



Market Structure, Conduct, and Performance in Indonesia's Cellular Telecom Industry

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Abstract

This research investigates the factors that impact the performance of the Indonesian mobile telecommunications sector by employing two predominant theoretical frameworks: the Harvard School (market power hypothesis) and the Chicago School (efficiency structure hypothesis). The methodology encompasses descriptive analysis to scrutinize the Structure-Conduct-Performance (SCP) model, data envelopment analysis (DEA) to assess technical and scale efficiencies, and panel data regression to determine the influences on company performance. The data derive from annual reports of mobile telecommunications entities spanning 2010 to 2022. Findings indicate the presence of market power within the industry, highlighted by the existence of five major operators and a notable concentration ratio. Further, the analysis of advertising and welfare expenses demonstrates significant investments in advertising to secure and expand market presence. Despite this, the industry exhibits low technical efficiency yet benefits from substantial scale operations. Regression outcomes suggest that company performance is predominantly driven by market power rather than efficiency, with market share significantly enhancing performance, whereas technical and scale efficiencies appear to have minimal impact. The results lend credence to the Harvard School's market power hypothesis.

Key words : Industrial Economics; Market Power; Industrial Efficiency; Data Envelopment Analysis; Cellular Telecommunications Industry.

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INTRODUCTION

The significance of the industrial sector within national economic frameworks is evident through the contributions of various sectors and sub-sectors to the gross domestic product (GDP). Notably, the cellular telecommunications sector has garnered considerable interest within the service industries during the globalized era (Zulfikar & Tri., 2016). The information and communication sector not only supports the GDP but also exhibits a growth rate surpassing that of other sectors.

Data from the Central Statistics Agency (BPS) reveal an annual increase in this sector's contribution. From 2016 to 2020, there has been a noticeable upward trend in the sector's proportion of Indonesia's total GDP at current prices. Given Indonesia's extensive population and geographic expanse, the telecommunications industry faces both significant market opportunities and challenges.

Building on the foundational importance of the industrial sector, particularly the cellular telecommunications sector, its economic impact extends significantly into the domain of state revenues. As the predominant contributor to non-tax state revenue (PNBP) within the information and communication sector, a 2020 study by the expertise agency of the DPR RI secretariat general revealed that the fees for frequency usage rights amounted to 20.71 trillion Indonesian rupiah, while the universal service obligation PNBP totaled 1.12 trillion Indonesian rupiah.

The telecommunications industry in Indonesia bifurcates into fixed telephones (public switched telephone network or PSTN) and cellular telephones, the latter offering full mobility and wireless communication. Mirroring societal trends towards greater mobility, the demand for mobile

telecommunications has surged, with cellular telephones becoming the dominant medium in recent years. By 2022, cellular telephone users constituted 96.99% of all telephone subscribers in Indonesia, showing continuous growth in subscriber numbers from 2018 to 2021.

This sector's operations are governed by Law No. 36 of 1999 on telecommunications and the Regulation of the Minister of Communication and Information No. 09 of 2009, which outlines the procedures for setting cellular telecommunications service rates.

Continuing from the discussion on the regulatory and market framework of Indonesia's telecommunications industry, the sector's organization under the Indonesian Telecommunications Providers Association (Asosiasi Penyelenggara Telekomunikasi Seluruh Indonesia - ATSI) plays a crucial role. ATSI comprises five key players: PT. Telekomunikasi Seluler, PT. Indosat Ooredoo Hutchinson, PT. XL Axiata, PT. Telekomunikasi Indonesia, and PT. Smartfren Telecom. The establishment of ATSI is designed to synchronize the strategic visions of these members to effectively navigate the competitive landscape and enhance service offerings. This collaboration aims to foster increased cooperation among network providers, ensuring a robust framework for industry growth and innovation.

Significant mergers within this organization highlight its dynamic nature. Notably, the amalgamation of PT. XL and PT. Axis in 2014 resulted in PT. XL Axiata, and the merger of PT Indosat and PT. Hutchinson Tri Indonesia in 2022, which formed PT. Indosat Ooredoo Hutchinson. Additionally, the Telkom Group, which includes PT. Telekomunikasi Seluler and PT. Telekomunikasi Indonesia, remains the sole state-owned entity in this sector, providing extensive telecommunications and network services across Indonesia. These developments signify strategic realignments within the industry, aimed at enhancing competitive capabilities and market reach.

Building on the structural dynamics within the Indonesian telecommunications sector, as facilitated by ATSI and underscored by key mergers, there arises a significant shift towards increased market power. While ATSI was originally formed to enhance service quality and foster cooperative advancements for consumer benefit, these consolidations could potentially culminate in monopolistic tendencies or even cartel-like behaviors. Such developments are critiqued for potentially undermining consumer bargaining power, as highlighted by Destiartono & Purwanti (2021). Monopolistic entities primarily benefit from the ability to dictate market prices.

An excessively concentrated market not only enables producers to collaboratively fix prices but also to partition market shares, thereby maximizing monopoly profits and erecting substantial barriers to entry, according to Lie et al. (2017). This concentration exemplifies the market power held by prevailing companies. Furthermore, studies by Ayadi & Ellouze (2013), Gonzales et al. (2019), and Mala et al. (2018) have documented that such market power significantly boosts performance, reinforcing the complex interplay between market structure and economic outcomes within the telecommunications industry.

Continuing from the discourse on market concentration and its implications within the Indonesian telecommunications industry, the rapid increase in smartphone adoption has significantly shifted consumer demand towards mobile internet data, marking a transformative shift in the industry from traditional services like SMS and telephone to mobile broadband. This shift, however, encounters substantial challenges due to the limited availability of the frequency spectrum in Indonesia, which becomes increasingly strained with the addition of

more operators, thus leading to inefficiencies in spectrum allocation as noted by Wulansari, Rismayani, and Pramudiana (2015). This scenario underscores the vital importance of operational efficiency as a determinant of long-term sustainability and competitive advantage in the telecommunications sector. Arsyad & Kusuma (2014) assert that efficiency is essential for companies to distinguish themselves in a competitive market. Supporting this, research by Li et al. (2017), Yongbo et al. (2019), and Fikri & Firmansyah (2022) demonstrates that efficiency significantly enhances company performance, highlighting its critical role in the evolving landscape of telecommunications.

Reflecting on the observed challenges and changes in the Indonesian telecommunications sector, especially regarding efficiency and limitations in spectrum capacity, this research endeavors to thoroughly explore the determinants that affect industry performance. It employs the structure-conduct-performance (SCP) paradigm as a framework for this examination, utilizing two principal theoretical perspectives: the Market Power Hypothesis (MPH) and the Efficiency Structure Hypothesis (ESH). The primary aim is to identify the most critical determinants that influence the performance of the cellular telecommunications industry.

This study seeks to determine the key performance drivers and other significant factors that positively influence industry outcomes. Methodologically, it utilizes descriptive analysis, panel data regression, and Data Envelopment Analysis (DEA) across a range of telecommunications companies in Indonesia. A distinctive feature of this research is the integration of descriptive and proxy analyses into the conduct variables of cellular telecommunications firms in Indonesia, which serves to deepen the specificity and relevance of the results.

RESEARCH METHOD

Industrial Organization (IO) theory transitioned into the modern era during the 1930s, coinciding with the formulation of the structure-conduct-performance (SCP) paradigm by scholars such as Mason and Bain. This pivotal concept examines how the characteristics of market structure can influence corporate behavior, which in turn impacts organizational performance. The SCP framework comprises several critical components, as outlined by Lelisa & Kuhl (2018).

Following the introduction of the structure-conduct-performance (SCP) framework, it is crucial to understand the components of market structure that dictate the competitive dynamics within an industry. Market structure encompasses characteristics such as the number and size distribution of sellers and buyers, barriers to market entry, product differentiation, as well as vertical integration and diversification. These factors critically shape the competitive landscape in which companies operate. According to Lipczynski, Wilson, and Goddard (2005), while market structures are prone to gradual change, they are typically considered stable in the short term. Consequently, the prevailing market structure can significantly influence corporate conduct and performance. Various market structures exist, ranging from perfect competition to monopolies and oligopolies, each positioned along a spectrum from pure competition to complete monopoly. These structures fundamentally affect the behavior and strategic decisions of firms.

Expanding on the exploration of market structures, it is essential to delve into the specific behaviors of firms as influenced by these structural conditions. According to Lipczynski, Wilson, and Goddard (2005), firm behavior is directly shaped by the overarching industry structure, particularly in scenarios of

imperfect competition where such analysis becomes exceedingly pertinent. Unlike in perfectly competitive markets where firms have little to no impetus to engage in promotional activities, respond to competitors, or obstruct new entrants, imperfect competition introduces a variety of strategic behaviors. These actions may not always aim for competitiveness; sometimes, they verge towards collusion to secure a firm's market position.

The range of behaviors observed among firms can be attributed to several variables, including the organization's objectives, pricing strategies, product characteristics, advertising efforts, product development activities, instances of collusion, and the occurrence of mergers. Each of these factors contributes to how a firm positions itself within the market, adapting its strategy in response to the competitive environment and seeking to maintain or enhance its market standing.

Continuing from the discussion of firm behavior, the subsequent impact on market performance provides an essential perspective on the overall efficacy of competitive strategies employed by market players. Market performance, as outlined by Teguh (2010), captures the outcomes of these strategies and their capacity to shape market dynamics. Carlton and Perloff (2000) define market performance as the effectiveness of the market in delivering benefits to consumers, which underscores the importance of strategic interactions among firms.

Elaborating further, Lipczynski, Wilson, and Goddard (2005) identify several key determinants of market performance, including profitability, growth, quality of products and services, technological innovation, and the efficiency of production and resource allocation. These factors collectively influence how well the market serves its consumers and progresses technologically and economically. Additionally, the discourse in industrial organization includes various theoretical approaches, among which the

Harvard School (SCP) and the Chicago School continue to be prominently debated, each proposing different views on the influence of market structure on firm conduct and performance.

Building upon the examination of firm behavior and its effects on market performance, the Harvard School paradigm presents a structured analysis within the SCP (Structure, Conduct, Performance) framework, focusing on the interconnections between market structure, firm behavior, and market outcomes. This paradigm posits that environments with high levels of market concentration are conducive to effective collusion, as noted by Li et al. (2017). Such conditions facilitate coordinated actions among firms, potentially leading to market power abuses.

Researchers including Ayadi & Ellouze (2013), Mala et al. (2019), Li et al. (2017), and Yongbo et al. (2022) have employed metrics like market share, the concentration ratio, and the Herfindahl-Hirschman Index to gauge relative market power within this framework. This approach, commonly referred to as the Market Power Hypothesis (MPH) within the Harvard School, underscores the hypothesis that greater market concentration can lead to higher profitability and market control, reflecting a direct link between market structure and performance.

Transitioning from the Market Power Hypothesis articulated by the Harvard School, the Chicago School Paradigm offers a contrasting perspective on the role of market power within the SCP framework. Critiquing the Harvard School, the Chicago School contends that the assertion that market power is the primary driver of company performance is overly simplistic. According to Lelisa and Kuhil (2018), this school argues that the superior performance observed in highly

concentrated industries could rather be attributed to economies of scale, which enhance operational efficiencies.

Further, the Chicago School posits that the generation of higher profits in such industries is more likely a result of heightened efficiency rather than an increase in market power, as suggested by Destiariono & Purwanti (2022). This perspective is encapsulated in what is known as the Efficiency Structure Hypothesis (ESH), which emphasizes efficiency as the crucial factor in improving performance, challenging the conventional wisdom that market concentration necessarily leads to monopolistic behaviors.

Building upon the theoretical debate between the Harvard and Chicago Schools, these paradigms are empirically tested in this study by focusing on cellular telecommunications companies as the research subjects. This examination is rooted in the contention that greater market concentration may lead to collusion within the industry, a central assertion of the Harvard School. It is noted by Lelissa & Kuhil (2018) that producers in such concentrated markets often collaborate tacitly or explicitly to set prices and output levels, practices that are expected to lead to monopoly profits and, consequently, higher profitability.

This line of reasoning underpins the formulation of the first hypothesis of the study, which posits that market power will exert a significant positive effect on performance. This hypothesis aims to explore the extent to which increased market concentration and the resultant market power influence the economic success of firms within the cellular telecommunications sector, testing the validity of the Market Power Hypothesis in a contemporary setting.

Continuing from the discussion on market power's role in firm performance as postulated by the Harvard School, the Chicago School presents a divergent view, emphasizing efficiency

rather than market power as the primary determinant of performance. As argued by Demsetz (1973), companies are able to maximize profits not through market power, but by enhancing levels of efficiency, both technical and scale. This perspective is supported empirically by studies such as those by Guillen et al. (2014), Li et al. (2017), Yongbo et al. (2019), and Fikri & Firmansyah (2022), which demonstrate a positive correlation between efficiency and performance.

Efficiency is intrinsically linked to factors such as production costs and productivity. An increase in efficiency reflects heightened productivity, characterized by improved technical efficiency, and a reduction in long-term average costs, indicative of scale efficiency. Enhanced technical and scale efficiencies are posited to increase profits and, consequently, profitability. From this standpoint, the second hypothesis of this study is formulated, proposing that efficiency will have a significant positive effect on performance, thereby testing the validity of the Efficiency Structure Hypothesis within the cellular telecommunications industry.

This investigation focuses on five cellular telecommunications companies affiliated with the Indonesian Cellular Telecommunications Association (ATSI). The research utilizes panel data extracted from the financial reports of these companies covering the period from 2010 to 2022, alongside telecommunications statistical data sourced from the Central Statistics Agency (BPS) and the Ministry of Information and Communication (KOMINFO). For the financial data tabulation process, Bloomberg Terminal is employed.

The structure of this study is bifurcated into two distinct sections. Initially, a descriptive analysis is undertaken to explore the market structure, behavior, and performance of the companies. Subsequently, a quantitative approach through panel data regression is applied to identify and analyze the primary determinants impacting performance, incorporating proxies from both the Market Power Hypothesis and the Efficiency Structure Hypothesis, as well as variables such as company size and risk ratio.

In the descriptive analysis, the study employs a market power approach, utilizing metrics such as the concentration ratio (CR4) and the Herfindahl-Hirschman Index (HHI). Additionally, the minimum efficiency of scales (MES) is utilized to evaluate the magnitude of barriers to new entries. Here, the specific formulations for calculating the concentration ratio are also presented, further detailing the analytical methodologies employed in this section of the study, CR4 and HHI.

$$CR_4 = \sum_{j=1}^4 Share_j \quad (1)$$

$$HHI = \sum_{i=1}^N S_i^2 \quad (2)$$

where CR4 is the share of each of the 4 largest companies in the industry to total revenue. While in HHI, S_i^2 is the value of the squared share of Company i in the industry.

The descriptive analysis of firm behavior in this study utilizes advertising and promotion strategy indicators. These indicators serve as key tools for increasing sales and retaining customers within the service sector, making them critical for assessing market behavior. Advertising and promotion expenses provide insight into how industry players conduct themselves in the competitive landscape. In this context, advertising costs are also applied to calculate welfare costs.

According to welfare economics theory, it is suggested that in equilibrium, when one party benefits (better off), another party must experience losses (Pratomo, 2010). This concept of welfare loss helps to evaluate the overall impact of advertising expenditures on consumer and producer welfare within the industry. The specific formulation for calculating welfare costs is presented, further grounding this analysis in established economic theory:

$$\text{Welfare cost} = \frac{2}{3} (\pi + A) - T \quad (3)$$

Where, π is the company's net profit, A is the advertising and promotion costs, and T is the tax paid in advance. A stable welfare cost value over time is indicative of a healthy and balanced market environment. However, if there is a significant and unreasonable increase in this value, it suggests the presence of unhealthy market behavior among mobile telecommunications industry players. Such fluctuations may point to inefficiencies or anti-competitive practices that could negatively affect overall market stability.

In terms of performance, this study employs Return on Assets (ROA) as a key metric. ROA reflects a company's ability to effectively manage its assets to generate profits, calculated as the ratio of net profit after tax to total assets. Additionally, efficiency scores, both technical and scale, are analyzed using Data Envelopment Analysis (DEA). DEA assesses the efficiency of each company relative to a group of comparable firms, as measured through Decision-Making Units (DMU) (Ayadi & Ellouze, 2013). This method allows for the calculation of aggregate scores that represent the relative efficiency of firms. DEA can be applied from two perspectives: input orientation and output orientation, and the results from both approaches generate a technical efficiency

score. The accuracy of this score depends on the assumptions made, whether based on constant returns to scale (CRS) or variable returns to scale (VRS).

The CRS model, developed by Charnes and Cooper (1962), evaluates companies (j) based on their use of (M) inputs to produce (N) outputs. DEA reduces this input-output relationship into a paired analysis. The CRS model is most accurate when all firms operate at optimal scale; however, in imperfect markets, companies often face constraints such as financial issues that prevent them from achieving this optimal scale. This leads to the development of the variable returns to scale (VRS) model, which extends the CRS framework by accounting for non-constant returns to scale (Ayadi & Ellouze, 2013). In such cases, the CRS model is modified by introducing constraints on the model's intensity parameters, allowing for a more accurate reflection of real-world conditions.

The measurement of scale efficiency is conducted by assessing the difference between technical efficiency values derived from the CRS (Constant Returns to Scale) model and the VRS (Variable Returns to Scale) model. Both technical efficiency and scale efficiency serve as independent variables in the analysis, with their values ranging from 0 to 1, indicating relative efficiency levels. In the context of the cellular telecommunications industry in Indonesia, the study employs an input-oriented DEA (Data Envelopment Analysis) approach using the variable returns to scale method.

The choice of inputs and outputs for this DEA measurement follows the framework established by Morita and Avkiran (2009), ensuring that the analysis is grounded in established methodologies for assessing the performance and efficiency of firms within this sector. This approach enables a comprehensive evaluation of both technical and scale efficiencies, providing insights into how well telecommunications companies in Indonesia

utilize their resources to archive optimal performance.

In addition, the study incorporates a variable representing company size, measured by the total asset value, which is transformed into its natural logarithmic form for analysis. Another key variable included is risk, quantified through the debt-to-total asset ratio. This ratio is calculated by dividing total debt by total assets, serving as an indicator of the extent to which a company's assets are financed by debt.

By including these variables, the study aims to provide a more comprehensive understanding of the factors influencing firm performance. The size of the company is crucial in understanding how asset magnitude correlates with efficiency and profitability, while the risk variable offers insights into the financial leverage employed by the company, illustrating the potential impact of debt on overall performance and sustainability. These additional variables contribute to a deeper analysis of the structural and financial determinants of firm success within the telecommunications industry.

The use of panel data estimation allows for the observation of individual characteristics within the data. The random-effects model assumes that individual effects are random and uncorrelated with the independent variables, while the fixed-effects model accounts for heterogeneity in individual effects that remain constant over time but may vary across entities. Given the potential for unobserved individual characteristics—such as variations in human resources, internal company policies, and government regulations—this study employs a fixed-effects panel regression model.

This choice is further justified by the fact that the study's observation period is longer than the number of observed entities,

making the fixed-effects model more suitable for capturing individual-specific factors that could affect performance (Gujarati & Porter, 2015). Supporting this decision, similar studies by Li et al. (2017), Destiartono & Purwanti (2021), Yongbo et al. (2022), and Fikri & Firmansyah (2022) have also employed the fixed-effects model. To ensure robustness, a Hausman test was conducted, confirming that the fixed-effects model is indeed the most appropriate choice for this analysis, compared to alternative models.

To evaluate the determinants of performance within the mobile telecommunications industry, this study conducted an empirical analysis of two primary factors influencing industry performance, drawing on the theoretical frameworks of the Harvard School (Market Power Hypothesis, MPH) and the Chicago School (Efficiency Structure Hypothesis, ESH). In addition to these core factors, two supplementary indicators—company size and risk ratio—were also examined. The objective of this research is to assess how each paradigm, along with these additional indicators, impacts overall industry performance, offering a comprehensive understanding of the elements that contribute to the success or failure of companies in the sector.

Building on prior studies by Li et al. (2017), Yongbo et al. (2019), Destiartono and Purwanti (2021), and Fikri & Firmansyah (2022), the analysis seeks to refine existing models by integrating both size and risk dimensions, thereby enhancing the depth of insight into performance determinants. The empirical model adopted in this study is presented as follows, reflecting the synthesis of these key variables:

Model (1)

$$ROA_{it} = \alpha + \alpha_1 MS_{it} + \alpha_2 TE_{it} + \alpha_3 SE_{it} + \alpha_4 SIZE_{it} + \alpha_5 DAR_{it} + \varepsilon_{it} \quad (4)$$

Building on the research conducted by Ayadi & Ellouze (2013) and Li et al. (2018), tests were conducted to determine whether the industry aligns with the Market Power Hypothesis (MPH) or the Efficient Structure Hypothesis (ESH). To this end, the MPH model (2) and the ESH model (3) were analyzed. A hypothesis is considered supported if the proxy variables for each respective hypothesis exhibit a positive and significant effect on the dependent variable.

Model (2)

$$ROA_{it} = \beta + \beta_1 MS_{it} + \beta_2 SIZE_{it} + \beta_3 DAR_{it} + \omega_{it} \quad (5)$$

Model (3)

$$ROA_{it} = \beta + \beta_1 MS_{it} + \beta_2 SIZE_{it} + \beta_3 DAR_{it} + \omega_{it} \quad (6)$$

Where, ROA_{it} is return on asset firm i in year t ; MP_{it} is market power (market share) of firm i in year t ; TE_{it} is technical efficiency score of firm i in year t ; SE_{it} is scale efficiency score of firm i in year t ; $SIZE_{it}$ is size score of firm i in year t ; DAR_{it} is debt-to-asset ratio of firm i in year t ; α, β is constant; $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ is intersep model (1); $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ is intersep model (2) dan (3); and $\varepsilon_{it}, \omega_{it}$ is error.

RESULTS AND DISCUSSION

Three indicators based on the SCP concept reference were used, namely the number of business actors, the market concentration ratio, and barriers to entry. There are five mobile telecommunications industry players who are members of ATSI where this is an initial indicator as an oligopoly market structure, namely 1) PT. Telekomunikasi Seluler; 2) PT. Indosat

Ooredoo Hutchinson; 3) PT. XL Axiata; 4) PT. Telekomunikasi Indonesia; 5) PT. Smartfren Telecom. Then the score of the concentration ratio measurement results using the CR4 ratio in 2010-2022 is very high (96.51 percent - 99.75 percent), further indicating that this industry is a very tight oligopoly industry. In addition to the CR4 indicator, this study uses the Herfindahl-Hirschman Index to measure market concentration, where the HHI score results for 2010-2022 show more than 2500, indicating that the mobile telecommunications industry is indicated as a dominant company. High market concentration also indicates that the Indonesian cellular telecommunications industry is moving towards an imperfect competition market and has a low degree of competition.

Table 1. The Characteristic of Industry

Indicator	HHI	CR4	MES
2010	3.246	99.75	45.20
2011	3.204	99.40	44.47
2012	3.161	99.07	43.65
2015	3.280	98.69	44.32
2016	3.382	98.59	45.23
2017	3.416	98.33	45.98
2020	3.374	96.71	47.75
2021	3.346	96.51	47.85
2022	3.134	96.54	45.54

Source: Annual Report, Processed. (HHI is Herfindahl-Hirschman Index; CR4 Ratio is the 4 biggest market share; MES is minimum efficient of scales).

The mobile telecommunications industry is classified as having high market entry barriers for several reasons. First, based on the Minimum Efficient Scale (MES) indicator, which stands at 44.32 percent, there are significant entry barriers. This high MES value suggests that new entrants to the industry would face substantially higher costs compared to the long-term minimum costs incurred by established companies that have been operating for a considerable period.

These higher cost can deter new competitors and make market entry challenging.

Second, stringent regulations related to licensing, frequency spectrum allocation, and the significant infrastructure investment required further complicate entry into the market. These regulatory and financial hurdles pose major obstacles for new firms trying to compete with established industry players. In response to these challenges, the government, through Government Regulation No. 46 of 2021 concerning postal services, telecommunications, and broadcasting, actively encourages industry consolidation through mergers and acquisitions to enhance the efficiency and productivity of the telecommunications sector. As part of this strategy, the government offers incentives, such as reducing the burden of frequency usage fees (BHP) and simplifying licensing processes for companies that engage in mergers or acquisitions.

In analyzing the behavior of the mobile telecommunications industry, the role of advertising and promotion expenses, as well as the calculation of welfare costs, must be carefully considered. Advertising and promotion strategies are crucial for service sector companies to expand their market share and retain existing consumers. These strategies are particularly important in industries like telecommunications, where competition is fierce, and maintaining customer loyalty is key to sustaining growth.

Mobile telecommunications companies tend to focus their advertising and promotion efforts primarily on prepaid products. This focus is driven by the fact that 97.05 percent of customers are prepaid users. Prepaid services are generally preferred by consumers due to their simplicity and greater price flexibility, which allows customers to manage cost more efficiently. This high level of price sensitivity makes prepaid services more attractive than

postpaid options, influencing how companies allocate their promotional resources.

Based on Figure 1, the total advertising and promotion costs in the Indonesian cellular telecommunications industry exhibit significant fluctuations, indicating a pattern that is relatively unstable. These fluctuations reflect the dynamic nature of the market as well as the evolving marketing strategies of the companies within the industry. The trend suggests that companies are adjusting their advertising expenditures in response to shifting market conditions and competitive pressures.

For instance, PT. Telkom Seluler and PT. Telkom Indonesia, two of the largest players in the industry, saw their advertising and promotion costs peak in 2017, followed by a sharp decline in 2018-2019. This downward trend may be attributed to factors such as market saturation, where growth in consumer demand slows, as well as efforts to improve the efficiency of advertising expenditures. Additionally, the industry has seen a shift towards more cost-effective and measurable digital advertising, which could explain the resurgence in spending in 2021-2022 as companies adapt to these new strategies.

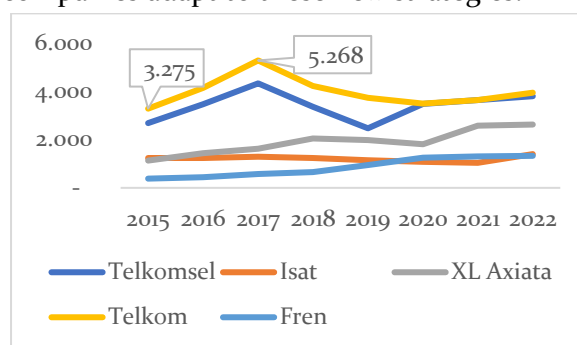


Figure 1. Adv & Promotion Cost

Conversely, Indosat has maintained relatively stable advertising spending, while PT. XL Axiata and PT. Smartfren Telekom have been more aggressive in increasing their advertising budgets. Smartfren, as a smaller player in the market, continues to expand its advertising expenditures in an effort to strengthen its market position. The surge in

advertising spending during 2021-2022 can likely be attributed to post-pandemic recovery efforts, increased competition for new services such as 5G, and shifts in consumer behavior, which require companies to adapt their marketing strategies.

Looking ahead, competition in the telecommunications sector is expected to be increasingly driven by technological innovation and the utilization of digital platforms for marketing purposes. The fluctuations in advertising and promotion spending suggest that companies allocate substantial budgets to attract and retain market share. This trend underscores the importance of strategic advertising investments in maintaining competitiveness within a rapidly evolving market environment.

The calculation of welfare costs for the mobile telecommunications industry reveals a fluctuating pattern, indicative of the broader economic shifts within the sector (as shown in Figure 2). These variations highlight the dynamic nature of the telecommunications market, where factors such as competition, consumer demand, and regulatory changes can influence overall industry costs.

In 2010, the welfare costs were recorded at 20,300.85 billion, marking a significant level of economic activity in the sector. However, by 2011, these costs saw a decline, decreasing to 19,818.06 billion. This reduction suggests adjustments within the industry, potentially driven by efforts to improve cost efficiency or changes in market conditions affecting the balance between industry revenues and consumer welfare.

Since 2012, there has been a notable rise in welfare costs, reaching a peak of 43,448.43 billion in 2021. This significant increase may be attributed to several factors, including the adoption of new technologies, intensified competition, and substantial investments in

infrastructure. Although 2022 saw a slight decline to 36,692.31 billion, the figure remains relatively high compared to previous years. This fluctuation underscores the volatility in advertising and promotion costs and its subsequent impact on producer welfare in the mobile telecommunications industry.

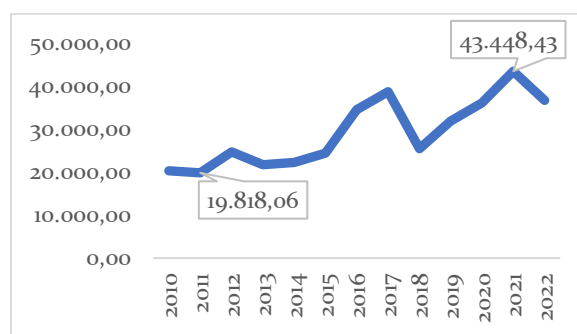


Figure 2. Welfare Cost

The instability in welfare costs has profound implications for industry players. First, the unpredictability forces companies to adapt their marketing strategies and budgets with flexibility. Firms must be prepared to anticipate shifts in advertising and promotion costs and adjust their strategies to maintain competitiveness. A sharp rise in welfare costs, such as the one observed in 2021, can significantly affect profit margins, requiring companies to strike a balance between promotional spending and profitability (Pratomo, 2010). Additionally, these spikes in costs are frequently linked to major investments in new infrastructure and technologies, prompting companies to carefully evaluate the trade-offs between capital investment and operational efficiency.

The performance of the mobile telecommunications industry is evaluated using two key metrics: Return on Assets (ROA) and company efficiency. ROA serves as an indicator of a company's ability to generate profits from its total assets, with a higher ROA reflecting stronger profitability and overall performance (Li et al., 2017). As illustrated in

Figure 4, the average ROA for the industry exhibits significant fluctuations over time, highlighting the variability in company performance across the sector.

Among the companies analyzed, PT. Telkomsel Seluler consistently achieved the highest average ROA between 2010 and 2022, indicating its superior ability to leverage assets for profit generation. In contrast, PT. Smartfren Telekom recorded the lowest average ROA during the same period, suggesting challenges in maximizing the efficiency of its asset utilization. These variations in ROA underscore the differing financial and operational capabilities of the major players in the telecommunications industry.

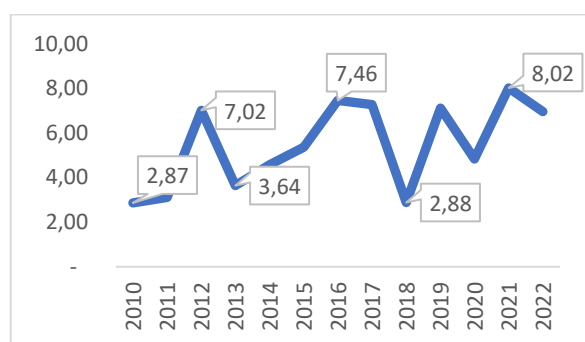


Figure 3. ROA, 2010 - 2022

The notable increase in ROA, particularly in 2021 when it reached 8.02%, reflects the company's ability to efficiently manage its assets to generate optimal profits. However, the decline in other years, such as in 2013 and 2022, highlights the challenges of maintaining consistent efficiency over time. These fluctuations emphasize the importance for companies to continuously enhance their asset management practices to remain competitive in a dynamic market. External factors, such as increasing competition and evolving economic conditions, also contribute to ROA variability.

For investors, ROA serves as a crucial indicator of a company's financial health. An upward trend in ROA typically attracts investment interest, signaling strong financial

performance, whereas a decline may prompt investors to reassess the company's strategies, particularly in terms of expansion and growth. Therefore, telecommunications companies must strike a balance between sustainable investment and operational efficiency to ensure their long-term viability and success amid the industry's ever-changing landscape.

Table 2. Average DEA Score, 2010-2022

Firms	ET (crs)	ET (vrs)	ES
Telz	3.246	99.75	45.20
Isat	3.204	99.40	44.47
Excl	3.161	99.07	43.65
Telkom	3.280	98.69	44.32
Fren	3.382	98.59	45.23
Average	3.416	98.33	45.98

Source: Annual Report, Processed (Efficiency score between 0 - 1.)

Table 2 reveals varying efficiency levels within the mobile telecommunications industry, as measured by the Data Envelopment Analysis (DEA) method. The average technical efficiency score based on the constant return to scale (CRS) model is 0.565, implying that approximately 43.5% of the production process is lost due to inefficiency. This finding suggests that mobile telecommunications companies in Indonesia have not yet achieved optimal efficiency in their operations. Similarly, the variable return to scale (VRS) model shows an average technical efficiency score of 0.649, indicating that 35.1% of the production process is also lost due to inefficiency. These results demonstrate that the industry has not fully optimized its use of technology or inputs.

In terms of technical efficiency, PT. Smartfren stands out as the company with the highest level of efficiency, while PT. Telkom Indonesia records the lowest technical efficiency among the companies analyzed. These differences in efficiency highlight the varying capabilities of companies within the industry to manage their resources effectively

However, while technical efficiency varies, scale efficiency presents a different picture.

The scale efficiency score, calculated as the difference between technical efficiency under the CRS and VRS models, indicates that the mobile telecommunications industry in Indonesia operates relatively efficiently in terms of scale, with an average score of 0.901. This high score suggests that the industry is nearing optimal production levels, with minimal differences between CRS and VRS efficiency scores. According to Watkins et al. (2014), these findings imply that the production scale of Indonesia's mobile telecommunications industry is approaching its maximum potential, reflecting an overall positive outlook in terms of scale efficiency.

The study employs panel data regression using a fixed-effect model to analyze the factors influencing performance and to test the hypotheses in the Indonesian mobile telecommunications industry. This analysis includes model (1), which incorporates proxies for market power (measured by market share) and efficiency (both technical and scale), along with additional variables such as firm size and risk management, represented by the debt-to-asset ratio. These variables provide a comprehensive view of how both internal and

external factors contribute to firm performance.

Further estimations are conducted on models (2) and (3) to assess whether the industry supports the Market Power Hypothesis (MPH) or the Efficiency Structure Hypothesis (ESH). A Hausman test is performed across all three models, and the results lead to the rejection of the null hypothesis (H_0), confirming that the fixed-effect model is the most appropriate for this analysis. This outcome ensures the robustness of the model selection in capturing the variations specific to each firm over time.

The regression results, as presented in Table 3, indicate that model (1) has an R^2 value of 0.904, meaning that 90.4% of the variation in the dependent variable (ROA) is explained by the independent variables included in the model. Similarly, models (2) and (3) show R^2 values of 89.7% and 88.7%, respectively, demonstrating a strong explanatory power across all models. Furthermore, the F-statistic values for models (1), (2), and (3) exceed their corresponding F-table values of 2.37, 2.76, and 2.53, respectively. This indicates that the independent variables collectively have a significant impact on the dependent variable, reinforcing the validity of the model's findings.

Table 3. Fixed-Effect Model Result

Dependent: ROA			
	Model (1)	Model (2)	Model (3)
Market Share (ms)	1.330*** (0.423)	1.234*** (0.402)	
Technical Efficiency (te)	6.462 (4.363)		8.615 (4.638)
Scale Efficiency (se)	5.249 (8.863)		4.852 (8.888)
Size of Firm	8.030** (3.658)	9.511*** (3.760)	12.110*** (3.892)
Debt-to-asset ratio (risk)	-0.231*** (0.074)	-0.192*** (0.070)	-0.243*** (0.080)
R-squared	0.904	0.897	0.887
F-statistic	57.96	71.23	55.23
Prob(F-statistic)	0.000	0.000	0.000
Obs	65	65	65

Note: Standard errors are in parentheses. *** p<0,01; ** p<0,05; *p<0.10

Source: Annual Report, Processed.

The estimation results of models (1) and (2) reveal that market share has a significant positive impact on company performance, with a coefficient value of 1.330. This finding suggests that the Indonesian mobile telecommunications industry aligns with the market power hypothesis. In highly concentrated markets, increased market power positively influences performance, as firms can leverage their dominant positions to enhance profitability (Ayadi & Ellouze, 2013). Companies with substantial market share benefit by fostering consumer loyalty, which allows them to maximize their profits.

A key factor supporting this market power is the prepaid registration policy in Indonesia, which automatically encourages consumer behavior that enhances customer loyalty. This policy creates a system where high-value customers are retained more effectively, further reinforcing the market power of dominant players in the industry. The ability to maintain a loyal customer base becomes a critical advantage for companies with a large market share, allowing them to secure consistent revenue streams and strengthen their market position.

In contrast, the efficiency variables, both technical and scale, in models (1) and (3) are found to have no significant effect on company performance. This outcome suggests that, burdens and operational costs. These rising costs can, in turn, erode profit margins and reduce overall profitability. Thus, effective debt management becomes crucial in ensuring long-term financial health and performance in this industry.

The findings of this study provide strong support for hypothesis (1), reinforcing the Market Power Hypothesis. In particular, model (7) demonstrates that market share (MS), used as a proxy for market power, has a positive and significant impact on company performance.

unlike the manufacturing sector, where input sensitivity is crucial, the telecommunications industry—focused on service delivery—does not rely as heavily on efficiency improvements to enhance performance. These findings diverge from the results of prior research by Li et al. (2017), Destiartono & Purwanti (2021), Yongbo et al. (2022), and Fikri & Firmansyah (2022), which indicated a stronger link between efficiency and performance in other contexts.

The company size variable demonstrates a significant positive effect across all models, consistent with the findings of Harnanto & Firmansyah (2018). This indicates that larger companies tend to exhibit stronger performance compared to smaller ones. The advantages of size are evident in the superior information systems, more comprehensive resources, and higher levels of competence found in larger firms. These attributes enable them to better adapt and enhance their overall performance, giving them a competitive edge over smaller companies.

On the other hand, the debt-to-asset ratio (DAR) variable shows a significant negative impact on performance, aligning with the research of Li et al. (2017) and Destiartono & Purwanti (2021). This suggests that cellular telecommunications companies need to optimize their liability management, as high levels of debt can lead to increased financial. Additionally, the estimation results from model (2), presented in Table 3, reveal that all independent variables collectively have a significant effect on performance, further highlighting the role of market power and company size as critical factors influencing the success of firms in the mobile telecommunications sector.

Given these results, companies in the industry can benefit from implementing strategies such as mergers and acquisitions to increase market share, a practice already

commonly seen in the field. Additionally, adopting technology like all-digital services can streamline customer access to product and price information, making it easier for companies to attract and retain consumers. Companies can also enhance their advertising and promotion efforts, particularly since prepaid customers tend to be highly sensitive to price and tariff changes, especially regarding internet services.

However, it is essential for the government to monitor the merger and acquisition processes to prevent collusion or the development of monopolistic behaviors. Beyond regulatory oversight, one of the primary challenges for telecommunications companies is the limited availability of frequency spectrum for 5G networks and the persistent digital divide. To address these challenges, the government should prioritize the equitable distribution of Base Transceiver Station (BTS) infrastructure across Indonesia and enhance national digital literacy to support the continued growth and development of the telecommunications industry.

CONCLUSION

This study sought to investigate the determinants of performance in Indonesia's cellular telecommunications industry, while also testing the Market Power Hypothesis (MPH) and the Efficiency Structure Hypothesis (ESH). The analysis of market power was conducted using two key indicators: the concentration ratio (CR₄ and Herfindahl-Hirschman Index) and market entry barriers. The findings revealed that the industry operates as a tight oligopoly or even exhibits monopolistic tendencies. Companies in this sector employ advertising and promotion strategies to increase market share and retain

customer loyalty, with prepaid products being preferred over postpaid services. However, it is crucial to consider that high advertising and promotional costs, combined with ineffective advertising strategies, can lead to decreased profitability or even financial losses.

The results of this research align with the Market Power Hypothesis of the Harvard School, indicating that in the Indonesian telecommunications industry, improving technical and scale efficiency is not the primary factor in enhancing company performance. Both proxies for efficiency were found to be insignificant in models (1) and (3). This suggests that expanding and maintaining market share is a more critical driver of performance in this industry. The novelty of this study lies in its expansion of behavioral analysis within the telecommunications sector, offering a more comprehensive understanding of the economic dynamics at play.

While the study provides valuable insights into the determinants of performance in Indonesia's telecommunications industry, several limitations must be acknowledged. First, the analysis heavily focuses on market power and efficiency proxies, without incorporating other important behavioral factors that could influence performance, such as innovation capacity, customer satisfaction, or corporate governance. The exclusion of these factors may limit the study's ability to capture the full scope of performance drivers. Additionally, the reliance on a single company, PT. Telkomsel Seluler Indonesia, as a private entity, posed challenges in data collection. The limited dataset, comprising only 65 observations over a 10-year period, constrains the degree of freedom in the analysis and may affect the robustness of the findings.

Another significant limitation is the exclusion of collusive market power variables

such as CR4 or HHI from the performance model, as these could provide a more comprehensive understanding of the industry's competitive landscape. While the potential for multicollinearity with market share was noted, exploring alternative approaches to include these variables could have strengthened the analysis.

Based on the findings of this study, several policy recommendations can be made to enhance the performance and competitiveness of Indonesia's telecommunications industry. First, regulatory authorities should closely monitor market concentration due to the oligopolistic or monopolistic tendencies identified, ensuring that anti-competitive behaviors such as collusion or monopolistic practices are prevented. Policies that encourage competition or facilitate market entry for smaller players could be beneficial. Additionally, companies in the sector need to optimize their advertising and promotion strategies. While maintaining market share is critical, over-investment in ineffective promotional activities can harm profitability. A shift toward more data-driven, targeted marketing approaches would improve cost efficiency and customer retention.

Furthermore, even though efficiency is not the primary performance driver, technological innovation remains essential for

long-term competitiveness. The government should prioritize policies that support infrastructure development, such as the widespread adoption of 5G networks, and provide incentives for research and development (R&D) to help firms innovate while maintaining efficiency. Given the significant role of market share in driving performance, regulatory frameworks should be strengthened to ensure that the largest companies do not engage in practices that stifle competition or limit consumer choice. Mergers and acquisitions, in particular, should be carefully regulated to prevent excessive market dominance. Lastly, improving data availability and transparency within the industry is crucial.

The government could mandate more comprehensive reporting from private companies, allowing for better industry monitoring and more robust future research. Implementing these policies would promote a healthy balance between market power and competition, ultimately benefiting consumers and ensuring the long-term sustainability of the telecommunications sector.

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