



Eighth IFC Conference on *“Statistical implications of the new financial landscape”*

Basel, 8–9 September 2016

Measuring wage and price stickiness using firm-level data and potential implications for monetary policy in Macedonia¹

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¹ This paper was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.

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Abstract

The aim of this paper is to measure wage and price stickiness in Macedonia based on evidence on firms' price and wage adjustment. It uses a dataset collected through a firm-level survey covering various sectors and firm sizes. We find that firms in Macedonia adjust wages less frequently than prices. Wages tend to remain unchanged, on average, for about 13 months, while prices for around 5 months. The other aspect of rigidity related to time-dependent strategies of wage and price changes, show that time-dependent wage adjustment is more widespread as a rule adopted by firms in Macedonia than time-dependent price adjustment. In some aspects wages and prices in Macedonia feed into each other at the micro level and that there is some relationship between wage and price rigidity. We conclude that the presence and degree of nominal rigidities are somewhat lower in Macedonia compared with the average of surveyed EU countries.

Keywords: survey data, wage and price stickiness, time dependent, Macedonia

JEL classification: C83, D21, E30, J31

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1. Introduction

Wage and price stickiness are important parameters for macroeconomic analyses, and their appropriate measurement is essential in the policy-making process. The literature has shown that the nature of nominal rigidities determines the response of the economy to shocks and has several implications for the conduct of monetary policy. This paper focuses its attention on firms' price and wage adjustment in Macedonia, emphasising the presence and degree of nominal rigidities. For this issue we concentrate on three aspects: the frequency of wage and price adjustment; the mechanism of adjustment and its timing; and the degree to which wage and price changes feed into each other. All these dimensions are analyzed based on survey data at firm-level in Macedonia.

The survey on wage and price setting behaviour at firm level in Macedonia was conducted in the first half of 2014, while in selected EU countries the survey was carried out between the end of 2007 and the first half of 2008. The survey uses the harmonized survey questionnaire and design applied within the Wage Dynamics Network (WDN)¹ of Eurosystem. The network consists of 23 central banks from the EU and is coordinated by the European Central Bank. The network developed the WDN Survey on wage and pricing policies at the firm level and was carried out by 17 national central banks.

In writing this paper and analysing the wage and price rigidity in Macedonia using survey data we have consulted research papers that have analysed WDN survey results, as well as the Final Report of the Wage Dynamics Network which summarises the results of the network.

In the literature we can find studies on price stickiness for EU countries based on micro quantitative data and survey data (Alvarez et al., 2006; Dhyne et al., 2007; Vermeulen, et al., 2007; Fabiani et al., 2006). By this type of survey data we are able to study price stickiness in Macedonia, having in mind that disaggregated micro consumer price data are limited (Petrovska and Ramadani, 2010). Moreover, survey data allow us to measure the extent of price and wage rigidity simultaneously.

Following Druant et al., 2009, several dimensions of wage setting are explored in this paper, which focuses explicitly on how firms set and adjust prices and wages and on the relationship between the two policies. In particular, the paper aims at providing answers to the following questions: (i) How often are prices and base wages changed in Macedonia? (ii) Are adjustments synchronized or not and do they tend to take place in specific months of the year? (iii) Are there significant differences across sectors, firms and average of EU regarding the frequency and timing of wage and price changes and their relationship?

The paper shows that firms in Macedonia adjust wages less frequently than prices. The other aspect of rigidity related to time-dependent strategies of wage and price changes, show that time-dependent wage adjustment is more widespread as a rule adopted by firms in Macedonia than time-dependent price adjustment. Different

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

pieces of evidence confirm that in some aspects wages and prices in Macedonia feed into each other at the micro level and that there is some relationship between wage and price rigidity. From the results of different aspects of wage and price adjustment we find that presence and degree of nominal rigidities are somewhat lower in Macedonia compared with the average of surveyed EU countries. There is ongoing project of building a standard DSGE model in central bank of Macedonia, and these findings will be useful for more effective calibration of model parameters.

The remaining structure of the paper is as follow. Section 2 briefly presents the survey and the data collected. Section 3 focuses on evidence on the frequency and timing of price and wage changes at the firm level, their relationship and the variation across sectors, firms and EU average. Section 4 summarizes the main findings.

2. Survey data and sample

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

Sample composition by sector and size

Table 1

<i>Number of firms</i>						
	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
<i>Percentages</i>						
	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).

Table 1 presents the sample composition by sector and firm size. The sample covers 514 firms in Macedonia with different size in regard to employees that operate

in manufacturing, construction, trade and market services. In order to make our results representative for the whole workforce in the sectors covered, we use employment adjusted sampling weights. A detailed description of the Macedonian survey sample and the results can be found in Ramadani and Naumovski (2015).

An advantage of this survey is that firms in Macedonia were directly asked about a number of features referring to the institutional setup within the firm or to the environment where it operates (e.g. the existence of a policy at the firm level that adjusts wages to inflation or the degree of competition). Information on these features is rarely available in administrative and other datasets. On the other hand, the survey has disadvantages inherent in ad hoc surveys, such as potential misunderstandings in interpreting the questions. Moreover, results may be influenced by the specific economic situation. As we noted above, the Macedonian survey was conducted in 2014, the period of sluggish economic recovery from the global economic and financial crisis and low consumer price inflation. In this paper, some of the findings for Macedonia we compare with surveyed EU countries, where interviews were carried out around the end of 2007 and the beginning of 2008, when the economic environment was perceived as quite favourable.

3. Wage and price adjustment

The way firms in Macedonia adjust their wages and prices plays an important role on the transmission of economic shocks. In particular, the degree of wage and price stickiness determines the speed of adjustment of the economy and the amount of the related costs. A deeper knowledge of the extent of rigidity is uncommonly useful for evaluating the performance of monetary policy and building and calibrating more effectively a macroeconomic model to be used for policy analysis and forecast.

To our best knowledge, empirical evidence on the stickiness of wages and prices in Macedonia for the whole economy and across sectors is rather scarce. One paper which deals with price dynamics in Macedonia is that by Petrovska and Ramadani (2010), which findings are based only on quantitative consumer price data. Moreover, because of unavailable micro consumer price data, the evidence is based on aggregate price data or only on consumer price categories rather than on more detailed consumer price product categories. Hence, findings from this paper are less relevant and incomparable. Correspondingly, inaccessible quantitative disaggregated consumer price data is an additional reason and motivation to conduct the study based on survey data, which covers both price and wage adjustments simultaneously. Another empirical study that uses same survey data with this paper is that by Huber and Petrovska (2015), but their focus is on determinants of nominal price and wage rigidities.

The rich information on wage and price adjustment collected by the survey contributes to fill the gap related to the lack of data on wage setting at the firm level and micro consumer price data. In addition, it makes possible to measure the degree of wage and price stickiness at the same time. Next, below we present some descriptive evidence on three different aspects related to this issue: i) the frequency of wage and price changes; ii) the prevailing mechanism of adjustment (time vs. state dependence) and its timing; and iii) the extent to which wage changes feed into price changes and vice versa.

3.1 Frequency of wage and price adjustment

The frequency of price and wage changes provides an indication of the degree of price and wage stickiness or delivers a rough measure of the extent of nominal rigidities. Price and wage rigidity are important parameters for macroeconomic analyses and represent essential element in the calibration of standard DSGE models that are widely used for monetary policy analysis (see Sbordone et al., 2010 and Christiano et al. 2010).

The survey delivers information on the frequency of both wage and price changes at the firm level. It explicitly asked firms in Macedonia about the frequency of price changes for their main product (see Appendix 1, question 31) and of wage changes for their main occupational group (question 9). For the case of price adjustment, firms could choose between the following range of options: daily, weekly, monthly, quarterly, twice a year, once a year, less frequently than once a year, other. The frequency of wage adjustment was captured through three separate questions taking different types of wage changes: those due to factors unrelated to tenure and/or inflation, those due to tenure and those due to inflation. Respondents in Macedonia could choose from the options: more than once a year; once a year; once every two years; less frequently than once every two years; never / don't know.

To make survey results more comparable, in the analysis of the responses concerning frequency of price adjustment, we aggregate the first three options, on the one hand, and the fourth and fifth, on the other, and end up with four categories: daily to monthly, quarterly to half-yearly, yearly and less frequent than yearly. Similarly, for wages we aggregate the third and fourth options into a single one, which we label "less frequently than once a year". In order to simplify the description of results, in the rest of this paper we consider a composite measure, defined as the highest frequency of wage change for each firm among the three factors described above.

The results derived from the surveyed firms in Macedonia show that in general firms change prices more frequently than they change wages (Table 2). Around 29% of firms report that they change prices once a year or less frequently, about 31% do it more often, while the remaining ones do not have any particular pattern. Base wages of workers are changed less frequently. Around 73% of firms change wages once a year or less often, only 21% of wages change more often, while the remaining ones do not report any change (option "never/don't know" was chosen).

The disaggregation by sector reveals that there is higher cross-sectoral variation in the frequency of price adjustment than in the case of wage adjustment in Macedonia. Firms in manufacturing and market services² change prices much less frequently than those in trade and construction sector (Table 2). Market services sector is with the highest proportion of firms reporting no regular pattern in price adjustments. Regarding wage adjustment, they are least frequent in construction and market services, more frequent in trade and most frequent in manufacturing sector.

² The lower frequency of price changes for services could reflect the lower volatility of consumer demand for them (see Clement, D. 2003). Another factor could be cost structure, which in services sector labour costs are more important than raw material costs. Hence, volatility of raw material prices has limited impact in the frequency of price revisions in services sector.

However, even in manufacturing, the base wages of around 60% of workers are adjusted with a yearly frequency and only 25% are adjusted with a higher frequency. A comparable analysis has been done by firm size, as defined in Section 2, and differences in frequencies of price and wage changes turn out to be negligible.

Frequency of price and wage changes across sectors

(percentages)

Table 2

PRICES					
	daily to monthly	quarterly to half yearly	Yearly	less frequently than once a year	no pattern
Total	10.2	20.7	11.4	18.0	39.7
Manufacturing	3.0	31.0	14.0	18.0	34.0
Construction	40.0	15.0	3.0	7.0	34.0
Trade	21.0	18.0	9.0	3.0	48.0
Market services	1.0	4.0	13.0	31.0	49.0
<i>Standard deviation</i>	<i>18.2</i>	<i>11.1</i>	<i>5.0</i>	<i>12.6</i>	<i>8.4</i>

WAGES (for any reason)				
	more frequently than once a year	yearly	less frequently than once a year	never/don't know
Total	21.3	56.3	16.2	6.2
Manufacturing	24.6	59.6	8.2	7.5
Construction	17.1	76.7	4.0	2.2
Trade	21.3	31.5	38.9	8.3
Market services	17.1	53.1	25.5	4.3
<i>Standard deviation</i>	<i>3.6</i>	<i>18.7</i>	<i>16.1</i>	<i>2.8</i>

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

Notes: Figures weighted by employment weights.

The evidence on the frequency of price and wage changes presented above can also be summarised through an alternative measure of nominal rigidity, i.e. the number of months for which prices and wages remain unchanged ("duration"). Moreover, this measure helps to simplify the comparison of results. The computation of the duration indicator is still based on the firms' answers to questions regarding the frequency of price and wage changes but requires additional specific assumptions. In particular, whereas most of those answers directly translate into durations (e.g. "once a year" translates into a duration of 12 months), a few of them refer to intervals (e.g. "less frequently than once every two years").³ A proxy for the average duration of wage and price spells was computed by simply multiplying each point category by its respective frequency. Following the approach of Martins (2011), for those categories expressed through intervals, the mid-point was assumed.

³ We need to put assumption for three interval categories. Two for wages: duration shorter than one year and duration longer than two years; and one for prices: duration longer than one year.

Other more complex approach is that from Druant et al. (2009). In order to impute expected durations for those categories expressed through intervals, this approach assumes lognormal distribution of durations (with different moments for prices and wages). Then, it estimates the parameters of the distributions from the other answers, and in the end compute the conditional expectations for these categories.⁴ We use imputed conditional expectations as given and calculate price and wage durations for Macedonian firms using both approaches. To save on space or for its simplicity, in our analysis we report the results about price and wage duration from the first approach only, as results show that differences are qualitatively of minor significance.

The results on duration should, therefore, be regarded as approximations. The impact of assumptions for interval categories on the estimates presented below is, however, quite negligible, as they concern only a minority of firms' answers. Another important qualification is that price durations are not computed for more than one-third of firms that report "no pattern" to the question on the frequency of price changes. A similar omission applies to wage changes, since wage durations are not computed for firms that choose the option "never/don't know" to the question on the frequency of wage changes. However, in the case of wages it is much less relevant since it contains only 6 percent of the firms.

Results in Table 3 show that wages in Macedonian firms remain unchanged, on average, longer than prices. Prices tend to remain unchanged on average only for about 5 months. Looking at sectorial differences, our results reveal that prices set by manufacturers and services firms tend to remain unchanged above average, whereas those set in construction and trade sector are more flexible (with duration up to 2 and 3 months, respectively). As expected, durations are longer for wages, as they remain unchanged on average for almost 13 months. There is evidence of some variation across sectors, but when looking to firms' size the variation becomes smaller.

When comparing the results with surveyed EU countries as a part of WDN, average price duration in Macedonia is shorter, which can be attributed to the high share of firms that experience severe or strong competition and follow competitor's price changes (see Ramadani and Naumovski, 2015). Also, average wage duration is somewhat shorter in Macedonia compared with average EU countries, which can be related to tenure rather than inflation as the most important factor producing frequent wage adjustment in Macedonia (more details in subsection 3.3). Moreover, if we look at individual EU countries, higher duration recorded for EU aggregate is mainly due to Italy, where wages remain unchanged for 2 years, consistently with the wage bargaining institutional setup (see Du Caju et al. 2008), whereas for most other countries wage duration is around 12 or 13 months, except for Italy (20.3). Also, differences for Macedonia with those from EU average might be related to the different period in time to which survey data refer.

⁴ For details, see Druant et al. 2009, Appendix 3.

Estimated average duration of wage and price spells

(months)

Table 3

	Prices	Wages
Total	5.2	12.5
Manufacturing	6.6	10.9
Construction	1.9	11.3
Trade	2.8	16.2
Market services	5.4	14.0
<i>Standard deviation</i>	2.2	2.5
Very small firms	6.6	11.9
Small firms	7.8	13.7
Medium-sized firms	7.7	10.7
Large firms	5.4	11.6
Very large firms	4.1	13.2
<i>Standard deviation</i>	1.6	1.2
Memo:		
Total EU	9.6	14.9
Euro area	9.6	15.0
Non-Euro area	9.6	14.7

Notes: Figures weighted by employment weights.

Source: Survey on wage and price setting in Macedonia (2014) and Druant et al. (2009)

3.2 Timing of wage and price changes

Another relevant indicator that signals the presence and extent of nominal rigidities, apart from the frequency of price and wage changes, is the nature or timing of adjustment itself. In order to account for the fact that firms do not change their prices and wages in response to every shock, the literature has modelled firms' strategies either as a time-dependent process, where the timing of the adjustment is exogenously given and does not depend on the state of the economy, or as a state-dependent one when it does. In the presence of shocks, time-dependent rules typically lead to greater price and wage rigidity.

Firms' behaviour whether time or state dependent, has important implications for monetary policy decision makers. In particular, the degree of time concentration of wage setting decisions may have an impact on the transmission of monetary policy decisions to the real activity. For example, Olivei and Tenreyro (2007) find for the U.S., where wage changes concentrate at the turn of the year; that monetary policy shocks that take place in the second half of the year have insignificant effects on aggregate economic activity. Same authors in 2008 derive similar results for Japan, where most firms set their wages between February and May, and find that monetary policy shocks occurring in the first part of the year produce a smaller impact on real economy.

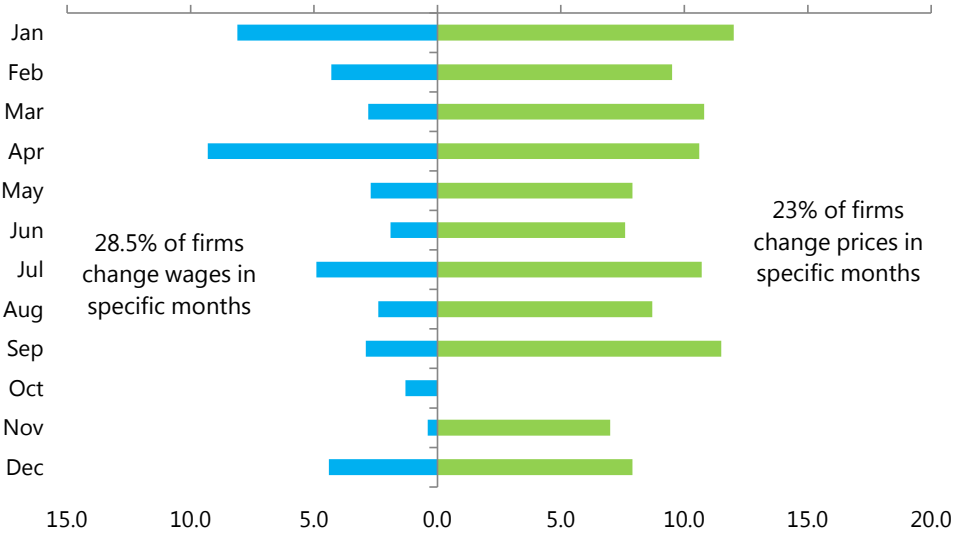
In order to obtain more empirical evidence on these issues, firms in Macedonia were asked to specify whether their wage and price changes are concentrated in

particular month(s) or they take place with no predefined pattern (see Appendix 1, questions 10 and 32). Figure 1 reports the results and show that time-dependent wage adjustment is more widespread as a rule adopted by firms in Macedonia than time-dependent price adjustment. The proportion of surveyed firms in Macedonia that typically change wages in specific months is 29 percent, whereas in the case of prices it amounts to 23 percent that declare such a "time-dependent" pattern. Among these firms in Macedonia, there appears to be some degree of synchronisation in the timing of both price and wage change, with significant clustering in January and April.

Concentration of price and wage setting decisions at the firm level

(percentages of firms reporting to change wages/prices in a particular month)

Figure 1



Notes: Figures weighted by employment weights.

Source: Survey on wage and price setting in Macedonia (2014). The sum of percentages exceeds the proportion of firms that change wages or prices in specific months as they could choose more than one month.

The sectorial analysis shows that firms in construction sector tend to concentrate more often their wage decisions in a particular month, while the concentration in particular months is least common in trade sector (Figure 2). Firms' operations in construction sector depend on seasonal factors, and their time concentration of wage decisions come exactly from seasonality, which particularly occur in the peak of construction works. Conversely, the pattern of concentration of price changes across sectors is with less variability compared with the pattern of wage adjustment. In this case, trade sector is above average and with highest concentration of price changes in particular month, while firms in construction report lowest time dependent price adjustment rules.

Time-dependent price and wage adjustment across sectors

(percentages of firms reporting to change wages/prices in a particular month)

Figure 2



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

The finding that time-dependent wage adjustment mechanism is more widespread than time concentration of price changes might be related to the existence of wage indexation mechanisms, as well as to the presence of collective wage agreements. Data comparisons between Macedonia and EU countries show that the degree of concentration of wage and price changes is significantly lower in Macedonia.⁵ The lower degree of concentration of wage changes can be explained by considerable low automatic indexation of wages and by the fact that tenure is main factor driving wage changes which are assumed to occur throughout the year (more details in subsection 3.3). The possible explanation of the concentration of price changes could be shorter price duration in the obtained results for Macedonia and larger share of firms that operate in highly competitive pressures.

3.3 The interaction between wage and price changes and indexation

After assessment the degree of rigidity of wages and prices gauged by the frequency and the timing of the adjustment process, now we focus explicitly on the interaction between wage and pricing decisions at the firm level. In this background we address both the issue of whether firms' wage and price change are related (and the causal link between the two) and how wages feed into prices. The very rich survey database allows us to find direct information on different aspects of wage and price relationship. For instance, the link between price and wage changes at the firm level,

⁵ 54% of firms in EU change wages in a typical month, whereas 35% change prices in a typical month

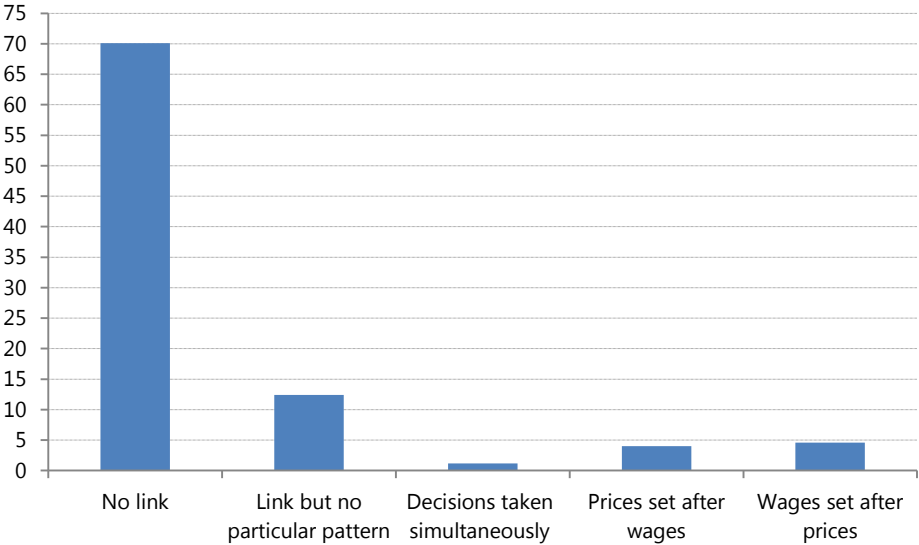
the response of prices to wage shocks, the existence and nature of internal policies of indexation and the frequency of wage changes due to inflation.

In order to analyse the link between price and wage changes, the survey questionnaire asks firms about the possible connection between the timing of their price setting and wage setting decisions (see Appendix 1, question 33). The intensity and direction of this relationship is illustrated in Figure 3. The results suggest that there is weak degree of interaction between the timing of price and wage changes, with around 22% of firms in Macedonia recognising that a connection does exist.⁶ However, from 22% of Macedonian firms, only 10% admit that the link is relatively strong: in 1%, the decisions are taken at the same time; in 4%, changes in prices are taken only after wages are set; and in 5%, changes in wages occur only after prices are set. The patterns with respect to intensity and direction of the relationship are very similar across sectors. In contrast, in around 70% of the firms there does not seem to be any link between the timing of both decisions. The weak price-wage link in Macedonia corresponds with results that inflation is the lowest important factor driving wage changes and this is striking difference from the EU, where inflation is the main driving factor of frequent changes in wages.

The relationship between wage and price changes at the firm level

(percentages)

Figure 3



Notes: Figures weighted by employment weights, rescaled excluding non-responses.
 Source: Survey on wage and price setting in Macedonia (2014).

The finding that the majority of firms in Macedonia (70%) do not explicitly recognise a direct relationship between their price and wage adjustment decisions, it does not automatically imply that these two policies are not related. Indeed, other pieces of evidence arising from the survey suggest that wages and prices feed into each other at the micro level. The existence and extent of the pass-through of wages

⁶ This percent in surveyed EU countries is much higher, where 40% report synchronisation in adjustment of prices and wages.

into prices can be captured by examining the firms' adjustment strategies as reaction to shocks. Indeed, when asked to assess the relevance of different adjustments strategies to a common permanent unexpected increase in wages (see Appendix 1, question 25), about half of firms in Macedonia reported that they would increase prices (see Table 4). This represents the second most relevant policy used after reduction of other costs as adjustment strategy when firms face unanticipated wage shock.

In a study also based on the same survey database, Ramadani (2016) finds that firm's technology or labour intensity in production process makes firms in Macedonia more likely to increase prices after wage shock. In other words, the pass-through of wages into prices is particularly strong in firms with a high labour share.⁷ This evidence is in line with the findings of Bertola et al. (2010) carried out in the context of WDN focused on EU surveyed firms. With this, we confirm previous evidence from section 3.1 that prices are stickier in sectors typically characterised by a high incidence of labour costs, such as market services or manufacturing sector.

Adjustment strategies to shocks

(percent of firms answering relevant or very relevant)

Table 4

	EU			Macedonia		
	Demand shock	Cost-push shock	Wage shock	Demand shock	Cost-push shock	Wage shock
Adjust prices	50.5	65.6	59.2	68.8	62.5	50.1
Reduce margins	56.6	53.5	49.8	56.4	54.3	40.7
Reduce output	49.9	21.4	22.5	60.5	44.6	34.1
Reduce costs	78	67.6	59	78.9	71.5	65.7

Source: WDN Final Report 2009, Survey on wage and price setting in Macedonia (2014).

Turning back to the wage and price relationship, an important aspect is the existence and nature of indexation policies or the extent to which wage changes in Macedonian firms are related to inflation. The existence and strength of this relationship is determined by the presence or not of indexation rules. Hence, of extreme relevance from a policy perspective is the nature of these mechanisms – specific to automatic or not, formal or informal, and forward or backward looking. Regarding this issue, two questions were included in the survey (see Appendix 1, questions 6 and 7). First, firms in Macedonia were asked whether or not they have a policy that adapts changes in base wages to inflation. If so, firms had to report whether the adjustment is automatic or not, is subject to a formal rule, and whether adjustment is “backward” or “forward” looking (take into account past or expected inflation).

On average almost 30% of 514 firms surveyed do have an internal policy that adapts base wages to inflation, which put Macedonia in group of countries with low level of indexation (Table 5). Of these 30%, nearly 91% has a policy that adapts wages to inflation without applying any formal rule and mostly based on past inflation, while the remaining of them adopt an automatic indexation mechanism, and adjustment is mostly of a backward looking nature. There is some variability across sectors, the

⁷ Results are based on multivariate probit regression models.

existence of an internal indexation policy is more widespread in construction and less common in market services. Predominant cases across each sector are the ones where the link of indexation of base wages to inflation is not formal and tends to be backward looking.

Firms' policies of adjusting base wages to inflation are somewhat less common in Macedonia, when compared with the surveyed firms in the EU countries. The differences are more evident in the mechanisms of indexation, where nearly half of EU surveyed firms that adapt base wages to inflation they adopt an automatic indexation mechanism.

Policy of adjusting base wages to inflation

Table 5

Firm-level policy of adjusting base wages to inflation					
	Automatic		Informal		Total*
	Past	Expected	Past	Expected	
Total economy	2.2	0.5	23.0	3.7	29.4
Manufacturing	1.3	1.0	23.4	7.3	33.0
Construction	0.0	0.0	49.0	0.0	49.0
Trade	7.3	0.3	20.3	0.9	28.7
Market services	1.8	0.0	10.7	0.5	13.0
Very small firms	5.3	0.0	15.0	3.0	23.2
Small firms	6.8	0.8	15.3	2.3	25.0
Medium-sized firms	1.1	0.0	13.7	3.2	18.0
Large firms	2.6	1.3	23.4	5.6	33.0
Very large firms	1.5	0.0	24.9	2.6	29.0
Memo:					
Total EU	13.2	3.9	12.7	6.9	36.7
Euro area	16.3	4.1	9.7	5.5	35.6
Non-euro area	5.5	3.2	19.8	10.2	38.7

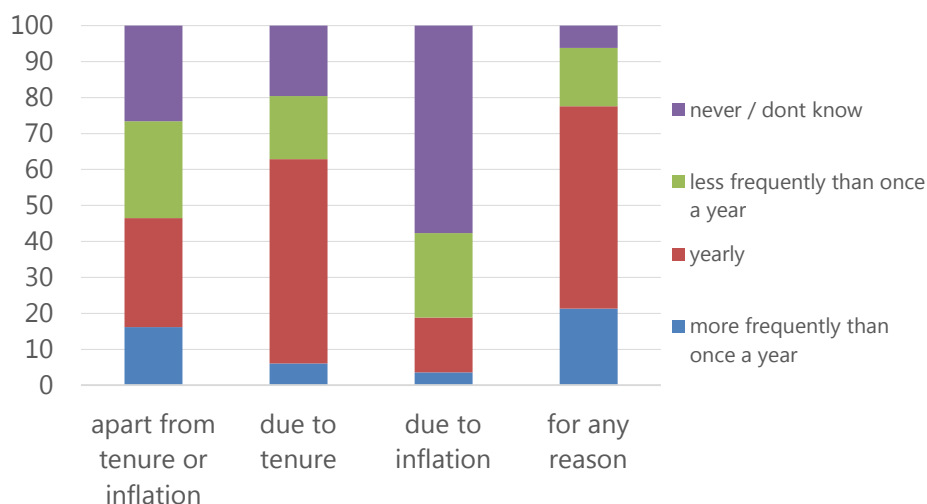
Figures weighted by employment weights. Source: Survey on wage and price setting in Macedonia (2014) and Druant, et al. (2009). (*) Percentage of workers covered by wage indexations clauses: Very low: 0-25%; Low: 26-50%; Moderate: 51-75%; High: 76-100%.

A last piece of evidence on how inflation affect firms' wage decisions is captured by survey question about the frequency of wage adjustments due to inflation, tenure or other factors. It is remarkable that tenure stands out as the most important factor producing frequent wage adjustment (on an annual or infra annual basis). The frequency of wage changes driven due to inflation is the lowest (see Figure 4). These results are somewhat different from the WDN Final Report results for the surveyed EU countries where inflation is the most important factor driving the frequent wage adjustment for the most EU countries. One possible explanation for this is the relatively low share of firms in Macedonia applying wage indexation, symbolic number that use automatic mechanism and lower presence of collective wage agreements compared to the surveyed firms in the EU.

Factors affecting the frequency of wage changes

(as a percentage of total employment in the sample)

Figure 4



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

4. Conclusions

Appropriate measurement of wage and price stickiness is essential in the policy-making process. This study provides evidence on firms' price and wage adjustment in Macedonia, and particularly emphasis the presence and degree of nominal rigidities. It focuses on specific aspects related with frequency, timing and interaction of wage and price changes across sectors and firms in Macedonia and compares them with EU average. The main conclusions are the following.

As to the frequency of adjustment, the paper shows that firms in Macedonia adjust wages less frequently than prices. Wages tend to remain unchanged, on average, for about 13 months, while prices for around 5 months. Wage and price durations in Macedonia are shorter than those observed in EU.

The other aspect of rigidity related to time-dependent strategies of wage and price changes, show that time-dependent wage adjustment is more widespread as a rule adopted by firms in Macedonia than time-dependent price adjustment. The fraction of surveyed firms in Macedonia that typically change wages in specific months is 29 percent, whereas in the case of prices it amounts to 23 percent. The finding that time-dependent wage adjustment mechanism is more widespread than time concentration of price changes might be related to the existence of wage indexation mechanisms, as well as to the presence of collective wage agreements. Comparing the results with EU, the directions of time-dependent wage and price adjustment are in line with EU surveyed countries, but the intensity of the degree of time-dependent adjustments in Macedonia is lower, delivering in general lower rigidity.

Different pieces of evidence confirm that in some aspects wages and prices in Macedonia feed into each other at the micro level and that there is some relationship between wage and price rigidity. First, around 22% of the firms in Macedonia admit a relationship (formal or informal) between the timing of their wage and price adjustment decisions. Second, when asked to assess the relevance of different adjustments policies to a common permanent unexpected wage shock, about 50% percent of firms report that they would increase prices as adjustment strategy. Third, firm-level wage changes appear to be related to inflation developments, although the level of indexation is low, and tenure rather than inflation produce more frequent adjustment. Fourth, firms with a high labour cost share report a tighter link between price and wage changes. All these evidences are with lower intensity in Macedonia compared with the average of surveyed EU countries.

From the results of three aspects of wage and price adjustment we can conclude that presence and degree of nominal rigidities are somewhat lower in Macedonia compared with the average of surveyed EU countries. Less sticky prices and wages, in turn might potentially make more effective monetary policy transmission mechanism.

The findings in this paper about wage and price stickiness are important and can help building and calibrating more effectively macroeconomic models that are widely used for monetary policy analysis and forecast.

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Appendix

Appendix 1: Survey questions

6 — Does your firm have a policy that adapts changes in base wages to inflation?												
Definition of base wage - direct remuneration excluding bonuses (regular wage and salary, commissions, piecework payments).												
No	<input type="checkbox"/> → GO TO QUESTION 8											
Yes	<input type="checkbox"/>											
7 — If “yes” in question 6, please select the options that best reflects the policy followed:												
Wage changes are automatically linked to:												
- past inflation	<input type="checkbox"/>											
- expected inflation	<input type="checkbox"/>											
Although there is no formal rule, wage changes take into account:												
- past inflation	<input type="checkbox"/>											
- expected inflation	<input type="checkbox"/>											
9 — How frequently is the base wage of an employee belonging to the main occupational group in your firm (as defined in question 1) typically changed in your firm?												
Please tick an option for each of the three types of wage changes listed below.												
	<i>more than once a year</i>	<i>once a year</i>	<i>once every two years</i>	<i>less frequently than once every two years</i>	<i>never / don't know</i>							
Wage changes apart from tenure and/or inflation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
Wage changes due to tenure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
Wage changes due to inflation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
10 — Under normal circumstances, are base wage changes concentrated in any particular month / months?												
No	<input type="checkbox"/>											
Yes:	Jan. <input type="checkbox"/>	Feb. <input type="checkbox"/>	Mar. <input type="checkbox"/>	Apr. <input type="checkbox"/>	May <input type="checkbox"/>	June <input type="checkbox"/>	July <input type="checkbox"/>	Aug. <input type="checkbox"/>	Sept. <input type="checkbox"/>	Oct. <input type="checkbox"/>	Nov. <input type="checkbox"/>	Dec. <input type="checkbox"/>
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?												
Please tick an option for each line.												
	<i>not relevant</i>	<i>of little relevance</i>	<i>relevant</i>	<i>very relevant</i>	<i>don't know</i>							
Increase prices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
Reduce margins	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
Reduce output	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
Reduce other costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
31 — Under normal circumstances, how often is the price of the firm's main product typically changed?												
Please choose a single option, the one that best describes the situation in your firm.												
More than once a year:												
- daily	<input type="checkbox"/>											
- weekly	<input type="checkbox"/>											
- monthly	<input type="checkbox"/>											
- quarterly	<input type="checkbox"/>											
- half-yearly	<input type="checkbox"/>											
Once a year	<input type="checkbox"/>											
Once every two years	<input type="checkbox"/>											
Less frequently than once every two years	<input type="checkbox"/>											
Never	<input type="checkbox"/>											
There is not a defined pattern	<input type="checkbox"/>											
32 — Under normal circumstances, are these price changes concentrated in any particular month / months?												
No	<input type="checkbox"/>											
Yes:	Jan. <input type="checkbox"/>	Feb. <input type="checkbox"/>	Mar. <input type="checkbox"/>	Apr. <input type="checkbox"/>	May <input type="checkbox"/>	June <input type="checkbox"/>	July <input type="checkbox"/>	Aug. <input type="checkbox"/>	Sept. <input type="checkbox"/>	Oct. <input type="checkbox"/>	Nov. <input type="checkbox"/>	Dec. <input type="checkbox"/>
33 — How does the timing of these price changes relate to that of wage changes?												
Please choose a single option.												
There is no link between the two	<input type="checkbox"/>											
There is a link but no particular pattern	<input type="checkbox"/>											
Decisions are taken simultaneously	<input type="checkbox"/>											
Price changes tend to follow wage changes	<input type="checkbox"/>											
Wage changes tend to follow price changes	<input type="checkbox"/>											
Don't know	<input type="checkbox"/>											



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Eighth IFC Conference on *“Statistical implications of the new financial landscape”*

Basel, 8–9 September 2016

Measuring wage and price stickiness using firm-level data and potential implications for monetary policy in Macedonia¹

Gani Ramadani,
National Bank of the Republic of Macedonia

¹ This presentation was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.



Measuring wage and price stickiness using firm-level data and potential implications for monetary policy in Macedonia

Gani Ramadani

8th IFC Conference on
"Statistical implications of the new financial landscape"
BIS Basel, 8 and 9 September 2016



Introduction

- Wage and price stickiness are important parameters for macroeconomic analyses, and their appropriate measurement is essential in the policy-making process
- The literature has shown that the nature of nominal rigidities determines the response of the economy to shocks and has several implications for the conduct of monetary policy
- The aim of this paper is to measure wage and price stickiness in Macedonia based on evidence on firms' price and wage adjustment
- Following Druant et al. (2009), the paper focuses on specific aspects related with frequency, timing and interaction of wage and price changes across sectors and firms in Macedonia and compares them with EU average
- The rich information collected by the survey contributes to fill the gap related to the limited data on wage setting at the firm level and micro consumer price data (Petrovska and Ramadani, 2010)
- A deeper knowledge of the extent of rigidity is useful for evaluating the performance of monetary policy and for building and calibrating more effectively a macroeconomic model to be used for policy analysis and forecast




Survey and data sample

- The survey about wage and price-setting in Macedonia was conducted in the first half of 2014, period of sluggish economic recovery from the global economic and financial crisis and low consumer price inflation
- The survey uses the common harmonized questionnaire and sample design, drawn up by European Central Bank for EU countries within the Wage Dynamics Network (WDN)
- The sample covers 514 firms with different size in regard to employees that operate in manufacturing, construction, trade and market services
- In order to make our results representative for the whole workforce in the sectors covered, we use employment adjusted sampling weights
- Some of the findings for Macedonia we compare with surveyed EU countries, where interviews were carried out around the end of 2007 and the beginning of 2008, when the economic environment was perceived as quite favourable

Sample composition by sector and size						
	Number of firms					Total
	1-4 employees	5-19 employees	20-49 employees	50-199 employees	>200 employees	
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
	Percentages					Total
	1-4 employees	5-19 employees	20-49 employees	50-199 employees	>200 employees	
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

How frequently are wages and prices adjusted? (1/2)

- The frequency of price and wage changes provides an indication of the degree of price and wage stickiness or delivers a rough measure of the extent of nominal rigidities
- The survey explicitly asked firms in Macedonia about the frequency of price changes for their main product and of wage changes for their main occupational group 
- To make survey results more comparable, we aggregate some frequency options and we consider a composite measure, defined as the highest frequency of wage change for each firm among the three factors
- The results derived from the surveyed firms in Macedonia show that in general firms change prices more frequently than they change wages
- The disaggregation by sector reveals that there is higher cross-sectoral variation in the frequency of price adjustment than in the case of wage adjustment in Macedonia

Frequency of price and wage changes across sectors (percentages)

	PRICES				
	daily to monthly	quarterly to half yearly	Yearly	less frequently than once a year	no pattern
Total	10.2	20.7	11.4	18.0	39.7
Manufacturing	3.0	31.0	14.0	18.0	34.0
Construction	40.0	15.0	3.0	7.0	34.0
Trade	21.0	18.0	9.0	3.0	48.0
Market services	1.0	4.0	13.0	31.0	49.0
<i>Standard deviation</i>	18.2	11.1	5.0	12.6	8.4
	WAGES (for any reason)				
	more frequently than once a year	yearly	less frequently than once a year	never/don't know	
Total	21.3	56.3	16.2	6.2	
Manufacturing	24.6	59.6	8.2	7.5	
Construction	17.1	76.7	4.0	2.2	
Trade	21.3	31.5	38.9	8.3	
Market services	17.1	53.1	25.5	4.3	
<i>Standard deviation</i>	3.6	18.7	16.1	2.8	

How frequently are wages and prices adjusted? (2/2)

- The previous results can also be summarised through an alternative measure of nominal rigidity, i.e. the number of months for which prices and wages remain unchanged ("duration")
- The computation of the duration indicator is still based on the same firms' answers but requires additional specific assumptions for those answer options expressed through intervals (for example: shorter than one year, longer than two years etc.)
- Calculation is done using two approaches
 - The approach of Martins (2011) assumes mid-point for those categories expressed through intervals
 - Other more complex approach is that from Druant et al. (2009), which assumes lognormal distribution of durations, it estimates the parameters of the distributions from the other answers, and in the end compute the conditional expectations for these categories
- Durations are computed by multiplying each point category (percentages of firms' answers) by its respective frequency
- The results on duration should be regarded as approximations
 - Durations are not computed for firms that report "no pattern" for price changes and "never/don't know" on the frequency of wage changes
- Differences in durations from two approaches are qualitatively of minor significance
- Wages in Macedonian firms remain unchanged, on average, longer than prices
- There is evidence of some variation across sectors, but when looking to firms' size the variation becomes smaller
- Average price and wage duration in Macedonia is shorter compared with average EU countries, which can be attributed to the high share of firms that experience severe or strong competition and to tenure rather than inflation as the most important factor producing frequent wage adjustment in Macedonia

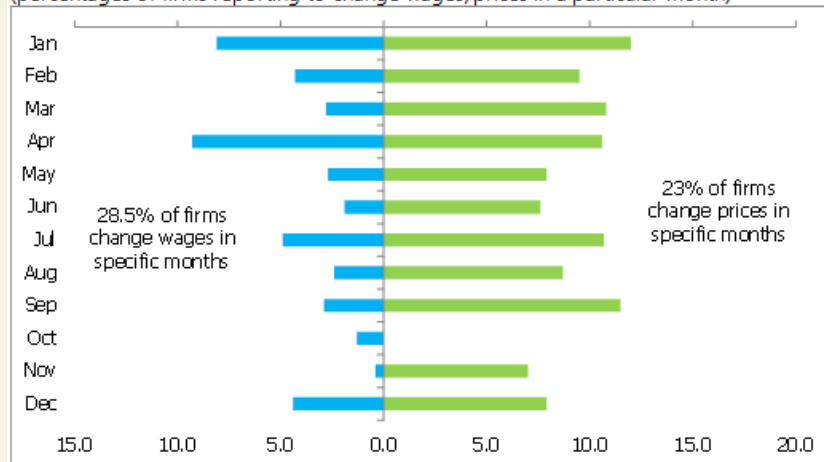
Estimated average duration of wage and price spells (months)

	Prices	Wages
Total	5.2	12.5
Manufacturing	6.6	10.9
Construction	1.9	11.3
Trade	2.8	16.2
Market services	5.4	14.0
<i>Standard deviation</i>	2.2	2.5
Very small firms	6.6	11.9
Small firms	7.8	13.7
Medium-sized firms	7.7	10.7
Large firms	5.4	11.6
Very large firms	4.1	13.2
<i>Standard deviation</i>	1.6	1.2
Memo:		
Total EU	9.6	14.9
Euro area	9.6	15.0
Non-Euro area	9.6	14.7

Timing of wage and price changes

- Another relevant indicator that signals the presence and extent of nominal rigidities is the nature or timing of price and wage adjustment
- In order to account for the fact that firms do not change their prices and wages in response to every shock, the literature has modelled firms' strategies either as a time-dependent process, where the timing of the adjustment is exogenously given and does not depend on the state of the economy, or as a state-dependent one when it does
- In the presence of shocks, time-dependent rules typically lead to greater price and wage rigidity
- Firms' behaviour whether time or state dependent, has important implications for monetary policy decision makers. The degree of time concentration of wage setting decisions may have an impact on the transmission of monetary policy decisions to the real activity (Olivei and Tenreyro, 2007)
- Survey results indicate that time-dependent wage adjustment is more widespread as a rule adopted by firms in Macedonia than time-dependent price adjustment
 - might be related to the existence of wage indexation mechanisms and to the presence of collective wage agreements

Concentration of price and wage setting decisions at the firm level
(percentages of firms reporting to change wages/prices in a particular month)



- Data comparisons between Macedonia and EU countries show that the degree of concentration of wage and price changes is significantly lower in Macedonia



The interaction between wage and price changes and indexation (1/2)

- The results suggest that there is weak degree of interaction between the timing of price and wage changes, with around 22% of firms in Macedonia recognising that a connection does exist (only 10% admit that the link is relatively strong)
 - This percent in surveyed EU countries is much higher, where 40% report synchronisation in adjustment of prices and wages
 - The weak price-wage link in Macedonia corresponds with the results that inflation is the lowest important factor driving wage changes. In EU, inflation is the main driving factor of frequent changes in wages
- Other pieces of evidence arising from the survey suggest that wages and prices feed into each other at the micro level
 - About half of firms in Macedonia reported that they would increase prices to a common permanent unexpected increase in wages

Adjustment strategies to shocks
(percent of firms answering relevant or very relevant)

	EU			Macedonia		
	Demand shock	Cost-push shock	Wage shock	Demand shock	Cost-push shock	Wage shock
Adjust prices	50.5	65.6	59.2	68.8	62.5	50.1
Reduce margins	56.6	53.5	49.8	56.4	54.3	40.7
Reduce output	49.9	21.4	22.5	60.5	44.6	34.1
Reduce costs	78	67.6	59	78.9	71.5	65.7



The interaction between wage and price changes and indexation (2/2)

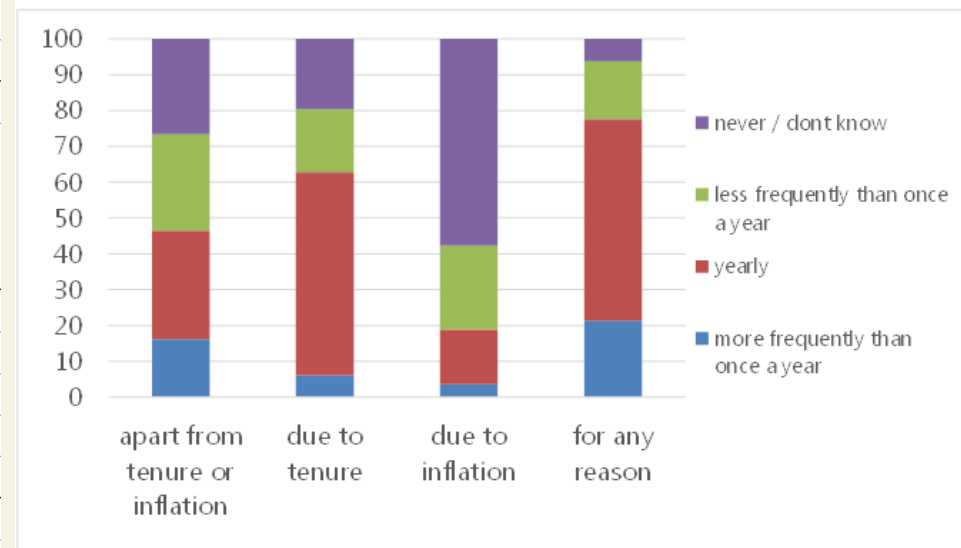
- Almost 30% of surveyed firms do have an internal policy that adapts base wages to inflation, which put Macedonia in group of countries with low level of indexation
 - Indexation is mostly informal rather than automatic, and of a backward looking nature
- Tenure stands out as the most important factor producing frequent wage adjustment (on an annual or infra annual basis)
 - The frequency of wage changes driven due to inflation is the lowest chosen option

Policy of adjusting base wages to inflation

Firm-level policy of adjusting base wages to inflation

	Automatic		Informal		Total*
	Past	Expected	Past	Expected	
Total economy	2.2	0.5	23.0	3.7	29.4
Manufacturing	1.3	1.0	23.4	7.3	33.0
Construction	0.0	0.0	49.0	0.0	49.0
Trade	7.3	0.3	20.3	0.9	28.7
Market services	1.8	0.0	10.7	0.5	13.0
Very small firms	5.3	0.0	15.0	3.0	23.2
Small firms	6.8	0.8	15.3	2.3	25.0
Medium-sized firms	1.1	0.0	13.7	3.2	18.0
Large firms	2.6	1.3	23.4	5.6	33.0
Very large firms	1.5	0.0	24.9	2.6	29.0
Memo:					
Total EU	13.2	3.9	12.7	6.9	36.7
Euro area	16.3	4.1	9.7	5.5	35.6
Non-euro area	5.5	3.2	19.8	10.2	38.7

Factors affecting the frequency of wage changes (as a percentage of total employment in the sample)





Conclusions

- Appropriate measurement of wage and price stickiness is essential in the policy-making process
- Firms in Macedonia adjust wages less frequently than prices
 - Wage and price durations in Macedonia are shorter than those observed in EU
- Time-dependent wage adjustment is more widespread as a rule adopted by firms in Macedonia than time-dependent price adjustment
 - Intensity of the degree of time-dependent adjustments in Macedonia is lower compared with EU average, delivering in general lower rigidity
- We conclude that the presence and degree of nominal rigidities are lower in Macedonia compared with the average of surveyed EU countries
 - might potentially have favourable impact on the transmission of monetary policy decisions to the economy
- There is ongoing project of building a standard DSGE model in central bank of Macedonia, and these findings will be useful for more effective calibration of model parameters



Thank you!

Appendix

- Survey questions

9 — How frequently is the base wage of an employee belonging to the main occupational group in your firm (as defined in question 1) typically changed in your firm?

Please tick an option for each of the three types of wage changes listed below.

	<i>more than once a year</i>	<i>once a year</i>	<i>once every two years</i>	<i>less frequently than once every two years</i>	<i>never / don't know</i>
Wage changes apart from tenure and/or inflation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wage changes due to tenure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wage changes due to inflation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

31 — Under normal circumstances, how often is the price of the firm's main product typically changed?

Please choose a single option, the one that best describes the situation in your firm.

More than once a year:	
- daily	<input type="checkbox"/>
- weekly	<input type="checkbox"/>
- monthly	<input type="checkbox"/>
- quarterly	<input type="checkbox"/>
- half-yearly	<input type="checkbox"/>
Once a year	<input type="checkbox"/>
Once every two years	<input type="checkbox"/>
Less frequently than once every two years	<input type="checkbox"/>
Never	<input type="checkbox"/>
There is not a defined pattern	<input type="checkbox"/>

