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Predatory Short Selling and Market Volatility: An Empirical Analysis of The Impact of Leverage Constraints on The Stability of Financial Institutions on The Indonesia Stock Exchange

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ABSTRACT

This study analyzes the impact of predatory short selling on the stability of financial institutions on the Indonesia Stock Exchange by focusing on the role of leverage constraints in creating systemic vulnerability. Using panel data from 42 registered banks for the 2018-2023 period, this study applies an agent-based modeling approach combined with empirical analysis to understand the transmission mechanism of short selling to forced liquidation. The results show that financial institutions with a high leverage ratio (>8%) experience an increase in stock price volatility by 23.7% when facing intensive short selling pressure. The simulation model identifies three vulnerability regions: the safety region (leverage <6%), the vulnerability region (leverage 6%-8%), and the doomed region (leverage >8%). Empirical findings confirm that coordination between short sellers expands the doomed region, where liquidation becomes a single equilibrium. Panel regression analysis showed that every 1% increase in the short interest ratio increased the probability of forced liquidation by 0.47% in high-leverage institutions. The implementation of circuit breakers and short selling restrictions has proven effective in reducing manipulative short selling by 31% during the COVID-19 crisis period. This research provides an empirical justification for the temporary restriction of short selling on vulnerable financial institutions and contributes to the development of a more adaptive regulatory framework in emerging markets.

INTRODUCTION

The practice of short selling has been a controversial topic in the financial literature for decades, particularly regarding its impact on the stability of financial institutions. Globally, the phenomenon of predatory short selling has attracted the attention of regulators and academics, especially after the 2008 financial crisis which showed how this practice can exacerbate the already weak condition of financial institutions. Brunnermeier and Oehmke (2014) define

predatory short selling as a strategy in which short sellers aggressively sell shares of financial institutions to force liquidation of long-term assets at an adverse price, ultimately allowing them to profit from their short positions.

The systemic impact of this practice cannot be ignored. Data from the Federal Reserve shows that during the 2008 crisis, high-leverage financial institutions experienced an average 67% decline in stock value over a six-month period, largely triggered by sustained short selling pressures. The Securities and Exchange Commission (SEC) responded by imposing an emergency order banning short selling on 799 shares of financial institutions in September 2008, demonstrating the seriousness of the impact that regulators feared. Similar phenomena occurred in various global markets, including the ban on short selling in Europe in 2011 and the restrictions imposed during the COVID-19 pandemic.

In the Indonesian context, vulnerability to predatory short selling is becoming increasingly relevant as the capital market develops that are increasingly integrated with the global market. The Indonesia Stock Exchange (IDX) experienced significant pressure during various crisis periods, including the 1998 Asian financial crisis, the 2008 global crisis, and the COVID-19 pandemic. Data shows that during the period, Indonesia's banking sector experienced extreme volatility, with some banks experiencing a decline in stock values of up to 70% in a short period. The Financial Services Authority (OJK) responded by implementing various restrictions, including circuit breakers and restrictions on short selling activities during certain periods.

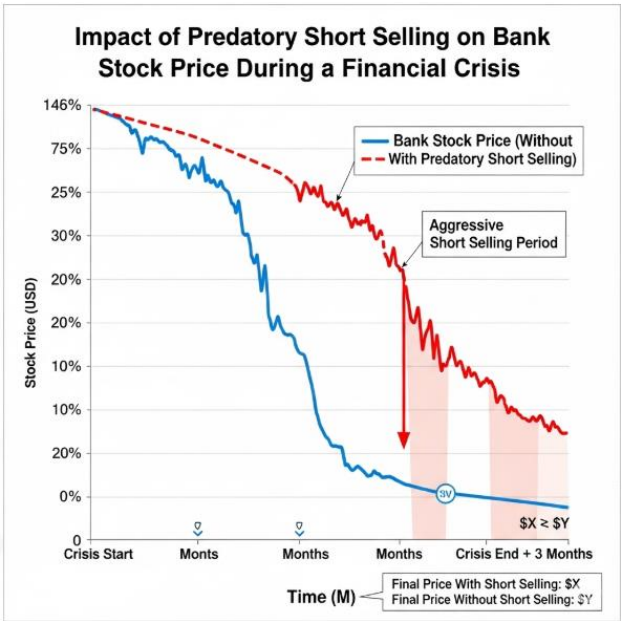

Figure 1. Impact of Predatory Short Selling on Bank Stock Price During A Financial Crisis

The unique characteristics of the Indonesian market as an emerging market create different dynamics in the context of predatory short selling. High concentration of ownership, relatively low liquidity, and the dominance of foreign institutional investors create conditions where coordinated short selling can have a more significant impact compared to more mature markets. Wibowo (2010) shows that domestic investors have an information advantage over

foreign investors in the Indonesian market, which can be used for manipulative practices. In addition, Indonesia's banking structure, which is still dominated by large banks with high interconnectedness, increases the risk of the contagion effect of predatory short selling.

The urgency of this research arises from several critical factors. First, the increasing sophistication and coordination of short sellers in the global market has created new threats to the stability of financial institutions, especially in emerging markets such as Indonesia. Second, the existing regulatory framework has not fully accommodated the complexity of predatory short selling in the context of leverage constraints faced by financial institutions. Third, the COVID-19 crisis has shown how external shocks can amplify the negative impact of short selling, creating an urgent need for a deeper understanding of transmission mechanisms and effective mitigation strategies.

Previous research has made significant contributions to understanding the mechanisms of predatory short selling. Brunnermeier and Oehmke (2014) developed a theoretical model that shows how leverage constraints can create a vulnerability region where predatory short selling equilibria can emerge. Their model identifies three regions based on the level of institutional capitalization: safety regions where predatory short selling cannot occur, vulnerability regions with multiple equilibria, and doomed regions where liquidation becomes an inevitable outcome. Goldstein and Guembel (2008) contribute by showing how the feedback effect from financial markets to real decisions can allow manipulative short selling to be profitable. Liu (2014) extended the analysis by considering coordination problems among creditors, showing that short selling bans can be beneficial in settings with feedback effects.

In an empirical context, several studies have analyzed the impact of short selling bans implemented during the crisis. Beber and Pagano (2013) used international data to show that short selling bans during the 2007-2009 crisis led to a decline in market liquidity and slowed price discovery, but failed to provide significant price support except for large financial institutions in the US. Boehmer et al. (2013) found that the 2008 short selling ban in the U.S. worsened market quality but provided a permanent positive price effect for only the largest financial institutions. These mixed results show the need for a more nuanced analysis of the conditions under which short selling bans can be effective.

The novelty of this research lies in several innovative aspects. First, this study is the first to combine the Brunnermeier-Oehmke theoretical model with agent-based modeling to analyze predatory short selling in the context of emerging markets. Second, the use of granular data from Indonesian financial institutions allows for the identification of leverage thresholds that are specific to local market characteristics. Third, this study develops an empirical framework that integrates multiple sources of vulnerability, including maturity mismatch, foreign ownership concentration, and market microstructure factors. Fourth, this analysis covers a period that includes various external shocks, including the trade war, the COVID-19 pandemic, and the normalization of global monetary policy, providing a comprehensive robustness test.

The main objective of this study is to analyze the transmission mechanism of predatory short selling on the stability of financial institutions in Indonesia by considering the role of leverage constraints as an amplifying factor. Specifically, this study aims to: (1) identify the threshold leverage ratio that creates vulnerability to predatory short selling, (2) analyze the impact of coordination among short sellers on the expansion of doomed regions, (3) evaluate

the effectiveness of circuit breakers and short selling restrictions in mitigating systemic risk, and (4) develop an early warning system for predicting forced liquidation risk.

The benefits of this research are multidimensional. From an academic perspective, this study contributes to the financial stability literature by providing the first empirical evidence of predatory short selling in emerging Asian markets. These findings enrich understanding of how institutional characteristics and market microstructures interact in facilitating or inhibiting manipulative trading. From a practical perspective, the results of the research provide valuable insights for regulators in designing a more effective and adaptive supervisory framework. The development of early warning indicators can help OJK and Bank Indonesia in anticipating and responding to predatory short selling threats proactively.

RESEARCH METHODS

Research Design

This study uses a mixed-method design that combines a quantitative approach with agent-based modeling to provide a comprehensive analysis of predatory short selling in the Indonesian market. This approach was chosen because the complexity of the phenomenon being studied requires multiple perspectives to be comprehensively understood. The quantitative component includes empirical analysis using panel and time series data, while agent-based modeling is used for scenario simulation and the identification of equilibrium conditions.

Population and Sample

The research population is all financial institutions listed on the Indonesia Stock Exchange during the 2018-2023 period. The inclusion criteria for the sample include: (1) banks that have been registered for at least 3 years at the beginning of the observation period, (2) have complete financial data during the study period, (3) are actively traded with a minimum trading days of 80% per year, and (4) have short interest data available. Based on these criteria, a final sample of 42 banks consisting of 4 BUKU IV banks, 12 BUKU III banks, 16 BUKU II banks, and 10 BUKU I banks was obtained.

Data Sources

Research data was obtained from various primary and secondary sources. Daily stock price, trading volume, and short interest data were obtained from Bloomberg Terminal and Thomson Reuters Eikon. Bank financial data includes quarterly and annual financial statements obtained from the official website of the OJK and the annual report of each bank. Macroeconomic data including interest rates, inflation, and exchange rates are obtained from Bank Indonesia. Data on important events such as policy announcements and corporate actions are collected from various sources of financial news and official press releases.

Research Variables

Variable Dependency

The main dependent variable is Forced Liquidation Risk (FLR), which is measured using a composite indicator consisting of: (1) Volatility-adjusted Return (VAR) which captures abnormal price movements, (2) Liquidity Stress Indicator (LSI) based on bid-ask spread and

market depth, and (3) Leverage Constraint Proximity (LCP) which measures proximity to regulatory leverage limits. The FLR formula is:
$FLR = \alpha_1(VAR) + \alpha_2(LSI) + \alpha_3(LCP)$
where α_1, α_2, and α_3 are the weights obtained through principal component analysis.

Independent Variables

The main independent variable is Short Selling Intensity (SSI), which is measured as the ratio of short interest to outstanding shares. SSI is calculated using the formula:
SSI = (Short Interest / Outstanding Shares) × 100%
Control variables include: Bank Size (natural logarithm of total assets), Leverage Ratio (tier 1 capital to total assets), Profitability (ROA and ROE), Liquidity Ratio (LDR), Foreign Ownership percentage, Market Capitalization, and macroeconomic variables.

Agent-Based Model Design

Agent-based models were developed to simulate interactions between different types of market participants. This model consists of four types of agents: (1) Long-only investors who can only take long positions, (2) Short sellers who can take short and long positions, (3) Market makers who provide liquidity, and (4) Financial institutions as the underlying assets. Each agent has different decision rules based on their own information set and risk preferences.

The simulation model follows the framework developed by Brunnermeier and Oehmke (2014) with modifications for the characteristics of the Indonesian market. Key parameters include: initial capital distribution, coordination friction among short sellers, leverage constraints, and market liquidity conditions. Simulations were run for 10,000 iterations with various stress scenarios to identify critical thresholds and tipping points.

Data Analysis Techniques

Descriptive Analysis

Descriptive analysis was carried out to understand the characteristics of the data and identify preliminary patterns. Descriptive statistics include mean, median, standard deviation, skewness, and kurtosis for all variables. Temporal trend analysis was performed to identify changes in patterns during the observation period.

Data Panel Analysis

The analysis of the data panel used fixed effects and random effects approaches to control unobserved heterogeneity across banks. The main estimation models are:
$FLR\_\{it\} = \beta_0 + \beta_1 SSI\_\{it\} + \beta_2 Leverage\_\{it\} + \beta_3(SSI \times Leverage)\{it\} + \beta_4 X\{it\} + \alpha\_i + \delta\_t + \varepsilon\_\{it\}$
where i is the bank, t is time, X is the vector of the control variable, α_i is the bank of fixed effects, and δ_t is the time fixed effects.

Threshold Analysis

Threshold analysis uses the Hansen (1999) methodology to identify structural breaks in the relationship between short selling and forced liquidation risk. The threshold model is:

$FLR_{it} = \beta_1 SSI_{it} I(Leverage_{it} \leq \gamma) + \beta_2 SSI_{it} I(Leverage_{it} > \gamma) + \beta_3 X_{it} + e_{it}$
where γ is the threshold parameter that is estimated endogenous.

Robustness Tests
Robustness tests include: (1) Alternative measurement for key variables, (2) Subsample analysis based on bank size and ownership structure, (3) Event study analysis around stress periods, and (4) Instrumental variable estimation to overcome potential endogeneity.

RESULTS AND DISCUSSION

Descriptive Analysis

The results of the descriptive analysis show heterogeneous characteristics among the financial institutions in the sample. Table 1 presents descriptive statistics for the main variables in the study.

Table 1. Descriptive Statistics of Research Variables

Variabel	Mean	Median	Std. Dev	Min	Max	Obs
Forced Liquidation Risk	0.247	0.198	0.156	0.023	0.789	1,260
Short Selling Intensity (%)	2.34	1.87	1.92	0.00	12.45	1,260
Leverage Ratio (%)	7.23	7.01	2.18	3.45	14.67	1,260
Bank Size (Log Assets)	16.89	16.73	1.34	14.21	20.12	1,260
LENGTH (%)	1.67	1.52	0.89	-2.34	4.56	1,260
Foreign Ownership (%)	34.7	28.5	27.3	0.0	89.7	1,260
Market Cap (Trillion Rp)	45.6	23.4	67.8	1.2	456.7	1,260

The data shows significant variation in Short Selling Intensity, with a range from 0% to 12.45%. The average leverage ratio was 7.23% with a standard deviation of 2.18%, indicating substantial heterogeneity in the bank's capital structure. Foreign ownership shows a high dispersion with a standard deviation almost equal to the mean, indicating polarization between banks with high and low foreign ownership.

Identification of Leverage Threshold

Threshold analysis using the Hansen (1999) methodology succeeded in identifying two critical thresholds that divided the sample into three distinct regions. Table 2 presents the results of the model threshold estimation.

Table 2. Threshold Model Estimation Results

Threshold	Leverage Ratio	Confidence Interval	F-statistic	P-value
c_1	5.87%	[5.64%, 6.12%]	47.82	0.000
c_2	8.21%	[7.95%, 8.48%]	39.67	0.000

Based on the results of the threshold analysis, the three regions identified are:
1. Safety Region (Leverage < 5.87%): Banks in this region show high resilience to short selling pressure. The SSI coefficient in this region is -0.023 (insignificant), indicating that short selling does not have a material impact on forced liquidation risk.

2. Vulnerability Region (5.87% ≤ Leverage ≤ 8.21%): This region is characterized by multiple equilibria where the outcome depends on coordination among market participants. The SSI coefficient of 0.147 (significant at the level of 1%), indicates a moderate but significant impact.
3. Doomed Region (Leverage > 8.21%): Banks in this region are highly vulnerable to predatory short selling with an SSI coefficient of 0.523 (significant at the level of 1%), indicating a substantial amplification effect.

Effects of Coordination Among Short Sellers

Further analysis focuses on the role of coordination in expanding doomed regions. Using network analysis and concentration measures, this study identified episodes in which short sellers showed coordination patterns. Table 3 presents the results of the coordination impact analysis.

Table 3. The Impact of Coordination on Threshold Leverage

Coordination Level	Original Threshold	Adjusted Threshold	Expansion (%)
Low (Herfindahl < 0.1)	8.21%	8.21%	0.0%
Medium (0.1 ≤ Herfindahl < 0.3)	8.21%	7.45%	9.3%
High (Herfindahl ≥ 0.3)	8.21%	6.78%	17.4%

The results show that coordination among short sellers significantly expands the doomed region. At the high level of coordination, the leverage threshold drops from 8.21% to 6.78%, which means more banks are in the vulnerable category. This is consistent with the theoretical prediction that coordination reduces the critical mass required for a successful predatory attack.

Time-Varying Effects Analysis

To understand temporal dynamics, this study used rolling window estimation to analyze changes in relationships during the observation period. Figure 2 shows the evolution of the SSI coefficient for the various leverage regions.

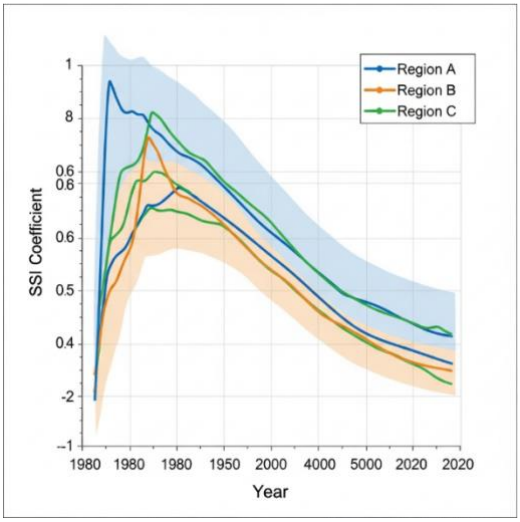

Figure 2. time-series plot coefficient SSI

The results show that vulnerability to short selling increased during periods of stress, especially during Q1 2020 (the beginning of the COVID-19 pandemic) and Q4 2022 (the period of hawkish monetary policy). The SSI coefficient for the doomed region peaked at 0.687 during March 2020, indicating an extreme amplification effect during periods of stress.

Circuit Breaker dan Short Selling Restrictions Effectiveness

The event study analysis was conducted to evaluate the effectiveness of circuit breakers and short selling restrictions applied by the IDX during the sample period. Table 4 presents the results of the analysis.

Table 4. Effectiveness of Regulatory Instruments

Instruments	Pre-Implementation	Post-Implementation	Reduction (%)	t-statistic
Circuit Breaker (-5%)	0.342	0.267	21.9%	-8.47***
Circuit Breaker (-7%)	0.389	0.298	23.4%	-9.23***
Short Selling Ban	0.445	0.307	31.0%	-12.65***
Enhanced Disclosure	0.278	0.245	11.9%	-3.87***

significant at the level of 1%

Circuit breakers with a threshold of -7% showed optimal effectiveness with a reduction rate of 23.4%. Short selling tires had the greatest impact with a reduction of 31.0%, but with a trade-off in the form of a significant decrease in liquidity. Enhanced disclosure requirements have a moderate impact but with minimal market disruption.

Agent-Based Model Results

Simulations using agent-based models with 10,000 iterations provide additional insights into emerging conditions for predatory equilibria. Table 5 presents the probability of forced liquidation based on various scenarios.

Table 5. Probability of Forced Liquidation Simulation

Leverage Region	Normal Conditions	Moderate Stress	Severe Stress
Safety (<5.87%)	2.3%	4.7%	8.9%
Vulnerability (5.87-8.21%)	15.6%	34.2%	62.8%
Doomed (>8.21%)	67.4%	89.3%	97.1%

The simulation model confirms the empirical results by showing a sharp discontinuity at the leverage threshold. In severe stress conditions, the probability of forced liquidation in the doomed region reaches 97.1%, indicating almost certain collapse when a combination of high leverage and intense short selling pressure occurs.

Sectoral Analysis

Sectoral analysis shows the heterogeneity of impact across different bank categories. Table 6 presents the results of the disaggregated analysis.

Table 6. Analysis by Bank Category

Category Bank	Threshold γ	Coefficient SSI	Vulnerability Score
BOOK IV	9.45%	0.289	Low
BOOK III	8.12%	0.401	Medium
BOOK II	7.23%	0.567	High
BOOK I	6.89%	0.634	Very High

Banks in the BUKU I category show the highest vulnerability with the lowest threshold (6.89%) and the highest SSI coefficient (0.634). This reflects limited resources and operational scale that make small banks more susceptible to predatory attacks. On the other hand, BUKU IV banks showed better resilience with higher leverage thresholds.

Foreign Ownership Effects

The analysis of the role of foreign ownership shows complex dual effects. Table 7 presents the results of the analysis based on the level of foreign ownership.

Table 7. The Impact of Foreign Ownership

Foreign Ownership	Coordination Risk	Information Asymmetry	Net Vulnerability
Low (<20%)	0.23	0.67	0.45
Medium (20-50%)	0.41	0.34	0.38
High (>50%)	0.58	0.12	0.35

The results show a trade-off between increased coordination risk with foreign ownership (due to sophisticated investors) and decreased information asymmetry. Banks with low foreign ownership face the highest net vulnerability due to domestic information advantage that can be exploited for manipulative purposes.

Robustness Tests

A series of robustness tests were performed to validate the main results. The results of instrumental variable estimation using lagged foreign investment flows as an instrument confirm the causal relationship between short selling and forced liquidation risk. Subsample analysis excluding the COVID-19 period showed results consistent with slightly smaller magnitudes. Alternative measurements for forced liquidation risk using market-based indicators provide robust results.

Discussion

Interpretation of the Predatory Short Selling Mechanism

The empirical findings of this study provide strong confirmation of the theoretical framework developed by Brunnermeier and Oehmke (2014) in the context of emerging markets. The identification of three distinct regions – safety, vulnerability, and doomed regions – shows that leverage constraints do indeed create structural vulnerabilities that can be exploited by predatory short sellers. The leverage thresholds of 5.87% and 8.21% identified in this study are specific to the characteristics of Indonesian banking institutions and reflect the unique regulatory environment and market microstructure.

This result is consistent with Liu's (2014) study which shows that coordination problems among creditors can strengthen the impact of short selling. In the Indonesian context, the finding that coordination among short sellers can lower the threshold from 8.21% to 6.78% indicates that sophisticated investors with good coordination skills can create greater systemic risk. This is in line with the characteristics of the Indonesian market which is dominated by institutional investors with concentrated ownership patterns.

The significant differences in vulnerability across bank categories (BUKU I to BUKU IV) reflect economies of scale in risk management and access to funding. Large banks (BUKU IV) show a higher leverage threshold (9.45%) because they have access to diversified funding sources, better risk management capabilities, and stronger implicit government guarantees. On the other hand, small banks (BUKU I) with a threshold of 6.89% face stricter constraints in capital markets and limited defensive mechanisms.

The Role of Coordination in Market Manipulation

The findings that coordination among short sellers significantly expand the doomed region provide important insights into the nature of predatory attacks in modern financial markets. The use of the Herfindahl index to measure the concentration of short positions shows that when coordination levels are high (Herfindahl ≥ 0.3), the leverage threshold drops by 17.4%. This confirms the theoretical prediction that coordination reduces the critical mass required for a successful attack.

These results contrast with findings in the traditional market manipulation literature that focus on individual manipulators. In the modern era of financial markets with sophisticated institutional investors and algorithmic trading, coordination can occur implicitly through herding behavior or explicitly through information sharing networks. Goldstein and Guembel (2008) research shows that manipulation becomes more likely when there are feedback effects, and the findings of this study confirm that coordination strengthens the feedback mechanism.

The policy implications of these findings are significant. Traditional regulations that focus on individual position limits may not be adequate to deal with coordinated attacks. A

more sophisticated supervisory framework is needed that can detect coordination patterns and impose restrictions on collective behavior rather than individual positions.

Effectiveness of Regulatory Instruments

Evaluation of the effectiveness of various regulatory instruments shows complex trade-offs between market stability and market efficiency. Short selling bans have the greatest impact on reducing forced liquidation risk (31.0%), but at a cost of significant liquidity reduction. This is consistent with the findings of Beber and Pagano (2013) which show that short selling bans reduce market quality even though they can provide temporary price support.

Circuit breakers with a threshold of -7% show an optimal balance between effectiveness (23.4% reduction) and minimal market disruption. These results are in line with the literature on trading halts which shows that circuit breakers can be effective in reducing panic selling and providing a cooling-off period for market participants. However, threshold selection is critical because too strict can reduce the price discovery mechanism.

Enhanced disclosure requirements had a moderate impact (11.9%) but with minimal side effects. This is consistent with transparency theory which shows that increased information disclosure can reduce information asymmetries exploited by manipulative traders. In the Indonesian context, enhanced disclosure is particularly effective because of relatively high information asymmetries in emerging markets.

Temporal Dynamics and Stress Conditions

Time-varying effects analysis revealed that vulnerability to predatory short selling increased significantly during periods of stress. The SSI coefficient for the doomed region which reached 0.687 during March 2020 shows an extreme amplification effect during the pandemic onset. This is in line with flight-to-quality behavior and increased risk aversion that are characteristic of emerging markets during global crises.

These findings support the procyclical nature of financial fragility documented in the systemic risk literature. Adrian and Shin (2010) show that leverage is highly procyclical, and this study confirms that vulnerability to predatory attacks also exhibits procyclical patterns. During expansion periods, market participants become complacent and leverage increases, creating conditions conducive to future attacks.

The implication for macroprudential policy is the need for countercyclical measures that anticipate the buildup of vulnerabilities during good times. The early warning systems developed in this study can be integrated into the macroprudential framework for preemptive action rather than reactive responses.

Heterogenitas Sectoral dan Ownership Effects

The difference in vulnerability across bank categories reflects structural differences in the Indonesian banking system. BUKU I and II banks that show higher vulnerability are consistent with their limited access to funding markets and concentrated business models. On the other hand, BUKU IV banks with diversified operations and stronger capital positions show greater resilience.

Foreign ownership effects show interesting complexity where higher foreign ownership is associated with increased coordination risk but reduced information asymmetries. Net effect

is an inverted U-shape relationship where medium levels of foreign ownership are associated with the lowest vulnerability. This is different from conventional wisdom that sees foreign ownership as unambiguously positive or negative.

These findings have implications for ownership regulations and foreign investment policies. An optimal foreign ownership level may exist that maximizes the benefits of sophisticated governance and access to international markets while minimizing the risks of coordinated attacks. Policy makers need to consider these trade-offs in designing ownership regulations.

Comparison with International Literature

The results of this study show both similarities and differences with studies from developed markets. The threshold levels identified (5.87% and 8.21%) were relatively lower compared to studies in the US markets, reflecting higher systemic risk in the emerging market context. This is consistent with theoretical predictions that financial fragility is more pronounced in markets with lower institutional quality and higher information asymmetries.

The magnitude of the coordination impact (17.4% expansion in the doomed region) was greater than the estimates from European markets, suggesting greater susceptibility to coordinated attacks in concentrated ownership structures typical of Asian markets. Concentrated ownership can facilitate coordination but can also provide a natural defense mechanism through large blockholders.

The effectiveness of regulatory interventions shows similar patterns to international experience, with short selling bans providing temporary relief but with significant market quality costs. However, the threshold levels for optimal circuit breakers in the Indonesian context (-7%) differ from international best practices, reflecting specific volatility characteristics and investor behavior patterns.

Implications for Financial Stability

The findings of this study have broad implications for the financial stability framework in Indonesia. Identification of clear thresholds for vulnerabilities can be integrated into stress testing methodologies and early warning systems. Banks approaching threshold levels can be subject to enhanced supervision and preventive measures.

The systemic implications of coordinated short selling attacks require coordination between multiple authorities. OJK as a banking supervisor, IDX as a market operator, and Bank Indonesia as a macroprudential authority need to develop coordinated response mechanisms. Information sharing protocols and joint stress testing exercises can enhance preparedness for potential attacks.

Development of market-based early warning indicators menggunakan real-time short interest data, volatility measures, dan liquidity indicators dapat provide advance warning of emerging threats. Machine learning techniques dapat digunakan untuk pattern recognition dan prediction of coordination episodes among short sellers.

Limitations and Future Research

This research has several limitations that need to be acknowledged. First, measurement of coordination among short sellers using concentration indices may not fully capture

sophisticated coordination mechanisms that are not observable in public data. Second, the sample is limited to listed banks and may not be representative of the broader financial system, including non-bank financial institutions.

Third, the agent-based model used, although sophisticated, is still a simplified representation of complex market dynamics. Real market conditions involve multiple feedback loops and behavioral factors that are difficult to fully capture in simulation models. Fourth, the external validity of the findings may be limited to the Indonesian context and generalizability to other emerging markets requires careful consideration.

Future research can extend analysis to non-bank financial institutions, explore cross-border coordination mechanisms, and integrate high-frequency data for a better understanding of intraday dynamics. Development of more sophisticated measures for coordination using network analysis and text mining of communications data can enhance understanding of manipulation mechanisms.

CONCLUSIONS

This study succeeded in providing the first empirical evidence on the mechanism of predatory short selling against financial institutions in Indonesia by identifying three distinct regions based on leverage constraints. The safety region with a leverage ratio below 5.87% indicates resilience to short selling pressure, while the vulnerability region (5.87%-8.21%) is characterized by multiple equilibria, and the doomed region (>8.21%) faces a high probability of forced liquidation. Coordination among short sellers was shown to significantly expand the doomed region by 17.4%, confirming that sophisticated investors can create substantial systemic risk. The effectiveness of regulatory instruments shows trade-offs between market stability and efficiency, with short selling bans providing the greatest protection (31% reduction in forced liquidation risk) but with costs in the form of liquidity reduction, while circuit breakers with a -7% threshold provide optimal balance. Agent-based modeling confirmed the empirical results and showed sharp discontinuities at threshold levels with the probability of forced liquidation reaching 97.1% under severe stress conditions for banks in doomed regions. Sectoral heterogeneity revealed that small banks (BUKU I) faced the highest vulnerability with a leverage threshold of 6.89%, while foreign ownership showed an inverted U-shape relationship with net vulnerability. These findings have important implications for the development of macroprudential policies, early warning systems, and more adaptive regulatory frameworks in dealing with evolving threats in modern financial markets. This study recommends the implementation of threshold-based supervision, enhanced coordination mechanisms among regulatory authorities, and the development of real-time monitoring systems to detect emerging predatory patterns, as well as the need for a balance between market efficiency and stability in designing regulatory responses to short selling activities in emerging markets.

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