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Why so sluggish? Analyzing the determinants of price adjustments in the service sector using survey microdata

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**WHY SO SLUGGISH? ANALYZING
THE DETERMINANTS OF PRICE
ADJUSTMENTS IN THE SERVICE
SECTOR USING SURVEY MICRODATA**

**Angelo Polydoro
Vagner Ardeo**

DISCUSSION PAPER



WHY SO SLUGGISH? ANALYZING THE DETERMINANTS OF PRICE ADJUSTMENTS IN THE SERVICE SECTOR USING SURVEY MICRODATA¹

Angelo Polydoro²
Vagner Ardeo³

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DISCUSSION PAPER

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ABSTRACT

In this article, we study how the economic environment for firms in the service sector affects their price adjustments by using a novel dataset from the Services Survey of the Brazilian Institute of Economics from the Getulio Vargas Foundation (FGV). The set of variables from the survey includes the firms' assessments of business conditions, demand, revenue, employment and capacity utilization, as well as the factors that limit their business development, such as a lack of space, an underqualified workforce and financing costs, etc.

We show that prices in the service sector are more sluggish because the response of firms to changes in their environment is heavily asymmetric. For example, when they foresee worse demand conditions, they are 3% less likely to increase prices, 2% more likely to keep prices constant and 0.6% more likely to lower prices.

In addition to studying price setting determinants in the service sector, we show that behavior is consistent with both state and time-dependent price setting models. By estimating a state-dependent pricing model augmented by variables that indicate the last time a firm decided to raise prices, we find that these variables are significant and their marginal impact on price adjustment probability is positive.

Keywords: Price-setting; discrete choice models; business surveys.

SINOPSE

Nesse artigo estudamos como o ambiente econômico para as empresas do setor de serviços, afeta a decisão das mesmas em reajustar seus preços. Para tal, utilizamos uma base inédita da Sondagem de Serviços do Instituto Brasileiro de Economia da Fundação Getulio Vargas (FGV). O conjunto de variáveis que utilizamos dessa pesquisa inclui a avaliação das empresas sobre as condições do negócio – demanda, receitas, emprego e utilização da capacidade, bem como fatores que estão limitando o desenvolvimento desta, como falta de espaço, força de trabalho com baixa qualificação, custo de financiamento etc.

Mostramos nesse artigo que os preços no setor de serviços possuem comportamento mais inercial, pois a resposta das firmas às condições econômicas é altamente assimétrica. Por exemplo, quando as firmas acreditam que haverá uma piora nas condições de demanda elas se tornam 3% menos propensas a aumentar preços, 2% mais propensas a manter os preços constantes e 0,6% mais propensas a diminuir preços.

Além de estudar os determinantes dos reajustes de preço no setor de serviços, mostramos que esse comportamento é consistente tanto com os modelos de *price-setting* dependentes de variáveis de estado quanto em modelos dependentes do tempo. Ao estimar um modelo de reajuste de preço incluindo variáveis que indicam o tempo desde o último período que a firma decidiu aumentar preços, encontramos que essas variáveis são significativas e o impacto na probabilidade de reajuste de preço é positivo.

Palavras-Chave: modelos de escolha discreta; pesquisas de sondagem; Price-setting; inflação de serviços.

1 INTRODUCTION

The rise in service sector inflation was responsible for the increase in overall inflation from 2008 to 2015. Since mid-2008, the yearly consumer price inflation index (IPCA) was above the targets' upper limit of 6.5%, only falling below this level in December of 2016. On average, the service items represented the largest share of the IPCA between 2008 and 2016 (35%), hence, understanding the determinants of price adjustments in this sector is important to evaluating and forecasting the overall inflation dynamics.

This paper studies the determinants of firm's price setting decisions in the services sector by using a new data set from the monthly survey of Brazilian companies in the service sector by the Brazilian Institute of Economics of Getulio Vargas Foundation (IBRE/FGV). This data set contains high-frequency information on the firm's assessment of economic conditions, such as demand or business conditions, and on factors limiting business improvement (lack of qualified workforce, financial costs, etc.). In all other studies of the inflation in the service sector in Brazil the firm's conditions had to be approximated by aggregate variables such as unemployment or total inflation. More importantly, the IBRE dataset contains variables in which these aggregate approximation are not available such as the company's assessment on future conditions.

We show that prices are more sluggish¹ in this sector because firms' response to changes in the business conditions is heavily asymmetric. For example, when faced with worse perspectives for revenue in the next three months companies are more likely to not increase prices than to decrease or keep prices the same. Also, changes in the assessment of future conditions are more likely to be significant into explaining price adjustments and also have a stronger impact. Firms reporting lack of qualified workers or high financial costs are more likely to increase their prices. On the other hand, the assessment of current and future business conditions, present and future demand, prospective employment and revenue have are positively correlated with price adjustments. For example, at the sample average, when firms report worse future revenue conditions they are 17% less likely to increase prices, 11% more likely to keep prices the same or 6% to decrease it.

1. "Klenow (2010) find that at one extreme are goods that change prices at least once a month (fresh food, energy, airfares), and at the other extreme are services that change prices much less often than once a year". The same results from Gouvea (2007) were shown for Brazilian data.

In this article, we also study whether time-dependent or state-dependent models explain the price setting decisions reported by the firms. We find support for both models. The probability of a price increase drops at least -19% one month after the firm reported that would do so. Then, there is an increase in the probability of a price increase as the spell of the last price approaches twelve months.

We follow the methodology proposed by Lein (2009) when studying price adjustments in Swiss manufacturing companies. Lein (2009) suggests estimating a model using the survey panel data where the dependent variable is the price adjustment and the set of independent variables contains the answers by the firm to questions about costs, their assessment about demand among others questions. The author also proposed a test for time-dependent vs. state-dependent pricing by adding Taylor dummies, e.g. dummies that take the value of one if the last time that the firm reported a price adjustment was periods ago. We find qualitatively the same results. Firm heterogeneity is important to model the likelihood of price adjustments and a combination of state and price-dependent pricing best describes the data. Still, our work differs from Lein (2009) in the estimation technique used. We estimate an ordered logit model where Lein (2009) estimates three binary logit models (one for a price increase, one for price decrease and another for any price adjustment). The methodology proposed by Lein (2009) was applied to some other countries. For example, Sahinoz and Saracoglu (2011) estimate for Turkey, Bekovskis (2011) for Latvia and Dias (2014) for Portugal. Still, ours is the first article studying the service sector and from a country outside Europe.

The results in this article corroborates the observations made by Correa, Petrassi and Santos (2016). For the service sector the authors find that 41% of firms adjust their prices in fixed intervals, 22% in fixed intervals but sometimes in response to cost or demand change, 17% always change in response to cost or demand change and 3.5% always changed when competitors change their prices. In our study, we show that both state and time-dependent variables are significant, providing support for both theories. Still, we expand the work by Correa, Petrassi and Santos (2016) in two important ways. First, we can quantify the effect of each factor on the probability of price adjustments. The second improvement is that by working with a panel data set our results take into consideration changes in the economic environment faced by the firms. The survey by Correa et al (2016) corresponds to a single point of time.

Our study adds to the growing price setting literature for Brazil. The first empirical study was Gouvea (2007). In the paper, the author used the microdata from the CPI calculated by IBRE to investigate the patterns of price adjustments in Brazil. For the services sector, the author finds that prices remain unchanged for a longer period and price adjustments are strongly asymmetric and conclude that there is a clear downward rigidity in price setting for the service sector. The article by Barros et al. (2009) extends the pioneering work by Gouvea (2007) by investigating the impact of macroeconomic variables on price setting behavior. They find that price increases are less frequent after a period of exchange rate appreciation, more frequent in periods of high economic activity and when macroeconomic uncertainty is higher. We confirm the results by Gouvea (2007) that price adjustments in the service sector are asymmetric and less frequent. The paper by Guimaraes et al (2015) provides a test for state or price-dependent pricing using the fact that the duration of a price spell depends on realized inflation, but not on expected inflation before firms decide on prices. By studying the large devaluation of the Brazilian real occurred between July 2002 and July 2003 they find support for time-dependent pricing models. For a survey of the price setting literature see Klenow (2010).

The rest of the article is as follows. In the next section we discuss the macroeconomic environment during our sample, the survey and provide some descriptive statistics. In the third section we describe the model and in the fourth the estimation results. The last section concludes.

2 DATA AND METHODOLOGY

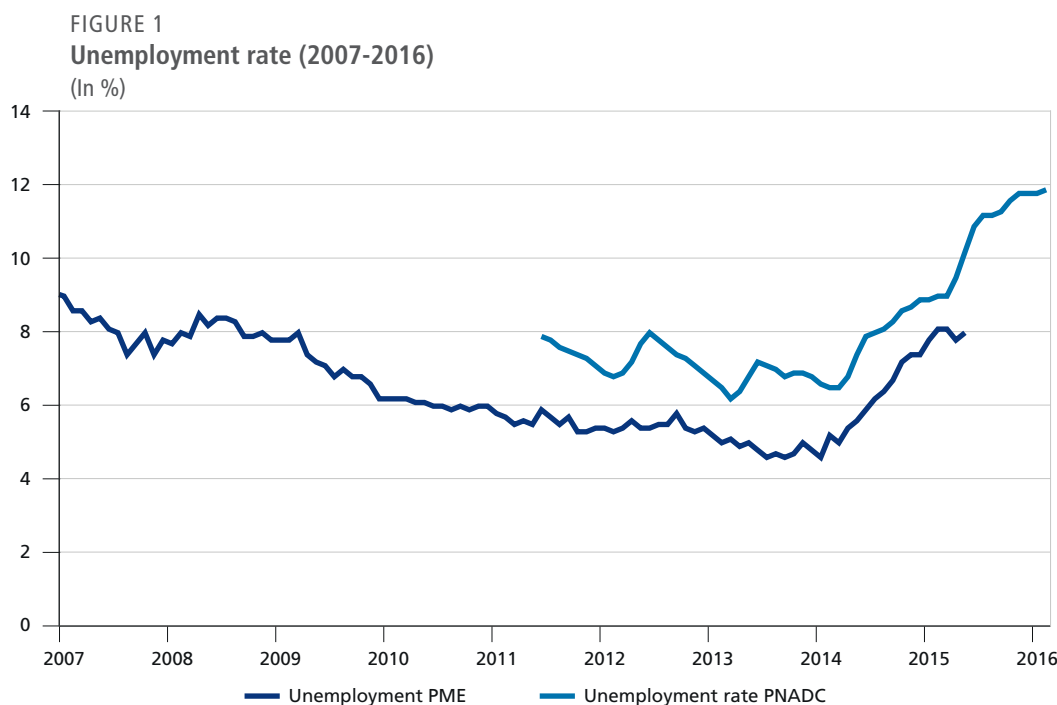
This section discusses the macroeconomic developments in Brazil during the period of 2007-2016 to give a brief overview on the environment of firms in the service sector. Then, we describe the survey data used in the empirical section, provide some descriptive statistics and present the econometric model.

2.1 Macroeconomic context

Our data set covers almost nine years from October 2007 to June 2016. According to Business Cycle Dating Committee of Getulio Vargas Foundation (CODACE), during this period, Brazil had two recessions. The first started in the fourth quarter of 2008 and ended in the first quarter of 2009. The V-shaped recovery of the economy started a new period of

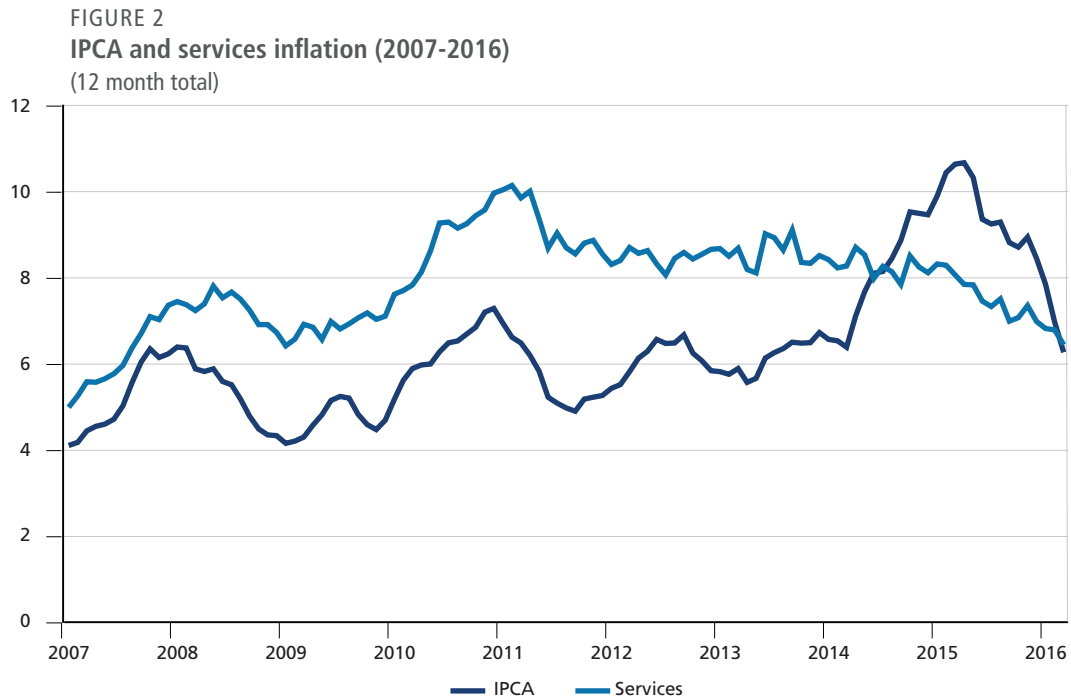
expansion that lasted until the first quarter of 2014. This expansion period lasted 20 quarters and had an average annualized growth of 4.2%. Since then, the economy entered a new period of recession that lasts until the end of the data used in this article. The occurrence of two recessions in our sample is important to provide enough variation in the answers by the firms and provide reliable estimates of the impact on their price setting behavior.

The behavior of the unemployment rate has two distinct periods. According to the unemployment measure by the survey PME, after a brief increase after the financial crisis, it resumed the downward trajectory until 2014 when it reached 4.6%. Then, impacted by the recession in Brazil the unemployment started growing again and reached 8% in the last point of the time series. With the discontinuation of the PME survey, the only official unemployment rate comes from the PNAD survey. This survey employs a different calculation methodology and the level of unemployment rate of PNAD is calculated as a three-month average. Also, since it only started in 2012, there is no official seasonally adjusted series. For the period where both series were available, the trend was the same. Both showed an increase in unemployment starting in 2014. Our sample ends in June of 2016 where the unemployment rate reached 11.3%, since then it kept growing and reached its highest level of 11.9% in November of 2016.



Elaboração dos autores.

The low unemployment rate and increased formalization in the job market contributed for the acceleration of services inflation. In figure 2 we show the 12-month total for the headline IPCA inflation and core of services inflation defined by BCB. The average weight of service items in the IPCA was 35% during the sample period. During most of the sample services inflation was above IPCA, e.g. from 2007 to early 2015. The peak of services inflation was 10.20% in November of 2011. Also, since 2008 the services inflation were always above the ceiling of the inflation target band. In 2015 this trend inverted and the IPCA was above services inflation due to the realignment of administered prices, i.e. electricity tariffs, gasoline, bus fares, large currency depreciation and the decrease in services inflation caused by the increase in unemployment and sluggish activity. The important feature of this time series for our estimation is that we observe during our sample the acceleration and deceleration in services inflation.



2.2 Description of the survey

This subsection describes the survey's questionnaire and data collection procedures. The dataset used in this paper consists of a large panel of approximately 2000 Brazilian firms in the service sector conducted on a monthly basis by the Brazilian Institute of

Economics from the Getulio Vargas Foundation. The objective of the survey is to construct business tendency indicators. Data is available from October 2007 to June 2016, a period of sharp acceleration of inflation in the service sector. The survey's coverage follows the Annual Service Inquiry (PAS) from IBGE, covering all service sub-sectors excluding government related activities, health, education, the financial sector and commerce. The industries in the service sector are defined using the CNAE 1.0 classification.² Using the CNAE code, the survey identifies 88 industries within the Brazilian service sector. The respondents are selected from a pool of firms that share the same characteristics such as a measure of size calculated from their revenue and CNAE. If a firm ceases operation or the collection team is not able to get the response for the questionnaire for some months they are substituted from the same preselected pool. From the 107 time periods available, firms stay on the survey on average for 44 months. That is, on average, 3% of the firms exit the sample every month. With this replacement procedure, they can keep the overall number and composition of firms constant. In the sample used in this paper there are 4359 firms. Each firm has a unique identification code. Hence, if a firm drops out of the sample its identification number is not used afterward. Also, if a firm provides more than one service it fills more than one questionnaire. The number of firms that fill more than one questionnaire compromises a small part of our sample, 13%. The data set characteristics identify an unbalanced panel.

There are two type of questions in the questionnaire depending on the time-frame. They can be coincident, e.g. asking for the economic environment in the current month or forward-looking, asking for the expectation about these variables for the next three months. We show below the translated questions and response categories for each of the six blocks. All these questions have been in the survey since its beginning.

- *Business Conditions*: Q1. How do you evaluate the business conditions for this time of the year? (*Good/Normal/Weak*). Q2. Discounting seasonal factors, how you think will be the business conditions in the next six months? (*Better/Equal/Worse*).
- *Demand*: Q1. How do you evaluate the total demand for your services for this time of the year? (*Good/Normal/Weak*); Q2. Discounting the seasonal factors,

2. The CNAE corresponds to the NAICS (North American Industry Classification) in the US.

how was the demand for your services in the last three months? (*Increased/Same/Decreased*); Q3. Discounting the seasonal factors, how will the demand for your services be in the next three months? (*Will improve/Remain the same/Will decrease*).

- *Revenue*: Q1. Discounting the seasonal factors, how was the revenue for this service in the last three months? (*Increased/Same/ Decreased*); Q2. Discounting the seasonal factors, how will be the revenue for this services in the next three months? (*Will Improve/Remain the Same/Will decrease*).
- *Prices*: Q1. Discounting the seasonal factors, how will be the price in the next three months? (*Increase/Same/Decrease*);
- *Workforce*: Q1. Discounting the seasonal factors, how was the change in the number of employees in the last three months? (*Increased/Same/Decreased*); Q2. Discounting the seasonal factors, how will be the number of employees in the next three months? (*Increase/Same/Decrease*).
- *Factors Limiting Business Improvement*: Option 1: No limitation; Option 2: Insufficient Demand; Option 3: Lack of space available or equipment; Option 4: Lack of qualified workforce; Option 5: Financial costs (ex: interest rate); Option 6: Financial problems (ex: insolvency); Option 7: Competition the sector; Option 8: Others, please specify.
- *Credit*: How do you evaluate the access to credit by your company at this time? (*Easy/Normal/Hard*).

Starting in June of 2011, IBRE added three questions about the level of capacity utilization. The questions and the options for the responses are: Q1. If there is an unexpected increase in demand, would you be able to increase the quantity offered by your company? (*Yes/No/I don't know*) Q2. In the case of a positive answer, what is the maximum increase in the quantity that would you be able to handle? *Quantitative answer*; Q3. How do you assess the production capacity when compared to the actual demand? (*More than enough/Enough/Insufficient*).

In our sample we have 13 questions total. For each of those questions, except on the limiting factors, the company may pick only one option or not answer the question. For the limiting factors, the companies may pick more than one option. In fact, in our sample 86% picked one option, 9% picked two options, 4% three options and 1% four factors.

2.3 Descriptive statistics and data illustration

Table 1 shows summary statistics for the variables in the data set. The table shows the summary statistics of the variables for the period between 2008 to 2016. The sample observations, mean, median and standard deviation are reported in the second to the fifth column. The missing values are excluded from the calculation. Note that for the qualitative questions; lower values are more favorable, e.g. Increased/Stronger/Will increase. On the other hand, higher values mean less favorable answers Decreased/Weaker/Will decrease. For the question in capacity utilization – increase in supply we dropped the variables with answers meaning that they do not know whether can meet the demand.

TABLE 1
Summary statistics

Variable	Obs.	Mean	Median	
Prices	191387	2.1	2	.46
Limiting Factors - None	201209	.17	0	.37
Limiting Factors - Insufficient Demand	201209	.24	0	.43
Limiting Factors - Lack of Space or Equip	201209	.07	0	.26
Limiting Factors - Lack of Qualified Workforce	201209	.26	0	.44
Limiting Factors - Financial costs (ex: interest rate)	201209	.17	0	.38
Limiting Factors - Financial problems (ex: insolvency)	201209	.066	0	.25
Limiting Factors - Competition the sector	201209	.35	0	.48
Limiting Factors - Others, please specify	201209	.16	0	.37
Business Conditions - Present	191283	2.0	2	.71
Business Conditions - Next 6 months	190673	1.7	2	.63
Demand - Past 3 months	190108	2.1	2	.65
Demand - Current	188601	1.9	2	.72
Demand - Next 3 months	189098	1.7	2	.65
Revenue - Previous 3 months	188952	1.9	2	.72
Revenue - Next 3 months	190047	1.7	2	.66
Employment - Previous 3 months	200163	2.0	2	.62
Employment - Next 3 months	199427	1.9	2	.55
Credit	185775	2.0	2	.61
Capacity Utilization - Increase in supply	72629	1.2	1	.43
Capacity Utilization - % increase	53057	31	25	31
Capacity Utilization - Ability to meet current demand	64506	1.9	2	.54
Firm Size	201209	2.2	2	.83

Elaboração dos autores.

We code the answer for the question on price variable so that it takes three values ordered from 1 to 3. The value equal to 1 means that the firm plans to lower the price, the value equals to 2 if it plans to keep the price constant and 3 if plans to increase the price. The median value in our data set is 2, e.g. at least half of the firms plan to keep

the price constant in the next three months. On the other hand, the average value is 2.1. Firms on average plan to increase their prices at some point.

The descriptive table also offers insight on which limiting factors are more important. In our sample, 35% of firms reported competition in the sector as a barrier to increasing sales. Almost tied in second place comes lack of qualified workforce with 26% and insufficient demand with 24% of firms indicating them as a hurdle in their business. The factors with the lowest share of firms reporting them as limiting their businesses were: lack of space or equipment and financial problems (ex: insolvency).

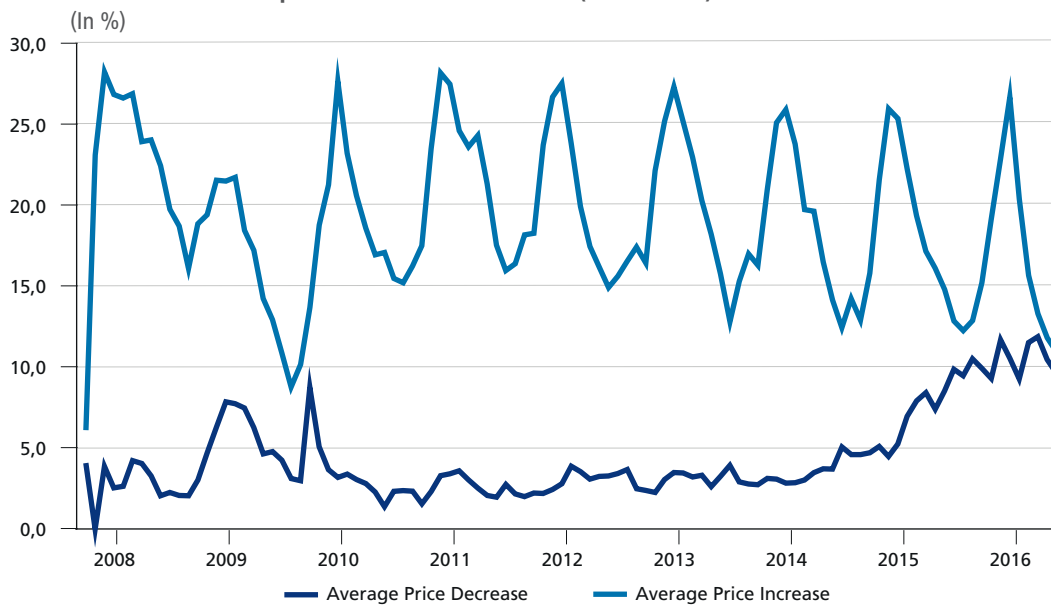
For all the other qualitative questions, lower values mean that firms are more optimistic and higher values that they are more pessimistic. The sample average of business conditions, demand and revenue suggest that firms are on average optimistic about future developments of their business. For example, on average, firms view their demand for the next three months at 1.7 compared to 1.9 for current demand and 2.1 for demand in the past three months.

For employment firms are also more optimistic about the future. The average answer for employment in the next three months is 1.9 and for the previous three months 2. Also, firms do not report on average problems to access credit. They report that they view the conditions to obtain credit as normal.

Since IBRE introduced the set of questions about capacity utilization in June of 2011, we have less than 40% of observations for this block. On average firms report that it is more likely that they would not be able to meet a surge in demand (1.2). Still, for firms that do report that would be able to increase their supply, on average they can meet 31% additional demand and at the median 25%. Also, firms view their ability to meet the current demand as slightly more than sufficient (1.9).

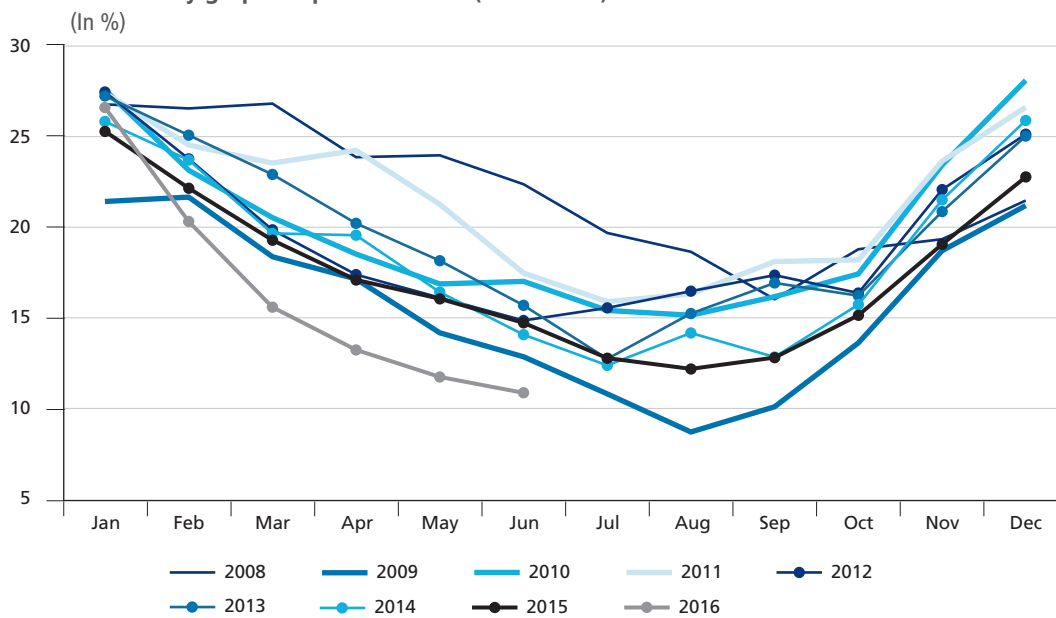
Firm size in our sample is slightly skewed to smaller firms as the average firm size is 2.2 and the median 2. Large firms have value 1 for this answer while small firms value 3.

FIGURE 3
Price increase and price decrease time-series (2008-2016)



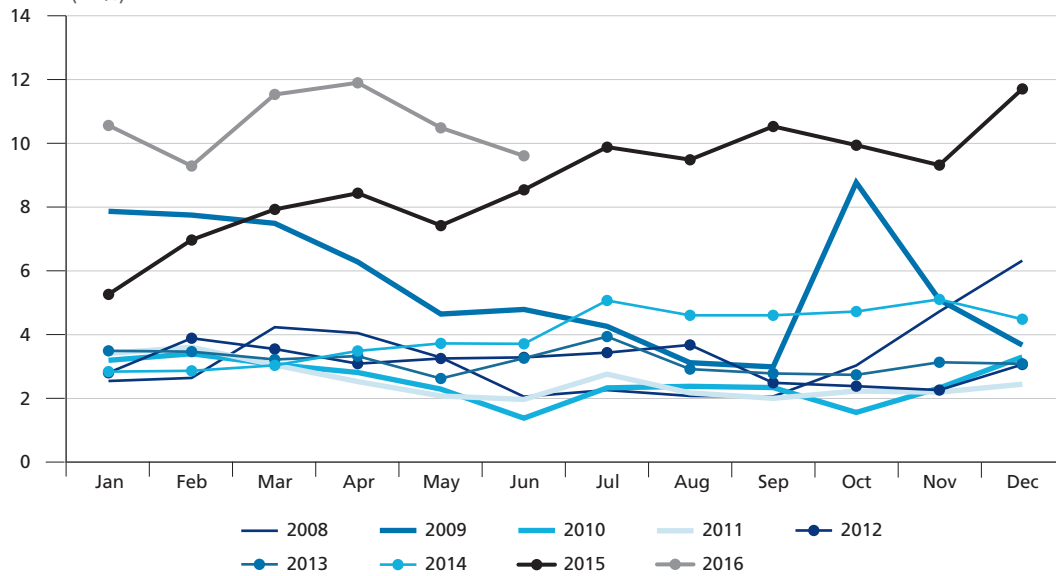
Elaboração dos autores.

FIGURE 4
Seasonality graph on price increase (2008-2016)



Elaboração dos autores.

FIGURE 5
Seasonality graph on price decrease (2008-2016)
(ln %)



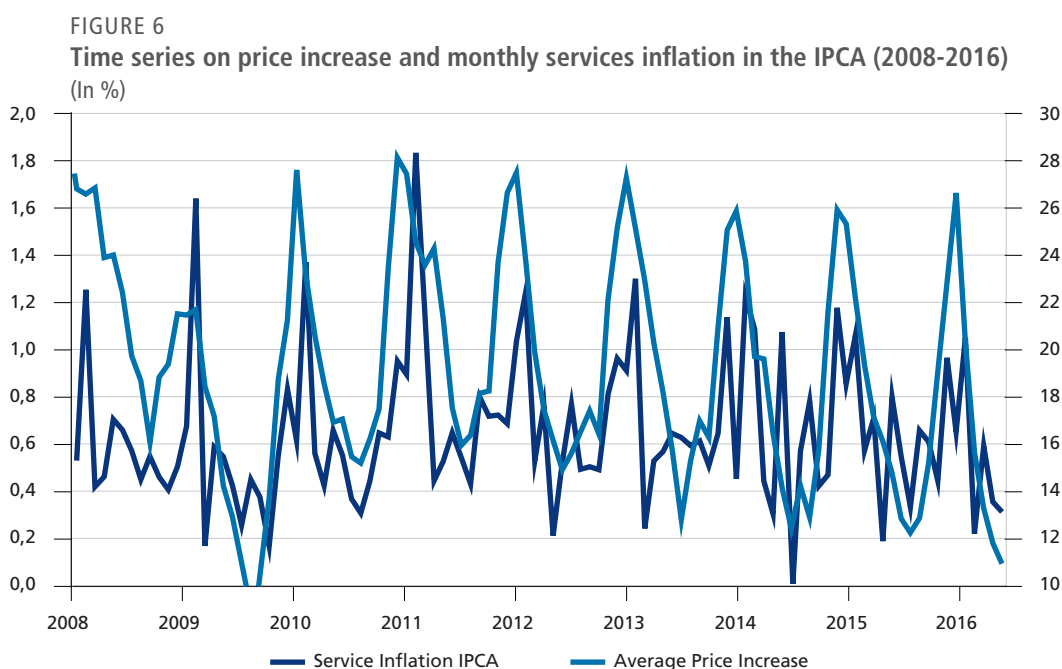
Elaboração dos autores.

Figure 3 illustrates the time-series of the average frequency of price changes. We represent the average price increase in the blue line and the average price decrease in the red line. The average price increase show strong seasonal behavior, which is presented in details in the next figures. For the average price decrease, we saw a large increase in the share of firms reporting that would lower the prices in 2009. Also, since 2015 we saw a steady increase in the share of firms that plans to lower their prices.

In figures 3 and 4, we show the seasonality graph for the share of firms reporting price increase and price decrease respectively. It is clear from figure 4 that there is a strong seasonal component to price increases. We see a large number of firms reporting that would like to increase their prices at the beginning and at the end of the year. Also, in 2015 the average number of firms reporting price increases was lower for each month, but not at the level seen in 2009. On the other hand, in 2016 since February we have seen the lowest average number of firms reporting that they would like to raise their prices of the whole series. In figure 5 we show the seasonality graph for the average price decrease. Unlike the average price increase, there is no strong seasonal pattern for price decreases. The average number of firms stating that would lower their prices is roughly the same each month. Still, since 2015 we have seen a large share of firms reporting that would

decrease their prices. The values observed for 2016 are the highest for the time series from January to June. Price increases are very seasonal, but prices decreases do not display such a strong seasonal pattern. These findings are in line with data from the US and Swiss (Kobel, Nakamura and Steinsson, 2008).

There is a .50 correlation between the monthly services CPI and the average price increase. Meanwhile, the correlation between the frequency of price decreases and the CPI is only -0.08. In figure 6 we show the time series for the frequency of price increase and services CPI.



2.4 Discussion of the data

The main limitation of our data set, as for every qualitative data, is that we do not observe how much firms adjusted their prices, only that they are planning to do so. Therefore we cannot evaluate the contribution of the frequency of price adjustment to aggregate inflation movements or the degree of pass-through of costs into prices quantitatively. Nevertheless, we can estimate how the firm reacts to changes in their environment.

In our data set, we only observe the extensive margin of price adjustments. That is, we can infer the number of firms that plan to change their prices, either increase or decrease, but not by how much they did it. This characteristic of the service sector survey does not pose a problem for the objectives of this paper. Our first task is to assess how deviations from the desired level of some variables such as demand, labor quality or financial constraints impact the firms' decision to change prices. The second objective is to test for time-dependent or state-dependent pricing.

When testing for state-dependent pricing the extensive margin is relevant (Lein, 2009). If the probability associated with state variables is significant there is evidence of state-dependent pricing. On the other hand, if only the passage of time is relevant, firms do not decide on the timing of their adjustments only on the size. Hence, the extensive margin provides enough information to test for both models.

The second shortcoming from our data is that firms respond on a voluntary basis. The team at IBRE is instructed to contact the respondents to guarantee that they answer the questionnaire. Still, after a couple of months of no response, they drop the respondent from the data set and recruit a new one from a list of firms sharing the same characteristics (size and CNAE code). We cannot be sure whether the firm that exits the survey was due to closing, which would constitute a sample selection bias or other idiosyncratic reason.

3 MODEL AND ESTIMATION PROCEDURE

In this section we describe a simple state-dependent price setting model that is suitable for estimation in our data set. For the estimation, we take full advantage of our data set and estimate a random-effects ordered logit model.

We suppose each firm sets its price in each period to maximize profits subject to a menu cost of repricing such as in (Golosov and Lucas, 2007; or Bonomo *et al.*, 2011). The economic environment at time t for firm i is given by \mathbf{z}_{it} . Let d_{it} denote the firm's decision at time t . They can either lower the price, keep it constant or increase it. Under the assumption that state variables enter linearly the optimal price decision of firm i and errors are distributed according to the extreme value distribution, the decision problem leads to an ordered logit model in which:

$$\text{Prob}[y_{it} = j | z_{it}] = \Phi(\beta_j' z_{it} + u_i + \varepsilon_{it} < \mu_j) - \Phi(\beta_j' z_{it} + u_i + \varepsilon_{it} < \mu_{j-1}) \quad (1)$$

The thresholds values for each decision are such that:

$$y_{it}^* = z_{it}'\beta + v_i + \varepsilon_{it} \quad (2)$$

and

$$y_{it} = \begin{cases} -1, & \text{if } y_{it}^* \leq \mu_1 \\ 0, & \text{if } \mu_1 \geq y_{it}^* \leq \mu_2 \\ 1, & \text{if } \mu_2 \geq y_{it}^* \leq \mu_3 \end{cases}$$

This model is identified if the individual specific random effects are unrelated to the state variables . That is, the conditional distribution does not depend on . For our data, we do not believe that differences across firms have an influence on the likelihood of increasing their prices. As we showed in the previous section, the decision of raising or lowering the prices depends on the conditions that the firm faces. These conditions are embodied in the other answers.

The errors are distributed logistic and are independent across firms and identically distributed. By estimating the random-effects model, we avoid the incidental parameters problem (Greene Hensher 2009). That is, the usual fixed-effect estimator relies on the number of observations increasing in the group . But, in our setting, not only is fixed, but small given that our data set covers a few years and the panel is unbalanced. The incidental parameters problem makes the estimator inconsistent with a bias that can be rather large (Hsiao 2003).

4 RESULTS

In this section, we present the results for the estimation of the ordered logit model described in the last section. In table 3 we show the estimation results for seven types of models where we include sequentially a set of variables related to the same topic. For example, the difference between models 2 and 3 is the inclusion of three variables with answers about demand conditions. For each model the base case is when the reported

variable takes value 1, e.g. the firm provides an affirmative answer to the question. The answers with value 1 are *Good / Better / Strong / Increased / Will Increase / Easy*. As we move along the scale, the answer for the question becomes neutral (*Normal / Equal / Same / Remain the Same*) or worse (*Weak / Worse / Decreased / Will Decrease*). All estimations in table 3 also control for seasonal effects and firm size.

In table 2 we show the marginal effect at the sample average for each model. Each value in the table corresponds to the difference in the predicted probability of a price change with respect to the base case in percentage points when the dummy variable changes from 0 to 1.

In the simplest model where we only include the limiting factors, only two of them are not significant. These are the financial costs and competition in the sector. As we increase the model complexity the items *Insufficient Demand*, *Lack of Space or Equipment* and *Financial Problems* turn out not to be significant. Still, two other factors remain relevant to explain the pricing decision by firms: *Lack of Qualified Workers* and *Financial Costs*. Also, for the most complete models 5 and 7 when a firm reports having some other limiting factor it has a significant effect on pricing decision.

For the business conditions, the answer for the question about the next six months is significant for all models, but not the question about current conditions. The business conditions are significant only when the firm assessment is that it became worse in seasonal adjusted terms. For demand conditions the opposite holds, e.g. current demand conditions are relevant but not how the firm evaluates the demand for the next 3 months. The only case where the firms' evaluation for the demand in the next three months is relevant is when they forecast that it would become worse. For both employment and revenue, the evaluation of conditions for the next three months is relevant but for the previous three months it is not. We also estimate the full model for the case where we have data from the answers for questions about capacity utilization. In these models, the quantitative answer on how much the firm can increase their supply is not significant, but their qualitative answer on whether it can meet the demand or not is.

One feature of ordinal logit models is that we cannot infer the signal of the impact of an independent variable from the coefficient estimates (Greene 1999). Hence to assess the signal and size of the marginal impact of each variable in the probability of changing the prices we have to use the coefficients and pick a point for the independent

variables. In table 2 we show the marginal impact of changing each independent variable on the probability of price adjustments at the sample average. For each variable we have the impact on lowering the price, keeping it constant or increasing the price. The base case is again when we set the qualitative answers are more favorable. The significance of each variable is also reported in the table.

For the limiting factors, when a firm reports financial costs as an item that prevents the improvement of the company, it increases the probability of raising prices and decreases the likelihood of both lowering and keeping the price fixed. This result suggests that firms use a cost-plus pricing methodology, e.g. when faced with higher costs, in this case, financial costs they likely raise their prices. Also, lack of qualified workers is positively correlated with price adjustments. As the labor market becomes more tight not only wages increase but it may take more time to find a worker to fill an open position. The impact of the labor market restrictions is making increase in prices more likely.

How firms see the business conditions in the next six months also have positive correlation with price adjustments. When firms believe the market conditions for the next six months will be better or remain the same, the probability of increasing prices is lower, and the likelihood of keeping or lowering the price becomes bigger. The evaluation of current demand has the same effect on the price adjustment prospects. Still, the estimated impact is larger than of the business conditions. The firm's assessment of demand conditions for the next three months is relevant only when it reports that will become worse.

The only variable in which past conditions have a significant impact on price adjustment is *Revenue*. When firms report that past revenue was worse than the average, discounting seasonal effects, the probability of increasing prices was smaller. Still, the assessment for revenue in the next 3 months is positively correlated with the likelihood of price adjustments and the effect is large. As firms expect worse revenue for the next 3 months the probability of increasing prices drops by 17 p.p.

As suggested by the marginal impact from lack of qualified workforce as a limiting factor, employment assessment for the next three months is also positively correlated with the likelihood of price adjustments. When a firm reports that would decrease employment in the next three months the probability of increasing prices decreases by 5.7 p.p. in the full model (5).

In the model with capacity utilization the ability to meet current demand is also positively correlated with price adjustments, but the effect is small. When firms report that they do not have sufficient capacity to meet current demand the probability of a price increase is smaller.

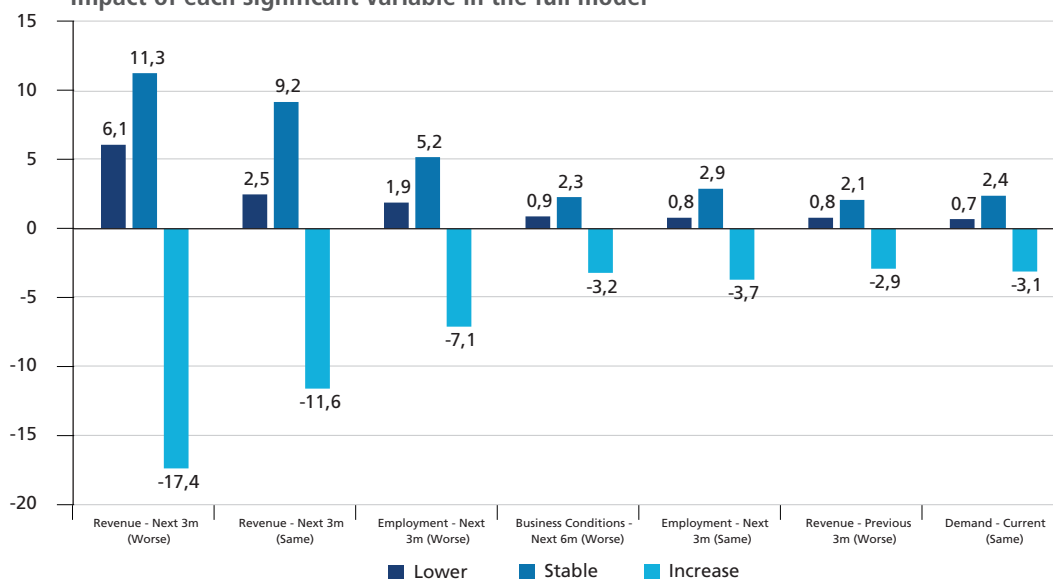
The results for the complete model without capacity utilization variable suggest that firms are more forward looking. Their answers about future conditions are both more likely to be significant into explaining price adjustments and also have a stronger impact.

In figure 7 we show the impact of each variable that is significant in the full model by magnitude. This chart suggests an answer to the question that we proposed in the title of the article. The service sector prices are more sluggish than in other sectors because firms response are heavily asymmetric. When faced with worse perspectives for revenue in the next three months companies are more likely not to increase prices than to decrease or keep them constant. The same holds for employment, business conditions, revenue and demand - the variable with the biggest impact on price adjustment probabilities.

We also estimate two versions of the model where the dependent variable is an indicator variable for price increase and another for price decrease. These models are suitable for estimation using a standard conditional logit, where we control for fixed effects. In the Appendix 1 we show the coefficients and marginal impact at the sample average for both models. The estimated marginal impact at the sample average for price increases in the ordinal logit and on the conditional logit with fixed effects have the same sign. Still, for the variables that are significant the marginal impact on the conditional logit is generally larger than in the ordered logit, but the difference is on average 1 p.p. For the price decrease model we observe the same pattern. The marginal impacts are usually larger in the conditional logit model, but only a few variables are significant.

The results from the ordered logit and the conditional logit models suggests that effects that are fixed during our sample play no role in determining the likelihood of price adjustments. For the price decrease model the fact that the dependent variable vary greatly across individuals, but have little variation over time for each individual makes the fixed effect estimates to have large standard error. This makes the coefficients to be rarely significant, as we found in our case. Estimating the ordered logit model have the advantage of correctly taking into account the firms' decision of not adjusting their prices.

FIGURE 7
Impact of each significant variable in the full model



Elaboração dos autores.

TABLE 2
Ordered logit - marginal impact at sample average

Variable		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Limiting Factors - None	Lower	-0.3**	-0.1	-0.1	-0.1	0	0.2	0.1
	Stable	-0.7**	-0.2	-0.2	-0.2	-0.1	0.3	0.2
	Increase	1**	0.3	0.3	0.2	0.2	-0.5	-0.3
Limiting Factors - Insufficient Demand	Lower	1.7***	0.5***	0.2**	0.2*	0.1	0.1	0.2
	Stable	4.3***	1.4***	0.7**	0.5*	0.3	0.1	0.3
	Increase	-6***	-1.9***	-0.9**	-0.7*	-0.4	-0.2	-0.5
Limiting Factors - Lack of Space or Equipment	Lower	-0.7***	-0.3**	-0.2*	-0.2*	-0.2	-0.7	-0.4
	Stable	-1.6***	-0.9**	-0.6*	-0.6*	-0.5	-1.1	-0.6
	Increase	2.3***	1.2**	0.9*	0.8*	0.6	1.7	1.1
Limiting Factors - Lack of Qualified Workers	Lower	-0.9***	-0.5***	-0.4***	-0.4***	-0.3***	-0.4*	-0.4*
	Stable	-2.2***	-1.4***	-1.2***	-1.1***	-0.9***	-0.7*	-0.7*
	Increase	3***	1.9***	1.6***	1.4***	1.2***	1.1*	1.1*
Limiting Factors - Financial Costs	Lower	-0.1	-0.4***	-0.4***	-0.4***	-0.4***	-0.8***	-0.9***
	Stable	-0.3	-1***	-1.1***	-1.2***	-1.2***	-1.3***	-1.4***
	Increase	0.4	1.4***	1.5***	1.6***	1.6***	2.1***	2.3***
Limiting Factors - Financial Problems	Lower	0.9***	0.2	0.1	0	-0.1	0.2	0.2
	Stable	2.3***	0.6	0.2	0	-0.2	0.4	0.2
	Increase	-3.2***	-0.9	-0.3	0	0.3	-0.6	-0.4

(Continues)

(Continued)

Variable		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Limiting Factors - Competition in the Sector	Lower	0.1	0.1	0.1	0.1	0.1	0	-0.2
	Stable	0.3	0.3	0.3	0.3	0.3	-0.1	-0.3
	Increase	-0.5	-0.3	-0.4	-0.5	-0.4	0.1	0.4
Limiting Factors - Others	Lower	0.9***	0	-0.1	-0.2*	-0.2**	-0.3	-0.4*
	Stable	2.2***	0.1	-0.4	-0.5*	-0.6**	-0.5	-0.7*
	Increase	-3.1***	-0.2	0.5	0.7*	0.8**	0.9	1.1*
Business Conditions - Present (Same)	Lower		0.8***	0.2***	0.1*	0.1	0.2	0.3
	Stable		2.7***	0.7***	0.4*	0.2	0.3	0.5
	Increase		-3.5***	-1***	-0.5*	-0.3	-0.5	-0.8
Business Conditions - Present (Worse)	Lower		2.2***	1***	0.6***	0.4***	0.5	0.5
	Stable		5.6***	2.6***	1.7***	1.2***	0.7	0.7
	Increase		-7.8***	-3.5***	-2.3***	-1.7***	-1.2	-1.2
Business Conditions - Next 6m (Same)	Lower		2***	0.8***	0.3***	0.2***	0.4**	0.5**
	Stable		6.6***	2.5***	0.9***	0.6***	0.7**	0.7**
	Increase		-8.6***	-3.3***	-1.2***	-0.8***	-1.1**	-1.2**
Business Conditions - Next 6m (Worse)	Lower		7.2***	2.4***	1.1***	0.9***	0.6**	0.6*
	Stable		9.4***	5.2***	2.8***	2.3***	1**	0.9*
	Increase		-16.6***	-7.6***	-4***	-3.2***	-1.6**	-1.6*
Demand - Current (Same)	Lower			0.9***	0.7***	0.7***	1.5***	1.6***
	Stable			2.9***	2.6***	2.4***	2.4***	2.5***
	Increase			-3.8***	-3.3***	-3.1***	-3.9***	-4.1***
Demand - Current (Worse)	Lower			0.9***	0.7***	0.6***	2***	2.1***
	Stable			3.2***	2.4***	2.2***	3.2***	3.2***
	Increase			-4.1***	-3.1***	-2.8***	-5.2***	-5.3***
Demand - Previous 3m (Same)	Lower			0.2***	0	0	0	0.1
	Stable			0.6***	0.1	0	0	0.1
	Increase			-0.7***	-0.2	0	0	-0.2
Demand - Previous 3m (Worse)	Lower			0.9***	0.3***	0.3**	-0.1	0
	Stable			2.4***	1***	0.8**	-0.1	0
	Increase			-3.4***	-1.3***	-1**	0.2	0
Demand - Next 3m (Same)	Lower			1.7***	0	-0.1	-0.1	-0.1
	Stable			6***	0	-0.3	-0.1	-0.2
	Increase			-7.7***	0	0.4	0.2	0.3
Demand - Next 3m (Worse)	Lower			5.7***	0.9***	0.7***	1.2***	1.2***
	Stable			9.1***	2.3***	1.8***	1.8***	1.8***
	Increase			-14.8***	-3.3***	-2.5***	-3***	-3***
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations								

Elaboração dos autores.

TABLE 3
Ordered logit - marginal impact at sample average (continuation)

Variable		(1)	(2)	(3)	(4)	(5)	(6)	
Employment - Previous 3m (Same)	Lower					0.2**	-0.3	-0.5
	Stable					0.5**	-0.4	-0.7
	Increase					-0.7**	0.7	1.1
Employment - Previous 3m (Worse)	Lower					0.2**	0.2	0
	Stable					0.8**	0.3	0
	Increase					-1**	-0.4	0
Employment - Next 3m (Same)	Lower					0.8***	1.3***	1.5***
	Stable					2.9***	2***	2.3***
	Increase					-3.7***	-3.3***	-3.8***
Employment - Next 3m (Worse)	Lower					1.9***	2.3***	2.3***
	Stable					5.2***	3.5***	3.4***
	Increase					-7.1***	-5.8***	-5.7***
Capacity Utilization	Lower						0	0
	Stable						0	0
	Increase						0	0
Capacity Utilization - Ability to meet current demand (Sufficient)	Lower						0	-0.1
	Stable						0	-0.1
	Increase						-0.1	0.2
Capacity Utilization - Ability to meet current demand (Insufficient)	Lower						0.9**	0.8*
	Stable						1.5**	1.2*
	Increase						-2.4**	-1.9*
Credit Conditions (Same)	Lower							0.2
	Stable							0.4
	Increase							-0.6
Credit Conditions (Worse)	Lower							0.3
	Stable							0.5
	Increase							-0.8
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations								

Elaboração dos autores.

TABLE 4
Ordered logit
(Coefficients estimates)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
Limiting Factors - None	0.08** (0.03)	0.03 (0.03)	0.03 (0.03)	0.02 (0.03)	0.02 (0.03)	-0.04 (0.07)	-0.02 (0.07)
Limiting Factors - Insufficient Demand	-0.45*** (0.03)	-0.15*** (0.03)	-0.07** (0.03)	-0.05* (0.03)	-0.04 (0.03)	-0.01 (0.05)	-0.04 (0.05)
Limiting Factors - Lack of Space or Equipment	0.17*** (0.04)	0.09** (0.04)	0.07 (0.04)	0.07 (0.04)	0.05 (0.04)	0.15 (0.1)	0.09 (0.1)
Limiting Factors - Lack of Qualified Workers	0.23*** (0.03)	0.15*** (0.03)	0.13*** (0.03)	0.12*** (0.03)	0.09*** (0.03)	0.1* (0.05)	0.1* (0.06)
Limiting Factors - Financial Costs	0.03 (0.03)	0.11*** (0.03)	0.12*** (0.03)	0.13*** (0.03)	0.13*** (0.03)	0.19*** (0.05)	0.2*** (0.06)
Limiting Factors - Financial Problems	-0.24*** (0.04)	-0.07* (0.04)	-0.03 (0.04)	0 (0.04)	0.02 (0.04)	-0.05 (0.07)	-0.03 (0.08)
Limiting Factors - Competition in the Sector	-0.03 (0.03)	-0.02 (0.02)	-0.03 (0.03)	-0.03 (0.03)	-0.03 (0.03)	0.02 (0.05)	0.04 (0.05)
Limiting Factors - Others	-0.23*** (0.03)	-0.01 (0.03)	0.04 (0.03)	0.06* (0.03)	0.06** (0.03)	0.08 (0.05)	0.1* (0.06)
Business Conditions - Present (Same)		-0.25*** (0.02)	-0.07*** (0.02)	-0.04* (0.02)	-0.02 (0.02)	-0.04 (0.05)	-0.07 (0.06)
Business Conditions - Present (Worse)		-0.62*** (0.03)	-0.28*** (0.04)	-0.19*** (0.04)	-0.14*** (0.04)	-0.1 (0.07)	-0.11 (0.07)
Business Conditions - Next 6m (Same)		-0.62*** (0.02)	-0.25*** (0.02)	-0.09*** (0.02)	-0.06*** (0.02)	-0.09** (0.05)	-0.1** (0.05)
Business Conditions - Next 6m (Worse)		-1.51*** (0.06)	-0.64*** (0.05)	-0.33*** (0.05)	-0.27*** (0.05)	-0.14** (0.07)	-0.14* (0.08)
Demand - Current (Same)			-0.28*** (0.03)	-0.25*** (0.03)	-0.24*** (0.03)	-0.35*** (0.07)	-0.36*** (0.07)
Demand - Current (Worse)			-0.31*** (0.04)	-0.24*** (0.04)	-0.22*** (0.04)	-0.46*** (0.08)	-0.46*** (0.09)
Demand - Previous 3m (Same)			-0.06*** (0.02)	-0.01 (0.02)	0 (0.02)	0 (0.05)	-0.01 (0.06)
Demand - Previous 3m (Worse)			-0.27*** (0.03)	-0.11*** (0.03)	-0.08** (0.03)	0.02 (0.06)	0 (0.07)
Demand - Next 3m (Same)			-0.57*** (0.02)	0 (0.03)	0.03 (0.03)	0.02 (0.06)	0.03 (0.06)
Demand - Next 3m (Worse)			-1.33*** (0.06)	-0.27*** (0.06)	-0.21*** (0.06)	-0.26*** (0.09)	-0.26*** (0.1)
Revenue - Previous 3m (Same)				-0.05** (0.02)	-0.03 (0.02)	-0.01 (0.06)	-0.02 (0.06)
Revenue - Previous 3m (Worse)				-0.28*** (0.04)	-0.24*** (0.04)	-0.16** (0.07)	-0.16** (0.07)

(Continues)

(Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
Revenue - Next 3m (Same)				-0.93*** (0.03)	-0.87*** (0.03)	-0.88*** (0.06)	-0.88*** (0.06)
Revenue - Next 3m (Worse)				-1.66*** (0.06)	-1.55*** (0.06)	-1.47*** (0.1)	-1.55*** (0.1)
Employment - Previous 3m (Same)					-0.05** (0.02)	0.06 (0.06)	0.1 (0.06)
Employment - Previous 3m (Worse)					-0.08** (0.03)	-0.04 (0.07)	0 (0.07)
Employment - Next 3m (Same)					-0.28*** (0.02)	-0.29*** (0.06)	-0.33*** (0.06)
Employment - Next 3m (Worse)					-0.58*** (0.05)	-0.5*** (0.09)	-0.5*** (0.09)
Capacity Utilization						0 (0)	0 (0)
Capacity Utilization - Ability to meet current demand (Sufficient)						0 (0.05)	0.02 (0.05)
Capacity Utilization - Ability to meet current demand (Insufficient)						-0.21** (0.08)	-0.17* (0.09)
Credit Conditions (Same)							-0.05 (0.05)
Credit Conditions (Worse)							-0.07 (0.08)
Time dummies							
Firm Size							
Observations							

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
Revenue - Previous 3m (Same)				-0.05** (0.02)	-0.03 (0.02)	-0.01 (0.06)	-0.02 (0.06)
Revenue - Previous 3m (Worse)				-0.28*** (0.04)	-0.24*** (0.04)	-0.16** (0.07)	-0.16** (0.07)
Revenue - Next 3m (Same)				-0.93*** (0.03)	-0.87*** (0.03)	-0.88*** (0.06)	-0.88*** (0.06)
Revenue - Next 3m (Worse)				-1.66*** (0.06)	-1.55*** (0.06)	-1.47*** (0.1)	-1.55*** (0.1)
Employment - Previous 3m (Same)					-0.05** (0.02)	0.06 (0.06)	0.1 (0.06)
Employment - Previous 3m (Worse)					-0.08** (0.03)	-0.04 (0.07)	0 (0.07)
Employment - Next 3m (Same)					-0.28*** (0.02)	-0.29*** (0.06)	-0.33*** (0.06)
Employment - Next 3m (Worse)					-0.58*** (0.05)	-0.5*** (0.09)	-0.5*** (0.09)
Capacity Utilization						0 (0)	0 (0)
Capacity Utilization - Ability to meet current demand (Sufficient)						0	0.02

(Continues)

(Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
						(0.05)	(0.05)
Capacity Utilization - Ability to meet current demand (Insufficient)						-0.21**	-0.17*
						(0.08)	(0.09)
Credit Conditions (Same)							-0.05
							(0.05)
Credit Conditions (Worse)							-0.07
							(0.08)
Time dummies							
Firm Size							
Observations							

Elaboração dos autores.

TABLE 5
Ordered logit (continuation)
(Coefficients estimates)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
Revenue - Previous 3m (Same)				-0.05**	-0.03	-0.01	-0.02
				(0.02)	(0.02)	(0.06)	(0.06)
Revenue - Previous 3m (Worse)				-0.28***	-0.24***	-0.16**	-0.16**
				(0.04)	(0.04)	(0.07)	(0.07)
Revenue - Next 3m (Same)				-0.93***	-0.87***	-0.88***	-0.88***
				(0.03)	(0.03)	(0.06)	(0.06)
Revenue - Next 3m (Worse)				-1.66***	-1.55***	-1.47***	-1.55***
				(0.06)	(0.06)	(0.1)	(0.1)
Employment - Previous 3m (Same)					-0.05**	0.06	0.1
					(0.02)	(0.06)	(0.06)
Employment - Previous 3m (Worse)					-0.08**	-0.04	0
					(0.03)	(0.07)	(0.07)
Employment - Next 3m (Same)					-0.28***	-0.29***	-0.33***
					(0.02)	(0.06)	(0.06)
Employment - Next 3m (Worse)					-0.58***	-0.5***	-0.5***
					(0.05)	(0.09)	(0.09)
Capacity Utilization						0	0
						(0)	(0)
Capacity Utilization - Ability to meet current demand (Sufficient)						0	0.02
						(0.05)	(0.05)
Capacity Utilization - Ability to meet current demand (Insufficient)						-0.21**	-0.17*
						(0.08)	(0.09)
Credit Conditions (Same)							-0.05
							(0.05)
Credit Conditions (Worse)							-0.07
							(0.08)
Time dummies							
Firm Size							
Observations							

Elaboração dos autores.

4.1 State or time dependent pricing

In this section, we investigate whether the behavior of firms is consistent with state or time-dependent pricing procedures. We augment the state-dependent pricing models from previous section with a set of Taylor dummies. The variable take value one if the last time that a company decided to increase their prices was months ago. We take between 1 and 24 to indicate the occurrence of price increases in the last 1 to 8 quarters approximately. We estimate each version of the state dependent pricing model presented in the previous section, where the dependent variable indicates if the firm reported a price-increase or not. As we estimate a standard panel logit model we control for fixed effects. Table 6 reports the results from this estimation and in table 7 we show the marginal impacts of each variable at the sample average.

We find support for time-dependent pricing in each estimated model. The first Taylor dummy is highly significant on each model. The marginal impact on the probability of a price increase is negative and large. It ranges from -35% in the simplest model where we control only for limiting factors to -19% in the full model. The intuition is that after a firm increasing their prices the adjust again one month later is small. There is a concentration of Taylor dummies that are significant close to 12 months. As firms price are set for longer the probability of increasing their prices also increases. This result corroborates the observation by Gouvea (2007) that prices in the service sector increase on average 1.2 times a year. After 12 months fewer variables are significant and some with negative marginal impact. The Taylor dummy for 24 months is significant for all models, but with smaller marginal impact than the Taylor dummy for 12 months. In figure 8 we show the marginal impact of each Taylor dummy for model 5.

TABLE 6
Time-dependent pricing model
(Coefficients estimates)

Variable	(1)	(2)	(3)	(4)	
Taylor 1	-1.49*** (0.06)	-1.66*** (0.06)	-1.73*** (0.06)	-1.77*** (0.07)	-1.78*** (0.07)
Taylor 2	0.33*** (0.05)	0.19*** (0.06)	0.12** (0.06)	0.06 (0.06)	0.05 (0.06)
Taylor 3	0.11* (0.06)	-0.02 (0.06)	-0.09 (0.06)	-0.13** (0.06)	-0.14** (0.06)
Taylor 4	0.06 (0.06)	-0.06 (0.06)	-0.13** (0.06)	-0.16*** (0.06)	-0.18*** (0.06)

(Continues)

(Continued)

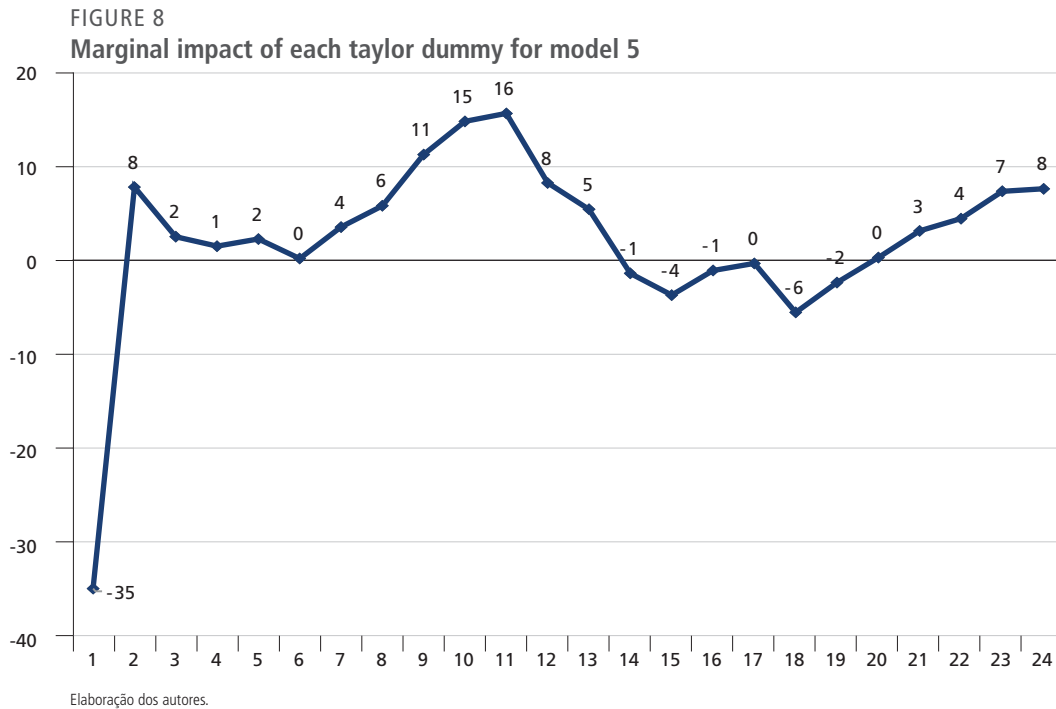
Variable	(1)	(2)	(3)	(4)	
Taylor 5	0.1 (0.06)	-0.02 (0.06)	-0.08 (0.06)	-0.12** (0.06)	-0.13** (0.06)
Taylor 6	0.01 (0.06)	-0.09 (0.06)	-0.15** (0.06)	-0.19*** (0.06)	-0.2*** (0.07)
Taylor 7	0.15** (0.06)	0.06 (0.06)	0 (0.06)	-0.03 (0.07)	-0.03 (0.07)
Taylor 8	0.25*** (0.06)	0.16** (0.06)	0.11* (0.07)	0.09 (0.07)	0.09 (0.07)
Taylor 9	0.48*** (0.06)	0.4*** (0.06)	0.36*** (0.07)	0.32*** (0.07)	0.32*** (0.07)
Taylor 10	0.63*** (0.06)	0.55*** (0.07)	0.5*** (0.07)	0.48*** (0.07)	0.48*** (0.07)
Taylor 11	0.67*** (0.07)	0.58*** (0.07)	0.54*** (0.07)	0.49*** (0.07)	0.49*** (0.07)
Taylor 12	0.35*** (0.08)	0.27*** (0.08)	0.21*** (0.08)	0.18** (0.08)	0.17** (0.08)
Taylor 13	0.23*** (0.08)	0.15* (0.08)	0.1 (0.08)	0.06 (0.09)	0.04 (0.09)
Taylor 14	-0.06 (0.09)	-0.14 (0.1)	-0.17* (0.1)	-0.2** (0.1)	-0.21** (0.1)
Taylor 15	-0.16 (0.1)	-0.22** (0.1)	-0.25** (0.1)	-0.29*** (0.11)	-0.3*** (0.11)
Taylor 16	-0.05 (0.1)	-0.11 (0.1)	-0.16 (0.11)	-0.18* (0.11)	-0.2* (0.11)
Taylor 17	-0.01 (0.11)	-0.06 (0.11)	-0.08 (0.11)	-0.09 (0.11)	-0.09 (0.11)
Taylor 18	-0.24** (0.12)	-0.28** (0.12)	-0.31** (0.12)	-0.31** (0.12)	-0.32** (0.13)
Taylor 19	-0.1 (0.12)	-0.15 (0.12)	-0.19 (0.12)	-0.24* (0.13)	-0.24* (0.13)
Taylor 20	0.01 (0.12)	-0.04 (0.12)	-0.07 (0.12)	-0.09 (0.13)	-0.1 (0.13)
Taylor 21	0.13 (0.12)	0.12 (0.12)	0.08 (0.12)	0.08 (0.12)	0.08 (0.13)
Taylor 22	0.19 (0.12)	0.17 (0.12)	0.16 (0.12)	0.15 (0.13)	0.16 (0.13)
Taylor 23	0.31** (0.12)	0.27** (0.12)	0.21 (0.13)	0.2 (0.13)	0.21 (0.13)
Taylor 24	0.32** (0.13)	0.3** (0.13)	0.28** (0.13)	0.27** (0.14)	0.27* (0.14)

Elaboração dos autores.

TABLE 7
Time-dependent pricing model
 (Coefficients estimates)

Variable	(1)	(2)	(3)	(4)	
Taylor 1	-34.8***	-29.7***	-24.6***	-23***	-19.2***
Taylor 2	7.7***	3.5***	1.7*	0.8	0.5
Taylor 3	2.5*	(0.01)	(0.01)	(0.01)	(0.01)
Taylor 4	1.5	-0.4	-1.8**	-2.1***	-1.9***
Taylor 5	2.2	-0.4	-1.3	-1.6**	-1.5**
Taylor 6	0.2	-1.6	-2.1**	-2.4***	-2.1***
Taylor 7	3.5**	1	0	-0.4	-0.3
Taylor 8	5.8***	2.8**	1.6*	1.2	0.9
Taylor 9	11.2***	7.1***	5.1***	4.2***	3.5***
Taylor 10	14.7***	9.8***	7.1***	6.3***	5.2***
Taylor 11	15.5***	10.4***	7.7***	6.4***	5.3***
Taylor 12	8.2***	4.9***	3**	2.3**	1.8**
Taylor 13	5.4***	2.7*	1.4	0.7	0.4
Taylor 14	-1.4	-2.6	-2.4*	-2.7**	-2.3**
Taylor 15	-3.7	-3.9**	-3.6**	-3.7***	-3.2***
Taylor 16	-1.1	-2	-2.3	-2.3*	-2.1*
Taylor 17	-0.3	-1.1	-1.1	-1.2	-1
Taylor 18	-5.5**	-5**	-4.5***	-4.1**	-3.5***
Taylor 19	-2.4	-2.7	-2.7	-3.2**	-2.6*
Taylor 20	0.3	-0.7	-1	-1.1	-1
Taylor 21	3.1	2.1	1.1	1	0.8
Taylor 22	4.4	3.1	2.3	2	1.8
Taylor 23	7.3**	4.8**	3	2.6	2.2
Taylor 24	7.6**	5.3**	4**	3.5*	2.9*
Time dummies					
Firm Size					
Observations					

Elaboração dos autores.



The marginal impact of the Taylor dummies on the probability of price increase is significant but remains constant as the last time the firm reported a price increase is in prior periods. The fact that the Taylor dummies are significant and its marginal effect large provides support for time-dependent pricing models. For service sector firms the best description of their behavior is a combination of state and time-dependent pricing. Hence, if economic and business conditions change firmly is likely to set prices accordingly. Also, even if these conditions remain constant firms are more likely to increase prices when the time since the last price update increases.

5 CONCLUSION

This paper studies how firm level conditions affect their decision on adjusting prices using monthly qualitative firm-level data for Brazilian companies in the service sector from 2007 to 2016. The information in the survey allowed us to measure the impact of changes in cost, capacity utilization rates, limiting conditions, etc. on the likelihood of changing their prices. More importantly, we also have firm's answers to questions about future economic conditions. Our main results can be summarized as follows.

We show that prices in the service sector are more sluggish because firms response to changes in the business conditions is heavily asymmetric. For example, one of the variables relevant to explain price adjustments is future demand conditions. On average, when firms reports a worse assessment of future demand conditions they become 3% less likely to increase prices, 2% more likely to keep prices constant and 0.6% more likely to lower prices.

The results in our article also provide support for both state and time-dependent price setting behavior. We show that the dummy variables to indicate whether the last time the firm reported a price increase was periods ago is significant and its marginal impact large on the likelihood of price adjustments.

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APPENDIX A

TABLE A.1
Price increase – coefficients estimates for a conditional logit model

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
Limiting Factors - None	0.05*	0.02	0.03	0.02	0.02	-0.08	-0.03
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.08)	(0.08)
Limiting Factors - Insufficient Demand	-0.25***	-0.08***	-0.02	0	0.01	0	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)
Limiting Factors - Lack of Space or Equipment	0.13***	0.08**	0.07**	0.07**	0.06*	0.19*	0.12
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.11)	(0.12)
Limiting Factors - Lack of Qualified Workers	0.19***	0.14***	0.12***	0.11***	0.09***	0.08	0.08
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.06)	(0.06)
Limiting Factors - Financial Costs	0.1***	0.14***	0.15***	0.15***	0.15***	0.21***	0.21***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.06)
Limiting Factors - Financial Problems	-0.06**	0.02	0.06*	0.07**	0.07**	0.02	0.05
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.08)	(0.08)
Limiting Factors - Competition in the Sector	0	0.01	0.01	0	0	0.01	0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)
Limiting Factors - Others	-0.06***	0.05**	0.08***	0.09***	0.09***	0.09*	0.13**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)
Business Conditions - Present (Same)		-0.3***	-0.12***	-0.08***	-0.06***	-0.08	-0.12**
		(0.02)	(0.02)	(0.02)	(0.02)	(0.06)	(0.06)
Business Conditions - Present (Worse)		-0.35***	-0.12***	-0.05	-0.03	-0.06	-0.08
		(0.02)	(0.03)	(0.03)	(0.03)	(0.08)	(0.08)
Business Conditions - Next 6m (Same)		-0.65***	-0.25***	-0.08***	-0.05***	-0.11**	-0.12**
		(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)
Business Conditions - Next 6m (Worse)		-0.7***	-0.19***	0.05	0.06	0.1	0.1
		(0.03)	(0.03)	(0.04)	(0.04)	(0.07)	(0.08)
Demand - Current (Same)			-0.3***	-0.27***	-0.25***	-0.34***	-0.37***
			(0.02)	(0.02)	(0.02)	(0.07)	(0.07)
Demand - Current (Worse)			-0.28***	-0.21***	-0.2***	-0.39***	-0.42***
			(0.03)	(0.03)	(0.03)	(0.08)	(0.09)
Demand - Previous 3m (Same)			-0.09***	-0.04**	-0.02	-0.03	-0.04
			(0.02)	(0.02)	(0.02)	(0.06)	(0.06)
Demand - Previous 3m (Worse)			-0.12***	-0.03	-0.02	0.05	0.04
			(0.02)	(0.03)	(0.03)	(0.07)	(0.07)
Demand - Next 3m (Same)			-0.66***	-0.01	0.02	0.01	0.01
			(0.02)	(0.02)	(0.02)	(0.06)	(0.06)
Demand - Next 3m (Worse)			-0.78***	-0.01	0.01	-0.14*	-0.13
			(0.03)	(0.04)	(0.04)	(0.09)	(0.09)
Revenue - Previous 3m (Same)				-0.07***	-0.04*	-0.01	-0.02
				(0.02)	(0.02)	(0.06)	(0.06)

(Continues)

(Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
Revenue - Previous 3m (Worse)				-0.15*** (0.03)	-0.14*** (0.03)	0.01 (0.07)	0 (0.07)
Revenue - Next 3m (Same)				-1.09*** (0.02)	-1.03*** (0.02)	-1.03*** (0.05)	-1.02*** (0.06)
Revenue - Next 3m (Worse)				-1.16*** (0.04)	-1.12*** (0.04)	-1.17*** (0.08)	-1.25*** (0.09)
Employment - Previous 3m (Same)					-0.11*** (0.02)	0.04 (0.06)	0.07 (0.06)
Employment - Previous 3m (Worse)					-0.03 (0.03)	0.03 (0.07)	0.07 (0.07)
Employment - Next 3m (Same)					-0.34*** (0.02)	-0.29*** (0.05)	-0.34*** (0.06)
Employment - Next 3m (Worse)					-0.2*** (0.03)	-0.11 (0.07)	-0.12 (0.08)
Capacity Utilization						0 (0)	0 (0)
Capacity Utilization - Ability to meet current demand (Sufficient)						-0.1** (0.05)	-0.08 (0.05)
Capacity Utilization - Ability to meet current demand (Insufficient)						-0.15* (0.09)	-0.09 (0.1)
Credit Conditions (Same)							-0.03 (0.06)
Credit Conditions (Worse)							0.09 (0.08)
Time dummies							
Firm Size							
Observations							

Elaboração dos autores

TABLE A.2
Price increase – marginal impact at the sample average for a conditional logit model

Variable	(1)	(2)	(3)	(4)	
Limiting Factors - None	1.2*	0.5	0.5	0.4	0.2
Limiting Factors - Insufficient Demand	-6.3***	-1.7***	-0.3	0	0.1
Limiting Factors - Lack of Space or Equipment	3.3***	1.7**	1.3**	1.3**	0.9*
Limiting Factors - Lack of Qualified Workers	4.6***	3***	2.3***	2***	1.4***
Limiting Factors - Financial Costs	2.5***	3.2***	2.9***	2.8***	2.3***
Limiting Factors - Financial Problems	-1.5**	0.5	1.1*	1.3**	1.1**
Limiting Factors - Competition in the Sector	0.1	0.3	0.2	0	0
Limiting Factors - Others	-1.5***	1.1**	1.5***	1.6***	1.4***
Business Conditions - Present (Same)		-6.8***	-2.2***	-1.4***	-0.9**
Business Conditions - Present (Worse)		-7.9***	-2.4***	-0.8	-0.4
Business Conditions - Next 6m (Same)		-14.5***	-4.8***	-1.4***	-0.8**

(Continues)

(Continued)

Variable	(1)	(2)	(3)	(4)	
Business Conditions - Next 6m (Worse)		-15.5***	-3.6***	0.8	0.9
Demand - Current (Same)			-5.9***	-4.9***	-4***
Demand - Current (Worse)			-5.5***	-4***	-3.2***
Demand - Previous 3m (Same)			-1.7***	-0.8*	-0.3
Demand - Previous 3m (Worse)			-2.2***	-0.5	-0.2
Demand - Next 3m (Same)			-12.8***	-0.3	0.3
Demand - Next 3m (Worse)			-14.6***	-0.1	0.2
Revenue - Previous 3m (Same)				-1.2***	-0.6*
Revenue - Previous 3m (Worse)				-2.7***	-2.1***
Revenue - Next 3m (Same)				-20***	-16.6***
Revenue - Next 3m (Worse)				-20.9***	-17.6***
Employment - Previous 3m (Same)					-1.7***
Employment - Previous 3m (Worse)					-0.5
Employment - Next 3m (Same)					-5.5***
Employment - Next 3m (Worse)					-3.4***

Elaboração dos autores

TABLE A.3

Price decrease – coefficients estimates for a conditional logit model

Variable	(1)	(2)	(3)	(4)	(5)	(6)	
Limiting Factors - None	-0,67*** (0,06)	-0,46*** (0,07)	-0,44*** (0,07)	-0,41*** (0,07)	-0,41*** (0,07)	-0,29 (0,18)	-0,21 (0,2)
Limiting Factors - Insufficient Demand	0,87*** (0,03)	0,29*** (0,04)	0,18*** (0,04)	0,16*** (0,04)	0,13*** (0,04)	0,23*** (0,08)	0,33*** (0,09)
Limiting Factors - Lack of Space or Equipment	-0,42*** (0,07)	-0,25*** (0,07)	-0,24*** (0,08)	-0,24*** (0,08)	-0,23*** (0,08)	-0,18 (0,22)	-0,14 (0,23)
Limiting Factors - Lack of Qualified Workers	-0,45*** (0,04)	-0,22*** (0,04)	-0,17*** (0,04)	-0,16*** (0,05)	-0,14*** (0,05)	-0,09 (0,11)	-0,03 (0,12)
Limiting Factors - Financial Costs	0,26*** (0,04)	0,04 (0,04)	0 (0,04)	-0,01 (0,05)	-0,04 (0,05)	-0,04 (0,09)	-0,06 (0,1)
Limiting Factors - Financial Problems	0,69*** (0,05)	0,25*** (0,05)	0,19*** (0,06)	0,17*** (0,06)	0,11* (0,06)	0,12 (0,12)	0,1 (0,13)
Limiting Factors - Competition in the Sector	0,09*** (0,03)	0,14*** (0,04)	0,14*** (0,04)	0,15*** (0,04)	0,16*** (0,04)	-0,08 (0,08)	-0,09 (0,09)
Limiting Factors - Others	0,72*** (0,04)	0,27*** (0,04)	0,17*** (0,04)	0,13*** (0,04)	0,12*** (0,04)	0,1 (0,09)	0,18* (0,09)
Business Conditions - Present (Same)		0 (0,05)	-0,1* (0,05)	-0,11* (0,06)	-0,1* (0,06)	-0,02 (0,14)	-0,06 (0,15)
Business Conditions - Present (Worse)		1,08*** (0,05)	0,53*** (0,07)	0,41*** (0,07)	0,32*** (0,07)	0,22 (0,16)	0,17 (0,17)
Business Conditions - Next 6m (Same)		0,73*** (0,04)	0,3*** (0,05)	0,18*** (0,05)	0,14*** (0,05)	0,02 (0,11)	0 (0,12)

(Continues)

(Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Business Conditions - Next 6m (Worse)		2,12***	0,88***	0,57***	0,45***	0,26**
		(0,04)	(0,06)	(0,06)	(0,06)	(0,13)
Demand - Current (Same)			0,01	-0,02	-0,03	-0,01
			(0,06)	(0,06)	(0,06)	(0,18)
Demand - Current (Worse)			0,29***	0,2***	0,17**	0,4**
			(0,07)	(0,08)	(0,08)	(0,19)
Demand - Previous 3m (Same)			-0,09*	-0,05	-0,01	-0,11
			(0,05)	(0,06)	(0,06)	(0,14)
Demand - Previous 3m (Worse)			0,47***	0,25***	0,24***	-0,02
			(0,05)	(0,07)	(0,07)	(0,15)
Demand - Next 3m (Same)			0,54***	0,15**	0,13**	0,22
			(0,05)	(0,06)	(0,06)	(0,14)
Demand - Next 3m (Worse)			1,77***	0,67***	0,57***	0,5***
			(0,06)	(0,07)	(0,07)	(0,16)
Revenue - Previous 3m (Same)				-0,06	-0,04	-0,21
				(0,06)	(0,06)	(0,14)
Revenue - Previous 3m (Worse)				0,4***	0,34***	0,25*
				(0,06)	(0,07)	(0,15)
Revenue - Next 3m (Same)				0,52***	0,47***	0,62***
				(0,06)	(0,06)	(0,14)
Revenue - Next 3m (Worse)				1,72***	1,57***	1,56***
				(0,07)	(0,07)	(0,15)
Employment - Previous 3m (Same)					-0,19***	-0,23*
					(0,05)	(0,13)
Employment - Previous 3m (Worse)					0,08	0,08
					(0,06)	(0,14)
Employment - Next 3m (Same)					0,1*	0,32**
					(0,06)	(0,15)
Employment - Next 3m (Worse)					0,78***	0,94***
					(0,07)	(0,16)
Capacity Utilization						0
						(0)
Capacity Utilization - Ability to meet current demand (Sufficient)						-0,15*
						(0,08)
Capacity Utilization - Ability to meet current demand (Insufficient)						0,23*
						(0,13)
Credit Conditions (Same)						0,35***
						(0,12)
Credit Conditions (Worse)						0,55***
Time dummies						
Firm Size						
Observations						

Elaboração dos autores

TABLE A.4

Price decrease – marginal impact at the sample average for a conditional logit model

Variable	(1)	(2)	(3)	(4)	
Limiting Factors - None	-6,9	-3	-2,9	-3,5	-4
Limiting Factors - Insufficient Demand	9*	1,9	1,2	1,4	1,3
Limiting Factors - Lack of Space or Equipment	-4,3	-1,6	-1,6	-2,1	-2,3
Limiting Factors - Lack of Qualified Workers	-4,6	-1,4	-1,1	-1,4	-1,4
Limiting Factors - Financial Costs	2,6	0,3	0	-0,1	-0,4
Limiting Factors - Financial Problems	7,1*	1,6	1,3	1,5	1,1
Limiting Factors - Competition in the Sector	1	0,9	0,9	1,3	1,5
Limiting Factors - Others	7,4*	1,7	1,1	1,1	1,1
Business Conditions - Present (Same)		0	-0,7	-1	-1
Business Conditions - Present (Worse)		5,8	3,1	3,1	2,9
Business Conditions - Next 6m (Same)		5,7*	2,1*	1,6	1,4
Business Conditions - Next 6m (Worse)		10,1	5*	4,3	4
Demand - Current (Same)			0,1	-0,2	-0,3
Demand - Current (Worse)			1,9	1,7	1,6
Demand - Previous 3m (Same)			-0,7	-0,5	-0,1
Demand - Previous 3m (Worse)			2,7	2	2,2
Demand - Next 3m (Same)			4,3*	1,4	1,3
Demand - Next 3m (Worse)			9*	4,9	5
Revenue - Previous 3m (Same)				-0,5	-0,4
Revenue - Previous 3m (Worse)				3,1	3,1
Revenue - Next 3m (Same)				5,2*	5,3*
Revenue - Next 3m (Worse)				11,2	12,1*
Employment - Previous 3m (Same)					-1,9
Employment - Previous 3m (Worse)					0,7
Employment - Next 3m (Same)					1,1
Employment - Next 3m (Worse)					6,5

Elaboração dos autores

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