Multilayer Groups With Hundreds Of Subsidiary Firms In Bankruptcy: Ownership Network And Recoveries

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ABSTRACT

The bankruptcy of multilayer corporate conglomerates that include hundreds of interconnected subsidiary firms constitutes one of the most complex and methodologically challenging areas of contemporary economic and legal reality. The study is aimed at overcoming the existing gap between quantitative financial models, which are traditionally focused on predictive assessment of default probability, and legal doctrine, which predominantly describes and analyzes ex post insolvency resolution procedures. The purpose of the article is to develop and theoretically substantiate a conceptual model that establishes a correlation between the topology of the ownership network within a corporate group, the effectiveness of legal instruments for resolving bankruptcy, and the final level of recoveries for creditors. The methodological basis of the study is interdisciplinary in nature and relies on a systematic review of the academic literature (Scopus, WoS, SSRN), a comparative legal analysis of key doctrines (substantive consolidation in US law and procedural coordination within the EU), as well as a detailed case study design (Parmalat, Lehman Brothers). The results obtained demonstrate that complex, opaque, and dynamically transforming ownership structures function not only as indicators of elevated risk, but also as an instrument for the deliberate exploitation of legal issues and uncertainties, including questions of determining the center of main interests (COMI) and the practice of forum shopping. The paper argues and demonstrates that the specific configuration and connectivity of the ownership network directly generate jurisdictional conflict and the chaotization of proceedings, disorganize the application of legal mechanisms, and systematically reduce the level of satisfaction of creditors' claims, especially those of unsecured creditors. The presented study has both practical and theoretical relevance for regulators, insolvency practitioners, institutional and private investors, as well as scholars working in the field of corporate law and financial analysis.

KEYWORDS

Corporate group, bankruptcy, insolvency, ownership network, complex network analysis, recovery rates, substantive consolidation, center of main interests (COMI), cross-border insolvency, corporate fraud.

INTRODUCTION

In the context of deepening globalization and the rapid digital transformation of the economy, particularly evident in the dynamics of 2024, corporate structures are undergoing a qualitative change in their architectural design [1]. The traditional linear-hierarchical construction of the parent company – subsidiary company type is gradually losing its dominant position, giving way to complex, multi-layered, often rhizomatic ownership configurations that include hundreds of legal entities distributed across multiple jurisdictions. Initially, such structures were formed as an instrument for enhancing operational flexibility, tax optimization, and risk diversification; however, under conditions of financial instability they are transformed into a source of systemic vulnerabilities. The collapse of a

single key operational node in such a network, as convincingly demonstrated by the case of the bankruptcy of Lehman Brothers, can trigger a chain reaction leading to a cascading collapse of the entire corporate configuration and affecting a wide range of creditors and counterparties at the global level [2]. The relevance of the issues outlined is confirmed by the steady increase in the number of scholarly works in leading bibliographic and full-text databases such as Scopus, Springer, and SSRN devoted to modelling and forecasting insolvency within complex corporate configurations [1].

At the same time, despite the intensity and interdisciplinary character of contemporary research, a systematic literature review reveals a fundamental methodological and disciplinary gap. On the one hand, representatives of financial science and specialists in data analysis concentrate their efforts on constructing advanced econometric models and machine learning algorithms aimed at bankruptcy prediction. Contemporary studies convincingly demonstrate that the application of complex network analysis (CNA) tools and the inclusion of relational information (for example, ties through boards of directors and other inter-organizational links) make it possible to achieve substantially higher predictive accuracy compared with classical models that rely predominantly on systems of financial ratios [3, 4].

On the other hand, legal doctrine retains a focus predominantly on the post-mortem dimension of insolvency, that is, on the analysis of the legal consequences of bankruptcy once it has already occurred. Legal scholars detail and reconstruct the development of doctrinal approaches such as substantive consolidation [5], mechanisms of procedural coordination within the EU Regulation on cross-border insolvency (EIR-R) [7], as well as conflicts-of-law issues arising in determining the debtor's centre of main interests (COMI) and the related jurisdictional conflicts [8].

The main research gap lies in the absence of an integrative conceptual model capable of linking these two strands – quantitative methods for analysing complex corporate networks and legal mechanisms of cross-border insolvency – within a single analytical framework. The question of how the quantitative characteristics of the topology of a corporate network (such as density, modularity, and various forms of centrality), applied at the stage of default forecasting, correlate and interact with the subsequent effectiveness and predictability of legal procedures for dispute resolution and, ultimately, with the financial outcomes for creditors, expressed in particular through the level of funds recovered, remains insufficiently explored [9].

The aim of this study is to formulate and theoretically substantiate a conceptual model that establishes a systemic link between the topological parameters of the ownership network of multilayer corporate groups, on the one hand, and the effectiveness of legal procedures in their bankruptcy, as well as the level of funds recovered by creditors, on the other.

The author's hypothesis proceeds from the premise that rhizomatic, weakly transparent, and dynamically changing ownership networks (described, in particular, through constructions such as stacked time-weighted connection networks [4]) are not merely a passive factor statistically associated with an increased probability of default. It is assumed that such architectures are deliberately designed to exploit legal uncertainties and cross-jurisdictional arbitrage (including manipulation of COMI and forum shopping practices [10]), which systematically reduces the degree of transparency of the structure, increases administrative costs within bankruptcy procedures and, as a consequence, leads to a substantial, often catastrophic, reduction in the final recovery rate for unsecured creditors.

The scientific novelty of the study lies in proposing and theoretically substantiating a direct conceptual link between quantitative metrics of the topology of complex corporate networks and the key determinants of the effectiveness of legal regulation in cross-border insolvency, including the predictability, speed, and costliness of procedures, as well as their impact on the distribution and restoration of value for creditors [4].

METHODS

The methodological basis of the present study is integrative and interdisciplinary in nature. The specificity and high complexity of the object under examination, namely insolvency procedures of multilayered corporate groups, predetermine the need to apply a multilayered approach, which in contemporary academic literature is regarded as the most adequate tool for analysing complex socio-economic and organizational structures. Within the framework of this work, categories and methods from three dominant disciplinary fields are consistently synthesized: law, finance, and network theory.

To achieve the stated aim, the following research approaches are used:

1.   Systematic literature review and content analysis. A targeted analysis of leading academic databases (Scopus, Web of Science, SSRN, Springer Nature), as well as publications of key research centres and universities, has been conducted. The objective of this stage was, on the one hand, to identify the main theoretical and legal constructs in the field of insolvency law (substantive consolidation, procedural coordination, COMI) and, on the other hand, the most recent methodological developments in finance (the application of network analysis for bankruptcy prediction, as well as approaches to the analysis of recovery rates).

2.   Comparative legal analysis. This method is used to compare two conceptually different models of regulating the insolvency of corporate groups. On the one hand, the American doctrine of substantive consolidation is examined, which proceeds from the understanding of a corporate group as a single economic unit; on the other hand, the European model of procedural coordination is analysed, which is based on the EU Insolvency Regulation (EIR-R) and the principle of separate legal liability of group members.

3.   Case study analysis. For empirical illustration and verification of the theoretical conclusions, the method of in-depth, multilayered examination of the most illustrative cases of corporate bankruptcies is applied, primarily Parmalat and Lehman Brothers. Particular emphasis is placed on examining the relationship between the configuration of the ownership structure, defects in corporate governance mechanisms, and the schemes of corporate fraud employed.

RESULTS AND DISCUSSION

Traditional models of bankruptcy prediction, primarily the Altman Z-model, which for decades has served as an industry standard, prove to be of limited applicability when analyzing complex corporate groups. Their main methodological limitation lies in the fact that each company is treated as an autonomous entity evaluated exclusively on the basis of its individual financial statements, whereas relational measurability – the architecture of intra-group relationships and its embedding in the external institutional and market environment – is effectively excluded from the analysis [4].

Contemporary literature demonstrates a qualitative methodological shift: it has been shown that predictors based on complex network analysis (CNA) make it possible to improve the accuracy of assigning companies to a particular risk class [4]. Within this approach, the firm is conceptualized not as an isolated point but as a node in a multi-connected network. The greatest predictive significance is shown by indicators derived from networks of ties between companies and board members and, most crucially, from networks of intercompany relationships accumulated over time and weighted by temporal parameters [4, 11].

These results allow for a natural theoretical generalization: the conclusions drawn in the field of default prediction can be transferred to the field of insolvency management. If the topological characteristics of the network and its evolutionary dynamics (in particular, the frequency of creation and liquidation of SPVs and subsidiaries) act as the best predictors of default, then these very characteristics should be recognized as the key determinants of the

complexity of the subsequent bankruptcy procedure.

A dynamic, opaque, and highly connected corporate network (see Table 1) is not merely a statistical marker of increased risk. For the insolvency practitioner, creditors, and the court, such a structure transforms into an almost insurmountable combination of operational and legal obstacles. It significantly complicates the identification and localization of assets, the tracking of intra-group flows (loans, guarantees, and other transfers), as well as the determination of the true economic center of the group. In this regard, quantitative CNA metrics, originally developed for forecasting purposes, can and should be institutionalized as tools for assessing the architecture of complexity and the risk profile of the bankruptcy procedure itself.

Table 1. Key metrics of complex network analysis (CNA) for risk assessment in corporate groups (compiled by the author based on [4, 6, 7, 19]).

Network metric	Definition	Impact on default risk	Hypothetical impact on Recovery Rate
Centrality	Degree of importance of a node (company) in the network (for example, an intra-group treasury).	High centrality of a key node, single point of failure, systemic risk.	High centrality, risk of cascading collapse (Lehman case), which paralyses the system and reduces recovery.
Density	Share of existing links (for example, intra-group loans, guarantees) in all possible links.	High density, strong financial interdependence, contagion risk.	Strengthens the arguments in favour of substantive consolidation, but complicates the separation of assets.
Modularity	Presence of dense but isolated clusters (subgroups) within the network.	High modularity, presence of hidden pools of assets or liabilities.	Complicates procedural coordination (EU model), enables asset stripping, reduces recovery.
Time weighting	Dynamics of changes in links (creation/liquidation of SPVs, change of directors).	High dynamics of changes, better predictor of default.	High dynamics, an indicator of fraud (asset concealment), growth of chaos in the procedure, reduction of recovery.

The contrast between a transparent organizational configuration, which is relatively simple for procedural administration within bankruptcy proceedings, and an opaque rhizomatic network structure that generates significant legal obstacles.

The complex configuration of a corporate network not only radically complicates the processes of coordination and control, but also creates almost ideal conditions for intra-firm fraud. A classic example of exploiting a multi-level, fragmented structure to mask losses and siphon off assets is the collapse of the Italian conglomerate Parmalat [18, 20].

Comparative analysis reveals fundamental differences between American cases (Enron, WorldCom) and European examples (Parmalat, Ahold) [18]. Whereas in the United States the dominant source of abuses was, as a rule, the agency conflict (management versus a dispersed shareholder base) combined with the use of complex financial structures and derivatives (as in the case of Enron), in European situations similar to Parmalat the decisive factor was the high concentration of property rights [16]. Control over the Parmalat group was in fact concentrated in the

hands of a single family [17], which created institutional conditions for exploiting an extensive network of hundreds of subsidiaries and SPVs, a significant share of which were incorporated in offshore jurisdictions (the Cayman Islands, Malta, etc.). These structures were used not to enhance operational efficiency, but primarily as an instrument of deliberate manipulation.

The key architecture of the fraudulent scheme consisted of related party transactions (RPTs). Empirical studies confirm that RPTs are a classic mechanism for distorting financial reporting, allowing either the artificial creation and inflation of revenues or the concealment of actual liabilities and organization of asset diversion [19]. In the case of Parmalat, offshore SPVs were used, in particular, to recognize fictitious revenues (for example, from milk buyback operations lacking real economic substance) and to conceal the true level of the group's debt burden. The combination of these practices ultimately led to one of the largest corporate bankruptcies in the modern economic history of Europe.

The entry of a rhizomatic corporate group permeated by pathological intra-group ties into insolvency proceedings confronts the legal order with a fundamentally irresolvable conflict. The court is compelled to choose between two mutually exclusive models: either to apply consistently the doctrine of separate legal personality, or to acknowledge the de facto existence of a single economic organism. This binary choice has predetermined the formation in global practice of two radically different regulatory approaches, schematically presented in Table 2.

The US legal system has developed a highly adaptive doctrine of substantive consolidation (SC) [6]. Within this construct, the bankruptcy court is empowered, in exceptional and extraordinary situations, to aggregate the assets and liabilities of all or selected members of the group into a single bankruptcy estate. The key policy aims of this mechanism are to ensure substantive fairness and parity of treatment for creditors who originally perceived the group as an integrated economic whole, as well as to maximise the aggregate value of the assets (a telling example is the Nortel Networks case, where the global pooling of assets made it possible to dispose of them at a significantly higher aggregate price) [6]. At the same time, this approach is accompanied by serious systemic costs: it undermines the legitimate expectations of those creditors whose claims were secured by collateral or guarantees provided by a specific subsidiary. As a result, the so-called squeeze down effect arises, namely, the dilution of the economic position of secured creditors in favour of unsecured creditors, which in effect transforms the original risk profile of their claims [6].

The legislation of the European Union, above all the recast Insolvency Regulation (EIR-R, Recast), institutionalises a directly opposite paradigm [7]. The EU model strictly adheres to the principle of the separate legal personality of each member of the group. Instead of substantive consolidation of assets, the Regulation introduces a mechanism of procedural coordination (Articles 56–77 EIR-R), aimed not at merging insolvency estates but at encouraging cooperation between courts and insolvency practitioners in different Member States in which parallel proceedings have been opened. Moreover, Article 72(3) of the Regulation expressly excludes the possibility of including in the coordination plan any recommendations to consolidate proceedings or pool insolvency estates [7]. Thus, a fundamental ideological break with the American model is entrenched, which in practice generates serious, often insurmountable, barriers in transatlantic insolvencies (a typical example is the Lehman group).

Table 2. Comparative analysis of approaches to group insolvency: substantive consolidation (US) vs. procedural coordination (EU) (compiled by the author based on [6, 7, 22]).

Criterion	Substantive consolidation (US)	Procedural coordination (EU, according to)
Main principle	Single enterprise	Separate legal entity

Objective	Maximization of the aggregate insolvency estate, fairness for the group's creditors.	Efficient and coordinated management of parallel proceedings.
Mechanism	Pooling of the assets and liabilities of several legal entities into a single pool.	Cooperation between courts and office-holders, exchange of information (Art. 56-77 EIR-R).
Approach to boundaries	Disregard of legal-entity boundaries.	Strict respect for legal-entity boundaries.
Risks / Problems	Infringement of secured creditors' rights, squeeze down effect, unpredictability.	Inefficiency where the level of economic integration is high; prohibition of consolidation.

The adoption of a particular doctrinal model has a direct, quantitatively measurable impact on the allocation of financial outcomes among different categories of creditors, as clearly illustrated in Figure 1.
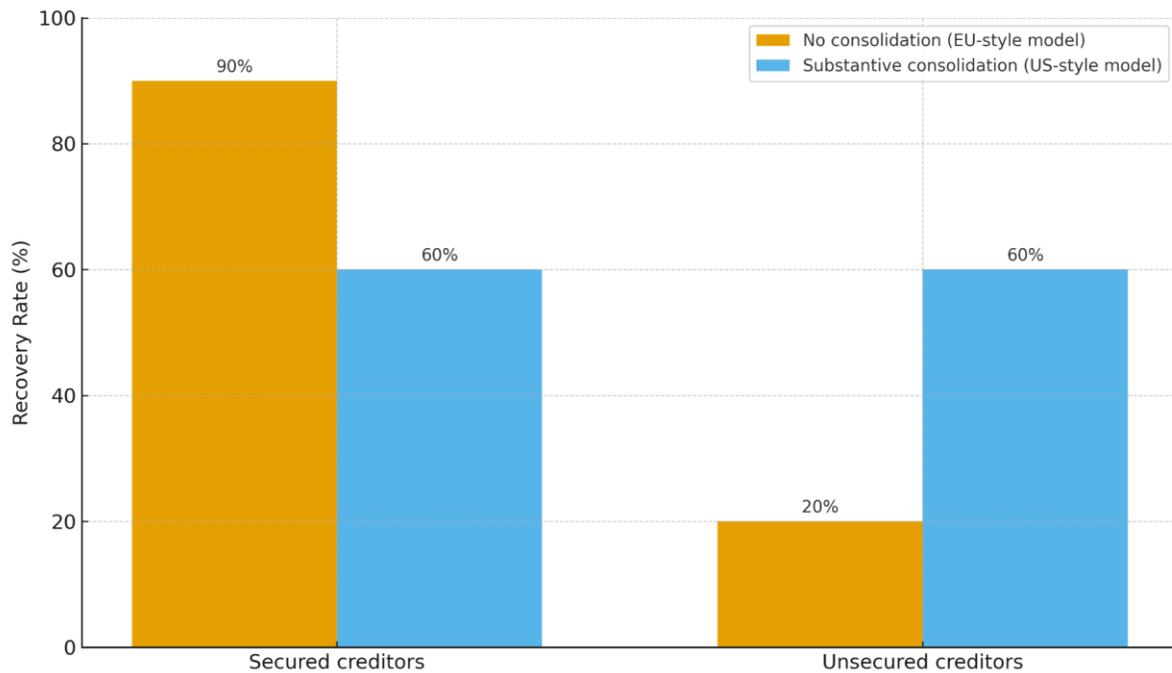

Fig. 1. Model of the influence of substantive consolidation on Recovery Rates (compiled by the author based on [6-8, 24]).

The legal chaos arising from the clash of competing doctrines (Table 2) is further aggravated by a fundamental jurisdictional conflict. In cross-border bankruptcies, the central methodological question is the determination of the centre of main interests of the debtor (COMI). This category is used both in the EU Insolvency Regulation (EIR-R) and in the UNCITRAL Model Law, performing the function of a key criterion for choosing the state whose courts are authorised to open the main insolvency proceedings with a claim to universal effect [8].

However, COMI is conceptually constructed for an isolated legal entity rather than for a sprawling corporate group comprising dozens or hundreds of interconnected structures. With regard to multi-level holding companies, this approach in fact loses its functionality [8]. Where should the COMI of a group be localised if its parent company is formally incorporated in Luxembourg (COMI at the place of registration), the financial management centre is concentrated in London (COMI by reference to the management function), the key production facilities are located

in Germany (COMI at the location of the principal assets), and the securities listing is carried out on an exchange in New York?

Such uncertainty is not reducible to a random defect of the construction but often becomes the result of deliberate aggressive corporate structuring. By forming a rhizomatic network of interconnected companies, the corporation consciously blurs its own COMI, creating space for a strategic choice of jurisdiction in a financial crisis. This opens the possibility of forum shopping, that is, the opportunistic selection of the most favourable legal order for initiating insolvency proceedings [10] (see Fig.2). The case of Pacific Andes Resources Development is illustrative: the group, which objectively had no close connection to the United States, nevertheless managed to initiate Chapter 11 proceedings in New York, thereby obtaining a global moratorium and effectively blocking the actions of creditors in other jurisdictions [10]. The result is jurisdictional conflicts, institutional paralysis of the procedure, and erosion of asset value.
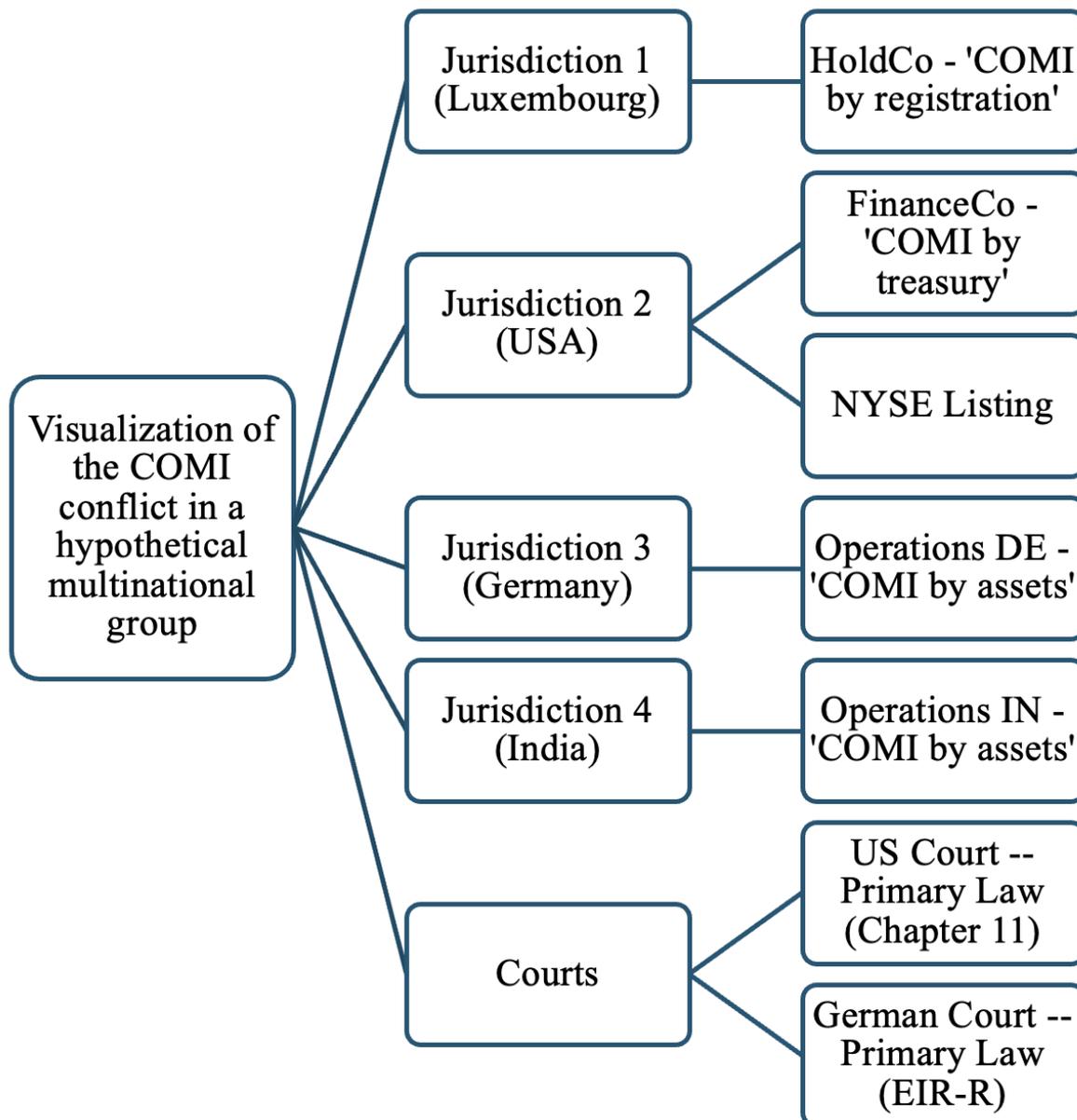

Fig.2. Visualization of the COMI conflict in a hypothetical multinational group (compiled by the author based on [8, 15, 21, 25])

The analysis conducted makes it possible to integrate fragmented observations into a single causal structure that explains the trajectory by which the bankruptcy of multilayer corporate groups leads to catastrophically low levels of recovery of funds for creditors.

– Network topology. At the foundation of such a group lies an extremely complex, opaque, and fluid network of ownership relations, characterized by high indicators of centrality and density and permeated by numerous intragroup financial obligations (guarantees, loans, etc.) [4, 6].

– Pathology. This network architecture serves as the infrastructure for aggressive tax planning, and in pathological variants (a typical example is Parmalat) turns into an instrument of corporate fraud implemented through RPTs [13, 18].

– Default. A structure built on high leverage and accumulating significant hidden risks exhibits an elevated probability of default; this is quantitatively confirmed by CNA models [4, 12].

– Legal paralysis. When default materializes, it is precisely the same network complexity that previously ensured optimization and masked abuses that paralyzes the operation of legal mechanisms. An intractable conflict arises regarding COMI (Figure 2), and courts face a dilemma between the Entity (EC) and Enterprise (US) approaches (Table 2) [6, 10].

– Outcome (low Recovery Rate). Jurisdictional chaos, the stretching of proceedings over many years (as in the case of Lehman Brothers), the exponential growth of administrative costs for lawyers and insolvency practitioners, as well as the continuing asset stripping by managers during the process, cumulatively lead to the de facto destruction of the insolvency estate [2, 14].

Empirical data are consistent with this model. Studies of recovery rates show that they are not a constant magnitude: these indicators are cyclical in nature and closely correlated with the probability of default [9]. Indirect confirmation is also contained in the World Bank statistics: in liquidation proceedings (which often constitute the inevitable outcome of the chaotic bankruptcy of a complex group) unsecured creditors are almost completely deprived of satisfaction of their claims [23]. Figure 3 graphically illustrates this price of complexity.
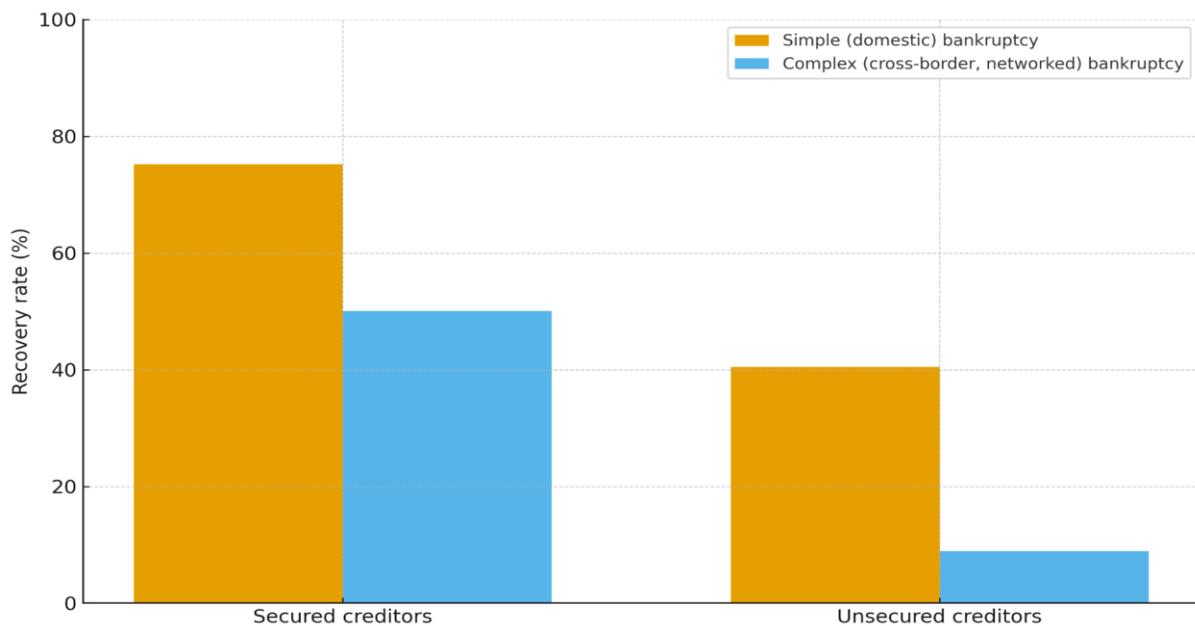

Fig.3. Decline in Recovery Rates in complex network bankruptcies (Estimated) (compiled by the author based on [9])

Thus, the results of the analysis show that the topology of a complex, dynamic, and opaque corporate network simultaneously acts as the initial cause of an increased probability of default and as a key driver of the subsequent destruction of value in bankruptcy proceedings, whereas traditional models such as the Altman Z-score are fundamentally incapable of capturing this dynamic. Complexity network analysis (CNA) metrics — centrality, density, modularity, and the temporal weighting of links — not only exhibit the highest predictive power with respect to the occurrence of default, but also prove to be directly connected with the configuration of operational, legal, and jurisdictional obstacles that determine the final Recovery Rate. The cases of Parmalat, Enron, Lehman, and Pacific Andes demonstrate that the rhizomatic architecture of groups, saturated with RPTs and offshore SPVs, creates a favorable environment for fraud, manipulations with COMI and forum shopping, and subsequently for jurisdictional chaos, protracted proceedings, and the de facto evaporation of the insolvency estate. The confrontation between doctrinal approaches — substantive consolidation in the US (enterprise view) and procedural coordination in the EU (entity view) — does not eliminate but merely redistributes in a new way the risks among different categories of creditors, without offering an adequate response to the structural complexity of modern groups. Taken together, this allows for the formulation of a general conclusion: it is precisely the network characteristics of a corporate group and their evolution over time that constitute the missing link between the stage of pre-default risk and the outcome of bankruptcy, and therefore quantitative CNA indicators should be institutionalized not only as early warning tools, but also as a basic instrument for the ex ante assessment of structural complexity, law-enforcement costs, and the expected level of satisfaction of creditors' claims in insolvency proceedings.

CONCLUSION

The present study empirically confirmed the initial hypothesis and showed that the topology of the ownership network in multilayer corporate groups functions not as an auxiliary, but as a structure-forming risk factor that predetermines the logic of development and the final outcome of insolvency proceedings.

The substantive results of the work can be condensed into the following causal construction:

– The set of contemporary methods of complex network analysis (CNA) demonstrates that the relational and dynamic characteristics of the corporate network (centrality, density, clusters, etc.) possess greater predictive power with respect to default than traditional financial ratios.

– Pathological network configurations with a high degree of opacity and a significant share of RPTs function not only as an indicator of elevated risk, but also as an instrumentalized infrastructure of corporate fraud, which is clearly illustrated by the Parmalat case.

– At the moment of the onset of bankruptcy, this same excessive network complexity de facto blocks the operation of legal doctrines: it generates hard-to-resolve jurisdictional conflicts (COMI collisions) and confronts courts with a dilemma of choosing between competing regulatory models, namely US-style substantive consolidation and European-style procedural coordination.

– The consequence of the resulting legal and procedural knot is the prolongation of the proceedings, an increase in transaction and administrative costs and, as a result, a systemic reduction in the level of recoveries, especially for the claims of unsecured creditors.

Thus, the stated research objective has been achieved: an integrative conceptual model has been developed and substantiated that links quantitatively measurable parameters of the topology of the ownership network, the effectiveness of the applicable legal doctrines, and the observed financial outcomes of insolvency proceedings.

The practical significance of the work is expressed in the following recommendations:

– For regulators: It is necessary to reorient the emphasis from predominantly post-mortem coordination (characteristic of the EU model) to ex ante regulation of the transparency and controllability of corporate structures. Supervisory authorities should require corporate groups to disclose the full topology of the ownership network. In cases where network complexity exceeds specified threshold values (determined on the basis of CNA metrics), such groups should be subject to increased capital requirements and/or mechanisms of mandatory structural simplification.

– For courts and insolvency practitioners: Quantitative analysis of the topology of the ownership network (CNA) should be institutionalized as a mandatory element of the early stages of bankruptcy proceedings. This will allow the court to objectively assess the degree of actual economic integration within the group and to make a more substantiated decision in favor of substantive consolidation or procedural coordination, minimizing the scale and intensity of jurisdictional conflicts.

– For investors and creditors: Metrics of network complexity and opacity should be integrated into credit risk assessment models on a par with traditional financial indicators. A high level of structural complexity and informational closeness of the network should be interpreted as an independent negative factor that reduces the expected recovery rate and, accordingly, the fair valuation of the debt instruments of the respective group.

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