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## Article

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# The effect of business cycle on the relationship between market structure and industrial performance in the Indonesian food and beverage industry

Hurriyah, Maman Setiawan , Rina Indiasuti, Berliana Anggun Septiani and Bayu Kharisma 

Faculty of Economics and Business, Universitas Padjadjaran, Bandung, Indonesia

## ABSTRACT

The Indonesian food and beverage industry contributes significantly to the economy of the country. However, previous studies have shown that the industry has a high industrial concentration and price-cost margin (PCM). High industrial concentration can exert market power to set price levels and affect performance. In this context, favorable business cycle conditions have been proven to have the potential to improve industrial performance. Therefore, this study aimed to investigate the effect of business cycle on the relationship between market structure and industrial performance. The study procedures were carried out using data obtained from food and beverage industry in Indonesia for the period 1990-2019. Panel cross-sectional data and instrumental variable methods were also used through a fixed-effect approach. The results showed that business cycle positively affected market structure, while industrial performance was positively affected by market structure. In addition, business cycle positively affected the effect of industrial performance on market structure, as well as the effect of market structure on industrial performance.

## IMPACT STATEMENT

This study examines the impact of the business cycle on the relationship between market structure and the performance of the food and beverage industry in Indonesia from 1990 to 2019. The findings indicate that the business cycle had a positive effect on market structure, while market structure positively influenced industrial performance. Additionally, the business cycle enhanced the impact of industrial performance on market structure, as well as the effect of market structure on industrial performance. This research highlights the complexity of market dynamics influenced by external factors like the business cycle. Understanding the relationship between market structure, the business cycle, and industrial performance is essential for developing effective regulatory policies and sustainable business strategies.

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## JEL CLASSIFICATION

L10; L11; L13; L16; L66

## 1. Introduction

The Indonesian food and beverage industry is known to significantly contribute to the economy of the country. According to Central Bureau of Statistics (BPS), the industry had an average growth rate of 15.57 and contributed approximately 8.89% to Gross Domestic Product (GDP) during the period 1990-2017. However, Setiawan and Oude Lansink (2018) and Setiawan (2019) showed that it had a high industrial concentration and price-cost margin (PCM). This high industrial concentration and PCM may affect economic welfare because the variables represent market power, which can make firms set a high price over the cost.

In line with previous studies, the variables of industrial concentration and PCM may fluctuate over time due to various factors. The internal factors of firms have also been reported to have the potential to affect these fluctuations. However, there are limited studies on the effect of external factors, such as business cycle. Changes in GDP or other macroeconomic indicators, such as employment, investment,

**CONTACT** Hurriyah  [hurriyah17001@mail.unpad.ac.id](mailto:hurriyah17001@mail.unpad.ac.id)  Faculty of Economics and Business, Universitas Padjadjaran, Bandung, Indonesia.

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and demand can affect market structure and industry performance through different phases of business cycle, including growth, expansion, or recession.

Several studies have found a significant relationship between business cycle, market structure, and industry performance. Specifically, macroeconomic trends in the economic cycle, either during high economic fluctuations or recessions can affect these factors (Lipczynski et al., 2005). Business cycle also significantly affects productivity, aggregate demand, and firms' processes. This suggests that it can affect market structure and industrial performance. The variable also affects market movements and industry dynamics through growth and contraction phases, revealing the crucial role in shaping industrial performance.

Business cycle in recent times is divided into 4 stages, namely recession, expansion, peak, and decline towards the lowest point (troughs) (Lipczynski et al., 2005). In addition, business fluctuations, as part of the business cycle, affect the macroeconomy by causing alternating increases and decreases in economic activity (Di Guilmi et al., 2004). Changes in business cycle in an industry represent both long and short-term economic alterations, including seasonal variations, and can affect overall economic fluctuations (Schumpeter, 1939). Although other underlying factors also cause contradictions, business cycle is associated with growth aspects from a macro perspective and results from short-term or temporary economic productivity shocks (King et al., 1988). These productivity shocks are central driving factors in macroeconomic activities that can lead to significant changes (Long & Plosser, 1983; King et al., 1988). Business cycle is generated by exogenous shocks from the aggregate output, technology, and growth (Donadelli et al., 2019). Building on this idea, Solow, as cited in King et al. (1988), revealed that technological changes significantly affected the dynamics of fluctuations in both the short and long terms. In this context, there are 2 primary reasons for measuring business cycle in the macroeconomy. Namely 1) the business cycle can draw conclusions from data on macroeconomic fluctuations, and 2) it can be used as a benchmark to assess the validity of macroeconomic trends, such as peaks and recessions (Canova, 1998). Regarding that, GDP growth can measure this macroeconomic cycle, as it is a major contributor to the macroeconomy due to the effect on market structure and industrial performance. Therefore, this study aims to analyze the effect of business cycle on the relationship between market structure and industrial performance in food and beverage industry.

The key difference between the current study and existing literature is the specific focus on measuring how GDP growth has a relationship with market structure and industrial performance in food and beverage industry in Indonesia. The empirical study also showed that during economic expansion, market structure and industrial performance growth increased competition and new market entrants. Meanwhile, during a recession, market structure and industrial performance decline, affecting macroeconomic performance.

The novelty is the use of a new model designed for Indonesia to examine how business cycle affects the relationship between market structure and industrial performance, and how industrial performance, in turn, affects market structure. Despite the existing literature, the effect of business cycle on these factors has not been studied internationally or in Indonesia.

The results of this current study are expected to have several contributions, such as 1) serve as a reference or a comparison for future studies, 2) provide insights that can be used by policymakers for the formulation of policies related to business cycle movements or macroeconomic performance, market structure, and industrial performance, specifically in food and beverage industry in Indonesia.

The paper is organized as follows: [Section 2](#) presents the literature review, [Section 3](#) provides the modeling approach, [Section 4](#) presents a description of the data, [Section 5](#) provides the empirical findings, and [Section 6](#) shows a conclusion.

## 2. Literature review

Studies investigating business cycle, market structure, and industrial performance have been conducted previously. For example, Haskel and Martin (1992) investigated the relationship between fluctuations and business cycle in terms of PCM, concentration, and labor unions. The results showed that business cycle correlated with market structure and industrial performance, as measured by PCM in the United Kingdom. In addition, Ambler et al. (2004) used data from 19 countries, such as Australia, Austria, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, the Netherlands, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, the United Kingdom, and the United States. With some exceptions, the data were quarterly, from 1960 quarter 1 to 1991 quarter 2. The study found that consumption, investment, output,

and employment were correlated with macroeconomic fluctuations. Navarro et al. (2010) revealed that business cycle affected firms' sales and profits. In addition, Antonakakis (2012) examined the variable in the Group of Seven (G7) countries, including Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States, during the period 1870-2011. The results revealed that the dynamics of business cycle correlations varied significantly among G7 countries, particularly during recessions. In this context, financial strength and economic growth acted as recession triggers, leading to asset price increases, output declines, and rising unemployment, resulting in destabilized economic cycles. Moreover, Hall et al. (1986) found that market structure and macroeconomics had a significant relationship because macroeconomic fluctuations could provide an overview of market structure performance. Bandyopadhyay and Barua (2016) used a balanced panel of 1594 Indian firms from 1998 to 2011. The results showed business cycle and macroeconomic policies significantly affected firms' performance. Sedláček and Sterk (2017) using U.S. firms also found that fluctuations in aggregate demand were affected by business cycles. In addition, Bloom et al. (2018) found that macroeconomic shocks during both downturns and expansions had an effect. Jeon (2018) also found a positive relationship between trade and business cycle in European countries, while Kim and Lee (2018) showed that investment decisions were affected by business cycle movements. Konon et al. (2018) found that a high GDP could have asymmetric effects, acting as a contraindication for newly entering businesses due to the struggle to adapt during macroeconomic cycles. For instance, during economic shocks or recessions, innovative firms tend to benefit more due to the ability to possess lower production costs or entry expenses. Carvalho and Grassi (2019) showed that large firms drove fluctuations in aggregate demand, thereby influencing business cycle. Crouzet and Mehrotra (2020) found that fluctuations in GDP affected market structure by calculating the percentage increase and decrease in sales or aggregate demand (business cycle).

Although studies investigating business cycle, market structure, and industrial performance have been conducted previously in several countries, it is hard to find the studies in the Indonesian context. Therefore, it is important to investigate the relationship between the variables in Indonesia.

### 3. Modeling approach

This study was used to observe the effect of business cycle on the relationship between market structure and industrial performance, as well as investigate the reciprocal relationship between the effect of industry performance and market structure. In this study, PCM was used as industry performance, the four-firm concentration ratio (CR4) as market structure, and GDP growth as a business cycle. Moreover, to measure these relationships, two models of estimation were used. First, it estimated Equation (1) in investigating the relationship between PCM and CR4, the relationship between GDP growth and CR4, and whether GDP growth affected the effect of PCM on CR4. Second, Equation (2) was estimated to investigate CR4 on PCM, GDP growth on PCM, and whether GDP growth affected the effect of CR4 on PCM.

The first model was conducted by modifying the model and adjusting variables from Kambhampati (1996) and Delorme, Klein, Kamerschen, and Voeks (Delorme et al., 2002). Estimation was performed using the following model:

The first model was written as follows:

$$CR4_{it} = \alpha_0 + ((\alpha_1 + \alpha_2 X_{it})PCM_{it}) + ((\alpha_3 + \alpha_4 X_{it})(Kq_{it}) + \alpha_5 X_{it} + \alpha_6 DecTrend_{it} + \alpha_7 inv_{it} + \alpha_8 size_{it} + \alpha_9 gDemand_{it} + \alpha_{10} Nfirm_{it} + \alpha_{11} Growth_{it} + \varepsilon_{it} \quad (1)$$

After deriving the mathematical equation in Equation (1), the model could be described as follows:

$$CR4_{it} = \alpha_0 + \alpha_1 PCM_{it} + \alpha_2 X_{it} PCM_{it} + \alpha_3 Kq_{it} + \alpha_4 X_{it} Kq_{it} + \alpha_5 X_{it} + \alpha_6 DecTrend_{it} + \alpha_7 inv_{it} + \alpha_8 size_{it} + \alpha_9 gDemand_{it} + \alpha_{10} Nfirm_{it} + \alpha_{11} Growth_{it} + \varepsilon_{it} \quad (2)$$

CR4 denoted the concentration ratio of the 4 largest firms in food and beverage industry<sup>1</sup> and PCM referred to the price cost margin.  $X$  was GDP growth (2010 = 100) as a business cycle variable.  $XPCM$  was obtained from the calculation of GDP growth multiplied by PCM. Furthermore,  $Kq$  was the capital-output ratio,  $XKq$  was obtained from the calculation of GDP growth multiplied by  $Kq$ . The variable  $DecTrend$  was derived from the calculation of an economic crisis dummy multiplied by a time trend.  $Inv$

referred to investment and *size* denoted the natural logarithm of the value-added of a sub-sector. *gDemand* referred to demand growth, while *Nfirm* meant the number of firms per subsector, *Growth* for industry growth,  $\varepsilon_{it}$  for error terms, and *t* described time.

Regarding the estimation of industrial business cycle and the effect on market structure and performance of the Indonesian food and beverage industry. This study used the CR4, which represented market share of the 4 largest firms to determine market structure measurement. The indicator of industrial concentration was based on market share of firms and was calculated using the following formula (Lipczynski et al., 2005):

$$CR4_j = \sum_{i=1}^4 s_i \quad (3)$$

where  $j = 1, 2, \dots, m$  indexes the subsectors,  $i = 1, 2, \dots, n$  indexes firm *i* in a subsector, and  $S_i$  represents market share of firm *i* in its respective subsector. CR4 value was between 0 and 1, the closer it was to 1, the higher the level of industry concentration (Setiawan et al., 2012).

Industry performance was measured by PCM (Khalilzadeh-Shirazi, 1974; Domowitz et al., 1986; Prince & Thurik, 1992; Lipczynski et al., 2005), which was the ratio of profit to sales revenue (Lipczynski et al., 2005), representing firms' ability to increase prices above production costs (Setiawan et al., 2012). In this study, PCM was formulated by Domowitz et al. (1986), Prince and Thurik (1992), and Setiawan et al. (2012). The approach described the cost and demand conditions for firms' industrial performance and made changes to firms' performance by determining the costs and market conditions that firms was willing to achieve. Industrial performance equation was as follows:

$$PCM = \frac{\text{Value added} - \text{Cost of labor} + \Delta \text{Inventories}}{\text{Sales} + \Delta \text{Inventories}} \quad (4)$$

where value added was calculated by sales minus intermediate inputs except labor cost.

The second model was developed by modifying the model and adjusting the variables from Domowitz et al. (1986, 1993) and Blažková and Dvouletý (2017). Estimation was performed using the following model:

$$PCM_{it} = \beta_0 + ((\beta_1 + \beta_2 X_{it})CR4_{it}) + ((\beta_3 + \beta_4 X_{it})(Kq_{it})) + (\beta_5 X_{it}) + \beta_6 Dlaw_{it} + \beta_7 imp_{it} + \beta_8 ts_{it} + \beta_9 lab_{it} + \beta_{10} trend_{it} + \beta_{11} DlawTrend_{it} + U_{it} \quad (5)$$

After obtaining the mathematical equation in Equation (5), the model could be described as follows:

$$PCM_{it} = \beta_0 + \beta_1 CR4_{it} + \beta_2 X_{it} CR4_{it} + \beta_3 Kq_{it} + \beta_4 X_{it} Kq_{it} + \beta_5 X_{it} + \beta_6 Dlaw_{it} + \beta_7 imp_{it} + \beta_8 ts_{it} + \beta_9 lab_{it} + \beta_{10} trend_{it} + \beta_{11} DlawTrend_{it} + U_{it} \quad (6)$$

where *Dlaw* was a dummy variable reflecting the period after the introduction of the competition law in 1999. *imp* referred to import, *ts* as total sales, *lab* as labor, *DlawTrend* was derived from the calculation of *Dlaw* multiplied by *Trend*, and  $U_{it}$  referred to the error term.

#### 4. Data

This study used Indonesian food and beverage industry data from 1990 to 2019 collected in the Survey of the Manufacturing Industry, conducted annually by BPS. The data corresponded to the 5-digit level of the *Klasifikasi Baku Lapangan Usaha Indonesia* (KBLI), which was comparable to the International Standard Industrial Classification (ISIC) codes.

Table 1 presented descriptive statistics of the variables used in the analysis. CR4 was defined as the share of 4 big firms in sales. PCM referred to price-cost margin measured by value added (VA) minus wage divided by output, where wage was deflated by Consumer Price Index (CPI) (2010 = 100), while VA and output were deflated by Wholesale Price Index (WPI) of manufactured commodities (2010 = 100). WPI of the manufactured commodity data was published by BPS. Moreover, *Kq* was capital-output ratio (COR) measured by fixed assets (FA) divided by output, where FA was deflated by WPI of manufactured commodities for capital and output deflated by WPI of manufactured commodities. GDP was measured



**Table 1.** Descriptive statistics of the variables used in the analysis, Indonesian food and beverage industry, 1990–2019.

Variable	Mean	Standard deviation	Coefficient of variation	Minimum	Maximum
<i>CR4</i>	0.732	0.238	0.325	0.069	1.000
<i>LnCR4</i>	1.490	1.791	1.202	−2.607	8.890
<i>PCM</i>	0.241	0.102	0.421	0.005	0.864
<i>XPCM</i>	1.184	1.055	0.891	−9.650	6.752
<i>Kq</i>	0.989	0.632	0.639	0.004	7.537
<i>XKq</i>	4.809	5.415	1.126	−74.034	38.213
<i>X</i>	4.945	3.613	0.731	−13.127	8.220
<i>DecTrend</i>	13.667	9.849	0.721	0.000	29.000
<i>Inv</i>	$3.80 \times 10^{08}$	$5.97 \times 10^{09}$	15.711	1000.000	$2.97 \times 10^{11}$
<i>size</i>	10.704	1.545	0.144	7.222	17.439
<i>gDemand</i>	0.342	1.294	3.786	−0.998	9.987
<i>Nfirm</i>	38.034	76.642	2.015	1.000	953.000
<i>Growth</i>	0.267	1.087	4.066	−0.995	9.910
<i>XCR4</i>	7.283	12.485	1.714	−90.835	56.478
<i>Dlaw</i>	0.669	0.471	0.704	0.000	1.000
<i>imp</i>	7241.948	5491.559	0.758	905.800	17372.100
<i>ts</i>	2.280	6.318	2.771	0.003	102.060
<i>lab</i>	245.909	334.766	1.361	10.333	4997.500
<i>Trend</i>	14.597	8.682	0.595	0.000	29.000
<i>DlawTrend</i>	13.107	10.356	0.790	0.000	29.000
<i>DEc</i>	0.735	0.441	0.601	0.000	1.000

Notes: Unbalanced panel data with  $n = 2,716$ .

Source: BPS and authors' calculation.

by GDP growth (constant price of 2010 = 100), as published by BPS. The investment was defined as purchases of additional FA minus the sales of FA. Size was calculated by the log of VA, where VA was deflated by WPI of the manufactured commodities. In addition, *imp* referred to the import, this data is published annually by BPS. *Ts* denoted the output, which was defined as the value of gross output produced per establishment annually and deflated by WPI of manufactured commodities. *Lab* referred to labor, which was quantified as the overall count of employees, including both production and non-production workers, regardless of gender, females and males. The other was discussed in the previous section.

Instrumental variables were used in this study because of the simultaneous equations between Models 1 and 2, resulting in endogeneity. In Model 1 (Equation (1)), the variables *CR4*, *PCM*, *XPCM* were classified as endogenous. Meanwhile, in Model 2 (Equation (5)), certain variables, including *CR4*, *PCM*, and *XCR4* were classified as endogenous.

This study used instrumental variables such as *Kq*, *XKq*, *X*, *DecTrend*, *inv*, *size*, *gDemand*, *Nfirm*, *Growth*, *Dlaw*, *imp*, *ts*, *lab*, *trend*, *DlawTrend*, and *DEc* to overcome endogeneity issues. The validity of the instrument used was tested using the Sargan-Hansen statistic test. Good instruments must not be related to the error term (valid instruments), while invalid instruments provided inconsistent estimation.

## 5. Empirical results

Table 2 presented the results of the regression using Equations (1) and (5). It showed the effect of business cycle on the relationship between market structure and industrial performance. In addition, the causal relationship between market structure and industrial performance in the Indonesian food and beverage industry during the period 1990-2019 was indicated. The models were estimated using a fixed-effects model in the panel data regression because the random-effects model was rejected by Hausman's (1978) test. The Hansen J-test failed to reject the orthogonality condition between the error terms and all instruments in the system at the 10% critical level. Consequently, all instrumental variables used for the endogenous variables, such as *Kq*, *XKq*, *X*, *DecTrend*, *inv*, *size*, *gDemand*, *Nfirm*, *Growth*, *Dlaw*, *imp*, *ts*, *lab*, *trend*, *DlawTrend*, and *DEc* were valid.

The results for Model 1 were presented in Table 2. The GDP growth variable as a measure of business cycle positively affected *CR4*. This indicated that when GDP growth increased, firms were more concentrated. However, business cycle positively affected the effect of *PCM* on *CR4*. The results showed that business cycle played a significant role in market dynamics, particularly in the context of *CR4* among

**Table 2.** Results of the regression.

Independent variables	Dependent variables	
	CR4	pcm
pcm	9.5053 (12.0695)	
gGDP*pcm	−4.9263** (2.4330)	
CR4		0.5894* (0.3028)
gGDP*CR4		−0.0882** (0.0447)
Kq	−0.5443 (0.5792)	−0.2199 (0.3259)
gGDP*Kq	0.1394 (0.1062)	0.0423 (0.0583)
gGDP	0.9398* (0.4987)	0.1155 (0.0753)
DEcTrend	−0.0407*** (0.0093)	
inv	$-2.63 \times 10^{-11}$ ( $3.66 \times 10^{-11}$ )	
size	0.9579*** (0.2870)	
gDemand	0.1951*** (0.0635)	
Nfirm	−0.003*** (0.0011)	
Growth	0.0021 (0.0804)	
Dlaw		−0.1353 (0.083)
Imp		$-8.8 \times 10^{-06}$ ** ( $3.90 \times 10^{-06}$ )
ts		−0.0003 (0.0109)
lab		−0.0001 (0.0001)
trend		0.0090* (0.0051)
DlawTrend		0.0084 (0.0072)
Constant	−9.3239*** (3.3385)	−0.6297 (0.4955)
R <sup>2</sup>	0.0381	0.0030
Wald statistic	37193.21***	915.33***
Sargan -Hansen test	0.1021	0.1021

Note. \*\*\*denotes the significance of the test statistic at the 1% critical level. \*\*denotes significance of the test statistic at the 5% critical level. \* denotes the test statistic at the 10% level. Standard errors parantheses.

Source: Authors' calculation.

industries, and was positively affected by business cycle. This relationship was affected by several factors. First, during the economic expansion or boom phases of business cycle, firms tended to experience increased demand for the products or services. This heightened demand often led to intensified competition among firms that strived to capture larger market share. Consequently, firms could engage in aggressive expansion strategies such as mergers and acquisitions (M&A) to consolidate market positions. These strategic moves often increased CR4. Second, during economic downturns or recessions, weaker firms struggle to survive the shrinking demand and heightened competitive pressure. During such periods, financially distressed firms could become acquisition targets for stronger competitors seeking to expand market presence or achieve economies of scale. M&A tended to accelerate during economic downturns, further consolidating market power among the top players and elevating CR4. Furthermore, the effect of business cycle on CR4 extended to the implications for PCM in industries. PCM, which represented the ratio of profits to costs, was intricately linked to market concentration. During periods of economic expansion, firms experiencing increased demand often possessed higher pricing power, to set higher prices for the products or services. This heightened pricing power, coupled with reduced competitive pressures, tended to inflate profit margins, leading to a favorable PCM. Meanwhile, during



economic downturns, firms resorted to aggressive pricing strategies to maintain market share and generate revenue under subdued demand conditions, exerting downward pressure on profit margins, which adversely affected PCM. The consolidation of market power among a smaller number of firms, as reflected by a higher CR4, further diminished competition and limited consumers' bargaining power, allowing firms to maintain relatively higher prices and profit margins, at the expense of consumer welfare. Therefore, it could be concluded that business cycle had a significant effect on CR4 in industries, with implications for PCM.

In this study, the results of Model 2 were presented in Table 2, showing several results. First, this indicated that CR4 had a positive effect on PCM. Second, business cycle affected the effect of CR4 on PCM. Moreover, there was a positive relationship between CR4 and PCM in industries which could be attributed to several factors. First, higher levels of market concentration, as reflected by elevated CR4 values, often corresponded to increased market power among top firms in an industry. Firms with greater market power could affect market prices and set prices at levels that exceeded marginal costs. This enabled firms to achieve higher profit margins and contributed to favorable PCM. Furthermore, in concentrated markets, firms could face reduced competitive pressure, maintaining relatively higher prices and profit margins over the long term. Business cycle served as a mediating factor that modulated the effect of market concentration on PCM under various economic conditions. The positive relationship between CR4 and PCM tended to be accentuated during the economic expansions or boom phases of business cycle. In addition, during economic prosperity, firms experience heightened demand for the products or services, which provided an opportune environment for firms with significant market share to capitalize on the pricing power. Firms in concentrated markets could command higher prices with robust demand and limited competitive pressure, leading to enhanced profit margins and favorable PCM. Meanwhile, during economic downturns or recessions, the effect of CR4 on PCM was dampened or even reversed. In times of economic hardship, firms faced slow demand and heightened price competition, which could erode the profit margins despite market concentration. Moreover, in recessionary environments, financially distressed firms engaged in aggressive pricing strategies to maintain market share, exerting downward pressure on prices and industry-wide profit margins. The magnitude of this relationship was contingent on the prevailing economic conditions shaped by business cycle, while CR4 remained positively associated with PCM in principle.

## 6. Conclusions

This research had several findings. Firstly, the market structure was positively impacted by the business cycle, namely GDP growth (CR4). Second, the impact of the economic cycle on the relationship between market structure and industrial performance (PCM) was favourable. Third, the performance of industry was positively impacted by market structure. Fourth market structure had a positive effect on industrial performance. Fifth, business cycle affected the effect of market structure on industrial performance. This suggested that business cycle played a significant role in moderating the relationship between market structure and industrial performance, influencing the significance as well as the direction of the relationship across the different phases of the economic cycle. During economic expansion, market structure exerted a stronger effect on industrial performance, reflecting the ability of firms to leverage market power and improve profit margins. However, during recessions, the effect of market structure on industrial performance could weaken due to increased price competition and declining consumer demand.

This study revealed the complexity of market dynamics affected by external factors such as business cycle. Understanding the relationship between market structure, business cycle, and industrial performance was crucial for formulating effective regulatory policies and sustainable business strategies.

This variable had a limitation due to the use of GDP growth to represent business cycle and did not provide detailed insights into the labor market, such as the unemployment rate, which was also crucial for understanding business cycle. Consequently, future study was recommended to investigate the effect of business cycle on the relationship between market structure and industrial performance using unemployment. This could be relevant since it was an important indicator of the economy's condition. Furthermore, this study suggested considering the endogeneity problem, which could change the estimation strategy in the future.

## Note

1. In this study, the CR4 score was transformed to a logit transformation using the formula  $CR4 = \ln\left(\frac{CR4}{1-CR4}\right)$  to maintain the predicted score within the range of 0 to 1.

## Author contributions

Writing the draft of the paper, H.; literature review and conceptual framework, H. and M.S.; data cleaning, analysis, and interpretation of the data; H., B.A.S., and M.S.; resources and reading, H.; supervision, editing, and final approval of the version to be published, B.K., M.S., and R.I.; project administration, H. and M.S. All authors have read and agreed to the published.

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## About the authors

**Hurriyah** is a Ph.D. candidate in the Economics Department at the Faculty of Economics and Business, University of Padjadjaran, Indonesia. Her research primarily centers on industrial organization and economic policy.

**Maman Setiawan** is a Professor from the Economics Department, Faculty of Economics and Business, University of Padjadjaran, Indonesia. He received his PhD from the Wageningen University, Netherlands. His research interests focus on industrial organisation, efficiency and productivity, industrial manufacturing, banking, and SMEs performances.

**Rina Indiastuti** is a Professor of Economics from the Economics Department, Faculty of Economics and Business, University of Padjadjaran, Indonesia. She received her PhD from the Osaka Prefecture University, Japan. Her research interests focus on industrial organisation, banking and SMEs' performances.

**Berliana Anggun Septiani** is a doctoral student from the Economics Department, Faculty of Economics and Business, University of Padjadjaran, Indonesia. Her research interests focus on industrial organization, efficiency, and productivity.

**Bayu Kharisma** is a lecturer at the Department of Economics, Universitas Padjadjaran. He obtained bachelor's degree in Economics from Universitas Padjadjaran, a Master's degree in Agribusiness Management from Bogor Agricultural University and in Economics from Universitas Indonesia. He earned her doctoral degree in Economics from Universitas Gadjah Mada. Bayu Kharisma's research interests are in development and institutional economics.

## ORCID

Maman Setiawan  <http://orcid.org/0000-0001-5141-0104>

Bayu Kharisma  <http://orcid.org/0000-0002-2625-5250>

## Data availability statement

Not applicable, as the data contain sensitive information that could compromise privacy.

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