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Assessing the Effect of Abnormal Stock Returns on the Content of the Autopoietic Restructuring Theory: A Case Study of Petrochemical Industry Companies

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ABSTRACT

With the increasing competitiveness of the capital market, one topic attracting the attention of many financial researchers in recent years is the formation of abnormal stock returns as a stimulus for restructuring companies due to the difference between actual returns and expected (normal) returns. It can motivate investment in the capital market. The purpose of this study is to evaluate the impact of the reasons for the formation of abnormal stock returns on the content of the autopoietic restructuring theory of companies operating in the petrochemical industry in the capital market. In this study, to identify the components (reasons for the formation of abnormal stock returns) and research propositions (content themes of corporate autopoietic restructuring theory), a combined analysis was used with 15 accounting experts at the university level. In the quantitative part, the components and propositions identified in matrix questionnaires were evaluated by the interpretive ranking process (IRP) by 20 financial managers of capital market petrochemical companies. The results showed that the most compelling reason for the formation of abnormal stock returns is the institutional and regulatory causes of the stock market, which has the most significant impact on the dimension of the autopoietic restructuring strategy of petrochemical companies. In other words, institutional and regulatory changes in the stock market by upstream institutions will be able to influence the restructuring process to match the content with the structural process (the autopoietic approach).

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1. Introduction

With the change in the approach of societies and the development of capital markets, accounting information systems today play a vital role in the information flow of companies in the development of stakeholder decisions because many economic decisions are made based on information derived from these systems. Accounting information systems in the form of an accounting unit as a part and process, from the company's organizational structure as a whole, play an influential role in developing the level of interaction between companies and stakeholders, including investors, shareholders, analysts, and legislators. In other words, companies and the market as a whole are affected by information transparency by developing interactions based on providing better and more desirable financial reporting (Wachira et al., 2019). One of the practical theories in the field of dynamics of corporate structure in interaction with the market is the autopoietic theory. This theory is considered an extensible basis for aligning corporate structures with accounting systems, which can develop corporate financial performance dynamics and create values in line with the functions of autopsy theory so that stakeholders can have more effective decision-making capabilities.

On the other hand, companies can make the most of their liquidity-generating capacity to develop their designs and projects through better quality information disclosure. This theory includes mechanisms of convergence between corporate structures based on macro-strategic dimensions, making the accounting unit an effective system in stakeholder communication by understanding the norms and social expectations to create a more tangible level of inclusive values for stakeholders. The autopoietic theory was first introduced in biology and examined different ideas about life and existence in a single phenomenon. Later, this theory was introduced to the theories of management and organizations by researchers such as Varela et al. (1974) and Maturana (2002) and tried to use more effective functions of structural and environmental cognition to create more dynamics of systems by modeling the definition of structural relationships with systems (Paucar-Caceres et al., 2011). The most important principle in this theory was the existence of cyclical causality as the basis for the interaction of the corporate structure with internal systems, which received its philosophy of existence from changes in the external environment to create value or so-called "productive self". In other words, cyclical causality means the production or creation of values that help create an independent identity and enable environmental needs and requirements within the corporate structural system to contribute to greater dynamism for committed accountability to stakeholders (Minagres, 2008). One of the external changes the autopoietic theory mentions as the axis of change in the organizational structure of companies is the abnormal return on stocks. In fact, abnormal stock returns as a model for predicting the expected returns of stocks of the capital asset pricing model are based on the assumption of the whole competition and equal access of traders to symmetric information, which can be very effective in shareholder investment decisions. Although internal dimensions such as managerial performance may be involved, according to the research of Chen et al. (2021), Kolari et al. (2020), and Chen et al. (2015), abnormal returns are more influenced by external stimuli in the market and the economy. Therefore, abnormal stock returns as a challenge to companies active in the field of competition, especially in a situation where the country's industries, particularly the petrochemical industry, face severe economic sanctions, can significantly reduce the competitive performance of companies due to rigid structures because abnormal functional returns from market interactions and decisions of upstream institutions try to control the economy through grammatical changes in the stock market to attract more investment in this area. For example, the instructions for regulating the market of petrochemical products, following the General Policy Implementation Law of Article 44 of the Constitution and its subsequent amendments communicated to companies active in this industry in the capital market in 2018 in the form of 11 articles, caused stock prices in other industries such as steel and the competitive functions of petrochemical companies to upset the market balance. Critics of the law have argued that when the price of a product (with leverage) is traded 90% higher than the export rate in the domestic market, the profits will not reach the complementary industries and petrochemicals because raw materials will reach companies in the field at a much higher price. This can affect abnormal returns due to the lack of competitive infrastructure.

Based on the autopoietic theory, a structure can be defined as components of a company's content dimensions such as the strategy, technology, culture, and internal environment. Under the influence of changes, such as abnormal stock returns, it can lose its practical competitive functions (Eshaqzadeh et al., 2017). Indeed, the importance of extending the autopoietic restructuring

theory to the reasons for the formation of abnormal stock returns could include a better understanding of the external values for restructuring companies as an output in a competitive capital market environment. Because abnormal stock returns due to the difference between the actual return and the expected (normal) return can disrupt the company's financial planning in the future, the need to match the content and the structural process based on the autopoietic approach can make the company more resilient to these changes. Therefore, the purpose of this study is to evaluate the effect of the reasons for the formation of abnormal stock returns on the content of the autopoietic restructuring theory of companies operating in the petrochemical industry in the capital market. Accordingly, in this research, first the research questions and then the experimental background of the study are presented. The second part states the theoretical foundations of the research based on the analysis of the subject. In the third part, the research tries to provide a more coherent path of research content by stating the research method, participants, collection tools, and study's validity. In the fourth part, the analyzes are presented qualitatively and quantitatively. Finally, the discussion and reasoning of the research results are presented, and the necessary suggestions are presented.

2. Literature review

2.1. The theory of autopoietic restructuring

Autopoiesis means the continuity of the functions of a system in creating integration and achieving a certain level of effectiveness, and it is called self-production (Iba, 2010). The metaphor of self-production in this sense is the maximization of the values of a system that can occur through coherence. It should be noted that structure does not determine the system's characteristics as a whole. Since the organization is the aspect of realized relationships in the design, it cannot exist independent of the structure realizing it. Therefore, the accounting system and related procedures will not have the necessary effectiveness without a coherent structural design in the company. In other words, autopoiesis refers to the functional coherence of decision-making within a cohesive whole, such as the company structure, which can be dynamic when the system interacts with the structure and goes back and forth with the environment. Maintaining the system's effectiveness is a condition for the existence of an integrated network. If a system changes without changing its structure, it will collapse and lose its functions (Brocklesby, 2011). Whitaker (1995) provides an exciting example to better understand the system and its structure and differences. He uses a painting by an Italian painter in the 16th century to convey this concept.

Figure 1. A schematic of the concept of the structure and system.

Look at the painting in Figure 1 as a whole shows the face of a human being, which is the structure of a whole. Still, looking at the painting more carefully demonstrates the face's components. This human face is all fruits and

vegetables, and if any of the fruits are removed, the structure will be damaged. This example creates a general picture by placing a real connection between fundamental components such as fruits and vegetables, which fall into a specific category. Thus, a structure is a way of relating elements that represent the identity of the system as a whole. In contrast, a structure refers to the essential components and the actual relationships between them that can change in terms of the type of components and the way they communicate, as long as its identity remains (Villalbos and Palacios, 2021). Therefore, in developing this theory, the operational functions of the company in a competitive market, namely strategy, culture, environment, and technology, are the nature of the content, and a structure put together correctly can bring a company's level of interaction closer to integration. In other words, the identity of the system (i.e., competitive functions and the preservation of practical values in supporting stakeholder resources in this research) is created based on structural content mechanisms. It will change identity if these dimensions are strategy, culture, technology, and the environment (Kilic et al., 2020). Maturana and Warel (1987) realized and visualized the structure of living things (utopian organization) in different systems and defined a structure as the basis for system identification. With this explanation, they introduced the structure of living things as self-production, that is, a valuable system that can have a coherent identity based on integrity (Razeto-barry, 2012). The utopian structure helps a system such as an accounting unit form a more cohesive level of stakeholder interaction based on information values. Self-production in idealistic companies will bring about practical features that balance operations with outcomes and change the system. Without alignment with the structure, financial reporting will not be effective (Rezaei et al., 2019).

3. Abnormal stock returns

Financial market stock prices are significant and vital for decision-makers and convey helpful information. On the other hand, the market value of a company reflects the aggregation of the information on a wide range of investors, which is the result of the influence and interaction of various factors in the market. Therefore, managers can obtain new information from the financial markets and include this information in the company's policies, including profit sharing (Arabsalehi et al., 2020). Nevertheless, prices alone cannot burden decisions significantly, and information about stock returns based on shareholder expectations is another critical issue, which contains essential information on investors' financial decisions. Stock return is one of the achievements of financial markets that has more informative content than performance criteria based on accounting (Ghasemi and Nikbakht, 2015) because performance appraisal based on market value better reflects investors' information. Abnormal stock returns are calculated by subtracting the firm's stock returns from the benchmark returns (returns of the Fama and French portfolios) and represent unexpected changes in the firm's value that carry an information burden and influence decision-making (Tai, 2020). In fact, unforeseen changes in the company's value reflect the news about cash flows and interest rates. Information of more cash flows than expected or an unexpected drop in interest rates will lead to a positive market reaction and increased returns. Managers in such favorable conditions will increase dividends (Rienganum, 2018). Thus, abnormal stock returns are associated with changes in dividends as part of intra-organizational performance processes.

Nevertheless, not all changes in abnormal returns necessarily depend on internal organizational and managerial decisions. Some of these changes may be related to outsourcing functions, i.e., changes shaped by the economic or political environment. They may pave the way for more cash returns for investors in the short term and possibly future fluctuations in return on investment. In fact, the abnormality of returns as one of the factors affecting the return of securities reflects the state of the investment environment in the capital market and countries' economies, and the ability to attract capital in different markets with various trading strategies can be influential. The occurrence of abnormal returns on stocks is a stimulus to investment behavior in the market, which, depending on whether it is positive or negative, will make investors want to invest more or sell stocks in bulk (Ebadi and Hasanpour, 2011). Therefore, recognizing the causes of the formation of abnormal stock returns, both at the macro level (capital market) and the microlevel (investor trading behavior), can be a reason for companies and capital market analysts to formulate strategies to create more dynamism in the capital market. Therefore, according to the theoretical foundations, the research questions are presented in the following order:

1. What are the components of the causes of the formation of abnormal stock returns as a basis in the interpretive analysis of matrix homogeneity?

2. What is the content of the theory of corporate autopoietic restructuring as a reference in interpretive analysis?

3. What is the most compelling reason for the formation of abnormal stock returns on the content of the autopoietic restructuring theory of companies operating in the petrochemical industry in the capital market?

4. Research background

Kumar et al. (2021) conducted a study entitled "Combining AHP and TOPSIS analysis to prioritize corporate restructuring functions". In this study, based on a theoretical analysis of similar studies, eight features of firm restructuring with agility in production were identified to be applied based on the comparison of the results of AHP and TOPSIS methods and the consequences of prioritization of specified components. The AHP was used to guide the priority weight of features, and TOPSIS was used to prioritize features to implement agile production successfully. The results showed that "information technology", "issues related to human resource management", "customer issues", "leadership support", and "organizational issues" were ranked as five crucial features that could pave the way. The top management should focus on critical areas and allocate significant resources to ensure the successful implementation of agile production. Plastun et al. (2021) conducted a study entitled "The evolution of price effects after abnormal one-day returns in the US stock market". The study was conducted between 1890 and 2018, examining leaked data from US stock market companies. The results, periodically reviewed through multiple regression and torque models, showed that between 1940 and 1980, after a day of abnormally positive returns on the US stock market, there was a substantial acceleration effect that could be exploited for profitability. Ramsheh and Jannati (2020) conducted a study entitled "Deviation from optimal leverage and abnormal stock returns". For this purpose, the data of 96 companies listed on the Tehran Stock Exchange from 2009 to 2017 and the approach of controlling the effects of years and industries were used. The results showed that the information market considered the deviation of the leverage from the optimal leverage in the stock price and the factors of leverage status relative to the optimal leverage (higher and lower than optimal). Incorrect stock valuation (overvaluation and undervaluation) moderated the price influence, indicating that the market increases the distance between the lever and the optimal leverage in companies with lower than optimal leverage. Their stocks are overvalued, react positively, and deviate from the optimal power in these companies, leading to an increase in abnormal stock returns. In order not to affect how to measure the optimal lever, four measures were used for it. The results obtained using the moving average lever measure were more compatible with the research literature. Yamrali (2020) conducted a study entitled "predicting abnormal stock returns with neural networks approach (evidence from Tehran Stock Exchange)". It used two approaches of artificial neural network and fuzzy neural network to evaluate the accuracy of predicting abnormal returns by these tools so as to predict abnormal stock returns. The input variables for predicting abnormal returns included the earnings forecast error, financial leverage, investment rate of return, accounting profit transparency, accounting conservatism, corporate brand value, and over-management confidence. For this purpose, 452 companies active in the Tehran Stock Exchange were examined by screening method for five years (2011–2016). The results showed that the predictive power of the artificial neural network was higher than the fuzzy neural network for predicting abnormal stock returns with a lower error rate.

Evaluating the related literature shows that no study has been done with the nature and approach of the current work. Thus, this paper can develop innovative analytical processes due to the combination of qualitative and quantitative methods. It can fill in the gaps of theories related to the structural functions of companies in finance and accounting with practical realities from a competitive and decision-making perspective.

5. Methodology

In terms of outcome categorization, this study is part of developmental research. The theoretical inconsistency in concepts and theories related to this field have led this study to identify the most effective dimensions of abnormal stock returns based on the content structure of the petrochemical industry. Based on the given explanations, the interpretive ranking process can be expressed in the form of the following procedures:

An efficient interpretive ranking process for multi-criteria valuation. The method of the efficient Interpretive ranking process (IRP) to perform multi-criteria valuation the reasons for the formation of abnormal stock returns should be considered, including the following essential steps:

(1) Identifying the components of the abnormal stock return and the contents of the

autopoietic content restructuring propositions or reference variables based on the definition of a contextual relationship between the elements and the offers.

(2) Relating components to propositions in the form of a cross-interaction matrix (binary matrix). Matrix ideas are interpreted based on the participation of experts and become an interpretive matrix.

(3) Identifying a centralized implicit relation is measured by comparing each of the propositions based on zero and one. If proposition A affects proposition B, the cell in question is one, and if it is the opposite, it is zero; if they are reciprocal, the cell is numbered one and is symmetric. If they are unrelated, both cells will be zero. In other words, if two options for a criterion have zero values, then it should be considered an implicit non-dominant relation and entered as zero in the dominant interaction matrix for that criterion.

(4) If the relation between two propositions is straightforward and the related proposition is directly related to one of the propositions and takes one, the other proposal is polarly associated with the corresponding suggestion. For example, if Proposition A has a direct effect on Proposition B, then Proposition B has a direct effect on Proposition C; The effect of Proposition A on Proposition C is a polar effect, or so-called transferable.

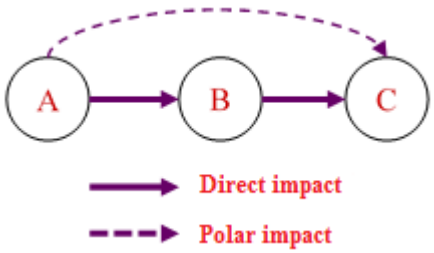

Figure 2. The process of direct and polar impact of propositions in the interpretive matrix

The sum of all dominant interactive matrices is represented by symbol D_i, and D indicates the reciprocal matrix. Equation (1) is used for the simple interpretive rating process, and Equation (2) is used for the weighted interpretive rating process with weight w_i for the first criterion:

$$D = \sum_i D_i \quad (1)$$

$$D = \sum_i w_i D_i \quad (2)$$

The derivatives of weights using total interpretive structural method (TISM) modeling are described in the next section. Comprehensive structural interpretive modeling can generate a hierarchy of metaphysical content restructuring theme criteria to obtain component weights, i.e., the causes of abnormal stock returns according to the Social (2017) approach. These steps can be viewed in the form of the following interpretive processes:

Step 1) they should be identified based on qualitative analysis methods such as over-composition of components (causes of abnormal returns) and propositions (themes of restructuring the autopoietic content); in the first part, the research findings were identified.

Step 2) checklists are compiled and prepared as a pairwise comparison to determine the self-interaction matrix and distributed among members of the research community. Parallel and columnar comparisons are made between individual variables to determine if row index *i* is the cause of column index *j* or vice versa; there is either a connection or no connection. It also shows the degree of symmetry of the relationship between the indicators.

Step 3) self-interactive matrices are created and interpreted. The pairwise comparison of elements forms the structural self-interaction matrix (SSIM). An interpretation identifies only the path of communication in the SSIM analysis. In contrast, the TISM comprehensive interpretation method fully interprets any

pairwise comparison by answering the interpretive question mentioned in the previous level. The *i*th index is compared in pairs with all elements from (i + 1) to *n*th for pairwise comparisons. For each relationship, the answer is yes (Y) or No (N), and if the answer is yes, the reason is stated. In this case, the interpretive logic of couple relationships is presented in the form of the scientific basis of interpretive sense. The table below shows the pairwise comparison form between the research indicators.

Step 4) the achievement matrix is determined as +1 or 0 in the matrix table based on pairwise comparisons made by the target community. These relationships are defined as:

- If *i* leads to *j*, and there is + ve symmetry, we set +1 in cell *ij* and 0 in cell *ji*;
- If *j* leads to *I*, and there is + ve symmetry, we put +1 in cell *ji* and 0 in cell *ij*;
- If *i* is equal to *j*, and there is a symmetry of + ve, we put +1 in both cells *ij* and *ji*;
- If there is no connection between *i* and *j*, we put 0 in both cells *ij* and *ji*;

Step 5) the hierarchy of the achievement matrix is done. The relationships between the variables must first identify the output set, input set, and common elements. The scoring level and priority of the variables are determined by the achievement set and the prerequisite set for each variable.

Step 6) a hierarchical diagram is prepared according to the symmetry of the relationships between components and propositions. Hierarchical level propositions are first sorted and then linked directly to the members based on the accessibility matrix with symmetry.

Step 7) an interpretive matrix is prepared with the symmetry so that the interpretation of nodes and links related to the indicators are developed in the form of a comprehensive interpretive structural model.

6. Statistical population of the research

In the qualitative part, this study selected 15 specialists and experts in the field of accounting at the university level through the basis of homogeneous sampling to determine the components and propositions based on the theoretical approach to the research topic. Further, based on meta-analysis, this part of the research used sites such as University Jihad in Iran, Iran Database of Publications, Iran Islamic Computer Science Research Center, International Science direct, Emerald insight reference, and OnlineLierary reference to determine components (abnormal stock returns) and research indicators (content propositions of corporate autopoietic structure). In the second phase, 20 financial managers of petrochemical companies in the capital market were asked to conduct the interpretive prioritization analysis. It should be done by participants based on a specific criterion such as experience or specialized knowledge, which is limited in terms of sample size and in accordance with research such as Soshil (2017) and Chithambaranathan et al. (2015).

7. Findings

Meta-synthesis analysis is used to enter the first phase of interpretive analysis by compiling the identified components and proposals in the form of research matrix checklists so as to connect the components of abnormal stock returns and the content propositions of the autopoietic structure of petrochemical companies.

8. Meta-synthesis findings

The meta-analysis method seeks to identify components and propositions related to the research topic through theoretical and research screening. The period for analyzing similar investigations was 2017 to 2021. In other words, studies related to the research goal were identified to find similar articles and research and use international and domestic research databases and references.

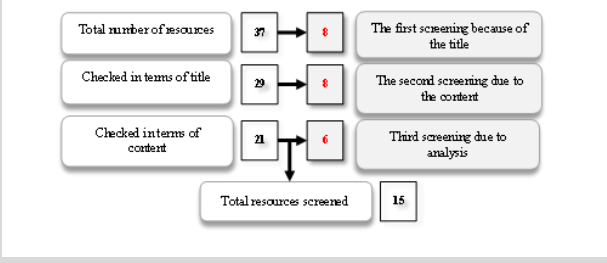

Figure 3. Screening of the initial research.

Figure 3 shows that 37 primary sources are identified. After several stages of the screening process in terms of content and title analysis, finally, 15 appropriate research contents, titles, and analytical processes are selected. It was found that eight studies are related to determining the components of abnormal stock returns, and seven studies are associated with determining the content propositions of the utopian structure of companies. At this stage, concepts should be broken down into components and propositions to determine the essential dimensions of abnormal stock returns based on the content themes of the autopoietic structure of petrochemical companies in the form of rating checklists. In fact, through the criterion of critical evaluation based on 10 measures of research objectives, the logic of research method, research design, sampling, data collection, reflectivity, the accuracy of analysis, theoretical and transparent expression of findings, and research value were determined: Section 8.1 determines the components of abnormal stock returns, and Section 8.2 determines the content propositions of the autopoietic structure of companies.

8.1. Identify the components of abnormal stock returns

According to the explanations given, the parts of abnormal stock returns with symbol A are identified in this section. Table 1 evaluates the components based on a 50-point index in the form of scores from 1 to 5 based on the 10 criteria described.

Table 1. The critical analysis process of screened research.

		Asem and Alam (2021)	Lyle and Yohn (2021)	Erickson et al. (2020)	Roszkowska and Langer (2019)	Amir et al. (2018)	Docherty et al. (2017)	Arabsaleh et al. (2020)	Rameshe and Jannati (2019)	Bakhshinejad (2018)	Kanaani Amiri et al. (2017)
	Confirm ☑	☑		☑	☑		☑	☑		☑	
	Delete ☒		☒			☒			☒		☒
Critical evaluation criteria	**Research purpose**	4	2	4	3	2	4	3	3	3	1
	The logic of the research method	3	3	3	3	1	5	4	4	4	2
	Research plan	4	2	4	4	2	4	3	3	3	2
	Sampling	4	3	4	3	3	5	4	2	4	3
	Collecting data	3	3	5	4	3	5	3	3	4	1
	Generalized findings	4	2	4	4	2	4	3	2	4	3
	Ethical	5	2	5	5	2	3	3	2	3	2
	How statistical analysis	4	4	5	4	3	3	3	2	4	2
	Theoretical capability	5	3	4	3	3	4	3	2	3	3
	Research value	4	3	4	4	2	4	3	3	3	2
	Total	**40**	**27**	**42**	**37**	**23**	**41**	**32**	**26**	**35**	**21**

The scores presented based on the fashion index showed that four studies were excluded because they received less than 30 out of 50 points, and according to the guidelines of good scores of this analysis, the research scores that scored 30 and above were eliminated. The reason was removed from the investigation. Next, the components of the causes of the formation of abnormal stock returns are extracted. Accordingly, the following scoring method is used to determine the mentioned components. Based on this method, all sub-criteria extracted from the text of approved articles are written in the table column, and then the names of the approved research researchers are listed in the row of each table. Based on each researcher's use of the sub-criteria written in the table column, symbol ☑ is inserted, then the scores of each ☑ are added together in the sub-criteria column; the scores above the average of the researches are selected as the research components.

Table 2. The process of determining the main components of research.

		Researchers	Causes of economic policy	Causes of parallel stock market changes	Reasons for corporate leadership	Institutional and regulatory causes	Stock market management causes	Commercial causes of the stock market
Research status	International	Asem and Alam (2021)	-	☑	-	☑	-	-
		Erickson et al. (2020)	-	-	☑	☑	-	☑
		Roszkowska and Langer (2019)	-	☑	☑	-	-	☑
		Docherty et al. (2017)	☑	☑	-	☑	-	-
	Internal	Arabsalehi et al. 92020)	-	-	-	☑	☑	☑
		Bakhshinejad (2019)	-	☑	-	☑	-	-
	Total		2	4	2	5	2	3

Based on this analysis, it was found that the three components have the highest frequency. Therefore, in this study, they are examined as the criteria for the formation of abnormal stock returns. In this section, after analyzing the theoretical foundations of the approved research, each of the identified components is defined according to Table 3.

Table 3. The components of abnormal stock returns.

Components	Symbol	Definition
Causes of parallel stock market changes	A1	Changes and developments in other parallel financial markets (bank, foreign exchange market, and housing market) change the stock return in the capital market according to the degree of market substitution. Extensive studies have been conducted on the effect of financial markets on each other: upstream institutions such as exchange rate changes and inflation control order changes in rules and regulations. Changes in bank interest rates are seen as changes in parallel markets, affecting stock returns in the capital market. These changes in similar markets indirectly affect investors' expected returns on investors' future cash flows by affecting risk and return on capital markets and increasing the incentive to invest more in companies in this market (Asem and Alam, 2021).
Institutional and regulatory causes of stock market	A2	According to the Emerging Markets Committee of the International Organization of Securities Commissions (2007), institutional and regulatory factors play an influential role in creating abnormal stock returns. Increasing the number of free float stocks, enabling foreign participation in the market, reducing transaction costs, improving the market trading infrastructure, and increasing the supply of securities promote abnormal stock returns due to the difference between the actual return and the expected (normal) return (Roszkowska and Langer, 2019).
Commercial causes of the stock market	A3	Effective business causes, such as the state of cycles of the economy (the state of recession and prosperity), financial cycles, financial and banking crises, and the structures of the country's financing system, externally play a decisive role in the formation of abnormal returns and cause excessive returns for stocks. Given that the environmental situation of the economy, such as the business cycle, has a direct effect on most companies' conditions, increasing the expected return of investors can affect the attractiveness of investing in the stock market compared to other markets (Bakhshinejad, 2017).

8.2. Identify the content propositions of the autopoietic structure of companies

As in the above steps and following the critical evaluation method in this section, the content propositions of the ideal structure of companies are identified by symbol B. Table 4 demonstrates how to evaluate the contents of a proposal based on an index of 50 points in the form of scores from 1 to 5 based on the 10 criteria described above.

Table 4. The process of critical analysis of screened research.

		Critical evaluation criteria										
		Research purpose	The logic of the research method	Research plan	Sampling	Collecting data	Reflexivity	Ethical considerations	Accuracy of analysis	Theoretical and transparent basis of the findings	Research value	Total
Researches	**Villalbos and Palacios (2021)**	4	5	4	4	4	3	4	4	4	4	40
	Jackson (2020)	2	3	2	3	2	2	2	2	2	3	**23**
	Bakken et al. (2020)	3	3	3	3	3	4	3	3	3	5	33
	Koo and Chae (2019)	4	3	4	4	4	4	4	4	4	4	**39**
	Cardenas (2018)	2	2	2	1	2	3	2	3	3	2	22
	Koskinen (2017)	4	5	5	3	4	3	3	3	4	4	**38**
	Abdolbaqi Ataabadi and Mirlouhi (2019)	5	3	4	3	4	3	4	3	4	4	37
	Sahrakaran and Rezaei (2017)	3	1	2	1	2	3	2	3	2	2	**21**
	Ishaqzadeh et al. (2017)	4	4	3	4	4	4	3	3	4	4	37

The scores based on the fashion index showed that out of 9 studies related to identifying the content propositions of the autopoietic structure of companies, 3 studies received less than 30 out of a total of 50 points. According to the guidelines for the adequacy of the score of this analysis, the studies with a score of 30 or higher are approved, eliminated, and therefore excluded from the review. Next, the research propositions are extracted. Accordingly, the following scoring method is used to determine the content propositions of corporate autopoietic restructuring. The results confirm the approval of seven content propositions of corporate autopoietic restructuring based on high-frequency distribution. After analyzing the theoretical foundations of the approved research, this section defines each of the identified propositions according to Table 5.

Table 5. Content propositions of the autopoietic structure of companies.

Propositions	Symbol	Definition
Peripheral dimension of the structure of utopia	B1	Environmental change is considered one of the structural pillars of companies, which is in line with the concept of autopoietic theory, expressing the difference between cohesive companies and competitive advantage over other competitors based on structural flexibility. In other words, if a company structurally has the necessary capabilities to respond quickly to changes outside its boundaries, it has a more specific direction and ability to improve its financial performance (Villalbos and Palacios, 2021).

Propositions	Symbol	Definition
The cultural dimension of the structure of utopia	B2	Culture is always an essential and significant criterion in shaping the structure of a company in terms of content dimensions. The structural culture dimension based on autopoietic theory refers to companies' norms and performance beliefs toward stakeholders, while fitting the content with strategies can increase the company's effectiveness in terms of financial transparency and shareholder rights (Bakken et al., 2019).
The size dimension of the autopoiesis structure	B3	The size dimension in the structure of capital market companies is another content criterion that, according to the autopoietic theory, measures the firm's performance processes in terms of flexibility in performance functions such as attracting liquidity and includes the reduction of financial constraints. Further, in terms of the hierarchical form, there is a noticeable difference between the structures of large companies compared to the structures of smaller companies, so it affects the functional area of information transparency in the company's accounting unit (Eshaqzadeh et al., 2017).
The technology dimension of the autopoietic structure	B4	The technology dimension is another dimension of content that refers to the fit between the technical nature of the company in terms of management information systems and effective decisions to information symmetry. In other words, the more structured a company is in terms of information systems, the more transparent the information disclosure functions are based on corporate governance, which can help develop the operational procedures of companies (Tannober et al., 2020).
The strategy dimension of the autopsy structure	B5	Strategy dimension, as the last content dimension following the theory of utopia, refers to the degree of coordination of the company's main strategies with the company's sub-strategies to maintain the stability of the company structure in competition with other companies in the capital market. In other words, the strategy of an autopoietic structure is a process to achieve the company's goals; an example is the company's financial goals that the organizational structure of a company should pay special attention to so as to succeed in a competitive environment (Eshaqzadeh et al., 2017).

9. Interpretive ranking process

As described in the qualitative part of the study, the components of the causes of the formation of abnormal stock returns (A) and the content propositions of the autopoietic restructuring of corporate (B) were identified. In this section, the processes related to this analysis are performed to affect line *i* on column *j* or vice versa. Therefore, to create interactive matrices, the level of direct, symmetrical, or indirect communication must first be considered in line with the explanations. Thus, preferably the matrix questionnaire is determined in the following order.

Table 6. Cross-matrix of abnormal stock returns under the content themes of the autopoietic restructuring of petrochemical companies.

			Research propositions					
		A /B	Peripheral dimension of the structure of utopia	The cultural dimension of the structure of utopia	The size dimension of the autopoietic structure	The technology dimension of the autopoietic structure	The strategy dimension of the autopoietic structure	
			B1	B2	B3	B4	B5	
Components	Causes of changes in parallel stock markets	A1	1	0	0	1	1	**Abnormal returns**
	Institutional and regulatory causes of the stock market	A2	0	1	1	1	1	
	Commercial causes of the stock market	A4	1	0	1	0	1	
			Autopoietic restructuring of petrochemical companies					

Creating an interpretation of the contrast between the components of abnormal stock returns under the content themes of the autopoietic restructuring of petrochemical companies is presented in the below table.

Table 7. The interpretive analysis of the abnormal matrix of abnormal stock returns under the content themes of the autopoietic restructuring of petrochemical companies.

	B1	B2	B3	B4	B5
A1	Causes of changes in parallel stock markets in creating abnormal returns are a reason to renew the environmental dimension of the autopoietic structure.			Causes of changes in parallel stock markets in creating abnormal returns	Causes of changes in parallel stock markets changing abnormal returns are a reason to reshape the strategy of the autopoietic structure.
A2		Institutional and regulatory causes of the stock market in creating abnormal returns are a reason to renew the cultural dimension of the autopoietic structure.	Institutional and regulatory reasons for the stock market in creating abnormal returns are a reason to resize the autopoietic structure.	Institutional and regulatory reasons for the stock market in creating abnormal returns are a reason to renew the technology dimension of the autopsy structure.	Institutional and regulatory reasons for the stock market in creating abnormal returns are a reason to renew the strategic dimension of the autopoietic structure.
A3	The commercial causes of the stock market in creating abnormal returns are a reason to renew the environmental dimension of the autopsy structure.		The commercial causes of the stock market in creating abnormal returns are a reason to renew the cultural dimension of the autopoietic structure.		Commercial stock market causes in abnormal returns are a reason to renew the strategy dimension of the utopia structure.

According to the obtained results, this section evaluates the effectiveness of each of the content propositions of the autopoietic restructuring of petrochemical companies. This evaluation is a scoring method based on developing a pairwise comparison score form, the result of which is used in the following sections of the matrix prioritization analysis.

Table 8. Comparison of content propositions of autopoietic restructuring of petrochemical companies.

Number	Couple comparison	Yes/No	Description of how the impact
Couple comparison at the level of the environmental dimension of autopoietic restructuring			
1	B1 – B2	**Yes ☒ No ☐**	The environmental dimension of autopoietic restructuring is the basis for changing the cultural size of autopoietic restructuring.
2	B2 – B1	**Yes ☐ No ☒**	
3	B1 – B3	**Yes ☒ No ☐**	The environmental dimension of autopoietic restructuring is the basis for changing the size of autopoietic restructuring.
4	B3 – B1	**Yes ☐ No ☒**	
5	B1 – B4	**Yes ☒ No ☐**	The environmental dimension of autopoietic restructuring is the basis for changing the extent of autopoietic technology restructuring.
6	B4 – B1	**Yes ☐ No ☒**	
7	B1 – B5	**Yes ☒ No ☐**	The environmental dimension of autopoietic restructuring is the basis for changing the size of an autopoietic restructuring strategy.
8	B5 – B1	**Yes ☐ No ☒**	

This table was presented as a part of the impact of relationships such as a pairwise comparison of the content level of autopoietic restructuring of petrochemical companies B, two propositions of the environmental dimension of autopoietic restructuring B1, and the cultural size of autopoietic restructuring *i*2 with impact *i*2. They are related, implying that the ecological extent of autopoietic restructuring is the basis for changing the cultural dimension. To form the structural self-interaction matrix, the pairwise comparisons of the research propositions are presented in Table 9. For pairwise comparisons, the *i*th index was compared in pairs with all elements from $(i + 1)$ to n. For each relationship, the answer is yes or no, and if the answer is yes, the reason is stated. In this case, the interpretive logic of pair relationships is presented in the form of the scientific basis of interpretive sense. In this step, the relations are entered in the form of an achievement matrix as "1" or "0", presented in Table 9. According to Table 8, the cells that have the option "Yes" are numbered one, and the cells that have the option "No" are numbered zero. In fact, this matrix is obtained by converting its structural interaction matrix into a zero and one binary matrix.

Then, in this stage, points are formed based on the interaction of the compared indicators to create the interaction achievement matrix. For a matrix $\mathbf{A}_{(\mathbf{n*n})}$, the matrix **P** (nonsingular) can be found to give $\mathbf{P^{-1}AP} = \mathbf{D}$, a diagonal matrix. In general, the coefficient of two matrices $n \times n$ can be defined as:

$$AB = A[X_1, X_2, \cdots X_n] = [AX_1, AX_2, \cdots AX_n]$$

where X_1, X_2, …, and X_n are columns B. Thus, if E1, E2, and E3 represent the columns E, and the diameter matrix is D as follows:

$$D = \begin{bmatrix} d_{11}^* & d_{12} & d_{13} \\ d_{21} & d_{21}^* & d_{23} \\ d_{31} & d_{32} & d_{31}^* \end{bmatrix}$$

Then, the result of AP = PD is $[\mathrm{AE}_1, \mathrm{AE}_2, \mathrm{AE}_3] = [\mathrm{d}_{11}, \mathrm{d}_{22}, \mathrm{d}_{33}\mathrm{E}_3]$.

Accordingly, according to the matrix of research components that have particular independent vectors E1 to E7, respectively, the diametric level is determined by the relation of imaginary eigenvalues, i.e., 1*. For this purpose, since $\lambda_1 = a + \beta$, the unique vector V_1 will also be imaginary. The solution of such a system of equations is given by:

$X_1 = V_1 e^{\lambda_1 t}, X_2 = \overline{V}_1 e^{\overline{\lambda}_1 t}$

Table 9. The access matrix.

				Research propositions			
	Content propositions of corporate autopsy restructuring	**B**	**Environmental dimension**	**The cultural dimension**	**The size dimension**	**The technology dimension**	**The strategy dimension**
			B1	**B2**	**B3**	**B4**	**B5**
Research propositions	The environmental dimension of the autopoietic structure	**B1**	1	1	1	1	1
	The cultural dimension of the autopoietic structure	**B2**	0	1	1	1	1
	The size dimension of the autopoietic structure	**B3**	0	0	1	1	1
	The technology dimension of the autopoietic structure	**B4**	0	0	1	1	1
	The strategy dimension of the autopoietic structure	**B5**	0	1	1	0	1

Table 10. The achievement matrix in terms of the degree of transferability of the relationship between propositions.

					Research propositions		
	Content propositions of corporate autopoietic restructuring	**B**	**Environmental dimension**	**The cultural dimension**	**The size dimension**	**The technology dimension**	**The strategy dimension**
			B1	**B2**	**B3**	**B4**	**B5**
Research propositions	The environmental dimension of the autopoietic structure	**B1**	1	1	1	1	1
	The cultural dimension of the autopoietic structure	**B2**	0	1	1	1	1
	The size dimension of the autopoietic structure	**B3**	0	1*	1	1	1
	The technology dimension of the autopoietic structure	**B4**	1*	0	1	1	1
	The strategy dimension of the autopoietic structure	**B5**	1*	1	1	1*	1
Impact determination process		Direct impact			**Transitional impact**		

To determine the level of direct and transferable impact of research propositions, in the next step, the percentage of the total level of effects is defined, as presented in Table 11.

Table 11. The percentage of impact levels of content statements of autopoietic restructuring of petrochemical companies.

	Content propositions of corporate autopsy restructuring		Direct impact	Transferable impact	Interpretive influence	Total impact	Percentage of interpretive impact
Research Proposition	Environmental dimension of the autopoietic structure	B1	5	0	2	7	22.85
	The cultural dimension of the autopoietic structure	B2	4	0	1	5	16.12
	The size dimension of the autopoietic structure	B3	3	1	2	5	16.12
	The technology dimension of the autopoietic structure	B4	3	1	2	6	19.39
	The strategy dimension of the autopoietic structure	B5	3	2	3	8	25.83
	Total		18	4	10	**31**	
	Percentage		58.06	12.90	29.04		

The results showed that 58.06% of the correlations between the content propositions of the autopoietic restructuring of petrochemical companies are direct, and only 12.90% have a transfer effect. From the total impact based on the pairwise scale between the research propositions, it is found that the percentage of the proposition influencing the dimension of the autopsy restructuring strategy (B5) is higher than the other propositions. This indicates that most of the restructuring process to match the content with the structural process (autopoietic approach) is related to the strategy dimension that can make the functions of the company's competitive structure dynamic in the petrochemical industry. Therefore, considering the influential role of this dimension of content propositions of autopoietic restructuring of petrochemical companies, according to Tables 10 and 11, Table 12 determines the level of effectiveness of the proposition of dimension of autopoietic restructuring strategy against the abnormal stock returns.

Table 12. Examining the interpretive impact of abnormal stock returns.

			Research components		
	Causes of abnormal stock returns		Causes of changes in parallel stock markets	Institutional and regulatory causes of the stock market	Commercial causes of the stock market
			A1	**A2**	**A3**
Research components	Causes of changes in parallel stock markets	**A1**	1	1	1
	Institutional and regulatory causes of the stock market	**A2**	1*	1	1*
	Commercial causes of the stock market	**A4**	1	1*	1

As can be seen, the highest level of transferability in this proposition is related to the transitional influence of the institutional and regulatory causes of the stock market "A2" relative to the other two components. In fact, this result shows that the existence of the utopia restructuring strategy dimension statement (B5), while being influenced by the other components, is the most common reason for restructuring petrochemical companies based on institutional and regulatory reasons for the stock market. Based on the results obtained, Table 13 lists the disciplines related to implementing interpretive ranking processes.

Table 13. Prioritizing the level of dependence and influence of abnormal stock returns.

			Research components					
	Causes of abnormal stock returns		**A1**	**A2**	**A3**	Dependency level D	Difference D – B	Rank
Research components	Causes of changes in parallel stock markets	**A1**	-	1	1	2	-2	3
	Institutional and regulatory causes of the stock market	**A2**	3	-	2	5	2	1
	Commercial causes of the stock market	**A3**	1	2	-	3	0	2
	Infiltration level B		4	3	3	10		

This table shows that the most compelling reason for the formation of abnormal stock returns is the institutional and regulatory causes of the stock market, which have the most significant impact on the dimension of the autopoietic restructuring strategy of petrochemical companies. In other words, institutional and regulatory changes in the stock market by upstream institutions will be able to influence the restructuring process to match the content with the structural process (the autopoietic approach). On the other hand, the level of dependence, as the sum of the most influential factors in the formation of abnormal stock returns, which indicates the influence of different components, is also related to the statement of institutional and regulatory causes of the stock market. After determining the most effective elements of research in this section by referring to Tables 9–11 to determine the set of output indicators, the common input and elements are used to formulate the TISM hierarchical model, i.e., the structural layer model.

Table 14. A set of output, input, and common elements of propositions.

		Abbreviation	**Output statement**	**Input statement**	**Common elements**			
Research Proposals	Peripheral dimension of the autopoietic structure	B1	1,2,3,4,5	1	1	II	Second level	**Leveling priorities**
	The cultural dimension of the autopoietic structure	B2	2,3,4,5	1,2,5	2,3,5	III	Third level	
	The size dimension of the autopoietic structure	B3	3,4,5	1,2,3,4,5	3,4,5	I	First level	
	The technology dimension of the autopoietic structure	B4	3,4,5	1,2,3,4	3,4,5	I	First level	
	The strategy dimension of the autopoietic structure	B5	2,3,5	1,2,4,5	2,5	IV	Forth level	

Therefore, the autopoietic restructuring strategy dimension proposition (B5) has the most compelling proposition among other petrochemical corporate restructuring content propositions. It is also found that the least practical proposals are the two dimensions of the autocomplete restructuring dimension (B3) and the autopilot restructuring technology dimension (B4) in petrochemical companies. This shows that they do not play a significant role in changing the content of the autopsy restructuring of petrochemical companies,

which is why a conical matrix is presented to better understand the most compelling proposition in Figure 4.

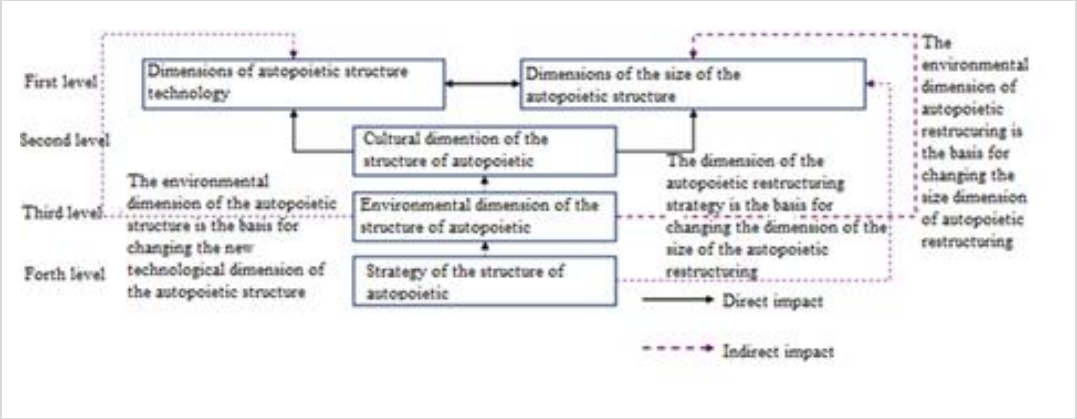

Figure 4. Leveling the content propositions of the autopoietic restructuring of petrochemical companies

As can be seen, the utopian restructuring strategy dimension proposition (B5) has the most compelling proposition among the other utopian restructuring content propositions of petrochemical companies. Finally, by identifying the most influential content propositions of the autopoietic restructuring of petrochemical companies, we attempted to weigh each of the research components, i.e., the causes of the formation of abnormal stock returns. In other words, this section seeks to determine the most important causes of the construction of abnormal stock returns by determining the level of effectiveness of the content propositions of the autopoietic restructuring of petrochemical companies.

Table 15. Selecting the most important reason for the formation of abnormal stock returns based on the content of autopoietic restructuring of the corporate.

	Causes of abnormal stock returns	**A**	**A1**	**A2**	**A3**	**Dependency level D**	**Difference D – B**	**Rank**
Components	Causes of changes in parallel stock markets	A1	-	0.52	1.13	1.65	–0.93	3
	Institutional and regulatory causes of the stock market	A2	1.54	-	2.22	3.76	0.5	1
	Commercial causes of the stock market	A3	1.04	2.74	-	3.78	0.43	2
	Infiltration level B		2.58	3.26	3.35			

By comparing the process of simple interpretive ranking in Table 13 and interpretive order in the above table, the most crucial factor in the formation of abnormal stock returns is determined. These results are tabulated in Table 16.

Table 16. Comparative ratings of the simple and weighted interpretive prioritization process.

	Causes of abnormal stock returns	**A**			
Components	Causes of changes in parallel stock markets	A1	Third rank	Third rank	**Simple interpretive ranking**
	Institutional and regulatory causes of the stock market *	A2	The first rank *	First rank	
	Commercial causes of the stock market	A3	Second rank	Second rank	
			Interpretive weighting ranking		

In fact, in the analysis of interpretive ranking process weights, it should be stated that the high weight of each component indicates the greater level of the importance of that component in the target population. Based on this result, it should be noted that the most influential factor in the formation of abnormal stock returns is the institutional and regulatory causes of the stock market in creating abnormal returns, which is the basis for renewing the strategic dimension of the autopoietic structure.

10. Conclusions

The purpose of this study was to evaluate the effect of the reasons for the formation of abnormal stock returns on the content of the autopoietic restructuring theory of companies operating in the petrochemical industry in the capital market. Based on the results, the most probable content proposition of the autopoietic restructuring of companies in the petrochemical industry is the dimension of the utopian restructuring strategy proposition (B5), which is more influenced by the restructuring component than the rest of the propositions. The goal is to match the content and the structural process (autopoietic approach) to the strategic dimension, making the functions of the company's competitive structure dynamic in the petrochemical industry. In other words, due to abnormal stock return fluctuations, companies operating in the petrochemical industry need to focus on the strategic dimension of their restructuring strategy to gain more competitive advantage, which refers to the proportionality of content restructuring criteria in a competitive market. Based on this dimension in the autopoietic theory for restructuring petrochemical companies in a competitive market and improving the level of coordination between the leading strategies and their sub-strategies, companies should try to develop adequate capacities for attracting cash resources through abnormal returns while gaining the stability of their structure to compete with other companies in the capital market. In other words, the dimension of autopoietic restructuring strategy is a process for achieving the company's financial goals, which strengthens the organizational structure of companies operating in the petrochemical industry to succeed in a competitive environment.

On the other hand, in line with the third question of the research, the results showed that the most influential factor in the formation of abnormal stock returns is the institutional and regulatory causes of the stock market for creating abnormal returns, which is the basis for renewing the strategic dimension of an autopoietic structure. In other words, this result indicates that institutional and regulatory reasons of the stock market due to decisions aimed at increasing investment attractiveness in the Tehran Stock Exchange, including the liberalization of floating stocks, enabling external market participation by attracting foreign investment, reducing transaction costs, improving the market trading infrastructure, and increasing the supply of securities while creating a difference between the actual return and the expected (normal) return of investors, are accompanied by an increase in abnormal returns, restructuring the content of petrochemical companies in terms of proportionality. Content is considered to be in line with the design processes of the organization, in line with the autopoietic theory. In other words, institutional and regulatory reasons are considered as a strategic dimension to change the content of autopoietic restructuring in petrochemical companies.

In this situation, due to the similarity between the main strategies with the sub-strategies and other content dimensions of structural design, companies will have more competitive capabilities in attracting their liquidity to use abnormal stock returns. Under these circumstances, companies operating in this field see the creation of abnormal stock returns as an opportunity to effectively develop their investment plans and projects. They can gain a competitive advantage to gain more trust of shareholders and investors and achieve the incentives to invest in the shares of petrochemical companies. The results obtained from the works of Asem and Alam (2021), Roszkowska and Langer (2019), Docherty et al. (2017), and Arabsalehi et al. (2020) are also addressed. Based on the obtained results, focusing on the restructuring process in line with the autopoietic theory is recommended. At the same time, it can help increase the liquidity level of the company's stock based on increasing the volume of companies' stock transactions, can help identify the market to balance supply with company stock demand, and can lead to more dynamism in stock exchanges due to increased incentives to invest in stocks of petrochemical companies. In other words, the amount of money generated by balancing the price increases the level of stock liquidity and trades it as a reliable cash asset. It is also suggested that the stock exchange organization and other regulatory bodies provide shareholders and investors with information such as the liquidity rating, the percentage of trading days, and the level of the company's capital structure to better understand the market and industry and upgrade the specialized level. Thus, they can select the

appropriate investment portfolio to help investigate, make decisions based on the functional realities of the industry and companies active in petrochemicals, and prevent the existence of bubbles in abnormal returns in the capital market. Hence, the risk of investments is reduced, and the resulting returns are more balanced and rationally surrounded by influential factors.

In expressing the limitations of research, we can also refer to the level of generalizability of qualitative research. In other words, since research with such an analytical process can have behavioral or executive discrepancies and complexities, it can be argued that there may be other aspects of the expansion of corporate restructuring values and abnormal stock returns, which are not examined. However, an attempt has been made to conduct such an analysis based on the link between such an analysis in the qualitative and quantitative sections, given the theoretical concepts and approaches that are not presented mainly in the form of a coherent model of competitive values.

References

Abdolbaghi Ataabadi, A., Mirlohi, S. (2019). Life cycle, Corporate Failure, and Restructuring Strategies: Evidence of Tehran Security Exchange, 11(1): 229–260.

Amir, E., Guan, Y., Livne, G. (2018). Abnormal Fees and Timely Loss Recognition—A Long-Term Perspective, AUDITING: A Journal of Practice and Theory, 38(3): 1–22. https://doi.org/10.2308/ajpt-52348

Arabsalehi, Mehdi, Amiri, Hadi., Rajaei, Marzieh. (2020). Abnormal stock returns, private information on stock prices and dividends paid, Quarterly Journal of Accounting and Auditing Research, 47 (3): 5–20.

Asem, E., Alam, Sh. (2021). The abnormal return associated with consecutive dividend increases, The European Journal of Finance, 27(3): 222–238. https://doi.org/10.1080/1351847X.2020.1801482

Bakhshinejad, M. (2019). The effect of information transfer on the impact of abnormal returns on business strategy of companies listed in Tehran Stock Exchange. Journal of Financial Accounting Research, 11(4): 1–22.

Bakken, T., Hernes, T. and Wiik, E. (2019). Chapter 9 An Autopoietic Understanding of "Innovative Organization, Magalhães, R. and Sanchez, R. (Ed.) Advanced Series in Management (Advanced Series in Management, Vol. 6), Emerald Group Publishing Limited, Bingley, pp. 169–182. https://doi.org/10.1108/S1877-6361(2009)0000006010

Brocklesby, J. (2011). From Building Environmental Representations to Structural Coupling—an Autopoietic Theory Perspective on the Theory and Practice of Strategic Management, Systems, and Behavioral Research Science, 28(6): 618–630. https://doi.org/10.1002/sres.1115

Cardenas, J, F. (2018). Effect of stress on a cognitive autopoietic system, Philosophical Psychology, 31(7): 1074–1096. https://doi.org/10.1080/09515089.2018.1473847

Chen, C, W, S., So, M, K, P., Chiang, Th. (2015). Evidence of Stock Returns and Abnormal Trading Volume: A Threshold Quantile Regression Approach, Japanese Economic Review, 67(1): 96–124. https://doi.org/10.1111/jere.12074

Chen, Zh., Li, S., Cai, M, L., Zhong, L., Ren, F. (2021). Cross-region risk spillover between the stock and stock index futures markets under exogenous shocks, The North American Journal of Economics and Finance, 58(2): 138–166. https://doi.org/10.1016/j.najef.2021.101451

Docherty, P., Dong, Y., Song, X., Tippet, M. (2017). The Feller diffusion, filter rules and abnormal stock returns, The European Journal of Finance, 24(5): 426–438. https://doi.org/10.1080/1351847X.2017.1309328

Ebadi, Javad., Hasanpour, Ismail. (2011). Capital increase and its impact on abnormal returns based on evidence from Tehran Stock Exchange, Financial Knowledge of Securities Analysis, 4 (2): 45–62.

Erickson, M, M., Ton, K., Wang, Sh. (2020). The Effect of Acquirer Net Operating Losses on Acquisition Premiums and Acquirer Abnormal Returns, Journal of the American Taxation Association, 41(2): 103–124. https://doi.org/10.2308/atax-52395

Eshaghzadeh, N., Mehregan, M., Abooyee Ardakan, M. (2017). Application of Autopoietic Theory in Management. Journal of Public Administration, 9(3), 427–462.

Ghasemi, Ali, Nikbakht, Mohammad Reza. (2015). The effect of stock overvaluation on abnormal returns

and their volatility in B over time, Empirical Studies in Financial Accounting, 12 (48): 29–51.

Iba, T. (2010). An Autopoietic Systems Theory for Creativity, Procedia - Social and Behavioral Sciences, 2(4): 6610–6625. https://doi.org/10.1016/j.sbspro.2010.04.071

Jackson, T.W. (2020). Applying autopoiesis to knowledge management in organizations, Journal of Knowledge Management, 11(3): 78–91. https://doi.org/10.1108/13673270710752126

Kanani Amiri, Mansour, Valizadeh Larijani, Azam., Bavarjeh, Maryam. (2018). The Relationship between Real Profit Management and Abnormal Return on Shares of Companies Listed on the Tehran Stock Exchange, Accounting and Auditing Research, 10(40): 75–86 (In Persian).

Kılıç, M., Uyar, A., Kuzey, C. and Karaman, A.S. (2020). Does institutional theory explain integrated reporting adoption of Fortune 500 companies? Journal of Applied Accounting Research, 22(1): 114–137. https://doi.org/10.1108/JAAR-04-2020-0068

Kolari, J, W., Pynnonen, S., Tuncez, A, M. (2020). Further evidence on long-run abnormal returns after corporate events, The Quarterly Review of Economics and Finance, https://doi.org/10.1016/j.qref.2020.10.011

Koskinen, K.U. (2017). Observation's role in technically complex project implementation: the social autopoietic system view, International Journal of Managing Projects in Business, 6(2): 349–364. https://doi.org/10.1108/17538371311319061

Kumar, R., Singh, K., and Jain, S.K. (2021). A combined AHP and TOPSIS approach for prioritizing the attributes for successful implementation of agile manufacturing, International Journal of Productivity and Performance Management, 69(7): 1395–1417. https://doi.org/10.1108/IJPPM-05-2019-0221

Lyle, M, R., Yohn, T, L. (2021). Fundamental Analysis and Mean-Variance Optimal Portfolios, The Accounting Review, https://doi.org/10.2308/TAR-2019-0622

Maturana, H (2002). Autopoiesis, structural coupling, and cognition: a history of these and other notions in the biology of cognition. Cybernetics and Human Knowing, 9(3–4): 5–34.

Maturana, H. R., and Varela, F. J. (1987). The tree of knowledge: The biological roots of human understanding. New Science Library/Shambhala Publications.

Minagers, J. (2008). Can social systems be autopoietic? Assessing Luhmann's social theory, The Sociological Review, 50(2): 278–299. https://doi.org/10.1111/1467-954X.00367

Paucar-Caceres, A., Harnden, R., Reichel, A. (2011). Autopoiesis, Systems Thinking and Systemic Practice: The Contribution of Francisco Varela, Systems and Behavioral Research Science, 28(6): 571–574. https://doi.org/10.1002/sres.1127

Plastun, A., Sibande, X., Gupta, R., Woher, M, E. (2021). Evolution of price effects after one-day abnormal returns in the US stock market, The North American Journal of Economics and Finance, 57(2): 143–177. https://doi.org/10.1016/j.najef.2021.101405

Ramsheh, M., Janati, A. (2020). The Deviation from Optimal Leverage and Abnormal Returns. Financial Management Strategy, 8(4), 135–156.

Razeto-Barry, P. (2012). Autopoiesis 40 years later. A review and a reformulation. Origins of Life and Evolution of Biospheres, 42(6): 543–567.

Reinganum, M, R. (2018). Abnormal Returns in Small Firm Portfolios, Financial Analysts Journal, 37(2): 52–56. https://doi.org/10.2469/faj.v37.n2.52

Rezaei, Farzin, Torabian, Mohsen, Mokhtari, Fereshteh. (2019). Relationship between the value of accounting information in the integrated reporting approach, Shabak Scientific Journal, 5(3): 67–80 (In Persian).

Roszkowska, P., Langer, L, K. (2019). (Ab)Normal Returns in an Emerging Stock Market: International Investor Perspective, Emerging Markets Finance, and Trade, 55(12): 2809–2833. https://doi.org/10.1080/1540496X.2018.1531241

Sahrakaran, Mina., Rezaei, Farzin. (2018).The Impact of Financial Information Risk on Representation Relationship with Corporate Capital Structure, Asset Management, and Financing, 6 (4): 93–102.

Tai, Y, H. (2020). The relation between the corporate governance evaluation and abnormal returns: the role of company financial performance, Asia-Pacific Journal of Accounting and Economics, https://doi.org/10.1080/16081625.2020.1828952

Thannhuber, M., Tseng, M, M., Bullinger, H. (2020). An Autopoietic Approach for Building Knowledge Management Systems in Manufacturing Enterprises, CIRP Annals, 50(1): 313–318. https://doi.org/10.1016/S0007-8506(07)62129-5

Varela, F. G., Maturana, H. R., and Uribe, R. (1974). Autopoiesis: the organization of living systems, their characterization, and a model. Biosystems, 5(4): 187–196.

Villalbos, M., Palacios, S. (2021). Autopoietic theory, emotivism, and their incommensurable marks of the cognitive, Synthese, 198(2): 17–87. https://doi.org/10.1007/s11229-019-02376-6

Wachira, M.M., Berndt, T. and Romero, C.M. (2019). The adoption of international sustainability and integrated reporting guidelines within a mandatory reporting framework: lessons from South Africa, Social Responsibility Journal, 16(5): 613–629. https://doi.org/10.1108/SRJ-12-2018-0322

Whitaker, R. (1995). Self-organization, autopoiesis, and enterprises. Available in: http://www.enolagaia.com/RW-ACM95-Main.html

Yamrali, O. (2019). Predict Abnormal Stock Returns with Neural Network Approach) Evidence from Tehran Stock Exchange (Accounting and Auditing Research, 11(43), 187–202.