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Firms' responses to shocks by price, wage and employment in Macedonia

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Abstract

This paper analyses the role of the intensity of output market competition, firm's technology and of the incidence of collective wage-bargaining on firm's adjustment strategies to adverse shocks using firm-level data for Macedonia. We find that international character of product market competition reduces the relevance of firms' price reactions to cost shocks, whereas firms' exposure to domestic competition seems to have an opposite effect. The presence of collective wage agreements at national level makes a price increase less likely. The results suggest that labour intensity in production process makes firms more likely to increase prices after wage shock. The second part of the paper focuses on cost-cutting strategies and the factors that explain the choice of the strategy. The data indicate that market competition and wage agreements signed outside the firm increase the likelihood of cost-cutting strategies via labour costs, particularly through employment reduction, after cost shock. On the contrary, empirical results indicate that fluctuations in permanent employment to cost and wage shock are safeguarded by presence of temporary and part time employment.

Key words: survey data, product market competition, labour market institutions, firm's technology, Macedonia

JEL classification: C42, D21, E30, J38

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1. Introduction

A crucial element of microeconomic and macroeconomic adjustment is the behavior of firms to adverse shocks and their decisions for prices, wages and employment. Firm-level reactions to shocks form the distribution and dynamics of wages and employment with important policy implications. Namely, the higher the labour market rigidities are the more difficult labour (re)allocation becomes. This, in turn, reduces productivity and profits and may increase the degree to which cost-push shocks and demand shocks are passed on to prices. On the policy side, higher labour market rigidities decrease the functionality of the monetary policy transmission and make it more difficult to achieve the price stability goal. This is especially important for a small and open economy, like Macedonia, with a fixed exchange rate regime and imperfect capital mobility, where autonomy of monetary policy is relatively high.

We focus on price, employment and wage adjustment strategies in firms' reactions to shocks and assess the influence of structural and institutional characteristics of the firms in their chosen response strategy. For this we use survey data collected at the firm level in Macedonia. The survey uses the harmonized survey questionnaire and design applied within the Wage Dynamics Network (WDN)[1] of Eurosystem. Moreover, we compare some of the factors that influence firms' decisions in Macedonia to supply shocks with firms from EU investigated by Bertola et al. (2010).

Using the very rich survey database, we analyse the role of the intensity and international character of output market competition, of firm's technology and of the incidence of collective wage-bargaining constraints on firm's adjustment strategies to shocks. Our findings indicate that these factors are relevant for price, wage and employment adjustment and in most cases are in line with theoretical considerations. Also, these determinants are found to be relevant for surveyed EU firms investigated by Bertola et al. (2010). The second part of the paper focuses on cost-cutting strategies and the factors that explain firms' choices.

The remaining structure of the paper is as follow: in Section 2 we describe the dataset of Macedonian survey, and outline theoretical considerations to be used in empirical specifications. Next, in Section 3 we investigate the influence of firms' characteristics on

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[1] The WDN is an ESCB/Eurosystem research network studying the features and sources of wage and labour cost dynamics in EU countries.

price and cost adjustment strategies to cost shocks, and in Section 4 we consider different cost-adjustment strategies applied by firms. In each case we report descriptive statistics as well as controlled probit regressions. Finally, in Section 5 we conclude the paper.

2. Data, relevant theory and literature

2.1 The dataset

In this paper, we use survey data for Macedonia. The survey contains questions on wage and price-setting behaviour at the firm level. It was conducted by the National Bank of the Republic of Macedonia for the first time during the first half of 2014, using an outsourcing global market research company. The survey design uses the common harmonized questionnaire and sample design, drawn up by the European Central Bank for EU countries within the Wage Dynamics Network (WDN)[2].

Table 1 presents the sample composition by sector and firm size. The representative sample covers 514 firms with different size in regard to employees that operate in manufacturing, construction, trade and market services. A detailed description of the Macedonian survey sample and the results can be found in Ramadani and Naumovski (2015). In order to make our results representative for the workforce in the sectors covered, we use employment adjusted sampling weights. As we noted above, the survey was conducted in 2014, which represents the period of sluggish economic recovery from the global economic and financial crisis and low consumer price inflation.

Table 1
Sample composition by sector and size

	Number of firms					
	1-4 employees	5-19 employees	20-49 employees	50-199 employees	>200 employees	Total
Manufacturing	12	32	30	64	23	161
Construction	7	14	10	15	3	49
Trade	51	72	19	18	4	164
Market services	25	67	17	20	11	140
Total	95	185	76	117	41	514

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[2] The WDN is an ESCB/Eurosystem research network studying the features and sources of wage and labour cost dynamics in EU countries.

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Percentages

	1-4 employees	5-19 employees	20-49 employees	50-199 employees	>200 employees	Total
Manufacturing	2.3	6.2	5.8	12.5	4.5	31.3
Construction	1.4	2.7	1.9	2.9	0.6	9.5
Trade	9.9	14.0	3.7	3.5	0.8	31.9
Market services	4.9	13.0	3.3	3.9	2.1	27.2
Total	18.5	36.0	14.8	22.8	8.0	100.0

Source: Survey on wage and price setting in Macedonia (2014).

This paper studies firm-level adjustment strategies in reaction to hypothetical shocks. The common questionnaire contains information on how firms respond to three different adverse shocks (oil, wage and demand shocks). Similar to Bertola et al. (2010), this paper concentrates on two cost shocks.[3] One shock is an unanticipated increase in the cost of an intermediate input (e.g. an oil price increase), and the other shock represents an unanticipated increase in wages (for example, due to contracts bargained at higher levels or legislation that changes the required minimum wage). Both shocks affect all firms in the market in a similar way, and the wage shock is of permanent nature. Minimum wage in Macedonia for all sectors was introduced in the beginning of 2012 and after that it was increased almost each year[4]. In this regard, the question about wage shock represents an event that firms in Macedonia, mainly in manufacturing sector, have faced it recently.

The respondents had to tick the relevance (choosing between "not relevant", "of little relevance", "relevant" and "very relevant") of four different adjustment strategies in response to cost-push shocks: (1) increase prices, (2) reduce margins, (3) reduce production and (4) reduce other costs. Firms that rated "cost reduction" at any relevance were also asked what strategy they pursued (how they reduced costs). They had to choose between six options: reduce base wages (this option is not relevant for the wage shock), reduce flexible wages, reduce the number of permanent employees, reduce the number of temporary employees, and reduce the number of hours worked or reduce non-labour costs. Appendix 1 reports the exact wording of the questionnaire. The construction of variables is given in sections 3.2 and 4.2, that deal with explanation of empirical results about firms' adjustment strategies and cost-

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[3] As stated at their paper, while firms were also asked to consider reactions to a demand shocks, it is conceptually easier to study whether and how labour-cost adjustment is shaped by the firm's environment in response to the two hypothetical cost-push shocks.

[4] Law on minimum wage ("Official Gazette of the Republic of Macedonia" 11/12; 30/14; 180/14; 81/15; 129/15).

cutting strategies.

2.2 Relevant theory and literature

The rich database allows us to investigate the key question of this paper, what factors make Macedonian firms to use price and cost adjustment strategies in response to adverse shocks. Put differently, we focus on how reaction strategies correlate with structural and institutional features of the firms' business environment in which choices are made. To our knowledge, no empirical study exists of the reaction of Macedonian firms to adverse shocks. One empirical study that uses the same Macedonian survey data is that by Huber and Petrovska (2015), but they focus on nominal price and wage rigidities. They find that higher price flexibility is associated with a higher degree of product market competition, and firms facing high levels of domestic and international competition tend to adjust prices faster.

The main reference paper for our research is Bertola et al. (2010). Bertola et al. (2010) analyse the overall results of wage and price setting surveys for EU countries with respect to price versus cost and wage versus employment adjustments in response to cost-push shocks. Their finding is that the intensity and character of the adjustment depends on the intensity of competition, the importance of collective bargaining and on other structural and institutional features of firms and their environment. Our analysis pay special attention to Macedonian survey data. More specifically, the paper focuses on the reaction of Macedonian firms to adverse shocks, compares the results of firm-level adjustment strategies with selected EU countries, and we extend the set of explanatory variables.

Dhyne and Druant (2010) also investigates firms' responses to adverse shocks. They concentrate their analysis on the reaction of Belgian firms versus other European firms. Their main findings are that the importance of wage bargaining above the firm level, the automatic system of index-linking wages to past inflation, the limited use of flexible pay, the high share of low-skilled blue-collar workers[5], the labour intensive production process as well as the less stringent legislation with respect to the protection against dismissal are associated with a stronger employment reaction of Belgian firms to adverse shocks.

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[5] Classification of employees is made according to the International Standard Classification of Occupations (ISCO-08)

The theory about firms' decisions is elaborated at Bertola et al. (2010). Amongst others, they elaborate that the relevance of price and cost reactions depends on the shape of the firm's marginal revenues and marginal productivity (hence marginal costs). In turn, these depend on the firm's market power, and on institutional constraints on wage and employment adjustment. Under flexible prices, margins may be adjusted if the elasticity of demand varies (as in e.g. Gali, 1994). If prices are sticky, however, margins need to be adjusted when costs change. Thus, the relative relevance of the 'increase prices' and 'reduce output' should depend on the extent of price stickiness.

As discussed in theoretical section by Bertola et al. (2010), in response to supply shocks that (like those mentioned in the survey questions[6]) are common to all firms, it is more likely that prices rather than costs are the preferred adjustment strategy, when the output market is more competitive and firms have less control over the prices they charge.[7] Moreover, according to Bertola et al. (2010), the relevance of employment and wage reactions in a firm's cost-minimisation strategy in response to shocks depends essentially on the elasticity of its demand function, and on institutional constraints. Wage and employment responses are expected to be larger when labour demand is more elastic[8]. Moreover, employment adjustment should be larger when wages are rigid, and smaller when turnover is more costly (Bertola and Rogerson, 1997).

3. Adjustment to cost and wage shocks

3.1 Descriptive analysis

The survey evidence allows us to understand the issues of interest by considering the information available on firm reactions to two different adverse shocks, particularly an increase in the cost of intermediate inputs (e.g. an oil price increase) and a general permanent rise in wages. Firms in Macedonia were asked to assume that these kinds of shocks hit them.

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[6] An increase in intermediate input prices (such as the rise of crude oil prices) and a permanent increase in wages (for example, legislation that changes the required minimum wage).

[7] When prices are sticky, however, a high elasticity of product demand and small margins make it easier for wage and cost shocks to overcome the cost of price changes.

[8] International economic integration is generally expected to increase the elasticity of labour demand as well as labour productivity (see Andersen et al., 2000 and Andersen and Skaksen, 2007). Also, the elasticity of labour demand is expected to be larger, when a firm's production and investment choice spans international borders (Scheve and Slaughter (2004).

Then, they had to assess how relevant the different adjustment strategies[9] in response to the shocks would be. They could choose among the options "very relevant" (4), "relevant" (3), "of little relevance" (2) and "not relevant" (1)[10].

Table 2 lists the four different adjustment strategies and their relevance for firms in Macedonia. The table contains the average score across all respondents and the proportion of respondents indicating that a particular shock-absorbing strategy is "very relevant" or "relevant" for them. The majority of Macedonian firms prefer to adjust to shocks by reducing their costs, where more than 70 percent of firms indicate that the reduction of other costs is "very relevant" and "relevant" option in response to a cost shock. Approximately 63 percent of the firms increase prices when facing a (hypothetical) cost shock. Around 54 percent of the firms indicate that a reduction in profit margins is a relevant answer, whereas only approximately 45 percent say that they reduce output after a cost shock.

Table 2
Reaction after cost shocks and wage shocks (firms assigning "very relevant" or "relevant" to any adjustment strategy)

Adjustment strategy	after a cost shock		after a wage shock	
	Av. Score	Proportion	Av. Score	Proportion
Increase prices	2.69	62.54%	2.38	50.15%
Reduce margins	2.39	54.31%	2.08	40.69%
Reduce output	2.22	44.61%	1.91	34.13%
Reduce costs	2.85	71.46%	2.69	65.69%

Source: Survey on wage and price setting in Macedonia (2014).

Consequently, almost two thirds of all firms increase prices in response to an input-cost shock, while more than one third will keep them constant. Furthermore, our results suggest that the fraction of firms increasing prices after a wage shock is somewhat lower compared with that after a cost shock. Moreover, reducing costs, reducing output and reducing profit margins seem on average slightly less important after wage shock than after other input-cost shock, probably suggesting that firms experienced on average smaller wage shocks than cost-push shocks in general. In addition, over the last few years, firms experienced two strong oil price spikes in 2007-08 and 2011-12 mainly owing to high demand coming from emerging markets economies.

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[9] The questionnaire includes four shock-absorbing strategies: 1. increase of prices, 2. reduction of profit margins, 3. reduction of output, and 4. reduction of other costs.

[10] The numbers in brackets give the scores attached to the degree of relevance.

In order to evaluate the pattern of covariation or substitutability across different survey answers, Table 3 reports the empirical correlations between the various adjustment channels, i.e. answers to the question on cost shocks and the one on wage shocks. All the cross-correlations presented in the table are positive and statistically highly significant. The diagonal elements of the sub-matrix reporting between-shocks correlations (the bottom-left quarter of Table 2) are all above 40 percent and significantly exceed the corresponding off-diagonal elements. This indicates that there is a tendency for firms to use the same adjustment strategies in response to both cost and wage shocks. The highest correlations in the "within-shock" sections of the table (figures in italic) correspond to the price-margin pair (approximately 50 percent in the case of wage shock) and margin-costs pair (approximately 53 percent in the case of wage shock). However, as correlations treat deviations from the mean in a symmetric way, these numbers indicate that the combination of increasing prices and reducing profit margins, and the combination of reducing profit margins and costs tend to go hand in hand in not being used. Put differently, both categories are often chosen to be "of little relevance" or "not relevant". Moreover, by looking at the lowest correlations in the "within-shock" sections of the table (figures in bold), the combination of increasing prices and reducing costs seems one of the most popular among the firms in Macedonia.

Table 3
Correlations across the relevance of different adjustment strategies

	Adjustment strategy	Cost shock				Wage shock			
		Price	Margin	Output	Costs	Price	Margin	Output	Costs
Cost shock	Price	1.0							
	Margin	0.52	1.0						
	Output	0.50	0.51	1.0					
	Costs	**0.50**	*0.53*	0.50	1.0				
Wage shock	Price	0.40	0.29	0.16	0.14	1.0			
	Margin	0.20	0.49	0.27	0.27	*0.50*	1.0		
	Output	0.26	0.36	0.49	0.20	0.39	0.43	1.0	
	Costs	0.31	0.32	0.27	0.56	**0.33**	0.45	0.37	1.0

Notes: Responses weighted by employment. All correlations are statistically significant at the 1% level. The sample size contains only non-missings for survey questions 23 (on cost-shocks) and 25 (on wage shocks). Survey questions are given in Appendix 1.

Summing up the descriptive evidence, survey data suggest that about two thirds of the firms in Macedonia increase prices after an input-cost shock, while one third tries to deal with

higher costs in a different way and will keep prices constant. The most popular combination seems to be increasing prices and reducing costs. This gives evidence that cost-push shocks are not passed through proportionately (1:1) in the production chain but smoothed by Macedonian firms. Finally, these results seem to challenge the theoretical assumption that firms always operate at minimal costs. About 65 to 71 percent of the firms (depending on the kind of shock) indicate that they try to reduce other costs after a cost-push shock, which opens up some room for manoeuvre by the occurrence of a shock itself. These results are very similar compared to those of surveyed EU firms. According to Bertola et al. (2010), this way of dealing with cost-push shocks by EU firms would then constitute - at least to some extent - a shock-absorbing mechanism in the economy, as prices have to be raised and output reduced by less than without these cost reductions.

3.2 Firms adjustment strategies and some relevant covariates

In this paper, we focus on the two most popular adjustment strategies, namely reducing costs and increasing prices (see Table 1). In theory, the choice of adjustment strategy is dictated by firms' marginal revenue and cost considerations. Though these are not directly observed in the survey, some of the variables available in the survey dataset can be used indirectly to capture certain characteristics of firms' marginal revenue and cost schedules.

We are interested to analyse whether cost reduction is a more relevant adjustment strategy than price adjustment for firms that behave as price takers rather than price setters. For this purpose we create the variable *competition*, which is a dummy variable coded as unity if the firm replies that it would be "very likely" and "likely" to decrease the price of its product if the firm's main competitor reduced its price (and as zero if "not likely", "not at all", and "do not know/does not apply" was indicated by the firm). The variable *share of foreign sales* in firm's revenues can also proxy for the intensity of price competition, since (controlling for sector and size) market power should be smaller for firms that are more exposed to large international markets. Moreover, to account for differences in production technologies and labour intensities across firms, our specifications also include: *labour share* - the share of labour costs in total costs; the *sector* in which the firm operates - four NACE-based sector dummies (manufacturing, construction, trade and market services); and *firm size* - a set of five dummy variables indicating firm size category in terms of employment (1-4, 5-19, 20-49, 50-199 and 200 and more employees).

While the choice of price adjustment as a shock-reaction strategy is shaped importantly by product market characteristics, the relevance of cost adjustment depends in theory on how easy it would be to do so. This depends on rigidities and adjustment costs in the labour market. In this respect, the survey dataset offers a number of variables that can be regarded as indirect measures of rigidities and adjustment costs associated with the labour input. To account for wage rigidities, our set of explanatory variables includes *collective agreement, higher level* - a dummy variable showing whether a given firm adopts a collective agreement concluded at national, regional, sectoral or occupational level, and *collective agreement, firm level* - a dummy variable indicating the presence of collective bargaining at the level of the firm. Table 2A reports some basic summary statistics for the covariates used in the analysis and is provided in Appendix 2.

3.3 The model and explanation of responses to shocks: what affects the adjustment channel at the firm level?

The main aim of the paper is to explain the firms' responses to different shocks. Following the approach of Bertola et al. (2010), the study explores the determinants of firms' choice to increase prices and/or lower costs in response to intermediate input and wage shocks by focusing on one of these adjustment strategies at a time. As described above, firms could indicate the importance of each strategy in their sets of measures by telling whether a given margin of adjustment is "very relevant", "relevant", "of little relevance" or "not relevant". On the basis of this information, we will define the endogenous variables as dummies, which are equal to unity if the adjustment strategy is "very relevant" or "relevant", and zero otherwise. Thus, we model the determinants of price increase and cost-cutting decisions using econometric technique by estimating probit models of the following form

$$Prob(Y = 1) = \Phi(\beta'x),$$

where *Prob* denotes probability, *Y* is response variable (endogenous variables described above, for example the adjustment strategies such as increase prices or reduce costs), β is a vector of coefficients, *x* is a vector of explanatory variables, and Φ (.) denotes the cumulative normal distribution function.

Table 4 presents the estimation results characterising firms' adjustment to cost and wage shocks. This table shows average probit marginal effects for price increase and cost reduction decisions. It gives the average over the marginal effects computed for all firms in the sample. The size of the average marginal effect and its significance, however, do not differ substantially from those computed for a (hypothetical) firm for which all model covariates are set at their average values. As explained by Bertola et al. (2010), these average marginal effects give an indication by how much the probability that a price increase or a cost reduction is a "very relevant" or "relevant" strategy changes, if one of the covariates changes by one unit (or change from zero to one if the covariate is a dummy variable). The bottom row of the table reports the predicted probability for a hypothetical benchmark firm to report that the response to a shock is "relevant" or "very relevant".

Table 4
Adjustment of prices and (other) costs in response to cost shocks and wage shocks, probit, average marginal effects

	Cost shock		Wage shock	
	Increase price	Reduce costs	Increase price	Reduce costs
competition_market2	0.2048**	0.1586*	0.1532*	0.1237
	(0.0842)	(0.0807)	(0.0833)	(0.0882)
share_of_foreign_sales	-0.2371**	-0.2561**	0.0605	-0.1114
	(0.105)	(0.111)	(0.1175)	(0.1227)
labour_share	-0.0014	0.0561	0.6043***	0.3858***
	(0.1476)	(0.1243)	(0.1327)	(0.1374)
coll_agr_higher	-0.1792**	-0.1488	0.0016	-0.0742
	(0.0857)	(0.0929)	(0.0829)	(0.0927)
coll_agr_firml	0.0481	0.0170	0.1483*	0.0440
	(0.0744)	(0.0705)	(0.0766)	(0.0769)
Observations	514	514	514	514
Pseudo-R^2	0.1006	0.1099	0.1515	0.0695
Log-likelihood	-305.7	-273.6	-302.3	-307.6
Observed frequency	0.625	0.715	0.501	0.657
Predicted frequency	0.633	0.733	0.500	0.668

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Not reported: sector and firms' size effects (see table 2B in Appendix 2 for these effects).

Let's start by analysing the estimation results with the effect of product market competition in firms' adjustment strategies. Our empirical results show that stronger competition is associated with more intensive adjustment in costs in the aftermath of (hypothetical) supply shocks. A firm in a very competitive environment is 15.9 p.p. more likely to reduce costs

after a cost shock and 12.4 p.p. after a wage shock. However, this effect is statistically significant only for the cost shock. On the same direction, but contrary to our theoretical considerations in Section 2.2, price increases are more likely when competition in the product market is strong, and this effect is statistically significant for both shocks. In this regard, qualitatively, domestic market competition makes firms in Macedonia more likely to use a combination of both price and cost adjustment.

The complementary indicator of competitive pressure, the share of foreign sales in total sales, appears to matter or is statistically significant for the way firms in Macedonia react to cost shock only. Specifically, we find that firms with a higher exposure to foreign product markets are less likely to respond to cost shock by increasing their prices. In this regard, exposure to foreign markets implies a qualitatively different effect to that of our more direct measure of price competition, and confirms the theory that firms facing strong competition have very few margins to adapt prices. On the other hand, we find that firms with a higher share of foreign sales in total sales seem to be less likely to reduce costs, which theoretically are expected to reduce them when acting in a competitive environment. This possibly can be explained by looking at which type of costs firms in Macedonia apply reduction (labour or non-labour cost). Below, in section 4.1, it is given evidence that majority of firms in Macedonia reduce non-labour cost after cost-push shock. Having this in mind, in a competitive environment, especially in international environment, these costs (for instance, advertising, marketing and other costs) should be minimised even without a presence of negative shock.

Summarizing the intensity of product market competition, firms increase their prices in cost-push shocks when they operate in competitive domestic environment, but when competition is from international character they are less likely to do so. Generally, firms that operate only in domestic environment are possibly less productive and less profitable compared with firms exposed in foreign markets, and, as a consequence, are more inclined to pass on to prices the cost-push shocks. Another explanation can be the nature of shock itself which imposes firms to automatically include this shock in their cost structure, especially oil shock, and general believe that this kind of shock may be implemented by firm's main competitor as well. So, the character of output market competition, whether international or local, matters for firms in Macedonia how they pass-through to prices when cost-push shocks happen.

Looking at wage rigidities, firms covered by collective bargaining at the firm level are more

likely to respond to shocks by increasing prices, whereas collective agreements at the national, regional or sectoral level do not seem to have strong effects on price and cost adjustment. Non influence of higher level collective bargaining corresponds with the World Bank difficulty of redundancy index for Macedonia, which indicates the relatively loose employment protection in Macedonia (WB, 2011). Thus, rigidities in marginal cost stemming from the presence of lower level collective agreements increase the likelihood that cost shocks and wage shocks will be passed-through to product prices by 4.8 p.p. and 14.8 p.p., respectively (statistically significant only for wage shock). Overall, the existence of collective agreements makes it more likely that adjustments are taking place by raising prices. In other words, rigidities in wages increase the likelihood that cost-push shock (increase in price of intermediate inputs or wages) will be passed on to prices and, hence, be a sign of the presence of second round effects.

A firm's production technology also affects the way it reacts to shocks. When the labour cost share is high, prices are more likely to be adapted. Since a higher labour share implies that marginal costs are more sensitive to labour costs, prices are more likely to be raised in response to a general wage increase. According to results presented in Table 4, a higher labour cost share increases the likelihood of price adjustment after a wage shock (a 10 p.p. rise in the labour share increases the incidence of price adjustment by about 6 p.p.). Also, a tight link between wage and price changes when labour costs are an important part of total costs has also been found in Druant et al. (2009) about surveyed firms in EU. At the same time, besides increasing prices, firms with high labour intensity are more likely to reduce other costs when there is occurrence of wage shock. In response to the input-cost shock, firms with higher labour intensity process seem to be neutral in their decisions on price and cost adjustment and coefficients are not statistically significant.

Our estimations suggest two additional results, and they are about sector and firm dummies. The continuations of results from Table 4 are reported in Appendix 2, table 2B. First, there is a clear sectoral effect indicating that compared to the manufacturing sector, firms operating in the market services sector and trade sector are less likely to respond to the input-cost shock. Similar reactions of these firms from these sectors can be seen also to the wage shock, but results are not statistically significant. Second, we find that larger firms are less likely to respond by increasing prices or reducing costs after a cost or wage shock.

Considering the goodness of fit of our model, the pseudo R² associated to the estimations of our probit specifications are relatively small. Moreover, it seems that most of the explanatory power of the model is associated to the dummy variables coding for the firm size and the sector.[11]

In an alternative specification (not reported in the study), the set of explanatory variables has been extended. We considered the firms covered by a collective agreement at any level and the share of the wage bill related to individual or company performance related bonuses or benefits as additional explanatory variables. Results with respect to firms covered by a collective agreement at any level are not significant. Firms with large share of flexible wage bill are more inclined to reduce costs in response to cost shock. This confirms that flexible pay structures (bonuses and other kinds of flexible pay) can be more easily adapted to the firms' situation.

4. Cost-cutting strategies

The survey and its rich information allows us for a deeper analysis with regard to the most popular adjustment strategy after cost-push shocks (see Table 1), namely reducing other costs. Thus, we proceed to analyse the determinants of different cost-cutting strategies reported by firms in Macedonia. The respondents were asked to report their most important strategy of cutting costs. They could choose among six different options: (a) reduce base wages, (b) reduce flexible wage components, (c) reduce the number of permanent employees, (d) reduce the number of temporary employees, (e) reduce hours worked per employee and (f) reduce non-labour costs. Our aim is to measure the extent to which wage rigidity implies larger employment responses to shocks when labour demand is more elastic[12].

4.1 Descriptive analysis

Before we proceed to analyse the empirical results first we observe the results from descriptive evidence. The answers are summarised in Table 5, which shows that about three quarters of firms prefer to reduce non-labour costs, while the other quarter prefers to reduce labour costs. These non-labour costs include for instance negotiating with suppliers about prices, reducing administrative costs and reducing advertising costs. The first three categories

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[11] The size and sector indicator variables account for around 85% of the pseudo R² of our model.
[12] When labour expenses are a high proportion of total costs, then labour demand is more elastic, and when there is presence of strong product market competition.

in Table 5 imply an employment response to a shock. In reaction to a shock, and without conditioning on any other variable, some 17-20 percent of the responding firms plan to implement their cost reductions by reducing employment. Only around 6 percent of the firms indicate that they are likely to reduce costs by cutting flexible wage components, and only about 1 percent would cut base wages. Finding that firms are more likely to cut employment than wages is of course common in the literature (e.g. Bewley, 1999). We will analyse below how these differences are related to features of the firms' environment.

Table 5
Acceptance of different ways of cost adjustment (share of firms)

Cost-cutting strategy	after a cost shock	after a wage shock
Reduce number of temporary/other employees	10.00%	10.00%
Reduce number of permanent employees	3.70%	4.80%
Reduce hours worked per employee	3.30%	4.90%
Reduce flexible wage components	6.50%	6.10%
Reduce base wages	0.80%	-
Reduce non-labour costs	75.70%	74.20%

Notes: Responses weighted by employment and rescaled excluding non-responses; figures are based on survey questions 24 and 26. Source: Survey on wage and price setting in Macedonia (2014).

On the basis of the simple theoretical considerations outlined above, wage and employment responses are expected to be bigger when firms are subject to strong product market competition. Moreover, they should be smaller when collective agreements reduce wage flexibility, and employment protection legislation (or non-availability of temporary contracts, or technological features) reduces employment flexibility. The following empirical analysis brings this reasoning to bear on the data, using information from the firm-level.

4.2 Adjustment channels and some relevant covariates

To determine factors explaining the choice of the most important cost-cutting strategy, we run a set of probit regressions relating each adjustment choice to theoretically relevant covariates. In particular, we focus on indicators of product market structure and labour market institutions. The dependent variable in the probit regression equals one if the firm

indicates that the respective cost-cutting strategy is the most important one, and zero otherwise. Additional to the covariates already described in Section 3 *(competition, share of foreign sales, labour share, collective agreement (higher level and firm-level)* as well as *industry* and *size)*, we include more variables on characteristics of the labour market, as we are especially interested in their influence on labour-cost cutting strategies.

For this reason, we include the *share of temporary employment,* as a continuous variable giving the percentage share of employees with a temporary contract. Also, we introduce the *share of part-time employment,* which gives the percentage share of employees with a permanent contract, but working part-time. Finally, we use the *share of variable wages*, which is also a continuous variable and gives the percentage share of the total wage bill that is related to individual or company performance related bonuses and benefits.

Results on cost reductions due to employment (permanent and temporary) and wage adjustments are presented in Table 6, whereas results on hours and non-labour cost adjustment are reported in Appendix 2 (see Table 2C). We analyse the impact of output market competition (competition and share of foreign sales)*,* the firm's technology (labour share)*,* the structure of the workforce and its remuneration (share of temporary and part-time employment as well as share of variable wages) and labour market institutions (collective agreement at firm level and higher level) on each type of cost-adjustment strategy separately. Moreover, as previously mentioned, we consider industry dummies and size dummies in order to control for all kinds of differences in technology.

Let's start by analysing the results for the impact of competition on the choice of the preferred cost adjustment channel. Product market competition appears to be positively associated with the relevance of employment and wage adjustment after both types of shocks (statistically significant in the case of intermediate input shock for employment). For a given degree of wage rigidity, this is consistent with standard labour demand theory, in that, for a given labour share, a more elastic product demand function implies a more elastic labour demand and a more pressing need for firms to reduce employment. As we mentioned above, wage adjustment is more likely in a highly competitive environment after both types of shocks, but appears to be not statistically significant. The main impact of competition is on

the choice between labour and non-labour costs, where reduction of non-labour costs[13] is less likely for firms with higher competitive pressures (shown in Table 2C). Overall, firms operating in a highly competitive environment are less likely to reduce non-labour costs and more likely to reduce labour costs, regardless which type of labour costs.

Table 6
Cost adjustment strategies (employment and wages) and some relevant covariates, probit, average marginal effects

	Cost shock			Wage shock		
	Permanent employment	Temporary employment	Wages	Permanent employment	Temporary employment	Wages
competition_market2	0.0547***	0.067***	0.0488	-0.0339	0.0149	0.0388
	(0.021)	(0.0185)	(0.0328)	(0.0611)	(0.0406)	(0.0259)
share_of_foreign_sales	0.0496	0.0879	-0.0781*	-0.0690	-0.0117	-0.0164
	(0.0479)	(0.0655)	(0.0455)	(0.06)	(0.0503)	(0.0301)
labour_share	-0.0533	-0.0053	0.0398	0.1553	-0.0090	0.0530
	(0.057)	(0.054)	(0.0676)	(0.0967)	(0.0874)	(0.064)
coll_agr_higher	0.0438*	0.0080	-0.0326	-0.0580	-0.0067	-0.0132
	(0.0257)	(0.0367)	(0.0295)	(0.0386)	(0.0383)	(0.0267)
coll_agr_firml	-0.0075	-0.0153	0.0299	0.0030	0.0562	-0.0106
	(0.0194)	(0.0282)	(0.0286)	(0.052)	(0.0401)	(0.0255)
share_temp_empl	-0.463***	0.0239	0.0920	-0.2791	0.1078	0.1012
	(0.1702)	(0.0642)	(0.0992)	(0.2346)	(0.0831)	(0.0628)
share_part_time_empl	-0.2694	-0.1359**	-0.5339*	-0.4026*	-0.6873	-0.1908
	(0.2709)	(0.0692)	(0.2828)	(0.2132)	(0.5987)	(0.2523)
share_variable_wages	0.0623	-0.0353	-0.0714	-0.2941**	-0.0666	-0.1026
	(0.06)	(0.0455)	(0.0772)	(0.1494)	(0.0735)	(0.0735)
Observations	433	433	433	412	412	412
Pseudo-R^2	0.2085	0.4552	0.1022	0.1788	0.1135	0.2103
Log-likelihood	-56.0	-79.3	-104.3	-61.4	-111.2	-70.2
Observed frequency	0.0371	0.1004	0.0726	0.0483	0.0999	0.0612
Predicted frequency	0.0084	0.0247	0.0464	0.0184	0.0692	0.0272

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Not reported: sector and firms' size effects (see table 2D in Appendix 2 for these effects).

With regard to labour market institutions, we find that collective agreements outside the firm (that is collective agreements signed at the national, regional, sectoral or occupational level) make an adjustment of permanent employment more likely. Imposing a wage agreement

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[13] These costs could include, for instance, advertising, marketing and other costs that in a competitive environment should be minimised even without a negative shock.

negotiated at a higher than the firm level to a firm increases the probability of laying-off permanent workers by 4.4 p.p. Again, this confirms the weak collective bargaining institutions in Macedonia and may reflect the less heavily regulated Macedonian labour-market, the more flexible lay-off arrangements, as well as weak enforcement of law. Additionally to wage-setting institutions, in case of cost-push shocks, firms with collective wage agreements at higher level are more likely to adjust the number of hours worked per employee. Overall, firms covered by collective wage agreements at higher level appear to reduce the number of permanent employees and to adjust the number of hours worked per employee.

Regarding the structure of workforce, the share of temporary workers shows a solid association with the character of cost-cutting strategies of Macedonian firms. Firms with a high share of temporary employment are less likely to reduce the number of permanent employees as the preferred adjustment strategy, and more likely to indicate layoffs of temporary employees. An increase in the share of temporary workers by 10 percentage points decreases the probability of cutting permanent employment by 4.6 p.p. and increases the probability of reducing temporary employment by 0.24 p.p. (not statistically significant for the second one). Thus, temporary employment in Macedonian firms, acts as a buffer against employment fluctuations for permanent workers.

Now we turn to additional variables included in our regressions that deal with firm's technology and the structure of remuneration. Looking at their sign, the results suggest that firms in Macedonia with high labour share are more likely to cut wages, although regressions cannot confirm its statistical significance. Furthermore, the results presented in Table 2C in the Appendix 2 suggest that firms using a labour intensive technology are associated with a higher likelihood of working hours reduction in reaction to shocks. On the other hand, a larger share of variable wages makes firms less likely to reduce permanent employees in reaction to wage shock. Moreover, a high share of variable pay increases the probability of non-labour cost adjustment after adverse wage shock. Thus, a larger share of variable wages safeguards permanent employment and increases the reaction through non-labour costs after wage shock.

Looking at size and sector of Macedonian firms (Appendix 2, Table 2D), we find a smaller employment reaction and hours worked for larger firms, while firms operating in construction

compared to the manufacturing sector tend to cut temporary instead of permanent employment. Firms operating in construction and trade sector are less likely to cut wages, while reduction of hours worked is less likely to occur in market services sector.

To summarize our main results regarding the cost-cutting strategies, we find that product market competition is a substantial determinant in the firm's decision to adjust labour costs instead of non-labour costs. Thus, firms operating in a highly competitive environment are less likely to reduce non-labour costs and more likely to reduce labour costs. The framework of the labour market has impact on firms' decisions choosing between different kinds of labour costs. In this respect, wage setting institutions, in particular, wage agreements signed outside the firm appear to reduce the number of permanent employees and to adjust the number of hours worked per employee. The structure of the workforce, such as temporary employment acts as a buffer against employment fluctuations for permanent workers. Firms using a labour intensive technology are associated with a higher likelihood of working hours reduction, whereas structure of remuneration safeguards permanent employment and increases the reaction through non-labour costs after wage shock.

5. Conclusions

This paper provides empirical evidence from the firm-level survey data by focusing on determinants of price, wage and employment reactions to unexpected changes in the economic environment for Macedonian firms.

Using the very rich survey database for firms in Macedonia, our findings indicate that factors such as: intensity and international character of output market competition, of firm's technology and of the incidence of collective wage-bargaining shape the relevance of firms' price, wage and employment adjustment strategies to shocks. Also, according to other studies, these determinants are found to be relevant for surveyed EU firms. In most cases, empirical results are in line with theoretical considerations. Firms in Macedonia that face strong market competition and are exposed to large international markets are more likely to reduce the relevance of price reactions to cost shocks, whereas the influence of domestic competition seems to have opposite role reflecting their possible lower productivity and profits compared with firms engaged in foreign markets. Consequently, less productive and

less profitable firms are more inclined to pass-through the cost-push shocks to product prices. The presence of collective wage agreements at national level makes a price increase less likely. Findings about EU firms are opposite, which reflects their stronger unions. Moreover, the data suggest that firm's technology or labour intensity in production process makes firms more likely to increase prices after wage shock and is in line with the findings for surveyed EU firms.

Regarding the cost-cutting strategies and the factors that explain the choice of the strategy, results indicate that competition increases the likelihood of cost-cutting strategies via labour costs, particularly through employment reduction, after cost shock. Also, wage agreements signed outside the firm appear to reduce the number of permanent employees and to adjust the numbers of hours worked per employee. Moreover, higher labour share increases the odds of reduction of hours worked after cost and wage shock. In addition, empirical results indicate that fluctuations in permanent employment to cost and wage shock are safeguarded by the presence of temporary and part time employment. Employment is also safeguarded by a large share of flexible pay in total wages, only in the case of wage shock.

Evaluating the extent to which such features influence the behaviour of firms in Macedonia could help determining the degree to which the recent positive oil shock and increases in minimum wage can be transmitted to consumer prices. However, in a situation when the oil shock has different direction (from negative to positive), the intensity of adjustment can be dissimilar. Moreover, this has important implications for transmission mechanism of monetary policy. Accordingly, identifying determinants and factors of firms' price and cost reaction to adverse shocks may help policymakers of Macedonia (and other countries with similar economic characteristics) assess their current policies and design a system that will lead to more optimal policymaking.

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Appendix 1: Survey questions

23 — How relevant are each one of the following strategies when your firm faces an unanticipated increase in the cost of an intermediate input (e.g. an oil price increase) affecting all firms in the market?
<u>Please tick an option for each line.</u>

	not relevant	*of little relevance*	*relevant*	*very relevant*	*don't know*
Increase prices	□	□	□	□	□
Reduce margins	□	□	□	□	□
Reduce output	□	□	□	□	□
Reduce other costs	□	□	□	□	□

24 — If the reduction of other costs is of any relevance in your answer to question 23, please indicate the main channel through which this goal is achieved:
<u>Please choose a single option, the most important factor.</u>

Reduce base wages	□
Reduce flexible wage components (for example bonuses, benefits, etc)	□
Reduce the number of permanent employees	□
Reduce the number of temporary employees / other type of workers	□
Adjust the number of hours worked per employee	□
Reduce other non-labour costs	□

25 — How relevant are each one of the following strategies when your firm faces an unanticipated permanent increase in wages (e.g. due to the renewal of the national contract) affecting all firms in the market?
<u>Please tick an option for each line.</u>

	not relevant	*of little relevance*	*relevant*	*very relevant*	*don't know*
Increase prices	□	□	□	□	□
Reduce margins	□	□	□	□	□
Reduce output	□	□	□	□	□
Reduce other costs	□	□	□	□	□

26 — If the reduction of other costs is of any relevance in your answer to question 25, please indicate the main channel through which this goal is achieved:
<u>Please choose a single option, the most important factor.</u>

Reduce flexible wage components (for example bonuses, benefits, etc)	□
Reduce the number of permanent employees	□
Reduce the number of temporary employees / other type of workers	□
Adjust the number of hours worked per employee	□
Reduce non-labour costs	□

Appendix 2: Statistics of variables used in analysis and details on empirical results

Table 2A
Variables used in the analysis

Variable	Type	Mean	Std. Dev.	Min	Max	Number of obs.
manufacturing_sector	Dummy	0.487	0.500	0	1	514
construction_sector	Dummy	0.128	0.334	0	1	514
trade_sector	Dummy	0.140	0.347	0	1	514
market_services_sector	Dummy	0.246	0.431	0	1	514
size_employees_5to19	Dummy	0.053	0.225	0	1	514
size_employees_20to49	Dummy	0.070	0.255	0	1	514
size_employees_50to199	Dummy	0.359	0.480	0	1	514
size_employees_200andmore	Dummy	0.510	0.500	0	1	514
size_employees_lessthan5	Dummy	0.008	0.090	0	1	514
competition_market2	Dummy	0.724	0.447	0	1	514
share_of_foreign_sales	Fraction	0.411	0.425	0	1	514
labour_share	Fraction	0.394	0.278	0	1	514
coll_agr_higher	Dummy	0.363	0.481	0	1	514
coll_agr_firml	Dummy	0.382	0.486	0	1	514
share_part_time_empl	Fraction	0.020	0.111	0	1	514
share_temp_empl	Fraction	0.068	0.176	0	1	514
share_variable_wages	Fraction	0.193	0.281	0	1	514

Table 2B

Adjustment of prices and (other) costs in response to cost shocks and wage shocks, probit, average marginal effects

	Cost shock		Wage shock	
	Increase price	Reduce costs	Increase price	Reduce costs
construction_sector	-0.1580	-0.2619	-0.0655	0.0401
	(0.1581)	(0.1666)	(0.1422)	(0.1737)
trade_sector	-0.3633***	-0.4238***	-0.0846	-0.1461
	(0.1206)	(0.1193)	(0.1157)	(0.1408)
market_services_sector	-0.2398***	-0.163*	0.0724	-0.0367
	(0.0919)	(0.0982)	(0.102)	(0.1114)
size_employees_5to19	-0.0928	-0.0572	-0.0573	-0.0785
	(0.0721)	(0.0681)	(0.0708)	(0.07)
size_employees_20to49	-0.0245	-0.0296	-0.0076	-0.0302
	(0.0935)	(0.0874)	(0.0885)	(0.0898)
size_employees_50to199	-0.0878	0.0144	-0.1100	-0.0275
	(0.0926)	(0.0903)	(0.0865)	(0.0926)
size_employees_200andmore	-0.0562	-0.0551	-0.1600	-0.0874
	(0.1166)	(0.1107)	(0.099)	(0.1157)
Observations	514	514	514	514
Pseudo-R^2	0.1006	0.1099	0.1515	0.0695
Log-likelihood	-305.7	-273.6	-302.3	-307.6
Observed frequency	0.625	0.715	0.501	0.657
Predicted frequency	0.633	0.733	0.500	0.668

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Reported sector and firms' size effects only.

Table 2C

Cost adjustment strategies (hours and non-labour cost reduction) and some relevant covariates, probit, average marginal effects

| | Cost shock | | Wage shock | |
	Hours	Non-labour cost	Hours	Non-labour cost
competition_market2	0.0343	-0.1701***	-0.0120	-0.0652
	(0.0236)	(0.05)	(0.0335)	(0.0761)
share_of_foreign_sales	-0.0246	-0.0495	-0.0562	0.1205
	(0.0364)	(0.0875)	(0.0391)	(0.0995)
labour_share	0.1264**	-0.0418	0.0899*	-0.1740
	(0.0589)	(0.1176)	(0.0507)	(0.1375)
coll_agr_higher	0.1045**	-0.0246	0.1256***	-0.0253
	(0.052)	(0.0674)	(0.0436)	(0.0784)
coll_agr_firml	-0.0612**	0.0066	-0.0227	-0.0583
	(0.0307)	(0.0591)	(0.0297)	(0.0726)
share_temp_empl	0.0428	-0.0616	0.0442	-0.3001
	(0.0702)	(0.1735)	(0.0675)	(0.1881)
share_part_time_empl	-0.0428	0.4544**	0.1943**	0.3687
	(0.0692)	(0.1826)	(0.0981)	(0.4365)
share_variable_wages	-0.0362	0.0795	-0.0153	0.3286**
	(0.0365)	(0.1299)	(0.0466)	(0.1503)
Observations	433	433	412	412
Pseudo-R^2	0.1921	0.1876	0.2332	0.1028
Log-likelihood	-52.6	-201.3	-57.7	-197.9
Observed frequency	0.0332	0.7567	0.0488	0.7419
Predicted frequency	0.0134	0.7960	0.0135	0.7714

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Not reported: sector and firms' size effects (see table 2D in Appendix 2 for these effects).

Table 2D

Cost adjustment strategies and some relevant covariates (sector and firms' size effects only), probit, average marginal effects

	Cost shock					Wage shock				
	Permanent employment	Temporary employment	Wages	Hours	Non-labour cost	Permanent employment	Temporary employment	Wages	Hours	Non-labour cost
construction_sector	-0.0432***	0.3903**	-0.0479	-0.0146	-0.2957*	0.0271	-0.0401	-0.0402***	-0.0263	0.1683**
	(0.0144)	(0.1897)	(0.0314)	(0.0293)	(0.1777)	(0.0802)	(0.0434)	(0.0151)	(0.0304)	(0.0848)
trade_sector	0.0026	-0.0111	-0.0868***	-0.0010	0.1306	0.0007	-0.0939***	-0.0409**	-0.1142***	0.2658***
	(0.0518)	(0.0563)	(0.0279)	(0.0406)	(0.0851)	(0.0827)	(0.036)	(0.0177)	(0.0303)	(0.0759)
market_services_sector	0.0190	-0.0117	-0.0105	-0.0547**	0.0777	0.0752	-0.0493	0.0213	-0.0905***	0.0710
	(0.0405)	(0.0481)	(0.0386)	(0.0248)	(0.0725)	(0.0642)	(0.0347)	(0.0325)	(0.0291)	(0.0827)
size_employees_5to19	-0.0084	0.0163	0.0674	0.0258	-0.0523	0.0588	0.0598	0.0040	-0.0482	-0.0719
	(0.0293)	(0.0423)	(0.0618)	(0.0396)	(0.0628)	(0.0522)	(0.0633)	(0.0426)	(0.0343)	(0.078)
size_employees_20to49	-0.0214	-0.0197	0.0932	0.0468	-0.0065	-0.0005	0.0349	-0.0101	-0.0412	0.0147
	(0.0319)	(0.0404)	(0.0896)	(0.056)	(0.0767)	(0.0593)	(0.0763)	(0.0381)	(0.0308)	(0.0885)
size_employees_50to199	-0.0537*	-0.0616*	0.0732	-0.0149	0.1000	-0.0090	0.0139	0.0051	-0.0564*	0.0527
	(0.0289)	(0.0365)	(0.0776)	(0.0362)	(0.0673)	(0.0581)	(0.0651)	(0.0438)	(0.0348)	(0.0878)
size_employees_200andmore	-0.0299	0.0289	0.0818	-0.0318	-0.0567	-0.0335	0.0846	0.0465	-0.0664***	-0.0307
	(0.0242)	(0.0527)	(0.1008)	(0.0282)	(0.0935)	(0.0552)	(0.0988)	(0.078)	(0.0193)	(0.1109)
Observations	433	433	433	433	433	412	412	412	412	412
Pseudo-R^2	0.2085	0.4552	0.1022	0.1921	0.1876	0.1788	0.1135	0.2103	0.2332	0.1028
Log-likelihood	-56.0	-79.3	-104.3	-52.6	-201.3	-61.4	-111.2	-70.2	-57.7	-197.9
Observed frequency	0.0371	0.1004	0.0726	0.0332	0.7567	0.0483	0.0999	0.0612	0.0488	0.7419
Predicted frequency	0.0084	0.0247	0.0464	0.0134	0.7960	0.0184	0.0692	0.0272	0.0135	0.7714

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Reported sector and firms' size effects only.