling the identification of primary drivers of ODR.

The process (Figure 1) of factor analysis [17] begins with assessing the adequacy of the data for factor analysis using the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure, ensuring that the dataset contains sufficient correlations to perform the analysis. Next, the Kaiser criterion and scree plot are used to determine the optimal number of factors to be extracted.

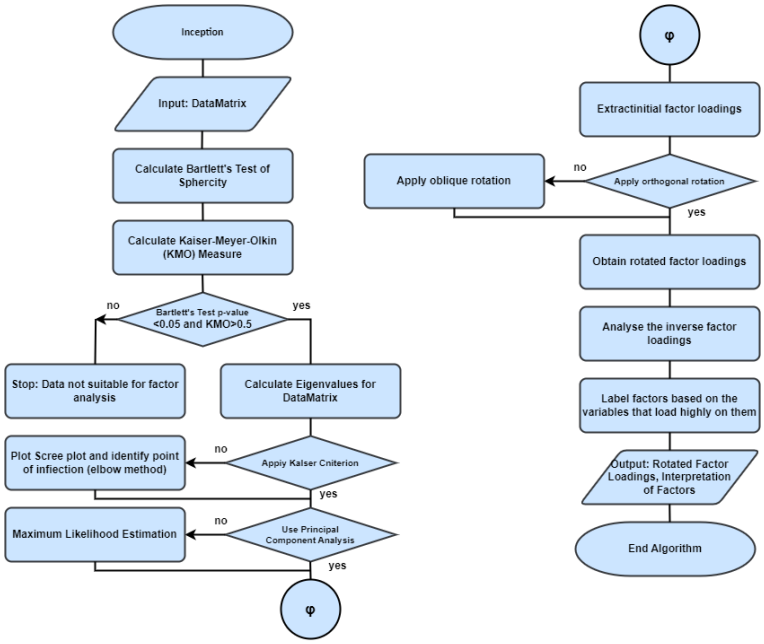

Figure 1: Algorithm of factor analysis revealing latent variables influencing ODR

Applying either the principal component method or maximum likelihood estimation allows for evaluating factor loadings, which indicate how each variable relates to the factors. Factor rotation, whether orthogonal or oblique, is conducted to enhance the interpretability of the factors, making the model more understandable. Finally, analysis of factor loadings enables the interpretation of the substantive significance of each factor, revealing the underlying dimensions inherent in the dataset and providing deep insights into the structure of the phenomena under investigation.

Such an approach is critically important for formulating effective strategies and policies aimed at supporting and developing ODR, taking into account the unique economic and socio-cultural contexts of each country.

For the task of analyzing the impact of economic, social, and technological parameters on ODR in different countries, factorial analysis can be mathematically described as follows:

Let there be m observed variables: GDP, Population, HICP (Harmonized Index of Consumer Prices), Unemployment rate, GNI, Tax rates, and ODR.

We are seeking a way to express these variables through a smaller number of latent factors $□_1, □_2, \ldots, □_□$, where $□ < □$, in order to maximize the retention of information about the relationships between the original variables. The mathematical model (1) for factor analysis in this context is as follows:

$$X_i = \lambda_{i1}F_1 + \lambda_{i2}F_2 + \ldots + \lambda_{ik}F_k + \epsilon_i, \quad (1)$$

where X_i — i-th observed variable, F_j — j-th factor, λ_{ij} — factor loading indicating the strength of the influence of the i-th variable, ϵ_i — is the unique error for the i-th variable representing the portion of variabilityX_i—, not explained by the common factors.

After determining and interpreting the factors using factor analysis, the next step is to construct a regression model [18] for the selected factor. The purpose of this step is to assess the influence of the selected factor (or factors) on the dependent variable, in our case - ODR. Mathematically, this process can be described as follows. Let F represent the selected factor from the factor analysis, and Y - the dependent variable (ODR). The regression model (2) for the selected factor will look like this:

$$Y = \beta_0 + \beta_1 F + \epsilon \quad (2)$$

where: Y — dependent variable (ODR), F — selected factor, which may represent a quantitative representation of the influence of economic, social, or technological parameters, β_0 — constant representing the value of Y, when $F = 0$, β_1 — coefficient measuring the change in Y

for one unit change in$F$, ϵ — error term representing the variation in Y not explained by the model.

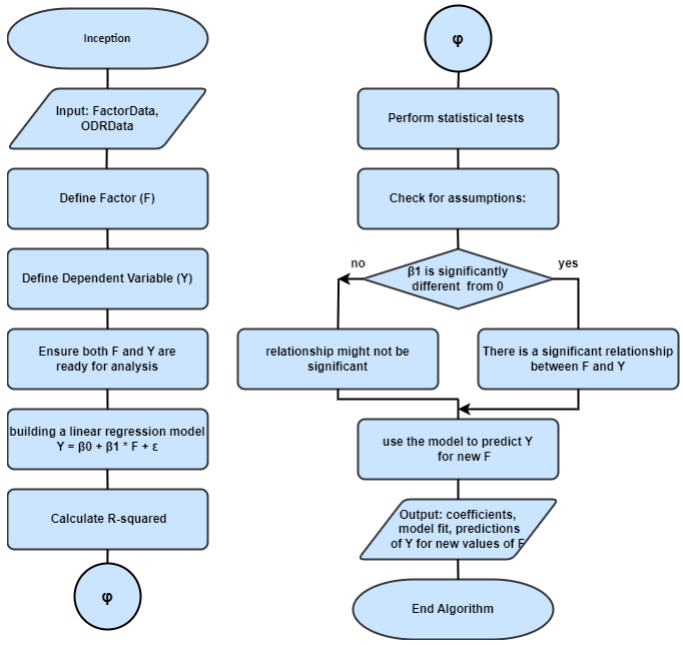

Figure 2: Algorithm of regression analysis for the regression model of the selected factor

The process of regression analysis (Figure 2) begins with careful data preparation, where the dependent variable Y and independent variable F are identified and prepared for analysis. In cases where the factor F consists of multiple variables, a composite index may be created. Model estimation is performed using statistical software that allows for the estimation of important model parameters, such as the coefficients β_0 and β_1, which highlight the relationship between F and Y. Checking the adequacy of the model through statistical tests and diagnostic helps ensure the reliability and validity of the conclusions. Analysis of the estimated coefficients reveals insights into the influence of selected factors on the dependent variable, and forecasting based on new data allows for the application of the obtained knowledge in practice.

In this section, theoretical aspects and methodological approaches to analyzing the influence of economic, social, and technological parameters on ODR through the application of factor analysis and subsequent construction of a regression model are considered. In the following section, we will focus on the practical implementation of the proposed approach, including a detailed analysis of data, the use of statistical software for factor and regression analysis, and the discussion of the obtained results. This will not only confirm theoretical assumptions but also provide practical recommendations for improving online dispute resolution processes.

4. Experimental Results

To implement the proposed approach described in section 3.2 using the dataset described in section 3.1, we utilized the Python programming language, which is widely recognized as a tool in scientific research due to its flexibility, extensive support, and rich set of libraries for data analysis. Key libraries used in our study include pandas for data processing and analysis, numpy for performing mathematical operations, scikit-learn for building regression models, and statsmodels for conducting statistical analysis, including factor analysis and regression model parameter estimation. The use of the matplotlib and seaborn libraries allowed us to effectively visualize the data and analysis results, facilitating a better understanding of the conclusions drawn. This comprehensive approach, which incorporates the use of advanced programming and statistical analysis tools, enabled us to deeply investigate and interpret the relationships between various economic, social, and technological parameters influencing ODR.

Figure 3 depicts a column chart illustrating the distribution of ODR across different countries. Each column corresponds to a specific country, with the height of the column proportional to the number of ODR cases in that country. The colors of the columns vary for each country, facilitating visual differentiation between them. The tallest column, standing out from the others, indicates a significantly higher level of ODR compared to other countries, while the rest of the columns have noticeably lower heights. This may indicate differences in the effectiveness or popularity of online dispute resolution systems in different jurisdictions.

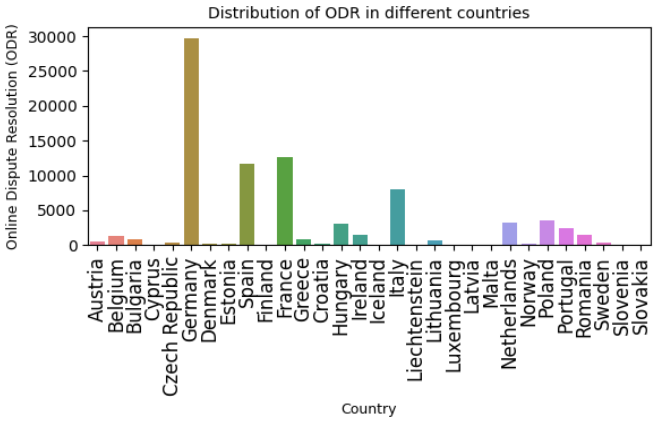

Figure 3: Distribution of ODR in different countries

After preprocessing the data, the results of the Bartlett's test (Figure 4) showed a p-value of 4.34e-21, significantly lower than the established threshold of 0.05. This indicates the presence of significant correlations between variables and suggests the inadequacy of the identity correlation matrix. Additionally, the Kaiser-Meyer-Olkin (KMO) index with a value of 0.67 exceeds the critical value of 0.6, demonstrating sufficient correlation between variables for their effective grouping using factor analysis. These results provide grounds for using factor analysis to identify interpretable relationships between selected variables in the investigated dataset.

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Bartlett's test p-value: 4.344987396237408e-21
KMO test: 0.6677516725501211
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Figure 4: Test Results

The results obtained from the factor analysis (Figure 5) indicate three significant factors, reflected by their eigenvalues, with the first three exceeding the critical threshold of 1, namely 3.20, 1.45, and 1.26. The highest factor loading is observed in the first factor for the first (0.96) and fifth (0.97) variables, indicating a high correlation with this factor. The second factor dominates in the second variable with a loading of 0.95. The third factor has the highest loading for the fourth variable (0.63), suggesting its significant influence on the third factor.

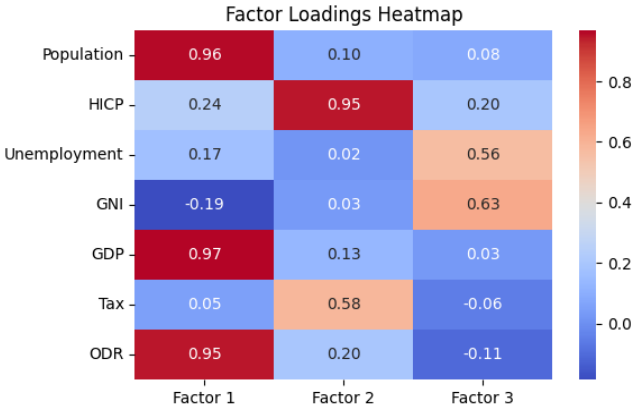

Figure 5: Factor Analysis Results

Regression analysis (Figure 6) using Ordinary Least Squares (OLS) method revealed that a model with two independent variables - GDP and population - has a high coefficient of determination R^2 at 0.893, indicating that approximately 89.3% of the variability in the dependent variable ODR can be explained by these variables. The F-statistic value of 112.5, with its corresponding p-value of 8.01e-14, signifies the overall statistical significance of the model. The coefficient for GDP is statistically significant with a p-value less than 0.05, highlighting its influence on ODR. However, the coefficient for population is not statistically significant (p = 0.566), indicating weak or no dependence of ODR on population size in this model. Analysis of model residuals, including Durbin-Watson, Omnibus, and Jarque-Bera statistics, does not suggest any clear violations of normality or autocorrelation.

OLS Regression Results

Dep. Variable:	ODR	R-squared:	0.893
Model:	OLS	Adj. R-squared:	0.885
Method:	Least Squares	F-statistic:	112.5
Date:	Mon, 12 Feb 2024	Prob (F-statistic):	8.01e-14
Time:	15:00:18	Log-Likelihood:	-269.72
No. Observations:	30	AIC:	545.4
Df Residuals:	27	BIC:	549.6
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-883.0713	459.898	-1.920	0.065	-1826.703	60.561
GDP	0.0058	0.001	4.022	0.000	0.003	0.009
Population	3.339e-05	5.74e-05	0.582	0.566	-8.44e-05	0.000

Omnibus:	2.594	Durbin-Watson:	2.175
Prob(Omnibus):	0.273	Jarque-Bera (JB):	1.387
Skew:	0.137	Prob(JB):	0.500
Kurtosis:	4.017	Cond. No.	3.22e+07

Figure 6: Results of Regression Analysis

Based on the provided results (see Figure 6) of the regression analysis, the created model can be expressed as:

$$ODR = -883.0713 + 0.0058 \times GDP + 0.00003339 \times Population \quad (3)$$

The model's constant (-883.0713) represents the baseline level of ODR when the values of GDP and Population are zero. The coefficient for GDP (0.0058) indicates that with each unit increase in GDP, ODR increases by 0.0058 units, while the coefficient for Population (0.00003339) indicates a slight increase in ODR by 0.00003339 units with each additional unit of population.

Figure 7 presents a comparison of actual and predicted ODR values in the form of a bar chart for different countries. Actual ODR data are represented in blue, while predicted values obtained from the linear regression model (3) are depicted in red, allowing for a visual comparison of the model's accuracy for each country. The diagram demonstrates significant variability between actual and predicted values, indicating potential complexity of the model and the need for further refinement of analytical models for better ODR prediction.

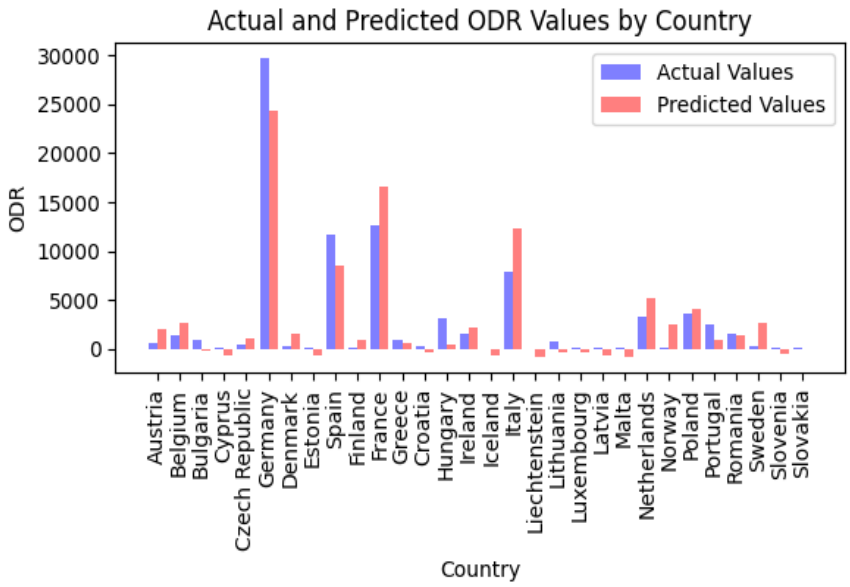

Figure 7: Actual and Predicted ODR Values by Country

Therefore, the linear regression model is capable of explaining a significant portion of the variability in ODR, although some discrepancies between actual and predicted values indicate the need for further model refinement. Regression analysis underscored the importance of GDP as a significant predictor for ODR, while the impact of population was found to be insignificant. To improve modeling results and ensure more accurate ODR forecasts, it is necessary to consider the possibility of increasing the number of parameters, including other potentially influential variables that may affect ODR in different countries.

5. Conclusions

During this study, a deep analysis of the influence of economic, social, and technological parameters on the effectiveness of ODR in various countries was conducted. The application of factor analysis allowed for the identification of key latent variables affecting ODR, including GDP, population, HICP, unemployment rate, GNI, tax rates, and other parameters. The results of regression analysis, which showed a high coefficient of determination R^2 at the level of 0.893, indicate that the selected variables have a significant impact on ODR. Particularly significant was GDP, confirming the hypothesis of a close relationship between a country's economic development and the effectiveness of online dispute resolution mechanisms.

The obtained results hold significant practical implications for policymakers aiming to develop and support ODR. Firstly, the high correlation between a country's GDP and ODR effectiveness underscores the necessity of investing in economic development as a factor contributing to improved access to justice and online dispute resolution. Secondly, the minimal impact of population size on ODR suggests that efforts should focus not only on quantitative aspects but also on qualitative improvements in the ODR system, including technological infrastructure and legal education for citizens.

Based on the analysis, it can be concluded that a comprehensive approach is crucial for enhancing ODR effectiveness, encompassing economic incentives, technological development, legal education for the population, and adaptation of legislation to the needs of the digital era. Such an approach will not only improve access to justice through online platforms but also ensure more efficient and fair dispute resolution.

Future research directions in the context of analyzing ODR effectiveness involve expanding the set of studied parameters to gain a deeper understanding of the impact of various factors on the success of these systems. This includes not only traditional economic and social indicators but also parameters related to legal culture, access to digital technologies, the level of population

education in digital law, and specific aspects of legislation regulating ODR in different jurisdictions. Additionally, researching the influence of international cooperation and integration of legal norms in the context of ODR on the effectiveness of resolving cross-border disputes is important. Expanding parameters will not only refine existing forecasting and analysis models but also uncover new, previously unconsidered correlations and drivers of ODR effectiveness. This will lay the groundwork for developing more comprehensive and effective strategies to enhance online dispute resolution at both national and international levels.

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