

PRICE SETTING IN LITHUANIA: MORE EVIDENCE FROM THE SURVEY OF FIRMS

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Abstract. *The article examines price setting in Lithuania, based on the ad hoc survey "On Price and Wage Setting" of the Bank of Lithuania. The study extends the survey data analysis presented in Virbickas (2009). The article points to the incidence of both time-dependent and state-dependent price reviewing policies used by the firms under study, though the price reviewing practices appear to be somewhat tilted to the state-dependent pricing. Analysis provides evidence on the reasons for the upward and downward stickiness of prices. Delayed price adjustment is found to be related to the price adjustment rather than the price reviewing stage. The most momentous explanations for not adjusting prices upwards or downwards rest on the cost-based pricing and the explicit contracts. The study finds an asymmetric influence of some of the price factors. In particular, the cost factors are found to be decisive in invoking a price increase rather than a price decrease.*

Key words: *price review, price adjustment, price stickiness*

Introduction

The ways prices are determined may have an impact on the real economic output. Economic shocks may have effects if prices are adjusted in a less responsive pattern. Stickiness of prices adds to the magnitude and length of the shocks affecting economy, influencing their transmission and having implications for policy design. Practices of pricing, thus, constitute an important part of economic setting, providing a momentous venue for the research.

The article presents evidence from the survey of price setting practices in Lithuanian firms. The study draws on the experience of the euro area countries that have carried out a research within the Inflation Persistence Network (IPN) coordinated by the European Central Bank. The network conducted price setting research based, among other sources, on firm-level data obtained from the surveys undertaken in nine euro area countries. The IPN surveys delivered a number of stylised facts on the review and adjustment of

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prices and on the determinants of pricing behaviour of euro area firms, shedding light on pricing practices in qualitative terms¹.

The survey approach to the analysis of pricing was introduced by Blinder (1991, 1994) and Blinder et al. (1998). The works investigated price setting behaviour in the United States. A similar approach was used also to analyse pricing in other countries. Hall et al. (2000) conducted a research for the United Kingdom, Apel et al. (2005) for Sweden, Amirault et al. (2006) for Canada. Dabušinskas and Randveer (2006) investigated pricing in Estonia, performing a study similar to the one undertaken under the IPN.

The survey analyses has few advantages compared to the other methods of studying price setting. Surveys on prices allow asking respondents to assess the factors underlying price decisions that are difficult to unveil on the basis of other sources. The pricing questionnaires, for instance, may tackle the reasons for price unresponsiveness or asymmetric adjustment that are hard to analyse using data on final prices and price indices. The survey questionnaires may scrutinise the patterns of price adjustment separately from the ones of price review – something not captured in other datasets. Along the advantages, the method of survey has some disadvantages. Results of surveys critically depend on the wording of questions. Theoretical concepts may be difficult to explain in a way understandable for the respondents. Because of complexity, the surveys are not always conducted repeatedly, limiting the possibilities to investigate the issues in a time dimension.

The purpose of the study was to investigate the price-setting practices of Lithuanian firms, determining the factors, ways and outcomes of pricing. The article uses firm-level data from the hoc survey “On Price and Wage Setting” of the Bank of Lithuania which has already been explored in Virbickas (2009). Apart from pricing patterns, the latter study examined wage formation and the link between labour costs and prices in Lithuania. The continuation of the survey data analysis covers a few pricing aspects. It considers time-dependent and state-dependent price-reviewing practices as these practices have implications for the degree of price responsiveness. The study also looks into the reasons for the delayed price adjustment when there are some motives to increase or lower prices. It investigates ten potential explanations for the upward and downward stickiness of prices. The article, finally, touches asymmetries in price adjustment. It shows the differences in price response to both heightened and dampened demand and in response to higher and lower costs. Besides the reaction to shocks, the study considers also the differences in the factors causing upward and downward changes in prices.

¹ The survey findings for euro area countries are summarised in Fabiani et al. (2006). The pricing evidence for individual euro area countries is provided in: Kwapil et al. (2007) for Austria, Aucremanne and Druant (2005) for Belgium, Loupias and Ricart (2004) for France, Stahl (2005) for Germany, Fabiani et al. (2004) for Italy, Lünne-mann and Mathä (2006) for Luxembourg, Hoerberichts and Stokman (2010) for the Netherlands, Martins (2005) for Portugal, Álvarez and Hernando (2005) for Spain.

The structure of the article is the following. Section 1 describes the survey conduct and overviews some of the ways of pricing and its environment. The time-dependent and state-dependent price-reviewing policies are analysed in Section 2. Explanations for the upward and downward stickiness of prices are given in Section 3. Section 4 shows the asymmetries in price adjustment, following the demand shocks and cost shocks, and the asymmetric influence of some of the factors. The concluding section summarises the findings of the study.

1. Survey conduct and selected results

The analysis is based on the survey of the Bank of Lithuania “On Price and Wage Setting”². The survey was undertaken in April and May 2008 referring to firms’ operational activities in 2007.

The survey involved firms operating in manufacturing, construction, trade, and business services. Firms were stratified according to Sections D-K of NACE rev. 1.1³. Apart from their economic activities, the firms were stratified also according to the number of employees. The survey considered the firm size categories of 5–19, 20–49, 50–149, 150–249, and 250 or more employees.

The survey involved 2810 firms. The targeted sample was 500 firms. Due to incomplete responses, however, the answers of only 343 firms were used in the research. Among these firms, there are 97 manufacturing, 27 construction, 104 trade and 115 business services firms. Most of them are small-sized firms with up to 19 employees. In this sample, the sizeable share of employees work in manufacturing and business services. Most of employees are employed by larger firms.

To make the realised sample reflect the distribution of the total population of the firms, employment-adjusted sampling weights were constructed. These weights account for the unequal probability of firms making into the realised sample and adjust the realised sample of firms so that to represent employees in the total population. The employment-adjusted sampling weights are used in the descriptive analysis.

Before turning to a more detailed analysis, this section overviews some of the characteristics of firms related to the price setting ways and environment .

The survey investigated the approaches used to determine prices. As figured out, the most common practice is to choose prices according to costs and a completely self-determined profit margin (see Table 1). This way of pricing – mark-up pricing (often used

² A detailed description of survey conduct is provided in Virbickas (2009). The survey questionnaire is available upon request.

³ Unless otherwise stated, the group of economic activities entitled “manufacturing” refers to manufacturing and electricity, gas and water supply (Sections D and E of NACE rev. 1.1); the economic activities “construction” and “trade” are self-explanatory (Sections F and G of NACE rev. 1.1, respectively); economic activities entitled “business services” refer to the rest of the market services (Sections H–K of NACE rev. 1.1).

in imperfectly competitive settings) – was reported by approximately half of the firms. Another incidental way to set prices is to follow the main competitors. This practice is applied by more than a quarter of the firms. Mark-up pricing is widely used in all economic activities, while pricing following the main competitors finds more support in trade.

TABLE 1. Selected characteristics of the surveyed firms (percent)

	Manu- facturing	Construc- tion	Trade	Business services	Total
Price setting ways:					
– share of firms in which the price is regulated or set by the parent company or by main customer	21.0	2.3	3.8	22.6	15.3
– share of firms that set the price following the main competitors	28.3	19.7	42.9	19.3	27.0
– share of firms that set the price according to costs and the completely self-determined profit margin	44.4	68.2	44.8	51.5	50.3
– share of firms that set the price in an other way	6.4	9.8	8.6	6.5	7.4
Use of price discrimination:					
– share of firms that set the same price for all customers	10.5	6.3	18.4	28.2	17.9
–share of firms in which price depends on the quantity of orders	35.0	10.5	40.0	16.9	26.2
– share of firms in which price is set for each customer individually	51.0	83.2	34.2	35.1	46.2
– share of firms in which price is set in an other way	3.6	0.0	7.4	19.8	9.7
Customer institutional setup:					
– share of revenue from sales to wholesale firms	28.3	5.4	6.2	6.5	12.7
– share of revenue from sales to retail firms	17.1	6.4	17.3	6.1	11.8
– share of revenue from sales to public sector institutions and firms	1.5	9.2	4.9	13.6	7.5
– share of revenue from sales to final consumers	27.6	44.8	56.5	43.4	41.8
– share of revenue from sales to other customers	25.5	34.1	15.1	30.3	26.1
Customer relationship (share of revenue from sales to regular customers)	76.2	46.6	54.3	67.1	64.1
Foreign sales (share of revenue from sales in foreign markets)	38.1	1.6	6.9	14.5	17.9

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s calculations.

The study revealed a rather widespread use of price discrimination in the firms. Somewhat less than half of the considered firms set the prices individually for each consumer(s), and in approximately one quarter of the firms prices are dependent on the quantity of orders. Price discrimination is, thus, reported by almost three quarters of the firms. Individual price setting for each consumer is more common in construction, and price setting dependent on the quantity of orders is more widely used in trade and manufacturing. No use of price discrimination was admitted by less than a fifth of the firms. The practice of setting the same price for all customers is more popular in business services.

Responses to survey questions deliver information on the customer institutional setup. In the surveyed firms, more than 40 percent of the total revenue is generated by sales to the final consumers, around one quarter of the total revenue is due to wholesale and retail firms and somewhat less than a tenth of the total revenue is due to public sector institutions and firms. Sales to the final consumers are most prevalent in trade, construction and business services, while in manufacturing sales to the wholesale firms generate the most sizeable share of the total revenue. Customers of the surveyed firms include not only the final consumers, implying that the practices revealed by the survey results reflect price setting at both the consumer and the producer levels.

The study has highlighted a rather high share of the revenue generated by sales to the customers described as regular ones. Sales to the customers with a lasting business relationship account for around two thirds of the total revenue. Such sales are more sizeable in manufacturing and business services.

The surveyed firms reported a substantial degree of openness to competition in foreign markets. The firms indicated generating somewhat less than a fifth of their total revenue via activities in foreign countries. The share of the total revenue raised by sales in foreign markets was highest in the manufacturing and business services.

2. Time-dependent and state-dependent prices

Literature differentiates time-dependent and state-dependent pricing rules. If firms are following the time-dependent rules, the time between reset of prices is viewed as independent from the economic shocks.

One of the time-dependent models was used by Taylor (1980) who applied the idea of non-continuous adjustment of labour contracts. In the suggested framework, only part of firms are allowed to change the contracts. The adjusted contracts remain unchanged for a certain period of time, which is assumed to be the same for all the firms. Contracts are adjusted in a non-continuous way; therefore, the firms that review the contracts take into account all the economic factors expected to prevail until the next review of the contracts.

The other time-dependent model is that of Calvo (1983) who considers a staggered price setting. The model is similar to the one of Taylor, except for the assumption on nominal contract duration. In the Calvo model, price duration is assumed to be random and uncertain when prices are reset.

In the time-dependent models, firms may not react immediately to the economic shocks unless the shocks occur at the time when firms review the prices. The possibility of response to economic shocks, contingent on the timing and intensity of shocks, is considered in state-dependent models. All else equal, state-dependent pricing yields a more responsive price adjustment than time-dependent pricing.

State-dependent models were used by Barro (1972) and developed further by Sheshinski and Weiss (1977). In Sheshinski and Weiss, firms are targeting the difference between the optimal and the actual prices and are following the pricing rule (s, S). Firms are setting prices so that the difference equals S , and do not adjust the prices because of adjustment costs until the difference reaches s . Firms, thus, follow the pricing rule under which they reset the prices in a state-dependent way.

To investigate the incidence of time-dependent and state-dependent pricing, the survey asked the firms to characterise the way of price review. The survey asked the firms whether (1) they review the prices regularly, (2) they review the prices in certain cases (for instance, when costs or demand change), (3) they review the prices regularly and additionally in certain cases (for instance, when costs or demand change), (4) they review the prices for other reasons, or (5) they never review prices without changing them. In the first case, price review is interpreted as time-dependent, in the second case as state-dependent, and in the third case as time-dependent with a switch to a state-dependent price review when it is deemed necessary (thereafter named as a time- and state-dependent price review).

As shown in Table 2, most of the surveyed Lithuanian firms follow the time- and state-dependent practice to review the prices. A practice to review the prices regularly and additionally to review them in certain cases was indicated by 45 percent of the firms. Comparing the incidence of time-dependent and state-dependent price reviewing practices, the latter practice appears to be more widely used than the former one. A similar prevalence of price reviewing practices is found in manufacturing and trade, while in construction and business services it is somewhat different. In construction, as opposed to practices observed in other economic activities, the state-dependent price review appears to be less widely used than the time-dependent one. In business services, a time- and state-dependent price reviewing practice dominates, although it finds a considerably lower support than in other activities.

The firms that have characterised their price review as regular (cases of time-dependent as well as time- and state-dependent price review) have been asked to provide information on how frequently they review the prices. Firms were inquired to indicate

whether price reviews occur (1) daily, (2) weekly, (3) monthly, (4) quarterly, (5) half-yearly, (6) once a year, (7) once in two years or (8) less frequently than once in two years.

TABLE 2. Price reviewing practices (firms, percent)

	Manu- facturing	Con- struction	Trade	Business services	Total
Price is reviewed regularly	16.5	21.0	21.2	20.4	19.5
Price is reviewed in certain cases (for instance, when costs or demand change)	30.3	18.1	26.0	34.0	29.0
Price is usually reviewed regularly and additionally in certain cases (for instance, when costs or demand change)	49.8	54.7	47.6	35.9	45.0
Price is reviewed for other reasons	3.2	4.0	2.1	5.1	3.7
Price is never reviewed without changing it	0.2	2.3	2.9	4.6	2.6

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s calculations.

The survey results show that approximately one third of all the surveyed firms (including those that do not characterise their price review as regular) review prices daily to monthly. In almost one quarter of the firms price review takes place quarterly to half yearly. Prices appear to be reviewed somewhat more frequently in trade and construction and less frequently in business services.

TABLE 3. Frequency of price review (firms, percent)

	Manu- facturing	Con- struction	Trade	Business services	Total
Daily to monthly price review	28.2	41.5	50.8	24.3	33.5
Quarterly to half yearly price review	33.4	31.8	16.0	17.2	23.7
Annual price review	4.7	2.3	1.1	10.3	5.6
Less frequent than annual price review	0.0	0.0	1.1	4.6	1.9
No regular pattern, price is never reviewed without changing it	33.8	24.3	31.1	43.7	35.4

Notes: responses are employment-weighted and rescaled to exclude non-responses; frequency of price review under category “no regular pattern, price is never reviewed without changing it” reflects the part of firms that do not review prices regularly as indicated in Table 2 under price reviewing categories “price is reviewed in certain cases (for instance, when costs or demand change)”, “price is reviewed for other reasons” and “price is never reviewed without changing it”.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s calculations.

Compared to the frequency of price changes, as reported in Virbickas (2009), prices in Lithuania appear to be reviewed more frequently than they are changed. Most of

the firms in Lithuania (around one quarter) change the prices quarterly to half-yearly; approximately one fifth of the firms change the prices once a year, and somewhat more than one tenth of the firms change the prices less frequently than once a year. The process of pricing, thus, takes place in two stages – price reviewing and price adjustment. This suggests that some forms of price stickiness may occur when prices are reviewed and when they are adjusted.

3. Upward and downward price stickiness

Stickiness of prices may occur for numerous reasons. Firms may shy away from price decisions because it may be costly to review the prices. Firms may also find it costly to adjust the prices or disadvantageous to change them because of the response of customers or reaction of competitors. Stickiness of prices may originate at both the price reviewing and price adjustment stages.

To investigate the reasons that prevent from upward and downward price adjustment occurring at both price setting stages, we have analysed the relevance of ten potential explanations for price stickiness. The examined explanations are described below⁴:

- at the starting point, stickiness of prices might be a result of non-substantial changes in the costs, related to the firms' operational activities. If firms are following the *cost-based pricing*, they do not change prices as long as there are no changes in the costs;
- the prices may remain unchanged due to *explicit contracts* between the firms and their customers. The contracts may foresee constant prices for prolonged periods of time, contributing to the enduring business relationship between sellers and buyers of the products. Explicit contracts allow the firms to plan the sales, while customers benefit from lower information and transaction costs;
- business relationship between firms and their customers may also be built up without engaging into formal contracts. It has been noted, that if prices are increased due to the costs, the customers may judge it as a legitimate way of pricing, while if prices are increased due to the heightened demand, the customers may view it as unfair. Firms, therefore, may opt to raise the prices following the cost increase shocks, and they may decide to keep the prices constant when facing the demand increase shocks, thus effectively engaging into *implicit contracts*;
- a change in prices might bear costs. It may be costly to print new labels and to attach them, to print new catalogues and to distribute them. The change in prices might also pose some other *menu costs*, such as advertising and negotiation costs. As shown by Akerlof and Yellen (1985), Mankiw (1985) and Dixit (1991), even

⁴ A summary of explanations for the upward and downward price stickiness rests on Fabiani et al. (2006) and Dhyne et al. (2009).

low menu costs might end up in a substantial stickiness of prices, with sizeable effects on aggregate variables. As already mentioned, price adjustment costs are used in state-dependent models of Barro (1972) and Sheshinski and Weiss (1977) where authors use the price adjustment costs that are not related to the size and timing of price changes (hence these costs are menu costs);

- apart from physical price adjustment costs, advertising and negotiation costs, change in prices is related to *information costs*. Before deciding upon new prices, firms analyse the markets, competition pressures and consumer sentiments, thus incurring costs of information gathering and information processing that may prevent from frequent price adjustment;
- price is an important feature of a product, though it goes along the other features. Every product is accompanied by delivery conditions, repair and replacement schemes, services of update and other attributes. Firms, therefore, may opt to use the *non-price* elements of *competition* while facing shocks. They can change the time of the delivery, introduce or cut some other services, thus managing product features and the costs, while keeping prices fixed instead of changing them;
- some features of a product, quality in particular, are not observed directly. To identify these features, customers may scrutinise the other (observable) characteristics of a product, for instance, its price. If the price goes down, the customers may interpret it as a switch to a lower quality. Therefore, similarly as in the case above, firms may decide to keep the prices constant even if they can lower them in order to abstain from the possibly misleading *quality signal*;
- the pricing pattern may also be affected by firms' interaction in the product market. Firms may opt to keep the prices without increasing them if they expect that the competitors will not be raising prices in response. On the other hand, firms may also wish to keep the prices instead of lowering them if they anticipate that the other firms will cut the prices afterwards. *Coordination failure*, thus, leads to a kinked demand curve, implying losses for the firms if they increase the prices, and only minor gains if they reduce the prices;
- economic shocks may differ in terms of their nature and persistence. Shocks may be short-lived, shocks may be long-lasting. If firms expect a shock to be temporary, they may decide to keep the prices fixed instead of changing them when shock occurs, and revising them again when the shock reverses back. The *temporary character of shocks*, thus, may imply a sticky price behaviour;
- customers may find some price levels more attractive than the other ones. This is particularly true if customers pay less attention to the last price digit and focus more attention to the other digits. Such kind of *price thresholds* imply a stepwise demand function which makes it optimal for firms to change prices only if the new prices reach the new thresholds, called also pricing points. Firms, thus, may maintain prices if economic shocks are not significant enough to move the prices to the new thresholds.

The respondents asked to indicate how relevant are the above reasons for a not immediate adjustment of prices when there are some factors forcing to change them. The list of the reasons did not include a reference to a *quality signal* in case of price increase and did not refer to *implicit contracts* in case of price decrease. Firms were asked to indicate whether each of explanations is (1) not relevant, (2) of little relevance, (3) relevant, (4) very relevant, or (5) they do not know.

As shown in Table 4, the most important explanation for not adjusting prices when there are some reasons to increase them rests on *cost-based pricing*. Firms indicate that they are not willing to engage into upward price adjustment as long as costs do not change. Mentioned in Section 1, this is consistent with the relatively wide use of mark-up pricing. The second and the third most important reasons for maintaining prices constant instead of raising them are *explicit contracts* and *implicit contracts*. They mirror the significance of cherishing the business relationship between the firms and their customers and thus avoiding disappointing moves in prices. This finding stands in line with the rather substantial role of regular customers in generating income.

The next important reason not to raise the prices is firms' concern that their competitors will not adjust the prices. The *coordination failure*, thus, proves to be important in price setting, evidencing that some firms set the prices following the main competitors. The other rather decisive explanation for not adjusting prices upwards relates to *information costs*. Quite a substantial share of firms admit that information costs prevent from price decisions, thus indicating that stickiness of prices also occurs at the price reviewing stage.

TABLE 4. Explanations for upward price stickiness (percentage of firms for which the explanation is "relevant" or "very relevant")

	Manu- facturing	Con- struction	Trade	Business services	Total
Cost-based pricing	74.0	88.2	65.8	74.0	74.2
Explicit contracts	70.5	64.6	48.2	65.9	63.2
Implicit contracts	70.4	51.2	40.2	41.5	50.9
Coordination failure	39.6	48.1	53.9	31.8	41.1
Information costs	37.0	40.3	38.6	44.7	40.5
Temporary character of shocks	37.1	45.9	34.9	24.6	33.4
Price thresholds	26.8	4.3	32.2	17.5	21.5
Non-price competition	24.9	21.3	17.6	12.3	18.3
Menu costs	15.8	2.0	26.0	18.2	17.0

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania "On Price and Wage Setting" and author's calculations.

The other explanations for the stickiness of prices – *temporary character of shocks*, *price thresholds*, *non-price competition* and *menu costs* – appear to be less relevant for firms when

they consider increasing the prices. Interestingly, the physical price adjustment costs – *menu costs* – are reported as the least important reason to abstain from price adjustment, although this explanation of price stickiness is frequently used in the literature.

A ranking of the five most important explanations for the upward price stickiness in all economic activities is different from the one found for the entire set of firms. For the firms in manufacturing and construction, the *temporary character of shocks* appears to be more significant than *information costs* in preventing price increase. Firms in trade report that *coordination failure* is a more relevant explanation for maintaining prices constant instead of raising them as compared to the relevance of *explicit contracts* and *implicit contracts*. This corresponds to the observation that trade firms follow the main competitors more often when setting prices. Business services firms indicate a relatively higher importance of *information costs* in comparison to *implicit contracts* and *coordination failure* in clarifying the significance of reasons for the upward price stickiness.

The present study shows that three out of five most important reasons preventing from increasing prices are also relevant when distinguishing the most momentous factors forcing to abstain from lowering the prices. Firms report that *cost-based pricing*, *explicit contracts* and *coordination failure* are among the most important causes of downward price stickiness (see Table 5). In addition, firms indicate that the *temporary character of shocks* is very relevant in for deciding to maintain the prices constant, although there are some reasons to decrease them. Firms also find it important to keep the prices constant due to a *quality signal*.

Information costs, *non-price competition*, *price thresholds* and *menu costs* are among the less momentous factors maintaining prices constant when there are some reasons to decrease them. Similarly as in the case of upward stickiness of prices, *menu costs* appear to be the least important factor in preventing the downward price adjustment.

TABLE 5. Explanations for downward price stickiness (percentage of firms for which the explanation is “relevant” or “very relevant”)

	Manu- facturing	Con- struction	Trade	Business services	Total
Cost-based pricing	56.3	75.3	51.5	66.8	61.7
Explicit contracts	56.3	62.6	26.8	57.1	51.1
Temporary character of shocks	53.8	57.6	47.8	47.7	50.9
Quality signal	59.2	46.5	51.7	37.5	48.1
Coordination failure	43.8	44.2	33.0	33.2	37.8
Information costs	37.4	28.5	32.8	23.5	30.2
Non-price competition	24.4	33.4	36.5	22.0	27.4
Price thresholds	24.5	4.0	20.2	21.3	19.6
Menu costs	24.1	0.0	21.6	13.5	16.4

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s calculations.

Firms in manufacturing, construction and business services indicate the same five most relevant explanations for the downward stickiness of prices as reported for the whole sample of the firms, although in manufacturing the explanations rank in a different way. Firms in manufacturing claim that the wish to prevent a *quality signal* stands above all other reasons for price stickiness. *Quality signal* also appears to be the most important factor in trade firms in deciding to keep the prices constant instead of lowering them. In these firms, the *quality signal* is followed by *cost-based pricing*, *temporary character of shocks*, *non-price competition*, and *coordination failure*.

4. Asymmetries in price adjustment

Pricing behaviour may feature different characteristics in the face of various economic shocks. Firms may find it optimal, for instance, because of customer specifics, to handle differently the increased demand and the decreased demand. Firms may also deal dissimilarly, say, due to employed technologies, with the higher costs and the lower costs.

To analyse the asymmetries of price response to economic shocks, the firms were asked whether they adjust the prices when the demand changes or the costs change enough to review the prices. Firms were inquired whether (1) they would change the prices, (2) they would not change the prices, or (3) they do not know what their reaction would be in response to four types of shocks: a demand increase shock, a demand decrease shock, a cost increase shock, and a cost decrease shock.

The answers make it difficult to infer whether firms react differently in case of heightened or dampened demand, while the firms' reaction to higher and lower costs appears to embed some asymmetry. As shown in Table 6, the number of firms that adjust prices following the demand increase is somewhat higher than the number of firms changing prices in response to demand decrease. Also, the survey has shown that the fraction of firms maintaining prices in the face of heightened demand is also higher than the fraction of firms not changing prices in response to dampened demand. This pattern of responses is valid in manufacturing, while in other economic activities it is somewhat different. In construction and business services, a larger portion of firms adjust the prices and a smaller part of firms maintain the prices in the case of a higher demand than in response a lower demand, while in trade the opposite pattern of reaction to demand shocks is observed.

The response of firms to cost increase and cost decrease shocks turns to exhibit an asymmetric reaction. A considerably larger portion of firms adjust the prices in the face of cost increase than in the case of cost decrease, while the fraction of firms maintaining the prices is smaller in response to the higher cost shock than in the case of the lower cost shock. This response pattern is evident in all the kinds of economic activities studied.

It is noticeable that firms' response to the demand increase and the demand decrease shocks differs markedly from the response to the respective cost shocks. Smaller share

of firms change the prices and larger share of firms maintain the prices when the demand increases compared to the case when the costs increase. Entirely the opposite reaction of firms is observed in the cases of the demand decrease and the costs decrease. Such response pattern is found in all the considered economic activities.

TABLE 6. Incidence of price change in response to demand and cost shocks (firms, percent)

	Manu- facturing	Con- struction	Trade	Business services	Total
Demand increase shock:					
firms that change the price	49.2	72.1	44.7	50.2	51.7
firms that do not change the price	47.6	27.9	50.0	42.7	43.6
firms that do not know	3.3	0.0	5.3	7.1	4.6
Demand decrease shock:					
firms that change the price	48.4	46.2	52.0	30.4	42.4
firms that do not change the price	42.4	34.5	36.1	49.6	42.5
firms that do not know	9.2	19.3	11.9	20.1	15.1
Cost increase shock:					
firms that change the price	92.2	95.7	76.6	80.9	85.3
firms that do not change the price	7.4	2.3	11.7	4.6	6.6
firms that do not know	0.5	2.0	11.6	14.6	8.1
Cost decrease shock:					
firms that change the price	37.4	42.3	27.8	23.0	30.9
firms that do not change the price	52.2	43.6	63.8	59.2	56.0
firms that do not know	10.4	14.1	8.4	17.7	13.1

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania "On Price and Wage Setting" and author's calculations.

The firms that indicated a change in prices following the analysed shocks were asked to provide information on the length of the lag of price adjustment. As shown in Table 7, the average lag of change in prices ranges from 2.2 to 2.7 months, depending on the shock. The length of lag is quite similar in the case of both increased and decreased demand shocks, and the length of lag is also quite similar in the face of both higher and lower cost shocks. The lag of price adjustment appears to be marginally longer following

TABLE 7. Lag of price change in response to demand and cost shocks (months)

	Manu- facturing	Con- struction	Trade	Business services	Total
Demand increase shock	2.3	1.6	1.9	2.9	2.3
Demand decrease shock	1.8	2.2	1.8	3.1	2.2
Cost increase shock	2.5	1.9	1.7	3.4	2.5
Cost decrease shock	2.5	2.4	1.8	3.7	2.7

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania "On Price and Wage Setting" and author's calculations.

the cost shocks than in the face of demand shocks. The time elapsed until the prices are changed is somewhat longer in business services.

A number of characteristics of firms might affect their decisions on prices following the shocks. The way of pricing might be influenced by contracts with customers, the degree of market competition, labour contracts and other factors. To get a perception of the determinants of pricing decisions in the face of shocks and of a possible asymmetric influence of some of the factors firms' reaction to shocks is modelled using binary probits. All the models (those of response to heightened or dampened demand, to higher or lower costs) include four sets of explanatory variables, namely those gauging the production technologies, accounting for labour compensation settings, capturing market competition, and reflecting the interaction of firms with their customers.

The variables of the first three sets are used in regression analysis in Virbickas (2009). To be more specific, the set of variables accounting for differences in production technologies contains five variables: *labour share* – the share of labour costs in the total costs (this variable is expressed as a percentage); *trade firms* and *services firms* – the economic activity dummy variables; the latter variables take the value 1 if a firm is a trade firm (Section G of NACE rev. 1.1) or any other market services firm (Sections H-K of NACE rev. 1.1) and take the value 0 otherwise (the reference category is manufacturing firms, Sections D-F of NACE rev. 1.1); *firms 20–49* and *firms 50 or more* – the firm size dummy variables; the latter variables take the value of 1 if the number of a firm's employees varies between 20 and 49 or 50 or more, and they take the value of 0 otherwise (the reference category is the firms with up to 19 employees). The set proxying labour compensation settings includes two variables: *collective pay agreements* – a dummy variable that takes the value of 1 if the firm applies any collective pay agreement, and it takes the value of 0 otherwise; *flexible wage share* – the share of individual or company performance-related bonuses in the total wage bill (this variable is expressed as a percentage). The set of market competition variables comprises two variables: *competition* – a dummy variable constructed using responses to the question whether the firm decreases its price following the price decrease of the product of the main competitor; the latter variable takes the value of 1 if the firm is “very likely” to decrease the price, and it takes the value of 0 if the firm is “likely”, “not likely” or “not at all” likely to decrease the price; *foreign sales share* – the share of revenue generated by foreign sales in the total revenue (this variable is expressed as a percentage).

Regression analysis includes a set of three explanatory variables that reflect the ways and outcomes of interaction of firms with their customers:

- *regular customers' share* – a variable constructed to account for the influence of non-formal business relationship of firms with their customers. The incidence of regular customers could possibly grasp the importance of, as titled above, implicit contracts. *Regular customers' share* is the share of revenue generated by sales to such customers. The latter variable is expressed as a percentage;

- *wholesale and retail firms' share* – a variable to capture the effects of the type of customer in shaping the behaviour of firms. Different types of customers might incur different costs when searching for an optimal price. The costs might be lower for wholesale and retail firms, and the costs might be higher for the final consumers. Firms, therefore, may show different pricing behaviour depending on the customers to whom they sell. *Wholesale and retail firms' share* is the share of revenue generated by sales to wholesale and retail firms. The variable is expressed as a percentage;
- *price discrimination* stands to grasp whether firms set the prices differently for different customers. Price discrimination represents the pricing outcome when prices are accommodated to customer ability or willingness to pay. Price discrimination, therefore, renders a different pricing pattern as compared to the one under a non-discriminatory setting. *Price discrimination* – a dummy variable that takes the value of 1 if the firm sets the price individually for customer(s) or depending on the quantity of orders or on some other factors, and takes the value of 0 if the firm sets the same price for all customers.

The dependent variable in all the models is the binary variable that takes the value of 1 if the firm changes the price in response to the shock (i.e. in response to demand increase, demand decrease, cost increase or cost decrease) and takes the value of 0 if it does not change the price.

The estimation results from binary probit models are provided in Table 8. To make it concise, the analysis is limited to the marginal effects on the probability that the firm changes the price following the shock.

Regression analysis shows that pricing decisions are influenced by the degree of competition when facing the demand shocks. Firms encountering a stronger competition are more likely to change prices not only when the demand decreases, but also when it increases. The finding on the role of competition in influencing price response to dampened demand is in line with the one reported in Virbickas (2009).

The results indicate that price adjustment is less likely in the face of demand increase when the firm's revenue generated by sales to regular customers is higher. This shows the importance of non-formal – implicit – contracts in taking decisions on prices and corroborates with the conclusions drawn on the upward stickiness of prices. A higher share of sales to regular customers does not appear to be statistically significant in shaping the reaction of firms to a decreased demand.

Firms accommodating prices to different customers are more likely to adjust prices when facing demand shocks. Firms that adhere to price discrimination are more likely to change prices in response to both demand increase and demand decrease shocks. One more factor having an impact on price decisions when the demand varies is the size of the firm. Firms with 20 to 49 employees are less likely to adjust the prices in response to

demand increase as compared with smaller firms. Firm size does not show up as a factor for price decisions in case of demand decrease.

TABLE 8. Explanations for price change in response to demand and cost shocks (marginal effects for binary probit models; the table provides only marginal effects on the probability that the price is changed in response to the shock)

	Type of shock:			
	demand increase	demand decrease	cost increase	cost decrease
Labour share	0.001	-0.001	0.000	-0.003**
Trade firms	-0.028	0.036	-0.067*	-0.035
Services firms	0.057	-0.031	0.038	-0.035
Firms 20–49	-0.151*	-0.023	0.040**	-0.102
Firms 50 and more	0.079	0.084	0.012	0.007
Collective pay agreements	-0.085	-0.034	0.006	-0.090
Flexible wage share	0.002	-0.002	-0.001	-0.001
Competition	0.205***	0.201***	-0.023	0.086
Foreign sales' share	0.002	-0.001	-0.001**	0.001
Regular customers' share	-0.003***	-0.002	0.001**	0.001
Wholesale and retail firms' share	-0.001	0.000	0.000	-0.001
Price discrimination	0.147*	0.244***	-0.021	-0.080
Pseudo R-squared	0.077	0.056	0.143	0.037
Wald statistics	27.690	19.110	21.600	13.340
Prob. (Wald statistics)	0.006	0.086	0.042	0.345
Number of observations	287	264	291	267

Notes: * – coefficient is statistically significant at the level of 10 percent, ** – significant at the level of 5 percent, *** – significant at the level of 1 percent; p-values are computed using Huber–White robust standard errors.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s estimations.

The study identifies a few forces influencing the pricing pattern following the higher costs shock, while the above described explanatory variables do not explain satisfactorily the pricing behaviour in the face of the lower costs shock; therefore, no inferences are drawn from the latter regression. Estimates show that a higher share of revenue generated by foreign sales reduces the likelihood of price adjustment when costs increase. Presumably, this relates to stronger competition effects. The higher share of revenue generated by sales to regular customers has an opposite effect. In the face of cost increase shock, in contrast to the case of demand increase shock, price adjustment appears to be more likely when firms have stronger the business relationships with their customers. This corresponds to the implicit contracts theory.

Regression estimates indicate another two factors associated with price decisions at increasing costs. Firms in trade turn out to be less likely to adjust the prices in response to higher costs as compared to the manufacturing firms, and firms that employ 20 to 49 employees seem to be more likely to change prices following this shock than do smaller firms.

To check the robustness of estimation results, all the models were estimated using alternative definitions of the dependent variables. These variables are constructed as binary variables that take the value of 1 if the price is adjusted in three or less months following the shock (i.e., following demand increase or decrease and cost increase or decrease) and take the value of 0 if the price is changed after three months or is not changed. The robustness analysis shows that, given the different definitions of the dependent variable, it cannot be concluded that in the face of demand increase, price adjustment is more likely in the firms that use price discrimination. Firms that employ 20 to 49 employees, contrary to the findings mentioned above, do not turn out to be less likely to respond to a higher demand by changing prices as compared to smaller firms. Additionally, the investigated set of variables is not statistically significant in describing firms' response to cost increase, using an alternative definition of the dependent variable.

The further regression analysis has been conducted to test whether firms are more or less likely to react to demand increase and cost increase as opposed to demand decrease and cost decrease. Data on both demand shocks and both cost shocks have been pooled. The model of responses to changes in demand and the model of responses to movements in costs include all the explanatory variables outlined above. Apart from these variables, the models include a dummy variable indicating whether responses concern an upward change in demand and an upward change in costs, respectively. *Demand increase* and *cost, increase* take the value of 1 if the responses indicate the reaction of firms to an increase in demand and an increase in costs, respectively, and take the value of 0 otherwise. The dependent variables are defined as binary variables taking the value of 1 if a firm changes the price following the investigated shocks, and take the value of 0 if it does not. Regression results conform to the ones presented earlier in this section. They point to a more likely response of firms by adjusting prices following cost increase rather than cost decrease, while the difference in reaction to opposite changes in demand has not been found to be statistically significant (see Table 9).

The inferences concerning the reaction to the upward as opposed to the downward change in demand and costs appear to be robust when the dependent variables in the models of pooled demand and cost shocks are redefined as in the robustness analysis above.

To investigate the asymmetries in price adjustment, the firms were also asked to provide information on the reasons that caused the upward change in prices and the reasons that have been behind the downward change in prices in the recent years. Firms were asked to render an assessment of the following potential explanations for the

TABLE 9. Explanations for price change in response to pooled demand and cost shocks (marginal effects for binary probit models; the table provides only marginal effects on the probability that the price is changed in response to the shock)

	Type of shock:	
	demand change	cost change
Labour share	0.000	-0.002
Trade firms	0.005	-0.104*
Services firms	0.017	0.001
Firms 20-49	-0.087	-0.014
Firms 50 and more	0.084	0.016
Collective pay agreements	-0.059	-0.056
Flexible wage share	0.000	-0.002
Competition	0.202***	0.028
Foreign sales share	0.000	0.000
Regular customers share	-0.002***	0.001
Wholesale and retail firms share	0.000	-0.001
Price discrimination	0.192***	-0.069
Demand increase	-0.025	-
Cost increase	-	0.608***
Pseudo R-squared	0.051	0.351
Wald statistics	36.430	216.630
Prob. (Wald statistics)	0.001	0.000
Number of observations	551	558

Notes: * – coefficient is statistically significant at the level of 10 percent, ** – significant at the level of 5 percent, *** – significant at the level of 1 percent; p-values are computed using Huber–White robust standard errors.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s estimations.

change in prices: change in labour costs, change in capital costs, change in prices of raw materials or services that the firms buy, change in taxes, change in prices of the competitors, the regularity of price change, change in the demand, the administrative measures of public authorities, the general price level (price change) in the country, and change in the prospects of inflation and/or other macroeconomic variables. The list of potential explanations for price increase included also a change in the quality of the main product, while the series of potential explanations for price decrease also covered changes in the technology that lowered the costs and competitors’ introduction of new and better products. Firms were requested to indicate whether the provided explanations were (1) not relevant, (2) of little relevance, (3) relevant, (4) very relevant for price increase and for price decrease or (5) they do not know.

The firms have indicated that the most momentous reasons for an upward price adjustment are related to costs. In particular, higher prices of raw materials or services that the firms buy and higher labour costs top the list of reasons for price increase (see Table 10). The other five most decisive factors of the upward change in prices include consideration of the general price level (price increase) in the country, higher quality of the main product and higher taxes. The factors, related to market conditions such as an increase of prices of the competitors and of the demand, stand out as somewhat less explanatory reasons for price increase. A change in the prospects of inflation and / or other macroeconomic variables and an increase in costs of capital are also viewed as somewhat less momentous explanations for an upward change in prices, while a regular increase in prices and the consideration of administrative measures of public authorities rank as the factors of lowest importance.

Firms in manufacturing and business services point up the same five factors that are regarded as the most momentous ones for an upward price adjustment as they are found for the whole sample of the surveyed firms. Construction and trade firms, however, attach relatively more importance to some other factors. In particular, for the firms in construction higher quality of the main product ranks somewhat below and a change in the prospects of the inflation and/or other macroeconomic variables ranks somewhat higher in the list of explanations for price increase. Trade firms attach relatively lower importance to higher taxes and greater importance to higher costs of capital when assessing the reasons for upward price adjustment.

TABLE 10. Reasons for price increase over the recent years (percentage of firms to which the reason is “relevant” or “very relevant”)

	Manu- facturing	Con- struction	Trade	Business services	Total
Prices of raw materials or services (that the firm buys) increased	98.6	100.0	95.3	92.4	96.1
Labour costs increased	92.4	90.5	79.3	95.8	90.4
General price level (price increase) in the country was taken into account	57.0	89.5	64.4	59.1	64.5
Quality of the main product increased	67.8	44.9	53.2	70.5	61.9
Taxes increased	53.9	71.2	48.2	62.8	58.4
Prospects of the inflation and/or other macroeconomic variables changed	44.5	62.2	42.0	55.0	50.3
Competitors increased the price	49.7	48.8	49.3	36.1	45.0
Demand increased	31.0	60.3	40.2	49.6	43.8
Capital costs increased	34.2	48.8	50.3	38.2	41.3
Price is increased regularly	23.9	35.7	19.6	29.4	26.7
Administrative measures of public authorities were taken into account	8.5	4.6	7.2	10.9	8.4

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s calculations.

The survey has revealed a rather different ranking of explanations for price decrease as compared with the ranking of factors for price increase. Firms have indicated that the most decisive explanations of downward price adjustment are related to market conditions. A decrease in prices of the competitors, a decrease in the demand, and the new and better products introduced by competitors stand out among the five most momentous factors of price decrease (see Table 11). The other most decisive factors are consideration of the general price level (price decrease) in the country and a decrease of the prices of raw materials or services that the firms buy. Changes in the technology that lowered the costs and a change in the prospects of inflation and/or other macroeconomic variables are regarded as less important explanations for downward price adjustment. All the other explanations, including those related to the costs – a decrease in the costs of capital and in labour costs – are regarded as least relevant.

TABLE 11. Reasons for price decrease over the recent years (percentage of firms to which the reason is “relevant” or “very relevant”)

	Manu- facturing	Con- struction	Trade	Business services	Total
Competitors lowered the price	96.2	92.5	89.7	42.8	82.3
Demand decreased	85.0	64.2	75.4	12.2	63.6
General price level (price decrease) in the country was taken into account	50.9	100.0	58.5	41.1	57.7
Competitors introduced new and better products	71.5	64.2	62.6	6.9	53.9
Prices of raw materials or services decreased	46.8	71.6	58.6	34.2	51.1
Technologies improved and thus lowered the costs	64.5	43.3	29.3	53.9	48.7
Prospects of inflation and / or other macroeconomic variables changed	24.3	92.5	28.5	30.9	36.1
Capital costs decreased	12.6	35.8	23.0	29.3	22.5
Labour costs decreased	22.2	7.5	15.2	25.7	18.8
Taxes decreased	11.0	14.9	23.1	25.7	18.3
Price is lowered regularly	19.9	0.0	13.6	27.3	16.9
Administrative measures of public authorities were taken into account	10.3	0.0	8.1	0.0	6.1

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s calculations.

Firms in trade report a similar set of five most explanatory factors of downward price adjustment, while firms in other economic activities assign a somewhat higher importance to other factors. Firms in manufacturing rate a decrease in prices of raw materials or services somewhat lower, whereas a change in the technology that has lowered the costs is rated somewhat higher. Construction firms assign a greater significance to a change in

the prospects of inflation and / or other macroeconomic variables and less significance to a decrease in the demand and competitors' introduction of new and better products in explaining the downward price adjustment. Firms in business services render a particularly different ranking to the most decisive reasons for price decrease. These firms assign a significantly lower importance to a decrease in the demand and the introduction of new and better products by competitors, and they assign more importance to the change in the technology that lowered the costs and a change in the prospects of inflation and / or other macroeconomic variables.

Assessment of the investigated explanations for the movements in prices reveals an asymmetric influence of some of the factors on the upward and downward changes in prices. The cost factors, specifically changes in labour costs and in prices of raw materials or services, turn out to be more decisive in invoking a price increase rather than a price decrease (see Table 12). This corroborates the above noted evidence of a rather more likely price adjustment following the cost increase than in response to cost decrease. The factors related to market conditions, in particular a change in prices of the competitors in the demand, appear to be more momentous in inducing a price decrease rather than a price increase – the observation that did not come out in the preceding shock analysis.

TABLE 12. Asymmetry of price change reasons (difference between the shares of firms for which the reason for price increase and price decrease is “relevant” or “very relevant”; percentage points)

	Manu- facturing	Con- struction	Trade	Business services	Total
Labour costs changed	70.2	83.0	64.1	70.1	71.6
Prices of raw materials or services changed	51.9	28.4	36.6	58.2	45.0
Taxes changed	42.9	56.3	25.1	37.1	40.1
Capital costs changed	21.6	13.0	27.3	9.0	18.8
Prospects of the inflation and / or other macroeconomic variables changed	20.2	-30.3	13.5	24.1	14.2
Price is changed regularly	4.0	35.7	6.0	2.1	9.8
General price level (price change) in the country was taken into account	6.1	-10.5	5.9	18.0	6.9
Administrative measures of public authorities were taken into account	-1.8	4.6	-0.9	10.9	2.3
Demand changed	-54.1	-3.9	-35.2	37.4	-19.9
Competitors changed the price	-46.5	-43.7	-40.4	-6.7	-37.2

Notes: responses are employment-weighted and rescaled to exclude non-responses.

Sources: the survey of the Bank of Lithuania “On Price and Wage Setting” and author’s calculations.

Manufacturing, trade and business services firms report the same most important factors leading to a more likely price increase or decrease as they are revealed for the whole set of the firms, with one exception of business services. In the latter economic

activity, only a change in prices of the competitors is viewed as an explanation for a more likely downward change in prices. In construction, a somewhat different list of concerned factors has been rescaled. Here, among the factors invoking a more likely price increase, a change in taxes ranks somewhat higher than a change in prices of raw materials or services and, among the factors causing a more likely price decrease, a change in the prospects of inflation and / or other macroeconomic variables is regarded as more important than a change in the demand.

Conclusions

Analysis of the firm-level data collected in an ad hoc survey has revealed a series of features of price setting practices in Lithuanian firms. The survey has shown the incidence of both time-dependent and state-dependent price reviewing policies used by the firms. Most of them review the prices depending on the time and in certain – state-dependent – cases. Nevertheless, price reviewing practices are somewhat tilted to the state-dependent pricing as the percentage of the firms that review prices only in certain cases is higher than that of the firms that review the prices regularly. All else equal, state-dependent pricing implies a more responsive way of price setting.

According to the survey, somewhat more than one third of all the firms under study review the prices irregularly. Approximately one third of the firms review the prices daily to monthly, and almost one quarter of the firms review them quarterly to half-yearly. Prices turn out to be reviewed more frequently than they are changed, implying that the stickiness of prices might occur at both the price reviewing and price adjustment stages.

However, in examining the delay in price adjustment when there are reasons for increasing or decreasing prices, firms mostly refer to explanations related to the price adjustment stage. Firms indicate that the most momentous explanations for not adjusting prices either upwards or downwards are related to the costs that they encounter in operational activities – cost-based pricing – and formal (or, alternatively, explicit) contracts with their customers. The list of reasons for the upward stickiness of prices is followed by a non-formal (or, alternatively, implicit) contracts, lack of coordinated actions with other firms (coordination failure) and information costs. Among the most important factors for a sticky downward price adjustment, firms also mention the temporary character of shocks, the possibly misleading signal on the quality, and the aforementioned failure of coordination among the firms. The physical price adjustment costs – menu costs – are viewed as least significant in causing both the upward and downward stickiness of prices.

The analysis has revealed an asymmetric influence of some of the price factors. The cost factors, namely movements in labour costs and in prices of raw materials or services, appear to be more decisive in invoking a price increase rather than a price decrease. As a

corroboration, the survey results indicate that prices are more likely to respond to higher rather than to lower cost shocks. At the same time, evidence on the influence of factors related to market conditions is less clear-cut.

A regression analysis has pointed to an asymmetry in the effects stemming from operational characteristics of firms when they decide on prices. The non-formal contracts, proxied by the revenue from sales to regular customers, are found to limit price adjustment when demand goes up, but not when the demand goes down. Price accommodation to different customers turns out to contribute to the response of prices to the demand decrease, but not to the demand increase.

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