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Legal Determinants of IPO Activity: Insights from European Stock Markets

SYLWIA CIEŚLIK

corresponding author
Department of International Finance and Investment, Faculty of Economics and Sociology, University of Lodz, POW 3/5, 90-255 Lodz
✉ sylwia.cieslik@uni.lodz.pl
ORCID: 0000-0002-8512-9983

TOMASZ SOSNOWSKI

Department of International Finance and Investment, Faculty of Economics and Sociology, University of Lodz
✉ tomasz.sosnowski@uni.lodz.pl
ORCID: 0000-0001-5610-0404

Abstract

Motivation: In evolving economic landscape, the legal framework serve as vital institutional structures that shape both investor confidence, but also the overall attractiveness of capital markets. As companies navigate the complexities of launching initial public offerings (IPOs), the presence of a robust legal environment can either facilitate or hinder their activities.
Aim: This research investigates the influence of legal determinants on IPO activity with a particular focus on the difference between foreign and domestic companies. By examining the institutional factors, the study explores the motivations that drive firms to pursue IPOs both in the short- and long-term.
Results: The results of panel ARDL model show that an effective legal system that safeguards individual rights positively impacts IPO activity. A less stricter regulatory environment can negatively affect the decisions of domestic companies. Additionally, the regression

tree analysis reveals that judicial independence and contract enforcement are the primary factors influencing IPO decisions.

Keywords: IPO; legal factors; going public; institutional differences
JEL: G15; G23; G28; G32

1. Introduction

The legal system of the European Union (EU) member states is shaped by regulations, which are characterised by considerable harmonisation through EU legislation (Helbing et al., 2019). This harmonization extends to the development of stock exchange policies, primarily shaped by regulations and directives as the key legislative instruments. Regulations apply directly in all member states, while directives require implementation, leaving countries discretion in choosing the measures to achieve their objectives. In addition, stock exchange regulations, such as the internal acts, and the recommendations and guidelines issued by capital market authorities, further differentiate the legal systems of EU countries. Although these regimes are striving towards harmonisation, differences remain, which can have an impact on firms' IPO decisions (Gupta et al., 2018; Rivas & Adamuz, 2019).

In terms of the number of IPOs, one of the most important European markets is London. Following the UK's exit from the EU, differences in legislation between the UK and EU countries have widened. In 2023, the Financial Services and Markets Act was introduced (HM Treasury, 2024), which reformed the UK capital market in response to the post-Brexit reality (Payne & Pereira, 2023). In the EU, in turn, the New Listing Act was introduced in October 2024, which revised key stock market regulations (European Commission, 2024). The changes to European stock exchange law are, among others, a response to the declining interest of companies in going public, which is observed across Europe (PwC, 2024). This trend underscores IPOs' importance for capital market development, as studies confirm (e.g. Aktas et al., 2019; Pešterac, 2020). In response to these challenges, legislators at the EU and national level are taking steps to reduce legal burdens in order to make the stock market more attractive.

In this context, this paper addresses the impact of legal factors on the number of IPOs in European stock markets. The aim of the article is to identify and assess the impact of legal environment on the IPO activity on stock markets in Europe. In view of the new challenges facing legislators in all EU member states, it is important to identify which areas of the legal system determine companies' decisions to go public. Moreover, the diversity of legal regulations in the individual EU member states may influence companies' preferences regarding the choice of listing venue, especially in the case of

foreign firms. Considering the above, the study formulated three research questions: 1) Which legal factors have a significant impact on the number of IPOs on stock markets in Europe?; 2) How do legal factors affect the number of IPOs in the short versus long term?; 3) Does the impact of legal factors on IPO activity differ between domestic and foreign companies?

The paper contributes to the literature on institutional determinants of IPO activity by providing a novel analysis of the impact of legal system and regulations on IPO activity in European markets. Specifically, it highlights how these factors shape the decision-making processes of domestic and foreign companies when considering going public. In addition, the study fills a gap in the literature by deepening the understanding of firms' motives to go public, considering differences due to their origin. Examining institutional-level factors can provide valuable insights for policymakers as creating a favourable regulatory environment by promoting competitiveness and reducing regulatory barriers can significantly increase the attractiveness of stock markets in Europe.

The article is structured into five sections: the introduction outlines the study's problem and purpose, section 2 reviews the literature, section 3 details the methodology, section 4 presents the results, and section 5 concludes.

2. Literature review

The impact of the legal environment on the decision to go public and activity in stock markets has been widely analysed in the literature. The theoretical foundations include several approaches, including institutional theory (DiMaggio & Powell, 1983). In the context of the stock market, this theory points to the influence of external factors, such as the quality of the regulatory environment, legal stability or regulatory transparency on IPO decisions (Meluzin et al., 2021). According to the bonding theory, firms choose to list on foreign exchanges — particularly in markets with stricter regulatory frameworks to "bond" themselves to higher standards of corporate governance, and investor protection. This phenomenon is particularly relevant for firms originating from developing countries and it was primarily focused on the U.S. market (Coffee Jr., 1999). Over time, the application of this theory has been extended to other markets (Johnson et al., 2015; Licht et al., 2018), including those in Europe (Liu et al., 2017; Liu & Li, 2019).

As showed by empirical research, strengthened formal institutions benefit companies' decisions to go public (Gupta et al., 2018; Rivas & Adamus, 2019; Meluzin et al., 2021). Studies also confirm a positive relation between institutional quality in local stock markets and IPO volumes (Meluzin et al., 2021). The impact of legal factors on the IPO market is measured by researchers with indicators such as regulatory quality (Gupta et al., 2018; Meluzin et al.,

2021), rule of law (Gupta et al., 2018; Helbing et al., 2019; Rivas & Adamus, 2019; Meluzin et al., 2021), regulatory incentives for IPOs (Meluzin et al., 2021) or regulatory efficiency (Helbing et al., 2019; Schnyder et al., 2021).

Research on the impact of legal factors also encompasses the legal protections afforded to minority shareholders. Studies suggest that enhanced legal safeguards for minority shareholders not only contribute positively to the performance of firms following their IPOs (Espenlaub et al., 2020), but also play a significant role in the overall development of the stock market. Specifically, stronger protections are associated with improvement of the equity market (Macoris et al., 2023) as well as financial performance of the company (Zahid et al., 2023).

When pursuing overseas listings, firms consider legal and regulatory factors in both their home and host countries (Liu et al., 2019; Schnyder et al., 2021). Companies often choose to list abroad to access markets with stronger securities regulations and reduce informational frictions that hinder investor confidence and market efficiency (Malen et al., 2023). This strategic move aims to enhance visibility, attract a broader investor base, and achieve higher valuations. However, a significant institutional distance between the country of origin and the listing country can negatively impact IPO performance (Liu et al., 2019).

3. Methods

The study examines how the legal framework influences IPO activity within European stock markets. The primary method used in this research is panel Autoregressive Distributed Lag Model (panel ARDL). This method was not applied uniformly across all markets due to the limited frequency of foreign IPOs. Therefore, a classification approach was employed, using classification trees to group individual markets based on similarities in their legal systems and regulatory frameworks. The grouping was conducted using variables listed in the Table 2, which include components such as judicial independence, property rights, and freedom to compete. The results of the cluster analysis indicate four classes of countries with similar legal regimes, as it is shown in Chart 1. This approach indicated significant differences in Turkey's legal system and therefore the country was excluded from further analysis.

Based on the above grouping, a panel ARDL was applied. This method effectively analyses both short and long-term relationships between variables, accommodating data with different integration orders. This flexibility is essential given the complexity of the legal factors influencing IPO activity across diverse markets. Furthermore, panel ARDL allows for the inclusion of lagged variables, which captures the dynamic nature of the relationship between legal frameworks and IPO activity.

The study period covers 2006-2021 and was established according to the availability of independent variables. The variables used in the panel ARDL model are presented in Table 1. The dependent variables in this study are the total number of IPOs (NT), domestic IPOs (ND), and foreign IPOs (NF). The analysis encompasses IPO activity on both the main and alternative markets of stock exchanges across Europe. The independent variables represent the legal system (LS) and regulatory framework (REG). These variables were constructed using the indicators outlined in Table 2. The study also used two control variables which are market size (C1) and capitalization (C2).

The equation applied in this study are presented as follow:

$$\Delta \begin{bmatrix} NT \\ ND \\ NF \end{bmatrix}_{i,t} = \sum_{j=1}^{p-1} \alpha_{i,j} \Delta \begin{bmatrix} NT \\ ND \\ NF \end{bmatrix}_{i,t-j} + \sum_{j=0}^{q-1} \beta_{i,j} \Delta \begin{bmatrix} LS \\ REG \end{bmatrix}_{i,t-j} + \delta_i ECT + \psi_i C1_{i,t} + \vartheta_i C2_{i,t} + \varepsilon_t$$

where:
α, β – denote the short-run coefficients of dependent and independent variables;
δ – marks the speed of adjustment from the short run to the long run equilibrium dynamics in the error correction term;
Ψ, ϑ – stand for the coefficients for control variables;
p, q – mark optimal lag orders;
ε – denotes the error term.

For ARDL estimation, the variables used in the study should be tested for stationarity. The stationarity of the variables was tested using several tests - Im, Pesaran and Shin (IPS), Augmented Dickey-Fuller-Fisher (ADF-Fisher) and Phillips-Perron-Fisher (PP-Fisher) tests. Table 3 presents the results of the stationarity tests. The variables selected for the study indicate a mixture of variables showing stationarity at level and at the first difference. The above indicates the applicability of the ARDL model and indicates a well-suited selection of variables for the study (Pesaran et al., 1999).

The Akaike Information Criterion was employed to determine the optimal number of lags for the analysis. To examine the causal relationship between the dependent and independent variables of our interest, the Granger causality test was applied. Additionally, regression tree models were utilized to identify the legal factors with the most significant impact on the IPO activity that reflect the legal system and regulatory framework, listed in Table 2.

The data on companies was sourced from the World Federation of Stock Exchanges, while the legal factors included in the study were drawn from reports published by the Fraser Institute (2024).

4. Results

The panel ARDL results for relationship between legal system and the number of IPOs are shown in Tables 3. In the short term the variable LS has a positive and statistically significant effect on the number of IPOs in total and domestic IPOs. The strong legal frameworks enhances accountability and integrity in financial markets, which in turn fosters investor confidence (Boissin, 2022; Wang et al., 2023) and stabilizes the IPO market (Abdu-ALgafoor & Herode, 2023).

The relationship between legal system and IPO activity has not be observed for foreign firms. The lack of significance of this variable for overseas IPO activity may be due to the geographical context of the studied countries. As research shows, the IPO activity of foreign firms might be influenced by the home country legal system, but not the legal system of host country (Jiang & Wang, 2019; Liu et al., 2019). Furthermore, according to signalling theory, firms and investors may be more responsive to the perception of the quality of the law than to the actual level of the law quality (Schnyder et al., 2021). If the perception of legal protection is stable, this variable may appear to be neutral in the context of overseas listing.

In the long term, the variable LS does not exhibit a statistically significant impact on IPO activity. As it is suggested by empirical research, legal systems may not play a crucial role in the long-term dynamics of IPOs, overshadowed by informal and cultural factors (Rivas & Adamuz, 2019).

The impact of second dependent variable (REG) of our main interest is presented in Table 4. No short-term impact of this variable on the IPO market has been observed. The absence of short-term effects may be attributed to the complexity of the legal environment, shaped by a wide array of regulations that interact over time. Additionally, an IPO represents a strategic decision of a long-term nature, as companies typically consider broader institutional and market conditions when planning such a significant step. While legal frameworks can undergo changes, their influence on shaping the institutional environment and supporting strategic decisions like IPOs tends to evolve gradually.

In the long term, the level of regulation (REG) fostering the market freedom has negative and statistically significant effect on the total number of IPOs and domestic IPOs. Therefore, the results show that the deregulation negatively affects companies' IPO activity. This is supported by international studies on accounting enforcement indicating that in countries where these rules have been strengthened, the level of underpricing has decreased significantly (Bigus & Dreyer, 2023). A higher level of legal protection positively influences investor confidence (Boissin, 2022), which in turn leads to higher initial returns (Sundarasen et al., 2017). As the US example shows, a drastic

reduction of the regulatory burden may nevertheless be perceived by traders and investors as weakening the legal security of the stock market or increase of financial frauds (Saddoris, 2021).

The results also show the weak positive impact of decrease of regulatory burdens restricting the economic freedom (REG) on IPO activity of foreign firms (p-value equals to 0.1). In this regard, the results align with studies that challenge bonding theory (Liu et al., 2017; Liu & Li, 2019). Easing regulatory constraints may serve as an incentive for foreign companies – especially those from developing economies – which often face significant internal adjustments to align with the institutional and disclosure requirements of foreign capital markets. However, the ambiguous statistical significance does not allow for definitive conclusions to be drawn.

In the next step, the relationship between the legal framework and IPO activity was analysed using a Granger causality test. The results presented in Table 5 reveals unidirectional causality, with legal factors affecting the number of IPOs. As expected, the test indicates no evidence supporting the influence of the number of IPOs on legal factors. These findings confirm that variables selected for the study are appropriate and align with the hypothesized direction of causality.

Finally, the regression tree analysis was conducted to investigate the relationships between the legal environment and IPO number, with the aim of identifying the most significant predictors. The results for the legal system factors are presented in Chart 2. The analysis reveals that judicial independence (LS1) exerts the strongest influence on IPO activity for domestic firms and IPO activity overall. The literature examines the implications of judicial independence and economic development (Touchton & Tyburski, 2022; Ximeng & Zhiwen, 2023). Therefore, these findings expand prior research by incorporating insights into the IPO market. In contrast, for foreign IPO activity, contract enforcement (LS6) emerged as the most significant factor. Research highlights that foreign IPO companies face higher failure rates in host markets, which may suggest that inadequate enforcement may exacerbate this issue, leading to reduced stakeholder support and increased delisting risk (Song, 2023).

The regression tree analysis for the regulatory framework variables is depicted in Chart 3. Among these variables, freedom to enter markets and compete (REG4) was identified as the most significant predictor. This pattern was consistently observed across all IPO groups. These findings are consistent with the work of Bae et al. (2021), which notes a negative association between stock market concentration and IPO activity. These findings are also supported by recent research on the US market indicating that changes in tariff policy, increasing trade with China, have had a downward effect on the number of public companies in the US and increased concentration in the industry (Griffin, 2023).

5. Conclusion

The paper has provided an empirical analysis of the impact of legal factors on firms' decisions to go public, contributing to a deeper understanding of the role of the external environment in shaping IPO market. The results of panel ARDL model have shown that a strong legal system providing effective safeguards for individuals positively affects the IPO activity of domestic companies and the overall market in the short term. However, no significant long-term effects were observed for this variable. This may indicate that, over time, other factors – such as the perception of legal certainty (Schnyder et al., 2021), levels of economic uncertainty (Demir et al., 2023), or cultural dimensions (Rivas & Adamuz, 2019) – may exert a more substantial influence on the sustained dynamics of IPO activity. In contrast, this paper has found that regulations promoting economic freedom significantly negatively impact IPO activity among domestic firms, while having a weak positive effect on foreign firms' decisions to go public. While domestic firms may perceive fewer benefits or support mechanisms in a more liberalized environment, foreign firms tend to view the reduced regulatory barriers as enhancing the attractiveness of entering the international market.

The regression tree analysis has revealed that judicial independence is the most significant factor affecting IPO activity in domestic companies, whereas contract enforcement is a crucial determinant for foreign firms. In addition, the analysis has highlighted the importance of freedom to enter and compete in markets, which was found to be a key driver of IPO activity for firms. These findings highlight the value of open and transparent regulation in attracting new issuers and supporting a dynamic IPO market. Thus, this study emphasizes the significant role of legal determinants in shaping IPO activity, underlining the need for robust legal frameworks to enhance investor confidence and market participation. The findings indicate that a key factor supporting the development of the IPO market is the creation of a stable and transparent regulatory environment that enhances legal certainty and investor protection. Such conditions foster greater confidence among market participants, reduce regulatory risk and support long-term capital market activity (Boissin, 2022; Abdu-ALgafoor & Herode, 2023; Wang et al., 2023). Therefore, policymakers should prioritize the establishment of effective legal systems ensuring high level of legal protection. In order to achieve this goal, it is advisable to further deepen the harmonisation of capital markets by implementing a single regulatory framework that ensures transparent, consistent and easy-to-implement legislation for issuers. A harmonised legal basis would encourage the development of cross-border investments and enable the free movement of capital between member state stock markets, thereby promoting financial integration in the region.

There are several limitations to this study. The Panel ARDL method relies on specific assumptions about linearity or stationarity, which may not fully capture the complexity of IPO market. The division into short-term and long-term effects may oversimplify the temporal dynamics of legal factors on IPO activity such as shocks or temporal instability caused by political tensions. Moreover, the variables used may not fully capture the multifaceted nature of legal systems and their interplay with stock market. Aggregate-level analysis might overlook country- or firm-specific nuances, such as sectoral variations or the influence of non-legal factors. This limitation may have contributed to the absence of statistically significant findings regarding the impact of legal factors on foreign IPO activity. Therefore, further exploration of this issue in future literature appears to be warranted.

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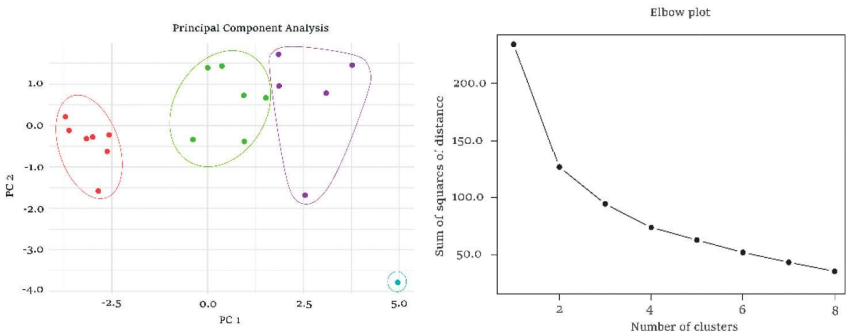
Note: the results of this study were not presented in another form, such as a poster/abstract at a conference.

Appendix

Chart 1. Cluster analysis of country legal systems



Cluster 1: Austria; Germany; Luxembourg; Netherlands; Sweden; Switzerland; United Kingdom
Cluster 2: Cyprus; Czech Republic; Malta; Poland; Slovenia; Spain
Cluster 3: Bulgaria; Croatia; Greece; Hungary; Slovak Republic
Cluster 4: Turkey

Source: Own preparation.

Table 1. Definitions of variables used in ARDL model

Type of variable	Code	Name	Description
Independent	LS	Legal System & Property Rights	Clustering factor (from LS1-LS8) measuring the level of protection of individuals and their property rights.
	REG	Regulation	Clustering factor (from to REG1-REG4) demonstrating how regulations positively impacts economic freedom.
Dependent	NT	Total IPOs	Number of IPOs listed in European stock markets
	ND	Domestic IPOs	Number of IPOs in Europe listed by domestic companies
	NF	Foreign IPOs	Number of IPOs listed by companies registered in jurisdictions outside the stock exchange's country
Control	C1	Market size	Natural logarithm of the total number of listed companies
	C2	Capitalization	Natural logarithm of the market capitalization in million USD

Source: Own preparation based on Fraser Institute (2024, pp. 71–75; 80–85).

Table 2. Definitions of indicators comprising the Legal System (LS) and Regulatory Framework (REG) variables

Group	Code	Name	Description
Components of variable LS	LS1	Judicial independence	Calculation based on three sources: 1) Global Competitiveness Report (GCR) question: "Is the judiciary in your country independent from political influences of members of government, citizens, or firms? No—heavily influenced (=1) or Yes—entirely independent (=7)"; 2) V-Dem dataset, namely: Judicial Purges, Government Attacks on the Judiciary, Court Packing, High Court Independence, and Low Court Independence; 3) A Global Measure of Judicial Independence (Harvard Dataverse).
	LS2	Impartial courts	Calculation based on four sources: 1) GCR question: "The legal framework in your country for private businesses to settle disputes and challenge the legality of government actions and/or regulations is inefficient and subject to manipulation (=1) or is efficient and follows a clear, neutral process (=7)", 2) the V-Dem dataset: Judicial Corrupt Decision; 3) Worldwide Governance Indicators: Rule of Law indicator; 4) the Economist Intelligence Unit (EIU): Transparency and the fairness of the legal system indicator.
	LS3	Property rights	Component based on three sources: 1) GCR question: "Property rights, including over financial assets, are poorly defined and not protected by law (=1) or are clearly defined and well protected by law (=7)"; 2) World Bank (WB) data: Property Rights and Rule-Based Governance from Country Policy and Institutional Assessment (CPIA); 3) EIU indicator: "Degree to which private property rights are guaranteed and protected".
	LS4	Military interference	Based on component Military in Politics from International Country Risk Guide of PRS Group.
	LS5	Legal integrity	Consists of two sources: 1) International Country Risk Guide law subcomponent of PRS Group which "assesses the strength and impartiality of the legal system, and the 'order' subcomponent assesses popular observance of the law"; 2) V-Dem dataset index: Judicial Accountability, Compliance with the High Court, Judicial Review, Transparent Laws with Predictable Enforcement, and Access to Justice for Men.
	LS6	Contracts	Based on three sources: 1) WB's Doing Business measuring the time and costs involved in debt collection; 2) Business Environment Risk Intelligence: Enforcement of Contracts from the Historical Ratings Research Package; 3) EIU: Efficiency of the legal system component.
	LS7	Real property	Measured using WB's Doing Business indicator measuring time and cost to transfer an ownership of a property.
	LS8	Police and crime	Consists of two sources: 1) GCR question: "To what extent can police services be relied upon to enforce law and order in your country? (1 = Cannot be relied upon at all; 7 = Can be completely relied upon)"; 2) EIU: "Impact of crime" component.
	LS9	Gender Disparity Index	Calculated on WB's report "Women, Business, and the Law" measuring the legal and regulatory obstacles that could hinder women's participation in formal economic activities.

Group	Code	Name	Description
Components of variable REG	REG1	Credit market regulation	Calculated on three components: 1) percentage of deposits held in privately owned banks; 2) private sector credit score measured as the difference between public and private sector borrowing; 3) level of market-driven interest rate system.
	REG2	Labor market regulations	Component based on seven sources: 1) labour regulations and minimum wage; 2) standards of workforce recruitment and dismissal rules; 3) flexible wage determination; 4) quality of work hours regulations; 5) costs of worker dismissal; 6) duration of military conscription; 7) quality of regulation in terms of foreign labour.
	REG3	Business regulations	Based on four components: 1) GCR question on the "Burden of government regulation, 1–7 (best)"; 2) Regulatory Burden Risk Ratings measuring the bureaucracy costs prepared by HIS Markit; 3) the V-Dem dataset: Rigorous and Impartial Public Administration; 4) tax compliance burden.
	REG4	Freedom to enter markets and compete	Calculated on three components: 1) market openness measured by WB Doing Business; 2) business permits based on the WB's Doing Business; 3) EIU: "Price controls" and "State control" indicators.

Source: Own preparation based on Fraser Institute (2024, pp. 71–75; 80–85).

Table 2. Unit roots tests

	IPS		ADF-Fisher		PP-Fisher		
Variable	**Level**	**Δ**	**Level**	**Δ**	**Level**	**Δ**	**Results**
LS	0,7418	-4,0512***	2,8971	26,6080***	3,3107	46,5229***	I(1)
REG	-0,1682	-1,5470*	4,7288	11,8891*	5,7975	32,1873***	I(1)
NT	-1,5640*	-3,0505***	11,6783*	20,7001***	8,5156	38,2630***	I(0)/I(1)
ND	-1,2067	-2,7010***	9,8709	18,6859***	6,8510	35,5500***	I(1)
NF	-3,8929***	-5,0046***	25,6370***	32,3521***	16,7121**	62,4668***	I(0)
C1	0,4399	-1,3803*	3,8149	13,9683**	6,9356	16,7309**	I(1)
C2	-1,7961**	-6,1116***	15,7268	38,8571***	8,2000	55,5860***	I(0)/I(1)

Note: *** 1%, ** 5%, *10% level of significance respectively. The first difference is marked as Δ.
Source: Own preparation.

Table 3. Results of ARDL estimation for variable LS

Independent variables	NT		ND		NF	
Panel A: Short run						
Variable	**Coef.**	**T-stat**	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**
COINTEQ01	-0.4850	-2.1101**	-0.4809	-2.1142**	-0.2734	-0.7912
D(NF(-1))	-0.3965	-1.0606	-0.3424	-0.8495	-0.4491	-1.4119
D(LS)	474.4841	1.9930*	530.3942	1.9150*	4.9732	0.5082
D(LS(-1))	755.0532	1.4196	645.3976	1.4683	58.0658	1.0130
D(C1)	1062.0870	1.8009*	1068.1410	1.8183*	52.4226	1.2887
D(C1(-1))	422.4912	1.8754*	459.1461	1.6051	72.8498	0.8803
D(C2)	108.1906	0.8661	125.9187	0.9899	19.1639	0.7210
D(C2(-1))	13.6452	0.3434	10.2150	0.2970	16.6849	0.8644
C	2607.5170	2.1213**	3018.6510	2.0938*	-131.6600	-0.7820

Independent variables	NT		ND		NF	
Panel B: Long run						
Variable	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**
LS	205.6439	0.6358	200.2956	0.6491	13.3675	0.8644
C1	-271.3616	-1.0661	-314.6631	-1.4088	16.9811	2.7871**
C2	-318.7331	-1.1124	-351.9118	-1.4277	19.6898	7.4433***

Note: *** 1%, ** 5%, *10% level of significance respectively.
Source: Own preparation.

Table 4. Results of ARDL estimation for variable REG

Independent variables	NT		ND		NF	
Panel A: Short-run						
Variable	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**
COINTEQ01	-0.7516	-1.8506*	-0.7793	-1.7777	-0.3121	-1.0246
D(NF(-1))	0.0115	0.0370	0.0779	0.2351	-0.2404	-0.8771
D(REG)	140.8243	1.3701	64.7111	1.2293	13.3943	0.8077
D(REG(-1))	-54.4147	-0.6623	-82.7633	-0.9785	-22.2770	-1.0782
D(C1)	543.8085	2.1659**	602.7167	2.1317**	38.5859	2.0866*
D(C1(-1))	-542.5258	-1.1062	-552.2138	-1.0887	14.9711	0.5055
D(C2)	-82.2585	-1.5095	-88.6673	-1.4832	6.3723	0.4297
D(C2(-1))	-60.9193	-1.2532	-73.0451	-1.2523	10.3985	0.7082
C	-2300.8910	-1.7799*	-2138.9870	-1.7002	-186.4691	-1.0649
Panel B: Long run						
Variable	**Coef.**	**T-stat**	**Coef.**	**T-stat.**	**Coef.**	**T-stat.**
REG	-130.4169	-4.1928***	-72.2018	-2.8105**	6.8949	1.7342*
C1	276.2956	5.8165***	202.7864	4.2027***	19.1252	4.2553***
C2	125.7074	2.2777**	112.2890	2.1425**	28.4907	7.1952***

Note: *** 1%, ** 5%, *10% level of significance respectively.
Source: Own preparation.

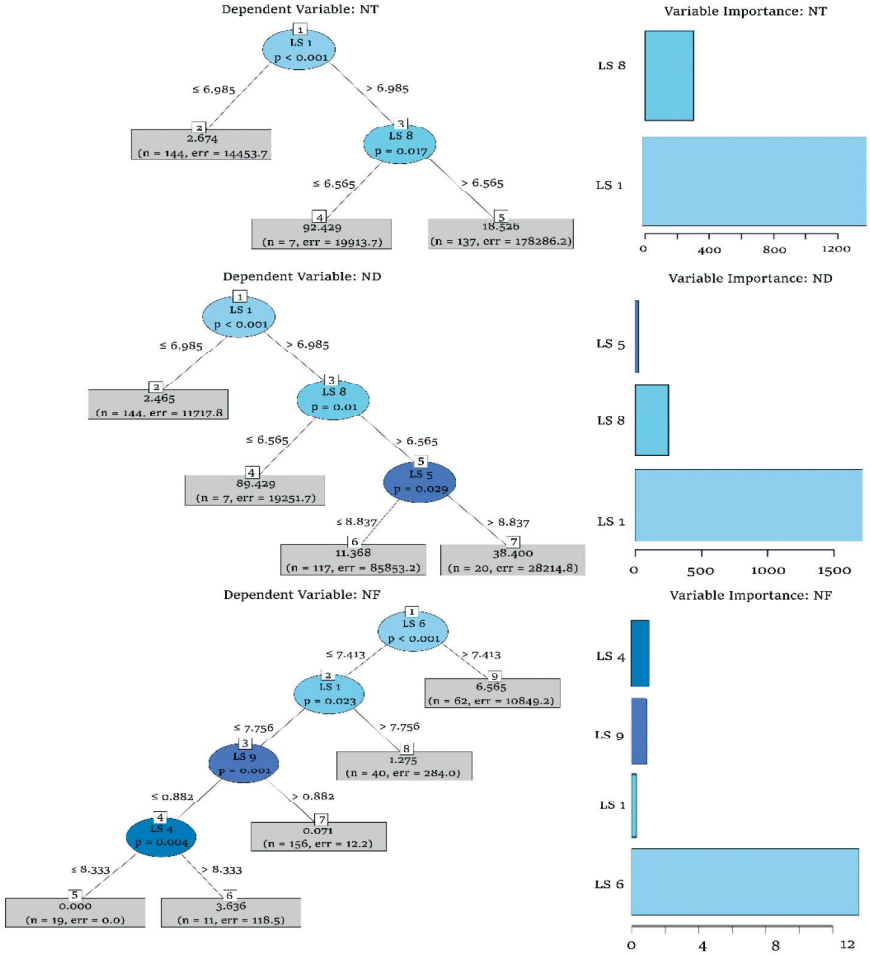
Table 5. Granger causality test results

Null Hypothesis	F-statistic	Prob.	Result
Panel A: Variable LS			
LS does not Granger Cause NT	7.0994	0.0025	Rejected
NT does not Granger Cause LS	0.0963	0.9084	Fail to reject
LS does not Granger Cause ND	4.9388	0.0126	Rejected
ND does not Granger Cause LS	0.1123	0.8941	Fail to reject
LS does not Granger Cause NF	3.6891	0.0346	Rejected
NF does not Granger Cause LS	0.0391	0.9617	Fail to reject

Null Hypothesis	F-statistic	Prob.	Result
Panel B: Variable REG			
REG does not Granger Cause NT	3.0206	0.0609	Rejected
NT does not Granger Cause REG	0.3087	0.7363	Fail to reject
REG does not Granger Cause ND	2.8025	0.0736	Rejected
ND does not Granger Cause REG	0.2340	0.7925	Fail to reject
REG does not Granger Cause NF	3.0184	0.0610	Rejected
NF does not Granger Cause REG	0.7487	0.4800	Fail to reject

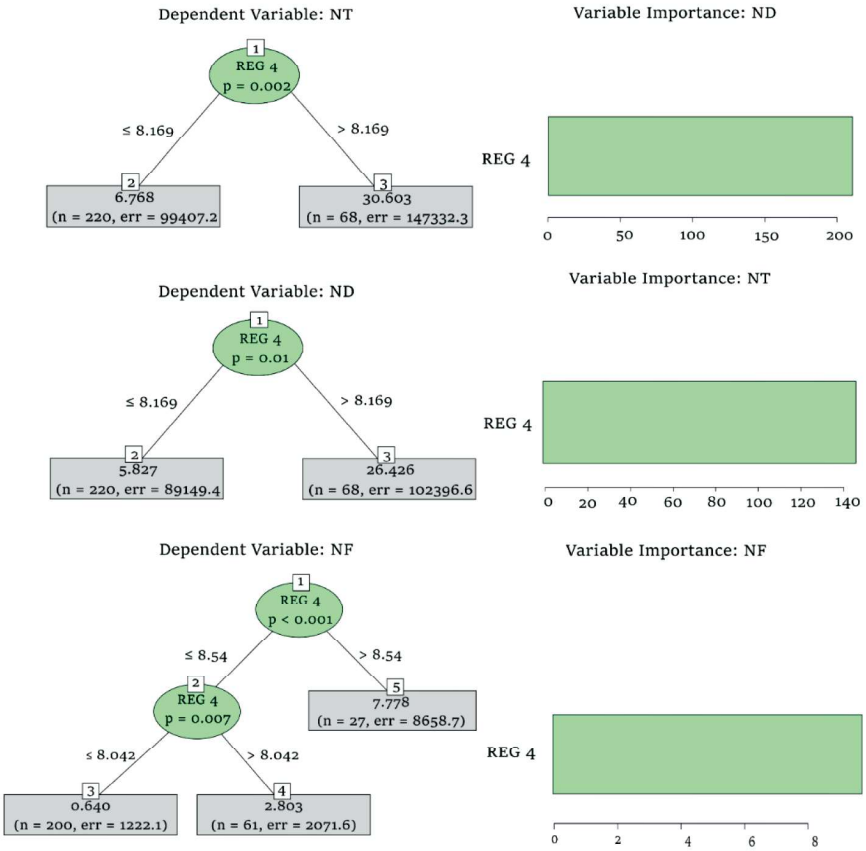
Source: Own preparation.

Chart 2. Regression trees for clustering LS variables



Source: Own preparation.

Chart 3. Regression tree for clustering REG variables



Source: Own preparation.