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## PRICE SETTING BEHAVIOR IN AN ONLINE MARKET

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### ABSTRACT

We study price-setting behavior in the Indonesian online market before and during the COVID-19 pandemic. We surveyed 297 online and offline markets dominated by Micro and Small Enterprises (MSEs). The results show that the online market's price-setting behaviors apply state-dependent pricing rules and price discrimination, evaluate prices more than once a year based on current information, and immediately respond to a shock. The main factor for price changes is input cost change. Meanwhile, price rigidities are influenced by implicit contracts. The probit model shows online markets face the high-competitive market, not applying a rule of thumb pricing, and frequently changing prices regarding shock.

*Keywords:* Online market; Price setting; Price changes; Price adjustments.

**JEL Classifications:** D40; E31; G21; G28.

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## I. INTRODUCTION

The development of online market in Indonesia experienced rapid increase despite the sharp decline in economic growth during the COVID-19 pandemic that began in early 2020. The use of digitalization has strengthened a critical resilience to cope with the devastating economic and social impact of the pandemic. World Bank (2021) stated that fast-growing internet connection has made Indonesia the most significant and fastest-growing digital economy in the South-East Asia. According to Google, Temasek, and Bain (2021), there is an expected increase of 75% in Global Merchandise Value (GMV) for e-commerce in Indonesia during the period 2019 - 2021. In 2019, the GMV of e-commerce in Indonesia was reported USD 40 billion which increased to USD 70 billion in 2021.

Given this rapid expanding e-commerce in Indonesia, the properties of price-setting behavior of the online market in requires significant attention. Price-setting behavior plays a crucial role in the conduct of monetary policy since, under the Keynesian assumption, monetary policy can effectively affect real variables such as output if the price is sticky in the short run.<sup>1</sup> Monetary policy can affect output by changing aggregate demand by adjusting money stock if the price does not change frequently.

This paper investigates price-setting behavior in the Indonesian online market before and during the COVID-19 pandemic. The paper reports the result of the survey conducted by Bank Indonesia between June – September 2020 using a sample of 297 respondents. As per our knowledge, this is the first paper that examines price-setting behavior in the online market before and during the COVID-19 pandemic in Indonesia. Our paper complements the empirical evidence on price-setting behavior in Indonesia studied by Juhro and Sugema (2004). The objective of the survey is twofold. First, we study the main features of pricing decisions in the Indonesian online market. Second, we explore the effect of the pandemic on price-setting behavior in Indonesia.

Overall, from our study we conclude that the online market in Indonesia, has a distinct characteristic from the offline market. This group works in the food and beverage industries and has no legal entity form. They are operated in a highly competitive market, are locally operated, have regular customers, use transfer for payment, and experience sales increases during the pandemic. Overall, the price-setting behavior of this group is applying the state-dependent pricing rule, using many indicators based on existing information to review and change the price, adopting flexible prices, adjusting prices more frequently, and responding to faster price speed adjustment. When changing and reviewing prices, the critical factors are input cost, competitor prices, demand conditions, and platform fees. Firms delay price changes because they have an implicit contract with their customer.

The rest of the paper is structured as follows. The second section discusses related literature on pricing behavior in the online market. Section III describes the survey sample, the structure of the questionnaire, and the methodology for processing the survey data. The fourth section presents the survey results, which include the firm's characteristics, pricing behavior, the main factors driving price

<sup>1</sup> For further discussion about the role of nominal rigidities, see Ball, Mankiw and Romer (1988), Blanchard and Kiyotaki (1988), and Ball and Romer (1989).

changes, and the factors causing price stickiness. The final section discusses the conclusion.

## II. LITERATURE REVIEW

The rapid increase in digitalization has significantly impacted the country's development. ECB (2021) stated that digitalization has implications for price measurement, productivity, the labor market, and inflation. Specifically, rising digitalization has spurred new ways of price setting, such as dynamic or customized pricing. Paulie (2019) stresses that digitalization may lead to lower price mark-ups which later contribute to holding back inflation. Charboneau *et al.*, (2017) conclude that growing e-commerce amplifies future downward prices through increased competition.

Gorodnichenko and Talavera (2016), using sizeable online dataset over longer time period documents that prices in online stores have the following features: shorter duration of price spells, smaller size of price changes, more significant pass-through, and faster speed of adjustment. Cavallo (2017) found that online and offline retailers have similar prices, frequencies, and sizes of price changes. In particular, Goldfarb *et al.* (2017) emphasized that digital technology can substantially lower five distinct economic costs, namely search costs, replication costs, transportation costs, tracking costs, and verification costs.

On the other hand, there are number of studies which examined companies price setting behavior using a survey-based approach (Borraz *et al.* (2020) for Uruguay, Correa *et al.* (2016) for Brazil, Sahinoz *et al.* (2008) for Turkiye, Alvarez, and Hernando (2006) for Spain, Kwapil *et al.* (2005) for Austria, Fabiani *et al.* (2005) for Euro-Area, Loupias, and Ricart (2004) for France, Apoel *et al.* (2001) for Sweden, Hall *et al.* (2000) for United Kingdom). Most of them discussed the main features of price-setting behavior in their particular country.

## III. SURVEY DESIGN

### A. Sample

We use the survey-based data to find price-setting behavior in the online and offline markets. The survey is also used to find the effect of the pandemic on price-setting behavior in online and offline retailers. This paper also aims to test the theory of price rigidities. To answer the above-mentioned research questions, we survey 297 companies from four main economic sectors, namely food and beverages, transportation and communication, housing area, and clothing. Altogether this includes three producers, four distributors, and 290 retailers (see Table 1). We pick these sectors to represent those who significantly contributes to the Indonesian economy. We also separate companies into 150 online and 150 offline retailers to better understand the difference in price-setting behavior between online and offline retailers.

This study uses primary data from the survey of several firms by using a questionnaire. Bank Indonesia surveyed in collaboration with the Faculty of Mathematics and Natural Sciences at Institut Pertanian Bogor (IPB) University. The survey was conducted over the period July 2021 until September 2021 for

those firms that operate in the online and offline markets in big cities on Java Island (Jakarta, Bogor, Depok, Tangerang, Bekasi, Bandung, Semarang, and Surabaya). The survey selected firms based on products with the most significant weight in the consumer price index basket.

**Table 1.**  
**Number of Respondents in Each Sector**

This table provides the number of respondents in the survey and segregated by sectors

<b>Sector</b>	<b>Number of Respondents</b>
Food and Beverage	128
Transportation and Communication	31
Housing Area	62
Clothing	76

The survey selects companies using the quota sampling method that meet the following criteria: (1) the minimum age of the firm is five years, (2) for online retailers, they conducted their business for at least three years, and their turnover/sales are at least 30% of the total turnover, and (3) for offline retailers, they sold all of their product offline.

### *B. Survey Analysis*

The research method uses both qualitative and quantitative analysis. Qualitative analysis studies the literature on pricing behavior by online and offline companies, while quantitative analysis utilizes graph, percentage, and Thurstone Case V analysis methods. Thurstone Case V analysis is a method of scaling or measurement based on The Law Comparative Judgment developed by Thurstone (1927). The main focus of this analysis is to measure the psychological aspects of respondents related to their opinions or assessments of some objects, both tangible and intangible. We assess ranking or sorting objects based on the level of importance or benefit and even the object's risk level. The most important objects are in the first place, and those with the next level of importance are in the second place. The ranking ends by placing the object that has minor importance.

### *C. Questionnaire Structure*

We use a simple Indonesian questionnaire with a description card that respondents can understand. In filling out the questionnaire, respondents used an enumerator that helped to explain the questions to avoid misperceptions. In general, the questionnaire consists of four parts based on the focus of the study. According to Alvarez and Hernando (2006), the four aspects are market structures, price-setting behavior, determinants of price changes, and factors that delay price changes.

Identifying characteristics and market structure provides an overview before analyzing price-setting behavior. The questionnaires comprise Section A, which contains general information about respondents, Section B which discusses the

market structure faced by respondents; and Section C which contains price-setting behavior. More specifically, Section A contains questions regarding the company's legal entity status, operation, number of employees, and the kind of products the company sells. Section B of the questionnaire asks questions about the category of the firm, whether online or offline retailers, annual turnover before and during the pandemic, geographical buyers, the competition faced by firms, product market share, and the most frequently accepted payment methods. Section C deals with firms' price-setting behavior, including whether firms follow time-dependent versus state-dependent pricing policy, timing, rule, and factors to consider for price changes and evaluation, and test for price rigidities.

The information contained in Section B also determines the firm's type of category based on the product's source and the type of consumer. The firms with 100% self-produced products are manufacturers and distributors that get products from manufacturers. Meanwhile, firms that sell directly to final consumers are retailers. The determination of the firms business scale uses information on turnover before COVID-19, which is from 2017 to 2019, and during the COVID-19 pandemic. Table 2 provides a classification of business scale based on annual turnover.

**Table 2.**  
**Firm Business Scale Based on Turnover (Rupiah/Year)**

This table provides the turnover of respondents in the survey by business scale

<b>Business Scale</b>	<b>Turnover (Rupiah/Year)</b>
Micro	0-300 Million
Small	300 Million > Turnover ≤ 2,5 Billion
Medium	2,5 Billion < Turnover ≤ 50 Billion
Big	Turnover > 50 Billion

Section C (pricing of products/services) of the questionnaire asks about the firm's price-setting behavior, including price evaluation, price changes, and price discrimination. Another objective of this study is to identify the factors to be considered for price evaluation which is to scale from the one with the largest to minor influences.

The firms decide to evaluate the prices in two ways, time-dependent and the state-dependent pricing rule. Companies that adopt the time-dependent pricing rule will review prices only at certain scheduled times. It means that the firm does not evaluate prices during an economic shock. On the other hand, companies with state-dependent pricing rules tend to review prices when a shock occurs, affecting product prices. The firm does not have a specific time to review product prices.

The questionnaire provides four answer options related to the rules in evaluating product prices, namely "periodic evaluation at a certain time", "evaluation of the consequences of certain events", "evaluation at a certain time and the consequences of certain events", and "others." Companies that evaluate prices regularly are time-dependent, while evaluations based on specific events are state-dependent. If respondents choose the third option, it combines time- and state-dependent.

There are three firm methods for evaluating prices: rule of thumb, current operating environment, and current and forward-looking. Companies with a rule of thumb will change prices according to established rules. Meanwhile, other companies consider current conditions and future conditions. Companies that apply forward-looking in evaluating prices are very beneficial for implementing an inflation-targeting framework (Gali and Getler, 1999; Haldane and Baltini, 1998).

Section C (pricing of products/services) of the questionnaire contains questions such as the frequency with which companies change prices before and during the COVID-19 pandemic, factors considered to change prices before and during the pandemic, and conditions based on which companies increase or decrease prices. Similar to the discussion in the previous section, there is also a sequence of factors with the largest to minor influence on price changes.

To find out the factors that influence price changes, respondents give an assessment of the level of importance (relative importance) with a value of 1 (not important) to 4 (very important). After that, the respondents ranked these factors from the most influential to the least influential. The assessment factors are labor costs, credit interest rates, exchange rates, raw material costs, electricity and fuel costs, sales costs, production capabilities, market demand, competitor prices, design and quality, and seasonal changes.

Additionally, Section C (pricing of products/services) of the questionnaire asks about the factors that hinder price changes. This question aims to measure price rigidity in various business sectors and products. The questionnaire contains questions about the speed adjustment of prices in the event of a shock. Research suggests that companies delay price changes during a shock because companies need much information before changing prices.

#### **IV. EMPIRICAL RESULTS**

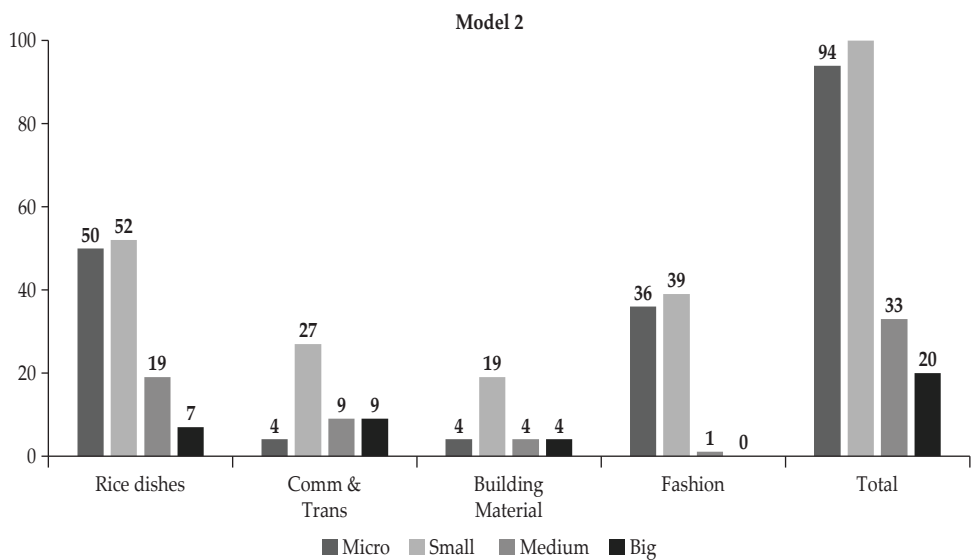
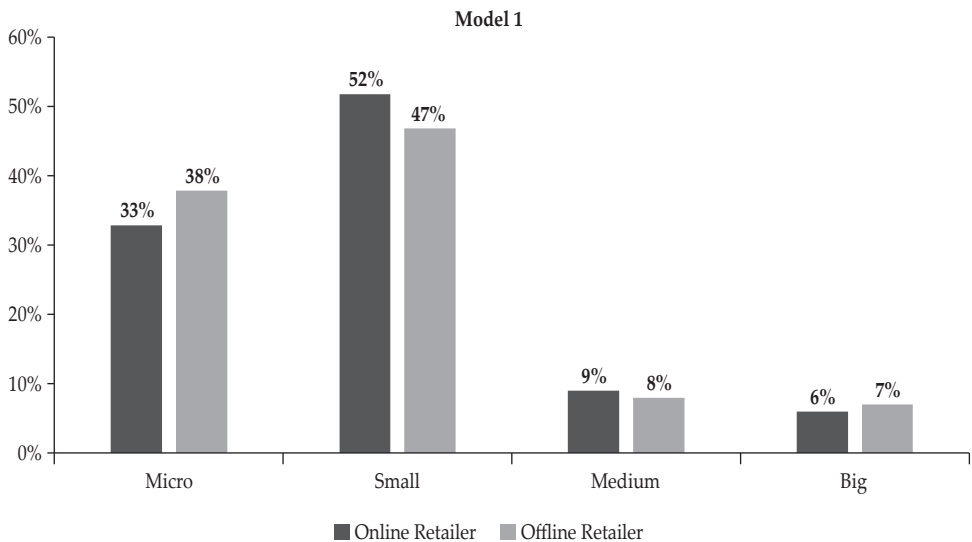
##### *A. Firm Characteristics*

This section discusses survey based findings on the characteristics of firms. Most of the firms participating in this study belong to the MSEs sector and do not have a legal entity (see Figures 1 and 2). We take the proportion of business scale dominated by small enterprises (that is, 140 respondents from 290 respondents). The most significant number of respondents were in the food, beverage, and cigarette sectors, with 134 respondents, followed by the clothing sector, with 76 respondents, while the lowest was in the housing sector, with 31 respondents.

The food sector comprise almost 30% of Indonesia's monthly consumer price index basket. Meanwhile, the most significant number of respondents from big companies is from the transportation and communication sectors, which is nine respondents. These respondents' results indicate that business agents in the online market, especially in the food and beverage sector, are still dominated by the MSE's business scale. Firms from the food, beverage, and clothing sectors are more responsive than others. These two sectors are retailers who mainly operate in the online market and still work from the office, thus simplifying the survey process. Therefore, this study is more related to price setting behavior of MSEs including both online and offline retailers in Indonesia.

**Figure 1.**  
**Companies Business Scale**

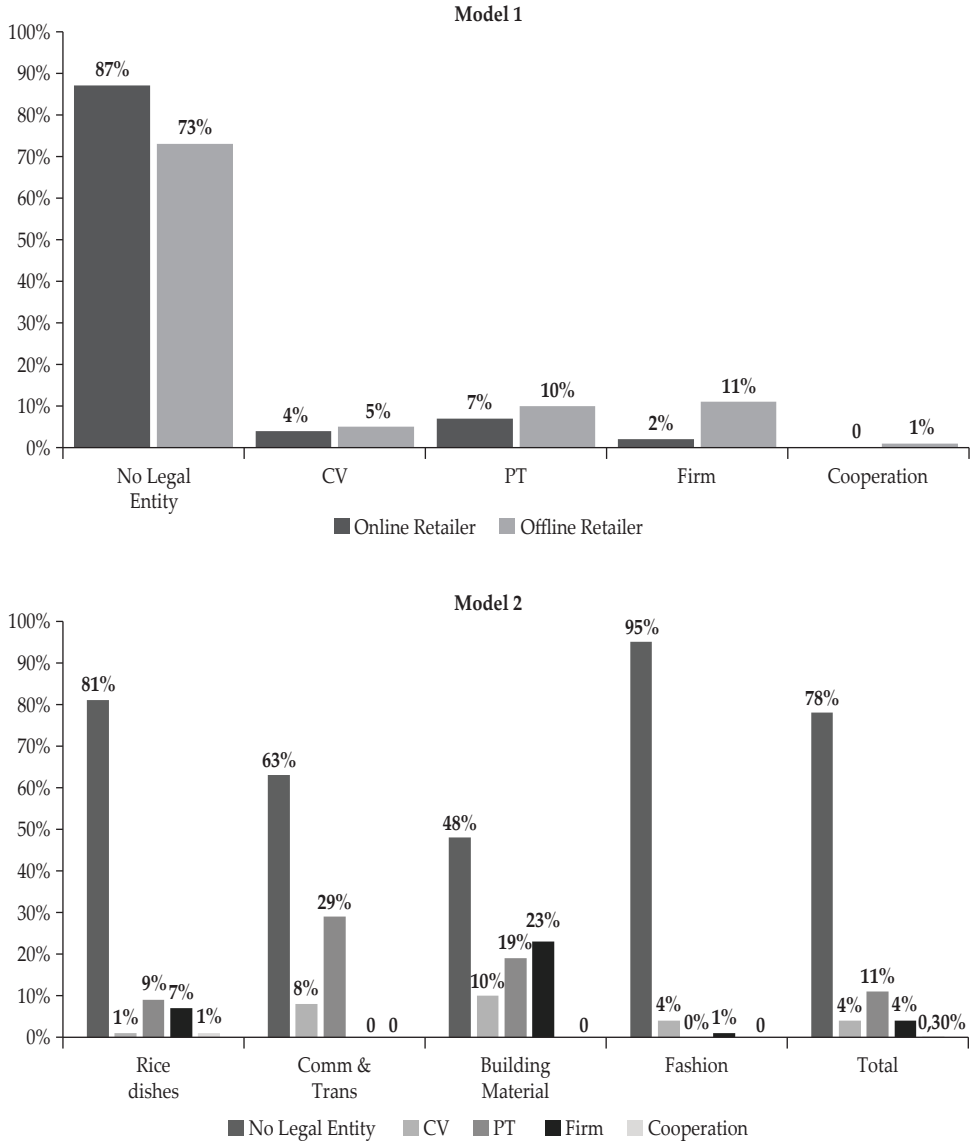
The figure shows the number of respondents in the survey and segregated by Business Scale (Model 1) and Sectoral Business Scale (Model 2).





**Figure 2.**  
**Companies Legal Entity**

The figure shows the legal entity of respondents in the survey and segregated by online and offline Market (Model 1) and also by sectors (Model 2).



Based on the turnover of retailers, online retailers with a turnover of 0 - Rp300 million experienced a more significant increase in turnover than offline retailers before and during the pandemic. Consumers switched their buying behavior to online shops, so total transactions increased during the pandemic. Most respondents in this study have been operating in the online market before the pandemic, which has become the initial criterion for this research to see the

difference in price changes before and during the pandemic. However, in Table 3, 9% of firms (or about 15 respondents), had just started selling products online during the pandemic.

**Table 3.**  
**Firm’s Years of Operation and Online Selling**

This table provides the time operation of respondents in the survey by business scale

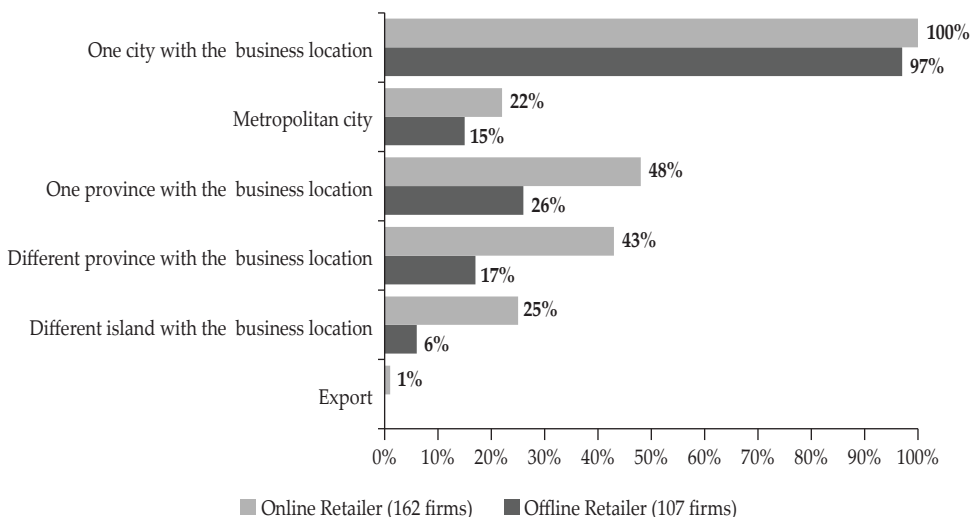
	Years of Online Selling				
	Total Respondents	1-2 Years	2-3 Years	>3 Years	
	162 Resp	15 Resp	33 Resp	114 Resp	
Years of Operation	1-2 years	1 resp	1%	-	-
	2-3 years	0	-	-	-
	3-5 years	31 resp	3%	4%	12%
	5-10 years	81 resp	5%	9%	36%
	10-25 years	34 resp	-	6%	15%
	25-50 years	15 resp	1%	2%	7%

*B. Market Structure*

The results obtained from the survey show that most firms operate around their business place. These show that most of the sales generate from the business location (see Figure 3). The online market does not equally mean that firms, particularly MSEs, will have a broader market scope. Although the online market has a wider market reach, delivery cost remains the primary consideration for consumers to buy from faraway retailers. A respondent that most MSEs in the food and beverages industry cannot expand their market considering the constraint of MSEs to serve more expanding market.

**Figure 3.**  
**Geographical Scope of Product**

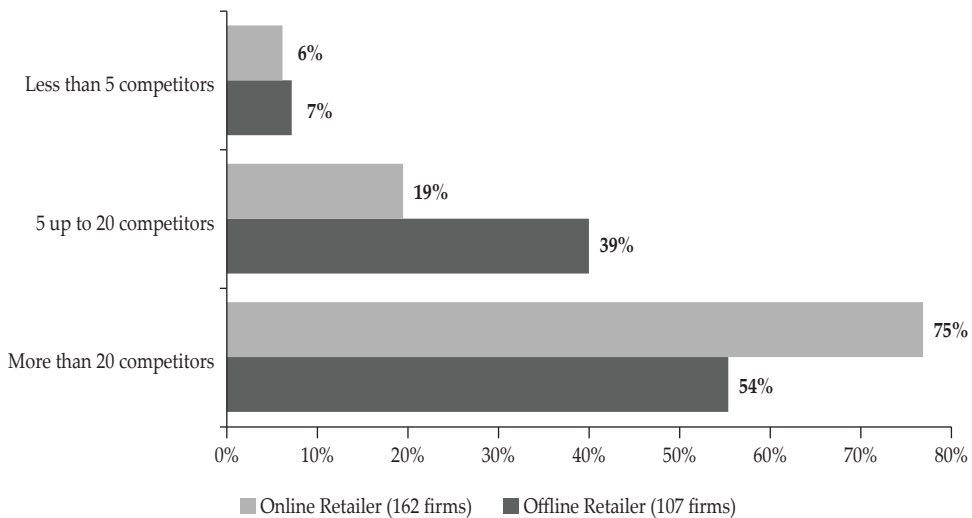
The figure shows the geographical scope of product of respondents in the survey.



Survey results show that firms face a relatively higher number of competitors when selling their products online than offline (see Figure 4). These indicate that the market structure in MSE online retailers has a more competitive market than offline retailers. By operating in an online market, MSEs retailers may face a competitive market as customers can easily access more information regarding the seller and product they want. Consumers or retailers can compare the price of the same product at several different retailers.

**Figure 4.**  
**Market Competition**

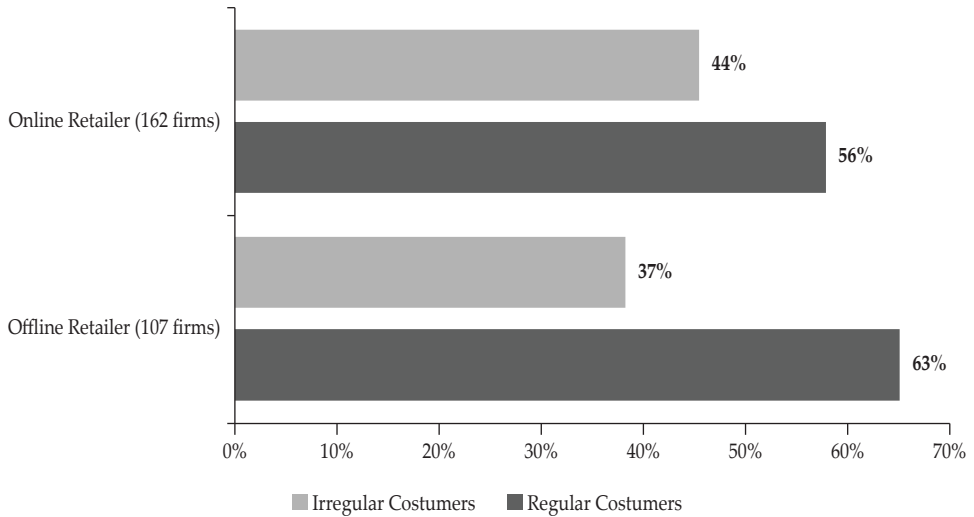
The figure shows the market competition of respondents in the survey.



Most of the respondents, both online and offline retailers, have regular customers (see Figure 5). The profile of the customer types of each retailer is relatively the same, both of which are dominated by regular customers. The proportion of regular customers in offline retailers is more significant than in online retailers. This fact implies that the online market's customer loyalty level is below the offline market. The relatively low level of customer loyalty in the online market is due to higher competition and transparency in the online market. Regular customers may commit to customers, so sellers have a special relationship with them. Price will be hard to adjust when there is a shock in the economy (see Alvarez and Hernando 2005).

**Figure 5.**  
**Type of Companies Costumer**

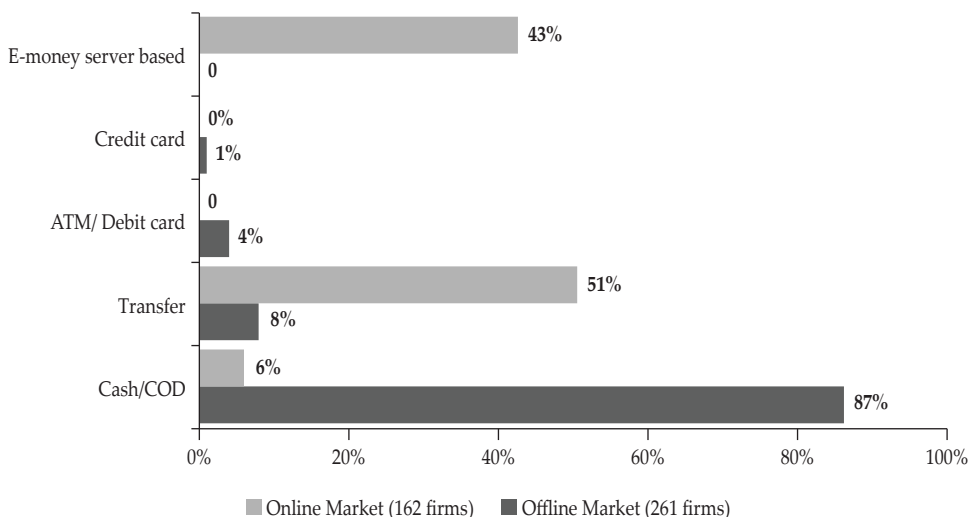
The figure shows the type of customer in the survey



The development of financial digitalization during the pandemic shows a sudden increase as customers change their shopping behavior to online markets. There are significant differences in payment methods between the online and offline markets. Buyers in the online market prefer to use transfer payment and electronic money to settle their transactions, while buyers in an offline market like to use cash. Customers prefer to use electronic money to settle their payments to make shopping more convenient (see Figure 6).

**Figure 6.**  
**Companies Payment Accepted**

The figure shows the type of payment accepted in the survey.



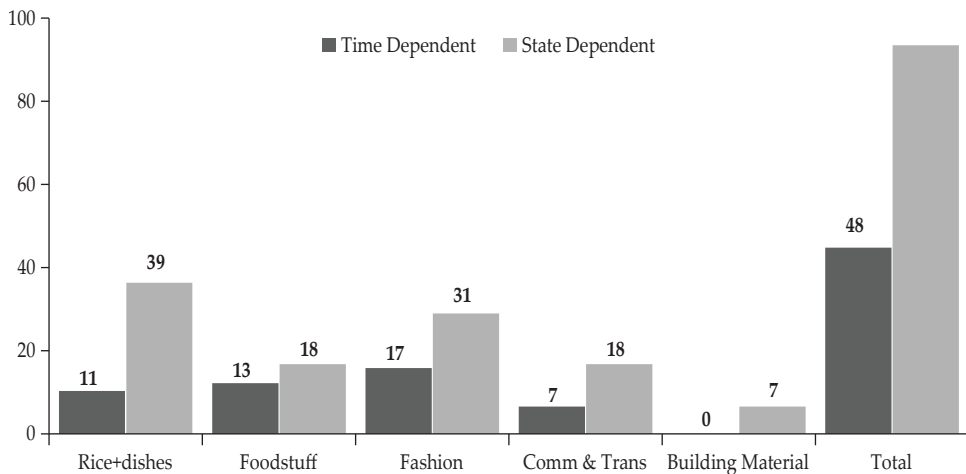
### C. Price Setting Behavior

The first section of the questionnaire discusses the firm's price-setting behavior about the firm's decision to adjust the price. We test two types of price-setting behavior: Time-Dependent (TDP) and State-Dependent Pricing (SDP). TDP relate to the fact that all firms determine their price on any particular exogenous date (Taylor, 1980) or follow a random signal (Calvo, 1983). These models introduce staggering price changes adopted by all firms in the economy. Under SDP, all firms change their price according to fixed costs that depend on the state of the economy (Klenow, 2005). The implications of these two pricing on macro variables, such as real output and inflation, can differ substantially. Dotsey (1999) argued that in response to the monetary shock, TDP produces more substantial output than SDP because of price sticky. In the TDP, the optimal price rises more than in SDP because firms cannot flexibly change the price on any date.

We ask firms how they make price evaluations to investigate the role of both types of rules in pricing strategies. Two possible answers exist: "at specific time intervals" and "in response to the specific event". We classify the first answer as TDP and the second as SDP. Figures 7 and 8 summarize the responses to the question for both online and offline retailers. Most of the firms in the online and offline market in all business sectors tend to adopt the SDP rule rather than the TDP rule in their price-setting behavior. Most firms, particularly MSEs in the food and beverages sectors, consider current economic conditions the primary consideration for setting the price. Hillen (2021) argued that online retailers make frequent price changes, particularly in the food sector.

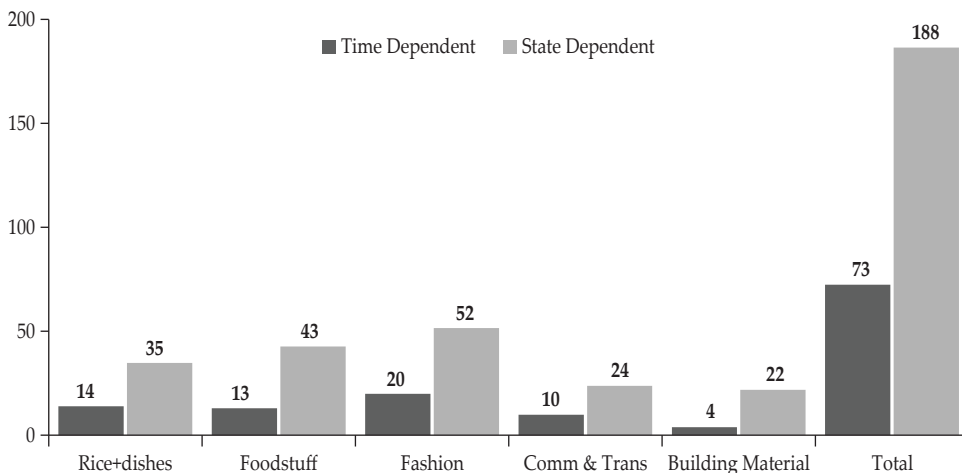
**Figure 7.**  
**Online Retailers Pricing Rules**

The figure shows time-dependent and state-dependent pricing rules of online retailers in the survey.



**Figure 8.**  
**Offline Firm Pricing Rules**

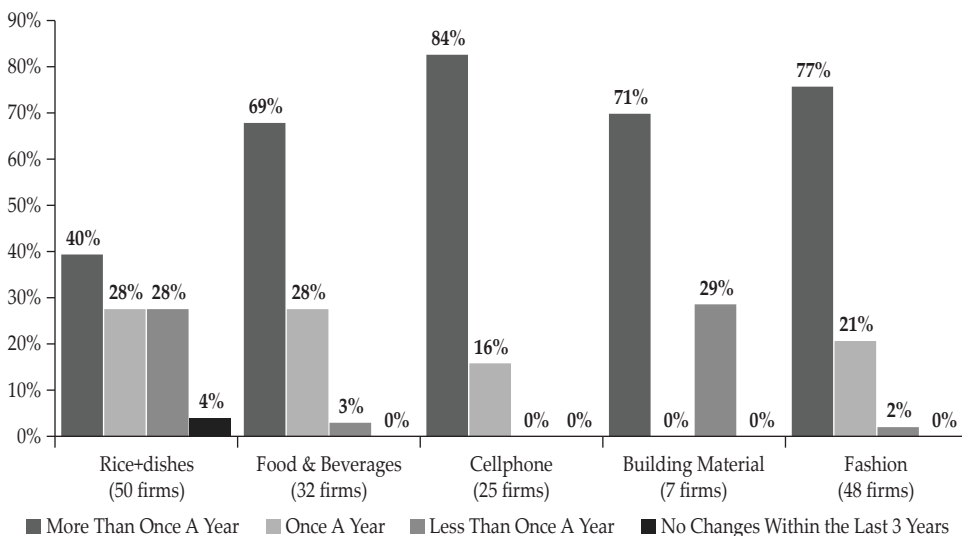
The figure shows time-dependent and state-dependent pricing rules of offline retailers in the survey.



Empirical specification to measure the degree of price stickiness is crucial in assessing the dynamic effect of aggregate demand on output and the price level. Mankiw and Reis (2002) stated that firms are reluctant to frequently change the price because they face menu costs that are costly and time-consuming. The questionnaire includes questions on the number of price changes a year to measure the duration of price spells. In particular, the questionnaire asked about the average number of annual price changes in the last three years.

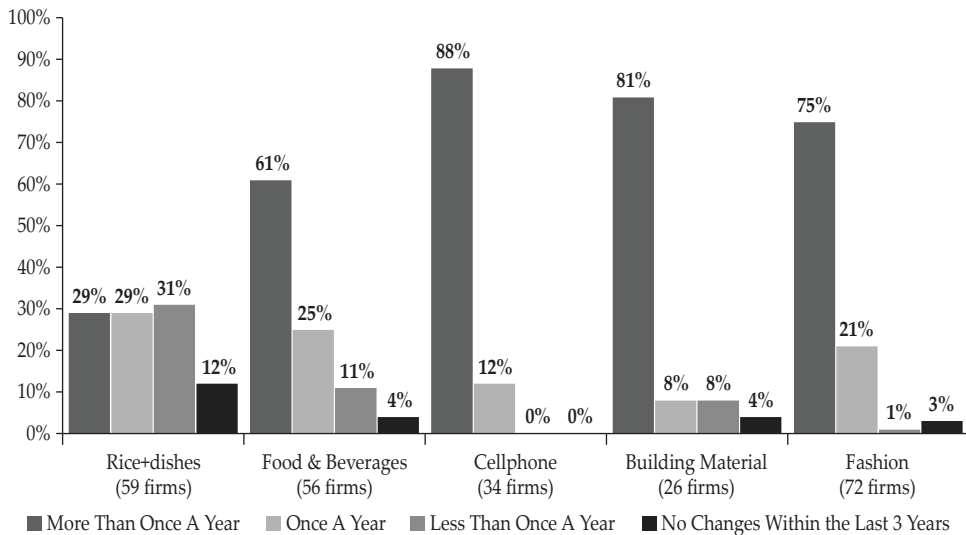
**Figure 9.**  
**Frequency of Price Changes in Online Markets**

The figure shows the frequency of price changes in online markets in the survey.



**Figure 10.**  
**Frequency of Price Changes in Offline Market**

The figure shows the frequency of price changes in offline markets in the survey.



On average, almost 60% of online and offline firms in all sectors except rice and dishes change prices more than once a year. For rice and dishes sector, firms are equally changing their price once and more than once a year. Figures 9 and 10 classify the results into four categories: more than once a year, once a year, less than once a year, and no changes within the last three years.

Economic agent expectations play a pivotal role in designing monetary policy. Gali and Gertler (1999) concluded that forward-looking price setters are more crucial than backward-looking price setters in explaining the inflation dynamic. Pfajfar and Zakelj (2015) argued that monetary policy rules that react to forward-looking pricing rules would produce lower inflation variability than backward-looking pricing.

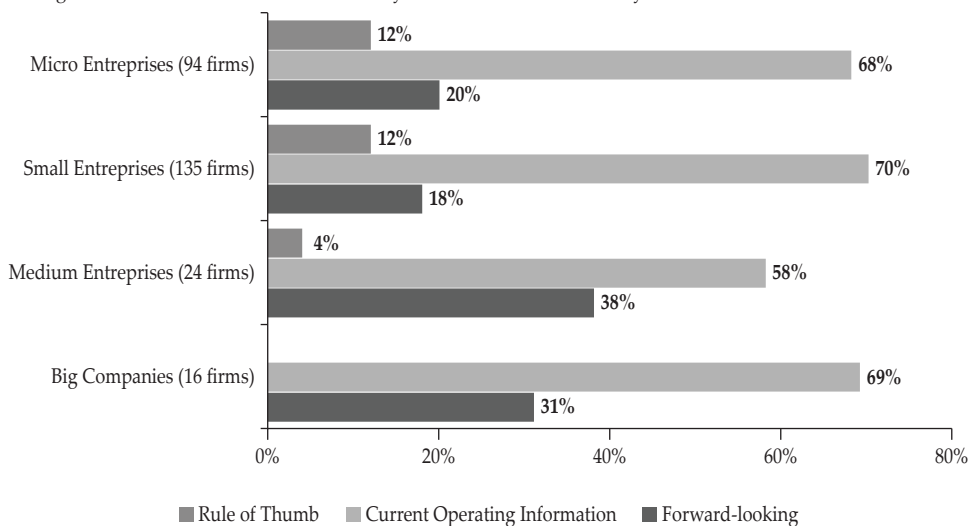
The study included a question to assess the importance of backward and forward information for evaluating price changes. Respondents have three potential options: applying a rule of thumb, using many indicators based on the firm's current situation, and using many indicators based on both firm's current and future information. Firms that apply rule-of-thumb strategies may not be at an optimal price in case of large shocks occur in the economy because they change prices on a fixed percentage. On the contrary, firms may reach their optimal price if they use many indicators, including future information, for evaluating price reviews.

Figure 11 shows that current information has the most significant weight in reviewing price evaluation. Almost 60% of surveyed online and offline firms use many indicators based on current information as very important. These companies follow a typical type of optimizing price behavior by taking much information in the pricing decision. Only 10% of firms apply the rule of thumb when reviewing the prices. This evidence is consistent with the surveys conducted in Spain, Brazil,

and Uruguay (Alvarez and Hernando (2006), Correa et al., (2016), Borraz *et al.*, (2020)). These results suggest that the central bank faces future challenges driving inflation expectations consistent with the inflation target.

**Figure 11.**  
**Information of Price Evaluation**

The figure shows the set of information used by online retailers in the survey in each business scale.



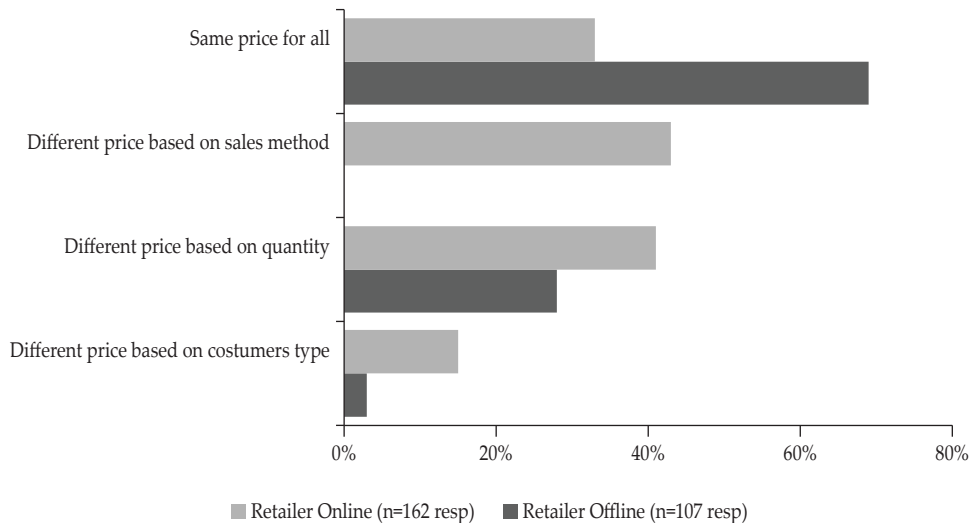
One of the critical features of price-setting behavior is price discrimination. Price discrimination is when different prices for a unit of the same product is set to different customers. Firms apply price discrimination to generate more sales and attract more customers. Price discrimination can take different forms of types: charging a product with different prices for different customers which consist of regular and irregular customers, setting the price depending on the number of the unit purchased, and making the price depend on sales methods that include buying other products from the same firms or only apply for first-time buyers.

The survey results are summarized in Figure 12 which reveals some exciting findings. Online and offline retailers exhibit different price discrimination strategies. Almost 70% of offline retailers charge the same price to all customers. On the contrary, only one-third of online retailers use a uniform pricing strategy. Most online retailers are adopting price discrimination based on the method of sales and the quantity purchased. Our findings are consistent with many studies that conclude the difference in price-setting behavior of online and offline retailers. Aparicio *et al.* (2021) argued that online retailers show significantly less uniform pricing than offline retailers because of lower barriers to search. As Goldfarb and Tucker (2017) points out, digital technology represented by the online market may significantly reduce the five distinct economic costs such as search costs, replication costs, transportation costs, tracking costs, and verification costs. ECB (2021) noted that digitalization has rendered new complex pricing strategies, including dynamic and customized pricing.



**Figure 12.**  
**Price Discrimination**

The figure shows the price discrimination in the survey.



#### *D. Factors Affecting Price Changes*

This section discusses the main factors for firms in determining price changes, particularly during the COVID-19 pandemic. We are interested to see the firm's price-setting behavior before and during the pandemic since the pandemic has enormously affected the economy. We also explore the presence of price asymmetries to determine price behavior to respond to monetary policy contraction or expansion.

Firms rank the relative importance of several factors that could lead to price increases and decreases before and during the pandemic. We construct the list of potential factors such as input costs, competitor prices, demand conditions, fee marketplace, energy costs, exchange rate, labor wage, and interest rates that affects the price. The response to this question can help address the following issues: firms can identify factors to change the price, see the pandemic's effect on firms' price-setting behavior, and test the presence of price asymmetries.

Tables 4 and 5 summarize the survey-based results for determinant factors that increase and decrease the price. We employ Thurstone Case V, developed by Thurstone (1927), as a scaling method to sort respondents' output based on the level of importance. The most important opinion is in the first place, and the second place is the one with the next level of importance. The ranking ends by placing the opinion that has minor importance.

Tables 4 and 5 indicate that firms, particularly MSEs, consider input costs, competitor prices, demand conditions, fee marketplace, energy costs, exchange rate, labor wages, and interest rate as the rank of determinant factors to increase and decrease the price. Under the Thurstone scaling method, input cost weight is an essential factor to be considered by firms to change the price. This finding confirms that most of the respondents who run the business as MSEs in the rice

and dishes sectors are more concerned with the input costs, such as raw material costs, when they want to change the price.

The survey results show little difference between the determinant factors before and during the pandemic. The other two crucial factors surveyed are competitor prices and demand conditions of a firm. Converting by the Thurstone scaling method, firms consider these two cases very important after input costs. For competitor prices, this element plays a crucial role in firms' pricing decisions, consistent with the market structure of firms, particularly MSEs in the previous section, which point to operating in a competitive market. The emphasis on demand conditions for pricing decisions is not surprising, considering online MSEs retailers apply price discrimination to satisfy the need of their regular customers. Firms also consider the online marketplace fee as an essential factor.

**Table 4.**  
**Rank of Factors on Price Increase**

This table reports the rank of factors on price increase in the survey. The rank is based on Thurstone Scaling Method that relies upon judgement of respondents to rate scale variables in terms of importance. Respondents were asked to rank variables from 1 (the most important) to 15 (the least important). The score is obtained from the comparison between factors and represent psychological scale value between factors.

Factors	Before Pandemic		During Pandemic	
	Rank	Score	Rank	Score
Increasing raw material cost	1	29.74	1	28.75
Competitor's price rising	2	8.75	2	8.47
Profit-earned Expectation	3	7.85	3	7.67
Demand increasing	4	7.21	4	6.91
Increasing fee marketplace	5	4.73	5	4.84
Reduced Good Supply	6	4.47	6	4.29
Increasing energy cost	7	1.85	7	2.03
Weakening of Rupiah exchange rate	8	1.67	9	1.54
Increasing labor wage	9	1.60	8	1.55
Availability stock of goods	10	1.10	10	1.09
Increased handling product cost	11	0.86	11	0.81
Increased credit interest rate	12	0.60	12	0.57
Presence of certain event	13	0.54	13	0.56
Increased promotion cost	14	0.20	14	0.32
Inflation	15	0.00	15	0.00

**Table 5.**  
**Rank of Factors in Price Decrease**

This table reports the rank of factors on price increase in the survey. The rank is based on Thurstone Scaling Method that relies upon judgement of respondents to rate scale variables in terms of importance. Respondents were asked to rank variables from 1 (the most important) to 15 (the least important). The score is obtained from the comparison between factors and represent psychological scale value between factors.

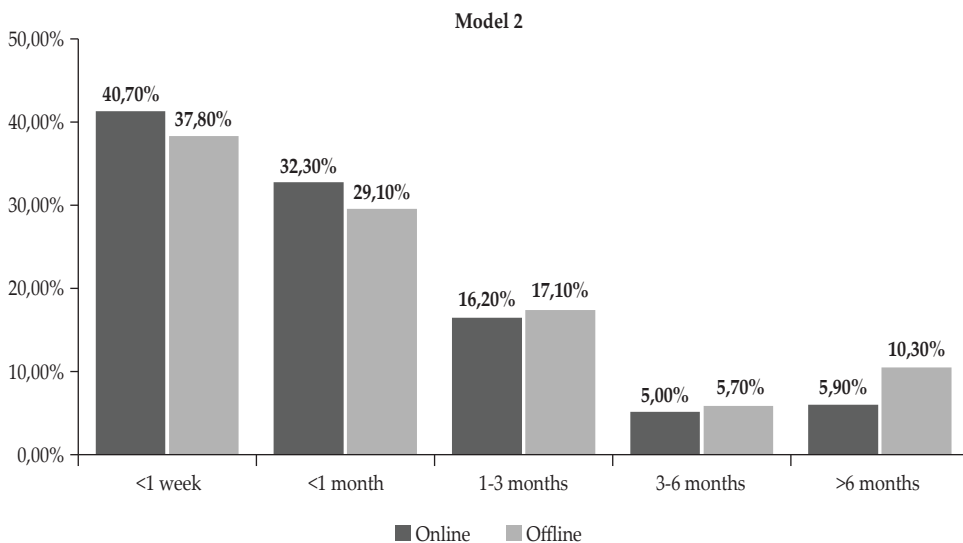
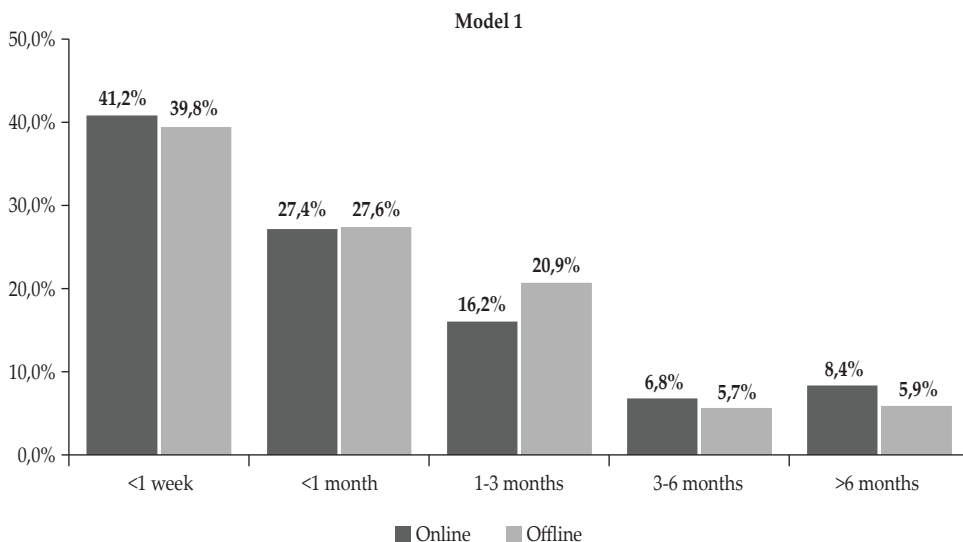
Factors	Before Pandemic		During Pandemic	
	Rank	Score	Rank	Score
Decreased raw-material's cost	1	29.74	1	28.75
Decreased competitor's price	2	8.75	2	8.47
Decreased market demand	3	7.85	3	7.67
Profit-earned Expectation	4	7.21	4	6.91
Availability stock of goods	5	4.73	5	4.84
Increased product supply	6	4.47	6	4.29
Decreased marketplace fee	7	1.85	7	2.03
Presence of certain event	8	1.67	9	1.54
Strengthening of Rupiah exchange rate	9	1.60	8	1.55
Decreasing Energy Cost	10	1.10	10	1.09
Decreased credit interest rate	11	0.86	11	0.81
Decreased handling product cost (delivery, and return policy)	12	0.60	12	0.57
Decreasing labor wage	13	0.54	13	0.56
Decreased production cost	14	0.20	14	0.32
Government interventions	-	-	15	0.00

#### *E. Speed Adjustment of Price Changes*

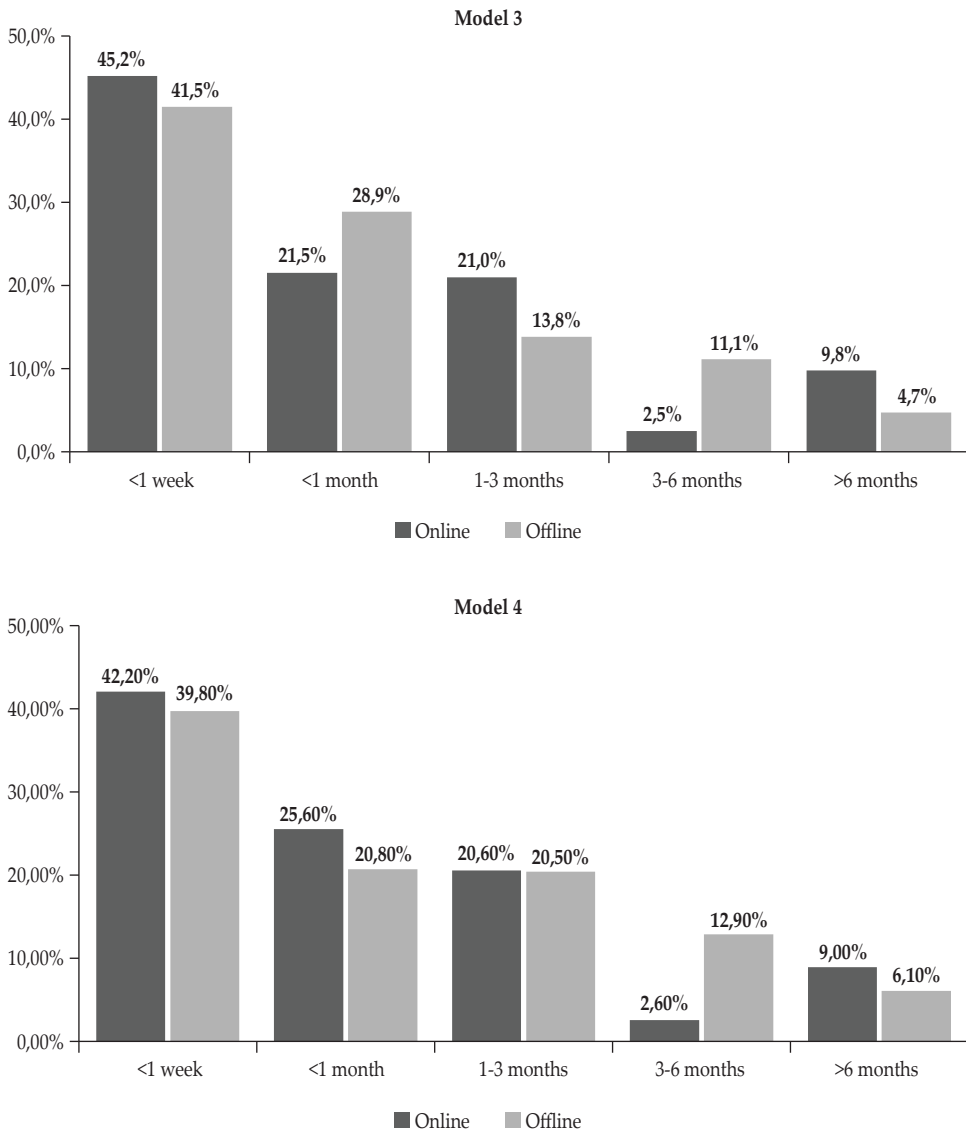
Respondents are asked to point out the average time frame between the occurrence of a shock in the economy and the firms' price reaction before and during the pandemic to investigate the speed of adjustment after the shock. We specifically emphasize the period of the pandemic to look at the effect of the pandemic on firms' price reactions. The questionnaire has six possible options: less than a week, less than a month, 1-3 months, 3-6 months, and more than six months. Figure 13 summarizes the responses to this question. Most online and offline firms adjust their prices within less than one week. This finding suggests that most Indonesian online and offline retailers will adjust their prices quickly to respond to a shock in the economy.

**Figure 13.**  
**Speed of Price Adjustment**

This figure shows the speed of price adjustment in the survey before and during pandemic. There are four functions: Increasing Price Before Pandemic (Model 1), Increasing Price During Pandemic (Model 2), Decreasing Price Before Pandemic (Model 3), and Decreasing Price During Pandemic (Model 4).



**Figure 13.**  
**Speed of Price Adjustment (Continued)**



*F. Factors Delaying Price Changes*

This section provides evidence of price stickiness in firms’ pricing decisions. The study’s objective is to test alternative theories of price rigidities and ask the respondents to choose which theory fits with them. The options in the questionnaire were translated and designed to resemble the critical understanding and reasoning of the alternative theory. The respondents were to rank the relative importance of each option that can explain price rigidities. Thurstone scaling method converts the results by sorting respondents’ output based on level of importance.

At first, we test alternative theories of price rigidities as follows:

1. **Implicit Contract**  
Firms will be likely reluctant to increase prices because doing so will result in losing their primary customer.
2. **Coordination Failure**  
Firms will have to wait for their competitors when they decide to increase the price.
3. **Temporary Shocks**  
Firms argue that increasing prices will only last for a while since they think the price will return to the current level.
4. **Pricing Points**  
Firms will decide to delay increasing the price until they wait for a significant price increase. They are reluctant to increase the price if there is a slight price increase.
5. **Information Costs**  
Firms will incur more costs if they decide to increase the price.
6. **Change Non-price Factors**  
Firms will increase other than the price since they think the increasing price will result in losing the customer. They prefer to reduce the product's quantity or other features such as the product's design.
7. **Explicit Contracts**  
Firms have written agreements with their regular customer to keep the same price.

Table 6 summarizes survey-based results on price rigidities . The five theories of price rigidities have the highest rank in explaining why prices may change infrequently. Those are implicit contracts, coordination failure, temporary shocks, pricing points, and information costs. The relative importance of the theory of price rigidities seems similar before and during the pandemic. The theory of implicit contracts earns an essential explanation for price stickiness. This theory assumes that customers prefer a stable price, and firms will likely avoid price changes as they may risk customer relations. Firms try to build a long-term relationship with their customers. The theory of coordination failure is ranked second. This theory argues that firms only intend to increase the price if competitors change the price to avoid losing customers. The third critical theory is temporary shocks which explain that firms are reluctant to raise the price because they think that the shocks are short-lived and will return to the average level immediately. The following essential ranks are pricing points and information costs. Theory pricing points are related to consumer psychology. Firms prefer to set prices at a psychologically significant figure, such as Rp199,000 rather than Rp200,000. The theory of information costs needs more emphasis in explaining price rigidities because the cost of price changes is relatively tiny for online retailers.

**Table 6.**  
**Relative Importance of Alternative Theories of Price Rigidities**

This table reports the relative importance of price rigidities theory in the survey before and during pandemic. The rank is based on Thurstone Scaling Method that relies upon judgement of respondents to rate scale variables in terms of importance. Respondents were asked to rank variables from 1 (the most important) to 7 (the least important). The score is obtained from the comparison between factors and represents psychological scale value between factors.

Factors	Before Pandemic		During Pandemic	
	Rank	Score	Rank	Score
Implicit contracts	1	11.99	1	16.03
Coordination failure	2	6.62	2	6.92
Temporary shocks	3	6.22	3	6.85
Pricing points	4	6.19	5	5.29
Information costs	5	5.26	4	6.55
Change non price factors	6	1.52	6	2.50
Explicit contracts	7	0.54	7	0.57

### G. Determinant Factors in Online Prices

In this section, we examine the behavior of pricing strategies in the online market. We investigate the number of factors that influence online prices. We assume that the behavior in online prices depends on several explanatory variables such as pricing variables, namely competitive environments, applying a rule of thumb pricing, number of employees, and frequency of price changes. We include several questions in the questionnaire to document this issue.

To examine the main factors for online prices, we expect online retailers are operating in a competitive market with many sellers. Charbonneau *et al.* (2017) shows that online markets have reduced entry barriers and led to increased competition. Goldfarb (2017) also shows that digitalization may increase the intensity of competition because it can significantly reduce five costs that constrain economic activity, such as search, replication, transportation, tracking, and verification costs.

Another factor that explains pricing strategies in online markets is the information set firms utilized to change prices. We assume that online retailers must apply rule-of-thumb pricing strategies to be more flexible in setting prices. Online markets have unique characteristics. Gorodnichenko and Talavera (2016) demonstrate that prices will fluctuate instantly in response to changing demand and supply conditions. The consumer can search for better prices at zero costs, and firms make pricing decisions in real-time considering market structure and characteristics.

We assume a positive correlation exists between the number of employees and online retailers. We also expect price changes in the online market to occur more frequently in line with the evidence provided by Gorodnichenko *et al.* (2017) and Cavallo (2017). Aparicio *et al.* (2021) also find that online retailers exhibit high flexibility in setting prices than offline retailers.

We use a binary choice model to investigate the relationship between price-setting behavior in online markets and several determinant factors described above. Using probit regression model, we estimate that the dependent variable is set to unity if the firm sells the product in online markets and zero otherwise.

Table 7 reports results for determinant factors in online pricing. First, we find that the level of competition significantly affects online markets. The coefficient of competition is positive and significant. This finding indicates that online markets operate in and lead to more intense competition as Ellison and Ellison (2005) conclude that there would be less product differentiation, lower search costs, and lower fixed costs in online markets, and Gorodnichenko *et al.* (2017) argue that the nature of online markets is high turnover.

Second, online retailers tend to avoid applying rule-of-thumb pricing since the coefficient of rule-of-thumb pricing is negative and significant. Online retailers use current and forward information to change and review prices because they closely monitor demand and supply conditions. This finding is consistent with the evidence provided by Cavallo (2017), which stated that online retailers face intense competition characterized by a high degree of price flexibility and lower monitoring of competitor prices.

Third, we find that price changes occur more frequently in online markets. The coefficient of frequency of price changes is positive and significant at the 10% significance level. This evidence is consistent with several studies that online prices are much more flexible than prices in an offline market (Gorodnichenko *et al.* (2017), Cavallo (2017), Aparicio *et al.*, (2021)). The other variables, such as time-dependent pricing and speed of price adjustment, are insignificant in affecting online pricing strategies.

**Table 7.**  
**Estimation Result using Probit Model**

This table reports the estimation results of determinant factors in online markets. The dependent variable is dummy variable which takes a value of one for firm selling in an online market, zero otherwise. Explanatory variables are competition proxied by question in the survey that ask the number of competitors in the market, time-dependent pricing is dummy variable which is equal to one for firms that apply time-dependent pricing, rule of thumb-pricing is a dummy variable which is equal to one for firms that apply rule of thumb pricing, frequency of price changes is the number of days that firms change their prices in response to shock, and speed of price adjustment is a dummy variable which takes a value of one if the firms declare to change their prices in reaction to shock within less than 1 week.

Variables	Coefficient	p value
Competition	0.1418	0.0401
Time Dependent Pricing	-0.0647	0.8131
Rule of Thumb Pricing	-2.4503	0.0001
Frequency of Price Changes	0.0055	0.0959
Speed of Price Adjustment	-0.1775	0.5225
R-squared 0.565		
Number of observations: 297		

## V. CONCLUSION

This study reports survey-based findings conducted by the Bank Indonesia to investigate price-setting behavior in the Indonesian online market before and during the COVID-19 pandemic. The study aims to explore the price-setting behavior of the Indonesian online and offline markets. The survey results reveal that online market respondents dominated by MSEs have the following market characteristics: operating locally, do not have legal standing, facing a high level of



competition, having regular customers, and experiencing increased sales during the COVID-19 pandemic.

We find that price-setting behaviors of the online market are applying a state-dependent pricing rule, evaluating prices using many indicators based on current information, evaluating prices more than once a year, applying price discrimination, and responding more quickly in the event of a shock. The change in input cost is the main driving factor for changing prices. An implicit contract is a fundamental theory of price rigidities related to a firm's pricing decision.

Our probit model estimation shows that pricing behavior in online markets is affected by the number of competitors, rule of thumb pricing, and frequency of price changes. We find that online markets operate in a highly competitive market, not applying a rule of thumb pricing, using current and expected information to review and change prices, and frequently changing prices in reaction to shocks.

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## APPENDIX

**Table A.1.**  
**Number of Respondents in Each Sector**

The table provides number of respondents in the survey and segregated by sectors.

<b>Sector</b>	<b>Number of Respondents</b>
Food and Beverage	128
Transportation and Communication	31
Housing Area	49
Clothing	76

**Table A.2.**  
**Firm Business Scale Based on Turnover (Rupiah/Year)**

The table provides the turnover of respondents in the survey by business scale.

<b>Business Scale</b>	<b>Turnover (Rupiah/Year)</b>
Micro	0-300 Million
Small	300 Million > Turnover ≤ 2,5 Billion
Medium	2,5 Billion < Turnover ≤ 50 Billion
Big	Turnover > 50 Billion

**Table A.3.**  
**Firm's Years of Operation and Online Selling**

The table provides the time operation of respondents in the survey by business scale

	<b>Years of Online Selling</b>				
	<b>Total Respondents</b>	<b>1-2 Years</b>	<b>2-3 Years</b>	<b>&gt;3 Years</b>	
	<b>162 Resp</b>	<b>15 Resp</b>	<b>33 Resp</b>	<b>114 Resp</b>	
Years of Operation	1-2 years	1 resp	1%	-	-
	2-3 years	0	-	-	-
	3-5 years	31 resp	3%	4%	12%
	5-10 years	81 resp	5%	9%	36%
	10-25 years	34 resp	-	6%	15%
	25-50 years	15 resp	1%	2%	7%

**Table A.4.**  
**Rank of Factors on Price Increase**

The table shows the rank of factors on price increase in the survey. The rank is based on Thurstone Scaling Method that relies upon judgement of respondents to rate scale variables in terms of importance. Respondents were asked to ranked variables from 1 (the most important) to 15 (the least important). The score is obtained from the comparison between factors and represent psychological scale value between factors.

Factors	Before Pandemic		During Pandemic	
	Rank	Score	Rank	Score
Increasing raw material cost	1	29.74	1	28.75
Competitor's price rising	2	8.75	2	8.47
Profit-earned Expectation	3	7.85	3	7.67
Demand increasing	4	7.21	4	6.91
Increasing fee marketplace	5	4.73	5	4.84
Reduced Good Supply	6	4.47	6	4.29
Increasing energy cost	7	1.85	7	2.03
Weakening of Rupiah exchange rate	8	1.67	9	1.54
Increasing labor wage	9	1.60	8	1.55
Availability stock of goods	10	1.10	10	1.09
Increased handling product cost	11	0.86	11	0.81
Increased credit interest rate	12	0.60	12	0.57
Presence of certain event	13	0.54	13	0.56
Increased promotion cost	14	0.20	14	0.32
Inflation	15	0.00	15	0.00

**Table A.5.**  
**Rank of Factors in Price Decrease**

The table shows the rank of factors on price increase in the survey. The rank is based on Thurstone Scaling Method that relies upon judgement of respondents to rate scale variables in terms of importance. Respondents were asked to ranked variables from 1 (the most important) to 15 (the least important). The score is obtained from the comparison between factors and represent psychological scale value between factors.

Factors	Before Pandemic		During Pandemic	
	Rank	Score	Rank	Score
Decreased raw-material's cost	1	29.74	1	28.75
Decreased competitor's price	2	8.75	2	8.47
Decreased market demand	3	7.85	3	7.67
Profit-earned Expectation	4	7.21	4	6.91
Availability stock of goods	5	4.73	5	4.84
Increased product supply	6	4.47	6	4.29
Decreased marketplace fee	7	1.85	7	2.03
Presence of certain event	8	1.67	9	1.54
Strengthening of Rupiah exchange rate	9	1.60	8	1.55
Decreasing Energy Cost	10	1.10	10	1.09
Decreased credit interest rate	11	0.86	11	0.81
Decreased handling product cost (delivery, and return policy)	12	0.60	12	0.57
Decreasing labor wage	13	0.54	13	0.56
Decreased production cost	14	0.20	14	0.32
Government interventions	-	-	15	0.00

**Table A.6.**  
**Relative Importance of Alternative Theories of Price Rigidities**

The table shows the relative importance of price rigidities theory in the survey before and during pandemic. The rank is based on Thurstone Scaling Method that relies upon judgement of respondents to rate scale variables in terms of importance. Respondents were asked to ranked variables from 1 (the most important) to 7 (the least important). The score is obtained from the comparison between factors and represents psychological scale value between factors.

Factors	Before Pandemic		During Pandemic	
	Rank	Score	Rank	Score
Implicit contracts	1	11.99	1	16.03
Coordination failure	2	6.62	2	6.92
Temporary shocks	3	6.22	3	6.85
Pricing points	4	6.19	5	5.29
Information costs	5	5.26	4	6.55
Change non price factors	6	1.52	6	2.50
Explicit contracts	7	0.54	7	0.57

**Table A.7.**  
**Estimation Result using Probit Model**

The table shows the estimation results of determinant factors in online markets. The dependent variable is dummy variable equal to one for firm selling in online markets. Explanatory variables are competition proxied by question in the survey that ask the number of competitors in the market, time dependent pricing is dummy variable equal to one for firms apply time dependent pricing, rule of thumb pricing is dummy variable equal to one for firms apply rule of thumb pricing, frequency of price changes is the number of days that firms change their prices in response to shock, and speed of price adjustment is dummy variable equal to one if the firms declare to change their prices in reaction to shock within less than 1 week.

Variables	Coefficient	<i>p</i> value
Competition	0.1418	0.0401
Time Dependent Pricing	-0.0647	0.8131
Rule of Thumb Pricing	-2.4503	0.0001
Frequency of Price Changes	0.0055	0.0959
Speed of Price Adjustment	-0.1775	0.5225
<i>R</i> -squared 0.565		
Number of observations: 297		