



# Survey Evidence on Wage and Price Setting in Estonia

Aurelijus Dabušinskas, Tairi Rõõm

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# Survey evidence on wage and price setting in Estonia

Aurelijus Dabušinskas and Tairi Rõõm \*

## Abstract

In this paper, we give a comprehensive overview of wage and price adjustment practices in Estonia, drawing from two managerial surveys which were conducted in autumn 2007 and summer 2009 within the framework of the Wage Dynamics Network (WDN), a joint research project by the Eurosystem/ESCB. Our discussion covers a broad range of results, including firm-level descriptive evidence for several institutional and structural characteristics of the Estonian economy such as unionisation and collective bargaining coverage, labour intensity of production, remuneration methods, product market competition, etc., and insights into the wage and price setting behaviour of Estonian firms. To illustrate this behaviour, we give an overview of the frequency and timing of wage and price changes; the extent of downward nominal and real wage rigidity; the determinants of wages paid to newly employed workers; and finally, the nature of firms' adjustments to cost push and negative demand shocks.

JEL Code: D22, E3, J3

Keywords: survey data, wage setting, price setting, Estonia

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## **Non-technical summary**

This paper gives a comprehensive overview of the Estonian component of the firm-level wage setting surveys that were conducted in the framework of the Wage Dynamics Network (WDN), a joint research project that the European System of Central Banks undertook in 2006–2009. These surveys were carried out in 17 EU countries by their national central banks during the second half of 2007 and the first half of 2008. The use of a harmonised questionnaire permitted pooling of the national data, which resulted in a large and uniquely rich cross-sectional dataset specifically tailored to address the demands and research questions of the WDN mandate, which was to clarify the relationship between wages, labour costs and prices and to identify the sources and features of wage and labour cost dynamics that are most relevant for monetary policy.

In summer 2009, 11 of the participant countries, including Estonia, carried out follow-up surveys in order to learn how firms were coping with the economic and financial crisis that had started in 2008. These surveys mainly focused on the strength of negative credit and demand shocks and the various means of adjustment to them, including wage cuts and freezes. The timing of the follow-up surveys made them particularly suitable for analysing the prevalence of downward wage rigidities in a recessionary environment.

The Bank of Estonia commissioned the survey fieldwork from an external company TNS Emor, which conducted the surveys over the internet, the first in September–October 2007 and the second in May–June 2009. In both cases, the target population of firms was defined as all industrial and market services companies that employed at least five people, and sampling was stratified by sector, size and location. At the response rate of 25 percent, the 2007 survey produced a final sample consisting of 439 firms. In 2009, the response rate reached 30 percent, and the resulting final sample covered 567 firms, 163 of which had participated in the 2007 survey as well. All descriptive statistics obtained using these data were weighted so as to adjust survey measurements in accordance with the distribution of employment in the target population of firms.

Given the wealth of information collected, the survey findings cover a broad range of topics, including evidence on the most relevant institutional and structural characteristics of the labour market, such as collective bargaining coverage, labour cost share, remuneration methods, and the intensity of competition in the product market. More importantly, the results provide insights into the wage and price setting behaviour of Estonian firms: the frequency and timing of wage and price changes, the extent of downward nominal and real wage rigidity, the determinants of wages paid to the newly hired,

and the adjustment of labour costs in response to demand and cost-push shocks.

The survey data reveal that in comparison to the euro area (EA) and to non-euro area (non-EA) countries, unionisation and collective bargaining coverage in the private sector of the Estonian economy are very low at 12 and 9 percent respectively. When it is used, collective bargaining is predominantly firm-level and decentralised, and it is largely irrelevant for the wage setting process in the economy. According to the OECD index of employment protection legislation (EPL), employment protection is somewhat less stringent in Estonia than it generally is in the euro area, but the difference is small.<sup>1</sup>

The survey-based measures of price competition are broadly in line with the corresponding indicators for the EA and non-EA countries, although claims that competition is severe are somewhat less frequent among Estonian firms. On the other hand, the relative openness of the economy makes firms more exposed to international competition; at about 30 percent, the share of exports in total sales is on average about a third higher in Estonia than in the EA or non-EA countries. Collective bargaining coverage and export intensity increase with firm size, and large firms are more likely to report facing a highly competitive business environment.

The distributions of wage change frequencies implied by the WDN survey data suggest that wages are changed somewhat more frequently in Estonia than in the EA and non-EA countries on average. In basically all countries the most common frequency of wage changes is annual; the share of firms changing wages yearly is about 60 percent across all countries and about 64 percent in Estonia. But the share of firms changing wages more frequently, at 20 percent, is higher in Estonia than the corresponding European average of only 12 percent. As a result, the implied average duration of Estonian wages of 13 months is shorter than the corresponding average estimates for the EA and non-EA countries, both of which are 15 months.

The Estonian survey also reveals that the frequency of base wage changes is higher in manufacturing and construction but lower in the trade sector. Interestingly, wage adjustments because of tenure are quite uncommon; they are reported by only one third of all firms. On the other hand, two thirds of firms adjust base wages to inflation, and about three quarters of them do so yearly.

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<sup>1</sup> Although the stringency of labour regulations was close to the EA average at the time the first WDN survey was conducted, the value of the EPL index dropped considerably in July 2009, when Estonia adopted the new Employment Contracts Act.

About 35 percent of Estonian firms adjust prices irregularly, while the rest change them at some typical frequency. The predominant frequency of regular price changes is annual, which is characteristic of almost all the countries covered by the WDN survey. About 47 percent of all firms in Estonia change prices once a year, and 43 percent adjust them more often. The highest frequency of price changes is reported by trade sector firms, followed by those in construction and manufacturing, and finally, by services firms. The frequency of price adjustment is positively associated with the intensity of price competition in the product market. The implied average duration of prices is 9 months, which confirms the expected result that the frequency of price changes exceeds that of wage changes. In general, the descriptive statistics for the frequency of price changes in Estonia are similar to the corresponding statistics for the EA and non-EA countries.

The extent of flexibility in the wage setting process, especially in recessionary situations, depends not only on how promptly wages can react once economic conditions shift — that should, in principle, be related to the frequency of wage changes — but also on whether or not individual wages can decline in real and/or nominal terms. Downward nominal wage rigidity (DNWR) characterises a situation when wages do not decline in nominal terms, while downward real wage rigidity (DRWR) prevails when individual wages tend never to be reduced in real terms, as nominal wages increase at a rate not lower than the actual or expected inflation rate. Since such asymmetry in wage behaviour has important macroeconomic and monetary policy implications, the WDN survey has inquired about wage setting practices that are indicative of such downward wage rigidities at firm level.

Empirically, DNWR is reflected in a relative lack of nominal wage cuts and, consequently, in a relative abundance of wage freezes. The cross-country evidence from the WDN surveys shows that wage cuts are very rare and that they tend to remain so even when firms face a severe economic crisis: the share of employees affected by wage cuts increased from 1 percent in the 2007 survey to only 1.8 percent in the 2009 survey. At the same time, the empirical frequency of wage freezes among employees increased from 5 percent to 32 percent, which implies that DNWR is prevalent in Europe as firms were freezing wages instead of cutting them even in the environment of a sharp economic downturn accompanied by near zero or negative inflation.

In this context however, Estonia stands out as the only country where wages demonstrated substantial downward flexibility during the recent crisis: in summer 2009, around 46 percent of Estonian firms had already cut wages and 40 percent planned to do so. The wage cuts applied to 30 percent of the work force, a far larger percentage than in any other country surveyed. Importantly, these results hold even if we take into account that the crisis affected firms more strongly in Estonia than in other countries.

To obtain a proxy for DRWR, the 2007 WDN survey inquired whether or not firms applied rule-based (automatic) adjustment of wages to inflation. On average, automatic wage indexation was reported by 20 percent of firms in the euro area and by 8.5 percent of companies in non-euro area countries. In contrast, it was indicated by less than 5 percent of Estonian firms, which suggests that DRWR is largely unimportant in Estonia.

The search and matching framework for modelling the labour market implies that job creation and the behaviour of employment and wages over the business cycle depend importantly on the flexibility/rigidity of a particular category of wages, those paid to newly hired employees. In this context, wage rigidity is understood as the tendency of the wages of the newly employed not to deviate from those of incumbent employees. The WDN surveys collected managers' opinions as to what they regard to be the main determinants of wages paid to the newly hired and as to whether firms pay higher or lower wages to their new employees than to present ones when the labour market is tight or when it is loose.

For almost 80 percent of European firms, the most important determinants of the wages offered to the newly hired are factors internal to the firm, such as collective agreements or the wages of incumbent employees. External factors, such as the availability of similar workers in the labour market or wages offered to them by other employers, are of most relevance to the remaining 20 percent of firms. In Estonia, the external factors are emphasized more strongly as the corresponding shares are 70 and 30 percent. Moreover, while the availability of workers and the wages of similar employees in the market get about equal support in the cross-country sample, the share of Estonian firms emphasising the importance of this availability is about twice the share of those stressing the significance of market wages. Hence, the wages offered to the newly hired in Estonia are not only more sensitive to market conditions in general but also relatively more responsive to the tightness of the labour market in particular.

Data collected using survey questions in which firms were asked to consider three hypothetical shocks — an increase in the price of an intermediate input, a rise in base wages and a slowdown in demand — reveal that the two most common elements in the adjustments by firms to such shocks are price changes and cost cuts. This implies that in the context of supply shocks, firms try to limit the pass-through of cost-push shocks to prices, whereas in the face of adverse demand shocks, they try to protect profit margins and levels of output.

The answers by firms to the hypothetical questions also imply that roughly half of all firms would reduce costs primarily by lowering non-labour costs, while the other half would mostly rely on cutting labour costs. Among the

latter, 20–25 percent of firms would lower labour compensation, while the rest would reduce the quantity of the labour input. Lowering base wages is particularly unpopular as it would be the main cost-cutting option for only 1–2 percent of firms. Considerably more firms, about 9–12 percent, would instead rely on cutting bonuses. Among the firms that would lower labour costs by reducing the quantity of labour, roughly 50 percent would achieve that by laying off temporary employees, 30 percent by firing permanent employees and about 20 percent by reducing hours worked. The structure of cost cutting strategies implied by the Estonian survey is generally similar to that derived from the pooled cross-country data. The two more interesting differences are that Estonian firms would rely relatively more on the reduction of bonuses but less on the reduction of temporary employment or hours per employee.

Most of the indicators discussed in the paper suggest that labour markets are on average more flexible in the non-EA sub-sample, which essentially groups the new EU member states, than in the euro area, which is clearly dominated by the old EU member states. On the institutional front, the former have lower trade union coverage and milder employment protection legislation. They also feature more flexibility in wage setting, as shown by their higher frequency of base wage changes, more widespread state-dependent wage adjustments and lower downward wage rigidity. A larger share of bonuses in total pay and the stronger responsiveness of the wages of the newly hired to market conditions contribute to the relative flexibility of non-EA labour markets as well. All of these conclusions are valid if we change focus to compare Estonia and the euro area, but for two indicators — collective bargaining coverage and downward wage rigidity — Estonia stands out as more flexible, even in comparison with the non-EA group.

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## 1. Introduction

In 2006, the European System of Central Banks (ESCB) initiated a joint research project, the Wage Dynamics Network (WDN), which was mandated to pursue two main research objectives: (i) to identify the sources and features of wage and labour cost dynamics that are most relevant for monetary policy, and (ii) to clarify the relationship between wages, labour costs and prices at both firm and macroeconomic level. An important part of this research agenda envisioned a coordinated effort to prepare a firm-level wage setting survey which would be carried out in the participant countries by their national central banks.

Between the second half of 2007 and the first half of 2008, such surveys were conducted in 17 European countries, including Estonia.<sup>2</sup> The use of a commonly agreed questionnaire permitted pooling of the national data, which resulted in a large and uniquely rich cross-sectional dataset with around 17,000 observations, specifically tailored to address a number of WDN research questions. Subsequently, four teams of WDN researchers have used the pooled data to examine several distinct topics: the frequency of wage and price setting and the interdependence between the two (Druant et al., 2009); downward nominal and real wage rigidity (Babecký et al., 2010) and margins of labour cost adjustment (Babecký et al., 2009); wage setting for newly-hired employees (Galušchák et al., 2010); and firms' adjustments to cost-push shocks (Bertola et al., 2010). In addition to the cross-country analyses, a number of papers have examined these and related issues using WDN survey data for individual countries.<sup>3</sup>

In summer 2009, 11 central banks participating in the WDN<sup>4</sup> carried out follow-up surveys in order to understand how firms coped with the economic and financial crisis that started in 2008. Compared with the original WDN survey, the focus of the follow-up survey was narrower, concentrating on three main themes: the strength of negative credit and demand shocks; the channels of adjustment that firms used in reaction to those shocks; and wage cuts or freezes as two particular responses to the crisis. The current paper exploits the information on the incidence of wage cuts and freezes during the initial phase of the crisis between Q3 2008 and Q2 2009 in order to draw

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<sup>2</sup> Austria, Belgium, the Czech Republic, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Slovenia and Spain.

<sup>3</sup> See, for example, M. Druant et al., 2008 (Belgium); Babecký et al., 2008 (Czech Republic); Montornès and Sauner-Leroy, 2009 (France); Keeney and Lawless, 2010 (Ireland); Virbickas, 2010 (Lithuania); Martins, 2009 (Portugal).

<sup>4</sup> Austria, Belgium, the Czech Republic, Cyprus, Estonia, France, Italy, Luxembourg, the Netherlands, Poland and Spain.

implications about the prevalence of downward nominal wage rigidity in Estonia in comparison to other EU member states covered by the follow-up survey.<sup>5</sup> The international comparisons of downward wage rigidity during the crisis are based on the study by Messina and Rõõm (2011).

The present paper has two main objectives. Our primary aim is to give a comprehensive overview of the Estonian component of the WDN surveys, its design, implementation, and main results. Because of the wealth of information collected, the findings cover a broad range of topics, including evidence on the most relevant institutional and structural characteristics of the labour market such as collective bargaining coverage, labour cost share, remuneration methods, intensity of competition in the product markets, etc., and insights into the wage and price setting behaviour of Estonian firms: the frequency and timing of wage and price changes, the extent of downward nominal and real wage rigidity, the determinants of wages paid to the newly hired, the adjustment of labour costs in response to various shocks, and other factors.

The second aim is to present our results in the context of similar evidence from the other European countries covered by the WDN surveys. To this end, we will often borrow from the descriptive sections of the WDN cross-country papers mentioned above, which already contain various country-level comparisons of the issues we address below. This has two implications: we will concentrate on the same questions that the WDN has deemed the most important, and we will adopt identical definitions and measure the various variables in the same way as in the WDN cross-country studies.

Most sections of the paper have the following “top-to-bottom” structure. For each new topic, we first provide a more general description of the issue based on the available WDN cross-country evidence — in most cases a comparison of some aggregate results for Estonia with those for other countries — and then we focus on the Estonian data more closely. This second step typically involves tabulating and describing the same indicators by sector or economic activity, firm size, and some other control variables, such as the intensity of product market competition, the share of sales to foreign markets, etc.

For the most part, therefore, our original contribution consists of documenting how wage setting by Estonian firms and other aspects of their behaviour related to labour cost dynamics vary across economic sectors and certain firm-specific characteristics. Such information sheds light on the extent and sources of potential heterogeneities, informing us how representative various

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<sup>5</sup> This is the only part of the analysis where we use the data from the follow-up survey. In the rest of the paper, we exclusively rely on the original WDN survey.

country-level characterisations of the Estonian labour market are. Finally, information on how these indicators relate to other variables in Estonia allows us to take a second look at whether certain relationships uncovered by the WDN cross-country papers hold at this lower level.

A unifying idea, a normative criterion that we often refer to when comparing labour market indicators throughout the paper, is flexibility. Depending on a topic, we talk about it in a variety of contexts: flexibility in labour turnover; nominal and/or real base wage flexibility; flexible pay; labour market flexibility, etc. Though our use of the term as an assessment criterion and especially our tendency to always view it in a positive light are sometimes admittedly heuristic, such a “flexibility perspective” is intentional, and in fact we have chosen it to be an integrating theme of the paper.

It reflects the idea that various frictions — institutional ones such as strict employment protection, or market-related ones like nominal and real wage rigidity — typically act as impediments to the efficient functioning of the labour market. Understanding these rigidities and their effects is essential for the conduct of a proper monetary policy. These issues are especially important for a country like Estonia, which operated a hard currency peg (currency board) until December 2010, after which the euro became the legal tender. The limited availability of monetary policy tools targeted to country-specific developments means that virtually all the burden of adjusting to asymmetric economic shocks vis-à-vis the rest of the euro area falls on the market mechanism, with the labour market playing the central role. Consequently, the policy interest in whether the product and labour markets are relatively flexible in Estonia has always been strong, and the recent economic crisis has made this issue even more relevant.

The paper is entirely descriptive, and it covers a broad range of topics, most of which have been analysed in separate research papers within the WDN. All sections of the paper are self-contained and can be read individually, depending on reader’s interests. Section 2 describes the survey design and the structure and representativeness of the samples used, and provides some details on the employment-based weights that are applied in computing various descriptive statistics. Section 3 discusses several institutional and structural features of the Estonian labour market: collective bargaining coverage (subsection 3.1); employment protection legislation (3.2); the share of labour costs in total costs (3.3); and the empirical frequency of different remuneration methods (3.4). In addition, subsection 3.5 considers the intensity of price competition in product markets. The rest of the paper focuses on firms’ behaviour related to wage and price setting and labour cost adjustment. Section 4 deals with wage and price changes: their frequency (subsections 4.1, 4.2 and 4.3) and timing (4.4), and the synchronisation between the two (4.5). Downward rigidity of base wages is addressed in section 5, whereas the

setting and relative flexibility of wages of newly hired employees is discussed in section 6. Section 7 investigates how firms adjust to shocks, and in this context, we regard price and wage changes as elements of a broader set of adjustment strategies that firms can use in response to demand and cost-push shocks. Section 8 is the summary and brings a number of results discussed previously together to give an overall assessment of the relative labour market flexibility in Estonia in comparison to other EU countries.

## 2. Design of the survey

For the most part, the Estonian survey questionnaires were designed using the questions that had been formulated collectively by the participants of the WDN survey group.<sup>6</sup> In several cases, the pre-agreed questions were modified slightly to get either more detailed or extra information, but their general form was left unchanged, so as not to compromise data compatibility. In addition, several questions have been added that can be found only in the Estonian surveys. These include, for example, questions about the typical speed of wage/price adjustments to various shocks in both directions with the aim of learning about potential asymmetries in the pace of adjustments depending on whether wages or prices need to be raised or lowered. We will not analyse these additional questions here as we investigate asymmetries in the speed of wage and price adjustments in a separate paper; see Rõõm and Dabušinskas (2011).

The Bank of Estonia commissioned the survey fieldwork from an external company EMOR, which conducted the surveys over the internet, the first in September–October 2007 and the second in May–June 2009. In both cases, the target population of firms was defined on the basis of the Estonian Business Registry, restricting the focus to companies that employ at least five people and operate in one of the following economic sectors: manufacturing (NACE code D), electricity, gas and water supply (E), construction (F), trade (G), hotels and restaurants (H), transport, storage and communications (I), financial intermediation (J), or real estate, renting and other business activities (K).<sup>7</sup>

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<sup>6</sup> For a short description of the 2007/2008 WDN survey and a copy of the questionnaire see Druant et al. (2009).

<sup>7</sup> This coding and classification of sectors corresponds to EMTAK 2003, a NACE-compatible classification system used by Statistics Estonia (SE). In 2008, SE started the transition to an updated system, EMTAK 2008, which introduced NACE Rev. 2 provisions. Because the business registry used in our sampling design was based on EMTAK 2003, we decided to stick with its definitions of economic activities in the present paper.

To ensure better coverage, sampling was stratified along three dimensions — sector, size and location — by the two surveys though not in exactly the same way. In both cases, the stratification was based on three sector groups: (i) manufacturing, electricity, gas and water supply, and construction (NACE codes D, E, F, respectively); (ii) trade and restaurants (G, H); (iii) transport, storage and communications, financial intermediation, and real estate, renting and other business activities (I, J, K). In addition, it involved three firm size categories for the 2007 survey (5–49, 50–99, and 100 and more employees) and four size categories for the 2009 survey (5–19, 20–49, 50–99, and 100 and more employees). Both sampling schemes differentiated the location of firms between Tallinn and the rest of Estonia. In total, the sample scheme involved 18 strata in 2007, and 24 strata in 2009.

The realised samples of the 2007 and 2009 surveys covered 439 and 567 firms, and the response rates for the surveys were 25 and 30 percent respectively. The number of filled-in questionnaires from the 2007 survey that could be fully used for the WDN purposes was 375. However, in addition to other measures that were agreed upon by the WDN participants to ensure data anonymity after the national datasets were pooled within the network, we decided to exclude from our sample firms belonging to sectors E (utilities) and J (financial intermediation), which had five and four observations respectively.<sup>8</sup> As a result, our final effective sample from the 2007 WDN survey for Estonia consists of 366 firm observations. For comparison purposes, the cross-country dataset of the 2009 WDN survey includes only firms that participated in both WDN surveys. There were 163 such companies in Estonia.

The composition of our final effective samples by sector and firm size is described in Table 1, with its panels A and B devoted to the 2007 and 2009 surveys respectively. Like other survey-based papers of the WDN, we distinguish between four types of economic activity and four size groups, both defined in accordance with the definitions used within the WDN. Specifically, the sectors are manufacturing, construction, trade, and market services,<sup>9</sup> and the four size groups are defined in terms of employment as 5–19, 20–49, 50–199, and 200 and more employees. It is important to note that these sectors and size categories do not exactly coincide with the sectoral and size categories used in the sample stratification schemes. For that reason, Table 1 not only characterises the structure of each sample in terms of the categories just

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<sup>8</sup> The populations of firms in these sectors (particularly utilities) are relatively small, and both are clearly dominated by several large companies. We excluded the observations associated with these business activities from the sample to lower the likelihood that the anonymity of respondents could be compromised.

<sup>9</sup> Market services combine hotels and restaurants (H), transport, storage and communications (I), and real estate, renting and other business activities (K).

defined but also provides similar information about the structure of the whole population of firms, defined using data from the 2005 Estonian Business Registry. The aim is to compare the structure of our samples with that of the population and see to what extent our employment-based weighting scheme, discussed below, reduces any discrepancies between them.

Table 1: Sample composition by sector and size

	Number of firms		Sample Employment	Employment weights	Population <sup>a</sup>	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: 2007 survey</b>						
Sector:						
Manufacturing	146	39.9	48.2	38.7	23.8	39.3
Construction	52	14.2	7.6	12.4	15.2	11.3
Trade	69	18.9	15.2	20.5	28.1	20.7
Market serv.	99	27.1	29.0	28.4	32.9	28.7
Total	366	100.0	100.0	100.0	100.0	100.0
Size:						
5–19	99	27.1	3.3	24.3	73.1	25.2
20–49	94	25.7	9.2	20.5	17.4	20.1
50–199	154	42.1	48.2	46.7	8.1	28.3
200 and more	19	5.2	39.3	8.6	1.4	26.3
Total	366	100.0	100.0	100.0	100.0	100.0
<b>Panel B: 2009 survey (sub-sample of firms that participated in the 2007 survey)</b>						
Sector:						
Manufacturing	70	42.9	52.3	40.0	23.8	39.3
Construction	23	14.1	11.2	11.1	15.2	11.3
Trade	28	17.2	18.2	20.2	28.1	20.7
Market serv.	42	25.8	18.3	28.7	32.9	28.7
Total	163	100.0	100.0	100.0	100.0	100.0
Size:						
5–19	38	23.3	4.0	21.7	73.1	25.2
20–49	45	27.6	11.9	23.0	17.4	20.1
50–199	72	44.2	67.0	46.4	8.1	28.3
200 and more	8	4.9	17.1	8.9	1.4	26.3
Total	163	100.0	100.0	100.0	100.0	100.0

Notes: (a) Population is based on the Estonian Business Registry of 2005.

The first column of Table 1 shows the distribution of sampled firms across sectors and size groups; the second column reports the corresponding percentages, and the third column characterises the samples in terms of actual employment. Information on the distribution of firms and employment in the population of firms is provided in columns five and six respectively. Consid-

ering sectoral coverage, a pairwise comparison of columns two and five (distribution of firms), and three and six (distributions of employment) shows that both samples over-represent manufacturing but under-represent trade and market services. The mismatch is stronger for size groups, where there is considerable under-sampling of small firms (5–19 employees)<sup>10</sup> and over-sampling of medium-sized (20–49 and 50–199 employees) and large firms.<sup>11</sup> Note also that our two samples share very similar structures, so the discrepancies are largely the same for both. The risk is, however, that unless we can be reasonably certain that firms’ demographic characteristics are unimportant for some particular issue, analysis of unweighted statistics may be misleading.

To address this issue, we have constructed employment-based weights that, if applied, re-scale survey measurements in accordance with the distribution of employment in the target population of firms. It is important to note however that, following some general methodological principles agreed by the WDN survey group concerning weights, the weights we construct are defined on the basis of the sampling strata, not the sector/size categories considered in Table 1. In particular, the weights are strata-specific, and they are equal to the amount of employment that firms in a given stratum need to represent, on average, in order to account for the total employment of that particular stratum in the whole population of firms.<sup>12</sup>

Since the sector/size categories shown in Table 1 are finer than the original strata used in sampling, it is not guaranteed that our strata-specific weights can eliminate the discrepancies highlighted by columns (3) and (6) of Table 1 sufficiently well. To clarify this, we report the distribution of employment as implied by the constructed employment-based weights in column (4) and compare it to column (6). The implications of this comparison are very similar for both panels of Table 1, so we highlight the main points by focusing on the 2007 survey alone. One of them is that the structure of weights matches the distribution of employment across the four sectors rather well. The outcome is somewhat less satisfactory for size groups, as the weighting scheme is able to replicate the relative importance of small and medium firms (firms with 5–19 and 20–49 employees), but it fails to properly distribute the weight between the other two size categories. In the population,

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<sup>10</sup> Consider the 2007 survey: in terms of firms, 27.1 percent in the sample but 73.1 percent in the population; in terms of employment, 3.3 percent in the sample but 25.2 in the population.

<sup>11</sup> Consider the 50–199 size category in Panel A: the share of such firms is 42.1 percent in the sample but only 8.1 percent in the population. Similarly, the in-sample share of employment by these firms is 48.2 percent, whereas it is only 28.3 percent in the population.

<sup>12</sup> Therefore, the sum of these weights within a stratum is equal to the total employment of that stratum in the target population; the sum of weights across all sample firms is equal to the total employment in the target population.

companies employing 50–199, and 200 and more people account for 28.3 and 26.3 percent of total employment respectively, but their relative importance in our weighting scheme for the 2007 survey is 46.7 and 8.6 percent respectively.

We regard this inconsistency as relatively inconsequential however. First, it will matter only in those cases when the behaviour of very large firms (200+ employees) turns out to be different from that of large firms (50–199 employees), but such situations can be spotted quite easily. Second, as the population of firms employing 200 or more workers is relatively small, our 2007 (2009) sample contains only 19 (8) such companies.<sup>13</sup> Therefore, it may be preferable not to put too much emphasis on the findings derived from 19 observations, or fewer, if the sectoral dimension is considered as well, even if the underlying companies account for a relatively large share of total employment.

All in all, we conclude that the employment-based weights adjust the structure of our samples towards that of firms' population reasonably well and in what follows, we discuss various survey results using employment-weighted descriptive statistics.

### **3. Labour market characteristics**

In this section, we review several institutional and structural features of the Estonian labour market and discuss a few other variables that provide relevant background information about the sampled firms and their business environments. Concerning labour market institutions, the survey provides firm-level evidence on the incidence and type of collective bargaining, the level at which existing collective agreements are concluded and their coverage. Though not part of the survey inquiry, another institutional aspect of the labour market that has received considerable attention within the WDN is the strictness of the national employment protection legislation (EPL). Hence, we comment on Estonia's relative standing in terms of the OECD EPL index as well.

In what follows, we also consider three additional descriptive variables: the share of labour costs in total costs, to see how the importance of labour input varies by sector and how the labour intensity of production in Estonia compares to that of other European countries; the incidence of different remuneration methods, some of which are potentially more flexible and performance-related than others; and finally, the intensity of price competition in

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<sup>13</sup> According to the 2005 Business registry, there were 186 such companies in the sectors covered by the survey.

the firms' product markets, one of the key characteristics of a firm's business environment.

In each case, we first try to provide a broad-brush description of a particular issue revealed by the WDN cross-country evidence, and then focus on the Estonian evidence more closely.

### **3.1. Labour market institutions: Collective bargaining**

As mentioned above, the WDN survey collected firm-specific information on the incidence and type of collective wage bargaining as well as on its coverage. Specifically, firms were asked if they had a collective wage agreement and, if so, whether it was concluded at the firm level or externally, e.g. at the national, sectoral or occupational level. In addition, the survey inquired about the proportion of workers covered, whichever the type of collective wage agreement. A cross-country summary of this information is presented in Table 2, which is taken from Babecký et al. (2010). Since the survey covered only private sector businesses, it gives a general picture of collective bargaining in this part of the economy.

One of the most notable messages emerging from the table is that there is a very clear difference in the importance of collective wage bargaining between euro area and non-euro area countries.<sup>14</sup> Most of it stems from a striking difference in the incidence of collective contracts negotiated at higher than firm level. Collective agreements determined externally affect wage setting in 88 percent of firms in the euro area (EA), compared to only 6 percent in non-euro area (non-EA) countries. The two country groups are much more similar in terms of the prevalence of firm-level collective wage bargaining, with 36 percent in the EA and 26 percent in non-EA countries. However, the disparity in overall coverage is still very noteworthy: 85 percent of employees are covered in the EA but only 24 percent in non-EA countries.

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<sup>14</sup> This classification covers the eurozone membership at the time when the surveys were conducted. Euro area countries are Austria, Belgium, Spain, France, Greece, Ireland, Italy, Netherlands, Portugal and Slovenia. Non-euro area countries are the Czech Republic, Estonia, Hungary, Lithuania and Poland.

Table 2: Collective bargaining — level and coverage: country overview

Country	Percentage of firms with a collective bargaining agreement			Share of employees covered by collective bargaining agreements, %
	either form	firm-level	higher level	
Austria	97.8	23.3	96.2	94.6
Belgium	99.4	35.3	97.9	89.3
Czech Republic	54.0	51.4	17.5	50.2
Estonia	12.1	10.4	3.4	8.7
Spain	100.0	16.9	83.1	96.8
France	99.9	58.7	98.8	67.1
Greece	93.4	20.8	85.9	91.0
Hungary	19.0	19.0	0.0	18.4
Ireland	64.6	18.1	61.6	29.4
Italy	99.6	42.9	99.6	97.0
Lithuania	24.2	23.7	0.8	15.6
Netherlands	75.5	30.1	45.4	67.6
Poland	22.9	21.4	4.7	19.3
Portugal	62.1	9.9	58.9	55.5
Slovenia	100.0	25.7	74.3	–
Total	76.5	33.1	65.4	68.1
Euro area	94.7	35.7	87.7	85.1
Non-euro area	27.7	26.3	6.0	24.1

*Notes: Figures are employment-weighted and re-scaled to exclude non-responses. The figures in the columns “firm-level” and “non-firm level” do not add up to those in the column “either form” as some firms might have bargaining agreements at both levels.*

*Source: Babecký et al. (2010).*

According to Table 2, the incidence and coverage rates for collective bargaining in Estonia are the lowest among the countries considered. Higher level agreements are very rare with only 3.4 percent of firms acknowledging them; and even though firm-level wage bargaining is more common, the 12 percent share of firms in which wage setting is affected by collective bargaining at any level is nevertheless very low and considerably lower than the corresponding average for non-EA countries of almost 28 percent. Similarly low is the share of employees covered by collective wage bargaining: at 8.7 per-

cent, it contrasts sharply with the corresponding average of 24 percent in non-EA countries and 85 percent in the eurozone.<sup>15</sup>

Table 3: Collective bargaining by sector and firm size, Estonia

Sector	Percentage of firms with a collective bargaining agreement			Share of employees covered by collective bargaining agreements, % *
	either form	firm-level	non-firm level	
Manufacturing	13.3	12.1	1.2	9.6 (72.2)
Construction	11.3	9.8	6.2	7.4 (65.4)
Trade	9.3	7.8	1.5	4.6 (49.2)
Market services	13.0	10.3	6.8	11.2 (86.0)
Size (num. of employees)				
5–19	4.9	4.1	0.8	3.8 (77.9)
20–49	3.9	1.8	2.1	2.5 (64.1)
50–199	16.0	13.7	6.1	12.4 (77.1)
200 and more	31.2	31.2	0.0	17.9 (57.4)

*Notes: \* Figures in parentheses show coverage conditional on a collective agreement, concluded on any level, being in place.*

*Source: Estonian WDN Survey 2007, authors' calculations*

The incidence and coverage of collective wage bargaining differ somewhat across sectors, but given the overall low importance of collective bargaining in the economy these differences are unlikely to have significant economic importance. For example, Table 3 shows that higher-level collective agreements are notably less common in manufacturing and trade at about 1.5 percent than in construction and market services where they are at 6–7 percent. However, once firm-level agreements are taken into account, the percentages of firms subject to collective bargaining at any level become more similar across sectors, falling between 9 and 13 percent, trade being at the bottom and manufacturing at the top of the list. There is similar variation in coverage, which ranges from a low of 4.6 percent in the trade sector to a high of 11.2 percent in the services sector, with manufacturing second with 9.6 percent coverage. All in all, this confirms that the economy-wide average coverage of 8.7 percent reported in Table 2 is quite representative even if viewed from a more detailed sectoral perspective.

<sup>15</sup> The 8.7 percent coverage discussed here is lower than that reported by Du Caju et al. (2008), see Table 1 therein, where it is categorised as “Low”, meaning between 26 and 50 percent. The difference is due to different sector coverage in the two data sources. In addition to the sectors covered by the present survey, Du Caju et al. (2008) considered non-market services (NACE sectors L–P), which are relatively more unionised in Estonia.

The importance of collective bargaining also varies with firm size. In this regard, two results are worth mentioning in Table 3. First, size correlates with the incidence of collective agreements: larger firms are more likely to have collective bargaining. Second, this positive relationship also holds between size and coverage measured as the share of covered workers in total employment. On the other hand, coverage conditional on the presence of a collective agreement does not appear to vary systematically with size and is broadly similar across size groups.

### **3.2. Labour market institutions: Employment protection legislation**

Whereas collective bargaining is mostly associated with the wage setting process, employment protection legislation is an institutional framework that directly relates to labour turnover: by influencing hiring and firing costs, it affects those labour market adjustments that involve changes in employment. A composite quantitative measure of such institutional arrangements that is comparable across countries is provided by the OECD index of employment protection legislation (OECD, 2004). In the context of WDN, this measure was extensively used to capture or explain various aspects of cross-country variation in the survey data, and in a number of cases, regression estimates indicated that the employment protection legislation (EPL) index could have implications for employment and wage adjustment at the firm level. Though such cross-country evidence is beyond the focus of this paper, we provide a short description of the EPL index to give a more complete comparative picture of the institutional background for firms operating in Estonia.

The EPL index for the select list of European countries is illustrated in Figure 1. The data are taken from OECD (2004) for OECD members and Tonin (2005) for Eastern European countries. The EPL index is a composite measure that assesses the strictness of regulations that govern collective dismissals, and the hiring and firing of regular and temporary workers. By construction, its value may fall between zero and six, denoting the least and the most stringent EPL respectively. However, the actual EPL levels for the countries considered in Figure 1 fall in the range of 1.3–3.5, the mean value being 2.5. Although the average level of the EPL index for non-EA countries is notably lower than that for the EA, 2.2 and 2.7 respectively, suggesting that employment protection legislation is generally less stringent among the former, the means within the group hide considerable differences. For example, the two countries with the lowest and the highest values of the ELP index are Ireland and Portugal respectively, both from the euro area. The group of non-EA countries is quite heterogeneous as well: the value of the EPL index

for Hungary is 1.7, whereas that for Lithuania is 2.8.<sup>16</sup> Thus, instead of considering the EA or non-EA argument, it might be more informative to group the countries into three categories depending on whether their EPL is below 2.0, between 2.0 and 2.5 or above 2.5. Though arbitrary, such categorisation would separate countries with relatively loose EPL from those with stricter EPL.

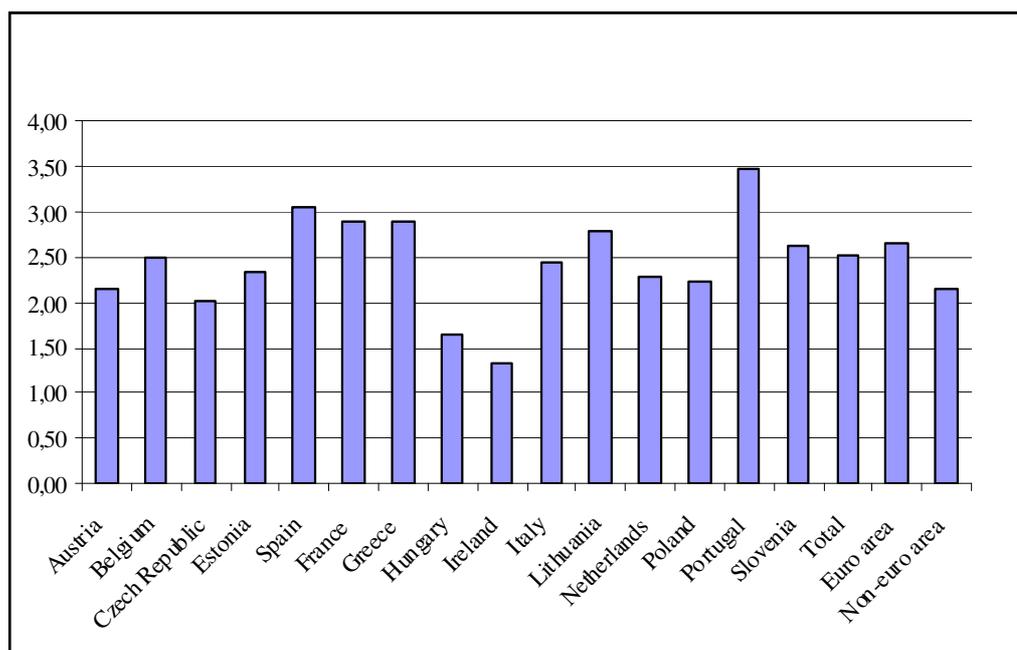


Figure 1: EPL index.

Source: OECD (2004), Tonin (2005).

The value of the EPL index for Estonia is 2.3, somewhat below the overall average EPL but above the mean EPL for non-EA countries. It also falls in the middle of the medium range for EPL values (2.0–2.5) suggested above. This means that although Estonia’s EPL clearly sets it apart from some European countries, it does not seem to differentiate Estonia from the majority of other countries considered here. Thus, from this observation alone, we would not expect the wage setting behaviour of Estonian firms to be substantially

<sup>16</sup> The four countries with the lowest EPL are: Ireland (1.32), Hungary (1.65), The Czech Republic (2.02) and Austria (2.15); while the four countries with the highest EPL are: Portugal (3.49), Spain (3.07), Greece (2.90) and France (2.89).

different from the typical behaviour of firms in the euro area or non-EA countries.<sup>17</sup>

### 3.3. Labour cost share

Another explanatory variable that is considered by all multivariate analyses reported in the WDN survey-based cross-country papers is the share of labour costs in a firm's total costs. As a measure of the importance of the labour input for a given firm, this covariate is often found to have economically relevant and statistically significant association with virtually all the main behavioural characteristics we examine in this paper: the frequency of wage and price setting, downward wage rigidity, firms' responses to shocks, etc. This suggests that some degree of correspondence between these characteristics and the labour cost share may be present at more aggregate levels as well. For example, the well-known stylised fact that services are more labour-intensive than manufacturing is often used to explain why labour cost dynamics may matter more for prices in the former sector than in the latter. With similar considerations in mind, we follow the structure of the previous subsection and provide a short comparison of the labour cost share across countries, sectors and firm size groups.

Table 4 reports the average labour cost share for all countries, the euro area, non-euro area countries and Estonia. It turns out that the average EA labour share (35 percent) is somewhat higher than that of the non-EA countries (32 percent), whereas the average labour share in Estonia (30 percent) is lower than both. Though these differences are statistically significant, their magnitude is hardly substantial from an economic point of view. Interestingly, the extent of variation in the labour share within these country groups is even greater. In the euro area, the mean labour share ranges from 30 percent in Spain to 44 percent in the Netherlands. Among the non-euro area countries, the estimate is lowest for the Czech Republic at 29 percent and highest for Lithuania at 41 percent. The unweighted standard deviation of the labour cost share across all sample countries is 4.5 percent.

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<sup>17</sup> Though it has no direct importance for the present paper, it is worth noting that a new law regulating employment relations was passed in Estonia in the summer of 2009. In general, the reform was aimed at relaxing employment protection in the context of building up temporary support for the unemployed.

Table 4: Labour cost share in total costs

	Labour cost share, percent
All countries	33.9
Euro area	34.9
Non-euro area	31.6
Estonia	30.0

*Notes: employment-weighted shares, in percent, adjusted for non-response.*

*Source: 2007/2008 WDN Survey*

Considering how the labour cost share varies by sector and firm size in Estonia, two results stand out. First, the data clearly confirm the already noted stylised fact that the service sector is labour intensive. As shown in Table 5, the labour cost share is 38 percent in services but only about 27 percent in manufacturing, construction and trade. Second, the labour cost share is approximately flat across different firm size groups.

Table 5: Labour cost share by sector and size

	Labour cost share, percent
Sector	
Manufacturing	27.1
Construction	26.2
Trade	26.5
Market services	37.6
Size (num. of employees)	
5–19	32.5
20–49	31.1
50–199	28.1
200 and more	31.2

*Notes: employment-weighted shares, in percent, adjusted for non-response.*

*Source: 2007/2008 WDN Survey*

In short, the 30 percent average labour cost share implied by the Estonian survey is among the lowest in the context of WDN, but it is not substantially different from the average levels among the EA or non-EA countries. The labour share does not vary with firm size, but it is about 10 percentage points higher in the service sector than in the rest of the economy.

### 3.4. Remuneration methods

In this paper, most of our analysis will be focused on base wages, which typically constitute not only the most important but also the most rigid component of overall pay. The extent of this rigidity however should depend, among other things, on the principle of remuneration adopted by the firm: for example, whether the base wage is paid as a monthly, hourly or piece-rate wage. Another relevant factor in this context is the share of performance-related pay or bonuses in total compensation. In this subsection, we review how these two aspects of pay structure compare across different European countries and consider what this evidence implies about the relative flexibility of labour costs in Estonia.

Panel A of Figure 2 shows that, across all countries, the average fraction of firms making use of performance-related pay is about 70 percent.<sup>18</sup> This share is somewhat lower in the euro area at about 66 percent and higher in non-euro area countries at 80 percent.<sup>19</sup> The 70 percent estimate seems to be quite close to the average incidence of the payment of bonuses in the majority of countries considered, but there are two countries that differ considerably from the mean. The share of firms paying bonuses is very high, close to 100 percent, in the Czech Republic, and substantially lower than average at roughly 40 percent in Spain. The share of firms paying bonuses in Estonia is 80 percent, which means that performance-related pay is on average more widespread in Estonia than generally in the EU or the euro area.

Panel B of Figure 2 provides an alternative view of the economic importance of performance-related pay by showing the fraction of the economy-wide wage bill that bonuses account for in the countries under consideration.<sup>20</sup> Thus, in addition to the previous result that bonus payments are more common in non-EA than EA countries, we find that a similar tendency holds for the share of bonuses in total compensation as well, where the level is approximately 15 percent in non-EA countries but only 8 percent in the euro area countries. Panels A and B also agree about the countries in which bonuses are the most important and the least relevant, respectively the Czech Republic and Spain. In Estonia, performance related pay constitutes 14 per-

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<sup>18</sup> Belgium, Greece and Portugal are not included in Figure 2 since the data for these questions could not be harmonized.

<sup>19</sup> We should stress here, however, that the data on the payment of bonuses and the share of bonuses in total pay is available in harmonised format for only seven euro-area countries (Austria, France, Italy, Ireland, the Netherlands, Slovenia, and Spain), so the averages given here may not be fully representative of the euro area as a whole.

<sup>20</sup> Importantly, Panel B is not conditional on bonuses being paid; it shows the share that performance related pay constitutes in the wage bill of the whole economy as opposed to that of only those firms that pay bonuses.

cent of the total wage bill. It therefore exceeds the 10 percent average level of bonuses observed across all the sampled countries and is only slightly lower than the corresponding average for non-EA countries at 15 percent.

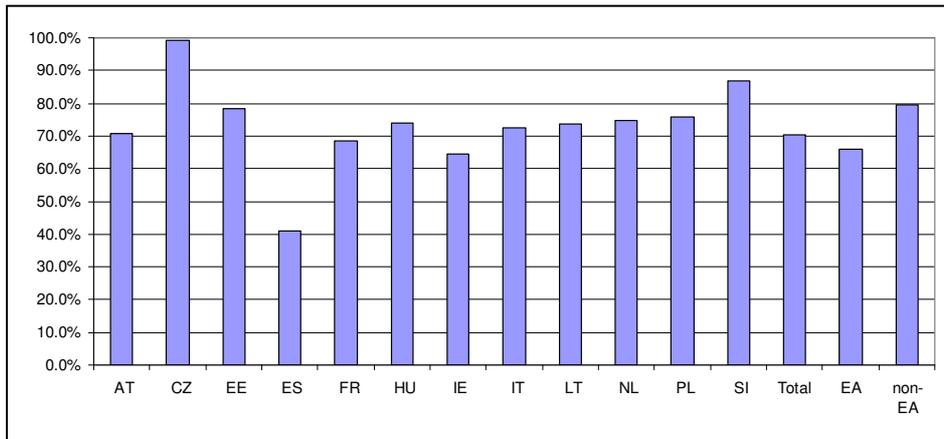
As an alternative indicator of the flexibility of payment systems, we considered a combination of two measures, the payment of performance-related bonuses and piece-rate pay. Both of these remuneration principles are flexible in the sense that they are more or less directly linked with labour productivity. Piece-rate pay is directly related to individual productivity, while performance-related bonuses can be linked with either individual or collective productivity, or both. Following this reasoning, we constructed a measure of flexible pay components in total pay by setting it at 100% for workers who are remunerated on a piece-rate basis and making it equal to the share of performance-related bonuses in total pay for other workers.

Panel C of Figure 2 illustrates the result and reveals a strong difference between the euro area and non-euro area countries for which this information is available. The average share of flexible pay components in total pay is about 27 percent in non-euro area countries but only around 9 percent in euro area countries. This share is the highest in Lithuania, where 46 percent of pay consists of flexible components. It is also substantial in Estonia and the Czech Republic at 36 and 35 percent respectively. The share of flexible pay components is the lowest in Italy at 8 percent and Austria at 10 percent. Judging from this metric, the payment system appears to be relatively flexible in Estonia in comparison to a group of nine other EU member states.

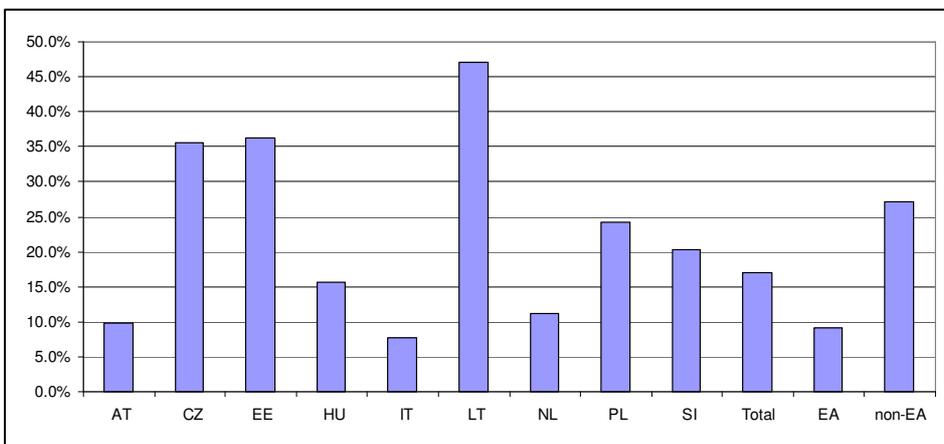
As argued above, the flexibility of *base* pay depends on the relative importance of different remuneration methods as some of them, like piece-rate pay, are more closely related to the level of productivity than other methods, for example, a monthly base wage. To give a feel about how this aspect of wage setting compares across countries, Figure 3 shows the relative importance of the three most common remuneration methods — monthly, hourly and piece-rate wages — in the countries covered by the WDN survey.<sup>21</sup>

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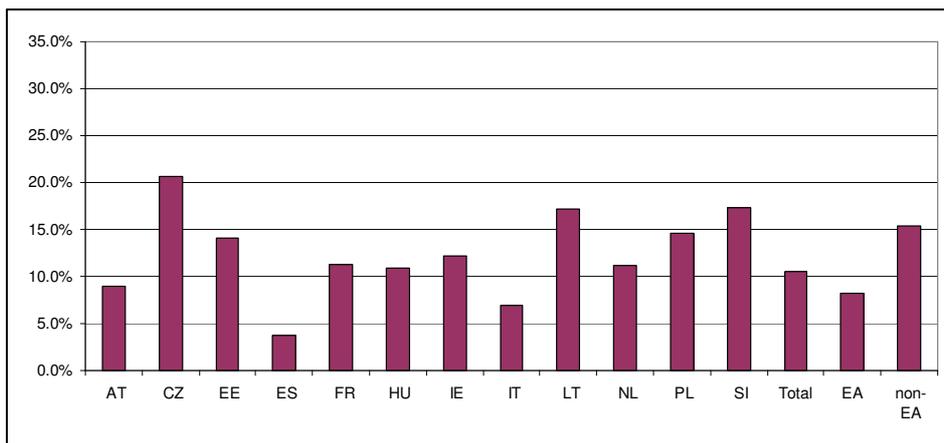
<sup>21</sup> The question on remuneration methods was excluded from the surveys in Belgium, France, Ireland and Spain. For that reason the number of countries shown in Figure 3 is smaller (11) than, say, in the Panels A and B of Figure 2 (15).



Panel A: Share of firms paying bonuses, percent



Panel B: Share of bonuses in total pay, percent



Panel C: Share of bonuses or piece-rate pay in total pay, percent

Figure 2: Bonuses

Source: 2007/2008 WDN survey, authors' calculations.

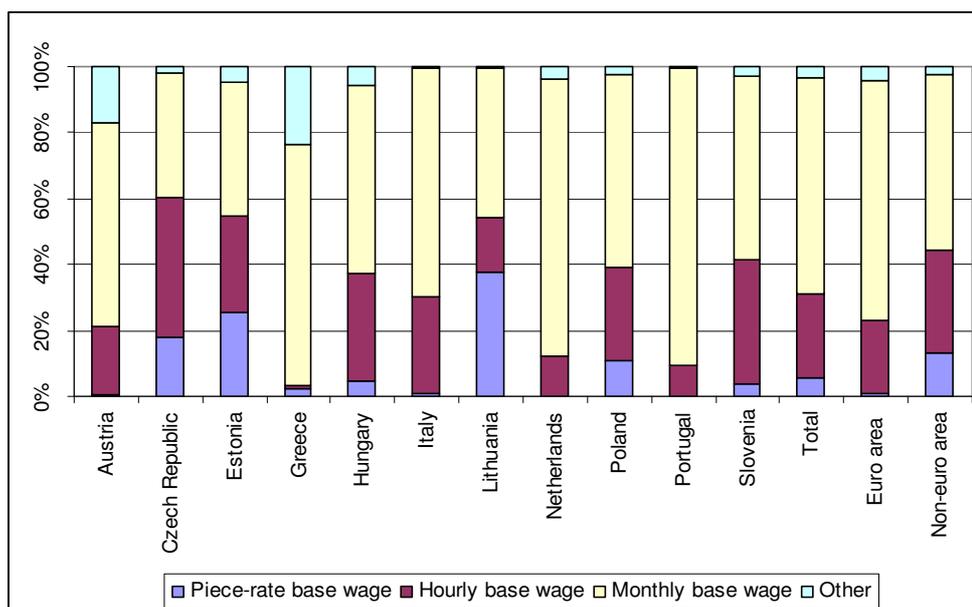


Figure 3: Remuneration methods

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

Source: 2007/2008 WDN Survey, authors' calculations.

It turns out that the cross-country variation in the structure of remuneration is quite substantial. Across all countries, about 65 percent of firms pay monthly wages, 25 percent of businesses determine pay on an hourly basis, and 6 percent of firms pay by the piece. Slightly more than 3 percent of firms apply other remuneration methods.<sup>22</sup> But this general pattern conceals several substantial differences between EA and non-EA countries. Most importantly, piece-rate remuneration is clearly more common in non-EA countries, where it is reported by 13 percent of firms, than in EA countries, where it is used by only 1 percent of firms. In addition, hourly pay is also more widespread in non-EA than EA countries, as it is characteristic of 30 and 22 percent of firms in the two areas respectively. It follows, then, that the converse holds for the third remuneration method, monthly base wages, which is reported by 73 percent of firms in the euro area but only by 55 percent of respondents in non-EA countries.

Though the country group averages are informative, they again hide some quite revealing country-specific differences. For example, the Greek, Dutch and Portuguese surveys imply that a monthly base wage is almost the only

<sup>22</sup> In the case of Estonia, some firms reported that they combine several remuneration methods for the same occupational group. Such firms are also included in the „Other“ category.

form of remuneration in these countries. Elsewhere, however, the hourly rate plays a non-trivial role as well. Its share ranges from 16 percent of firms in Lithuania to 43 percent in the Czech Republic.<sup>23</sup> In Estonia, the share of firms reporting hourly pay is also relatively high at 29 percent.

The piece-rate method, on the other hand, seems to be used almost exclusively by firms in non-EA countries, though its importance is minimal in Hungary. In Lithuania, Estonia, and the Czech Republic, piece-rate pay is reported by 37, 26 and 18 percent of firms respectively. Given that hourly and piece-rate compensation schemes establish a tighter link between labour costs and productivity at the level of the firm, the survey evidence thus implies that non-EA countries generally use more flexible remuneration methods than the euro area countries for which this information is available, i.e. Austria, Greece, Italy, the Netherlands and Portugal.

### **3.5. Competition in the product market**

The relevance and implications of product market competition for wage setting and labour cost dynamics are of considerable interest for monetary policy makers. For that reason, the survey included two questions that were specifically designed to infer the intensity of price competition at the level of the firm. The first asked respondents to assess competition on an ordinal qualitative scale as severe, strong, weak, or no competition. The second question inquired about competition indirectly. Firms were asked to indicate how likely they would be to lower the price of their product if their main competitor or competitors did so first. The extent of price competition could then be deduced by assuming that competition was stronger if the follow-up price reduction was more likely.

Because participation in foreign markets implies exposure to international competition, the share of foreign sales (exports) in a firm's total sales can be seen as yet another proxy for price competition provided by the survey. In this subsection, we discuss what these three measures reveal about competition in the Estonian economy and how the findings compare with similar evidence for other European economies.

The first three columns of Table 6 summarise the data on perceived competition: the first two columns show the percentages of firms reporting "severe" and "strong" competition respectively, while the third column

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<sup>23</sup> The Czech Republic is the only country where the most popular remuneration method is hourly pay (monthly base wages are paid by 38 percent of Czech firms). Though it needs to be confirmed, this result might have something to do with the fact that the Czech survey did not sample small firms; the minimum firm size in this case was 20 employees.

shows the incidence of either. The next three columns draw on the indirect measure: columns (4) and (5) show the percentages of firms for which lowering the price would be “very likely” and “likely” respectively, while column (6) reports the combined share. To save space, Table 6 focuses only on Estonia and three country groups — EA, non-EA, and all countries together.

The levels of perceived competition appear to be very similar in the three country groups and Estonia if we compare the shares of firms claiming that competition is either “severe” or “strong” (column 3). In all four cases, this share is roughly 85 percent. Some interesting differences emerge, however, if we compare the incidence of “severe” and “strong” separately. The former is notably higher in the EA than the non-EA countries at 41 and 33 percent respectively, while it is only 26 percent in Estonia. The incidence of strong competition, on the other hand, is then higher in the non-EA than EA countries at 53 against 47 percent, and it is even more so in Estonia at 60 percent.

Table 6: Competition and the share of foreign sales

	Perceived competition			How likely to lower price?			Foreign sales
	Severe	Strong	Severe or strong	Very likely	Likely	Very likely or likely	
	(1)	(2)	(3)	(4)	(5)	(6)	
Estonia	25.6	59.5	85.1	12.8	43.1	56.0	28.8
Euro area	40.9	47.0	87.9	15.2	37.9	53.1	20.2
Non-euro area	33.0	52.5	85.5	15.1	47.8	62.9	18.2
Total	36.9	49.8	86.7	15.2	41.1	56.3	19.8

*Notes: employment-weighted shares, in percent, adjusted for non-response.*

*Source: 2007/2008 WDN Survey, authors' calculations.*

The combined share of firms that would be “very likely” or “likely” to reduce prices in response to a price reduction by competitors — our alternative measure of price competition — is on average higher among non-EA than EA countries, 63 and 53 percent respectively, and this difference is mostly due to the larger share of non-EA firms than of EA firms having chosen the option “likely”; the incidence of “very likely” is equal between the two country groups. The corresponding statistics for Estonia fall in-between those for the EA and non-EA countries.<sup>24</sup>

<sup>24</sup> The Estonian share of firms indicating the most intense competition, i.e., price reduction is “very likely”, is again smaller than the more aggregate averages at 13 as opposed to 15 percent.

The last column of Table 6 reports the average share of foreign sales (exports) in total sales. This share is slightly lower in non-EA countries than in the EA at 18.2 and 20.2 percent, respectively, but it is substantially higher in Estonia at 29 percent, confirming the fact that the Estonian economy is relatively more open.<sup>25</sup> As noted above, we expect that this higher exposure to foreign markets should make price-taking behaviour more likely.

We next compare competition intensity by sector and firm size (Table 7). As before, conclusions concerning perceived competition depend on whether we look at the incidences of the answers “severe” and “strong” together or separately. In the latter case, sectors differ noticeably: for example, the share of firms facing “severe” competition is 38 percent in the construction sector but only 21 percent in the services sector. In contrast, the *combined* share of “severe” and “strong” is about the same across sectors, and in this case the economy-wide average of 85 percent is quite representative.

Table 7: Competition and the share of foreign sales by sector and size, Estonia

	Perceived competition			Lowering price			Foreign sales
	Severe	Strong	Severe or strong	Very likely	Likely	Very likely or likely	
<b>Sector</b>							
Manufacturing	26.9	56.7	83.6	9.9	38.7	48.5	50.0
Construction	37.5	44.8	82.3	12.3	53.7	66.0	3.9
Trade	22.4	64.2	86.5	18.7	45.0	63.7	6.6
Market services	21.0	66.4	87.3	12.9	43.3	56.2	26.7
<b>Size (num. of employees)</b>							
5–19	24.3	57.3	81.6	14.3	45.5	59.8	13.2
20–49	26.1	56.0	82.1	12.9	37.6	50.4	26.4
50–199	26.0	60.4	86.4	11.3	42.8	54.1	34.8
200 and more	25.6	69.2	94.8	17.2	51.6	68.8	45.5

Notes: employment-weighted shares, in percent, adjusted for non-response.

Source: Estonian WDN Survey 2007, authors' calculations.

The measure of competition based on the likelihood of price reduction implies that competition intensity differs across sectors; the share of firms that would be “very likely” or “likely” to lower prices following a price cut by their main competitors varies from 66 percent in construction to 49 per-

<sup>25</sup> In terms of individual countries, Estonia comes third after the Czech Republic (32.7%) and Slovenia (29.9%). At the bottom of the list are Spain (14.4 %) and France (16.2%).

cent in manufacturing. It also suggests that manufacturing firms are less sensitive to competitor prices than services firms.

Finally, we consider price competition in relation to firm size. As shown in the bottom part of Table 7, the intensity of perceived competition tends to rise monotonically with firms' size; the price-sensitivity measure, on the other hand, suggests that the relationship between price competition and firm size is U-shaped: very small and very large firms are more likely to follow their competitors in lowering prices than medium-sized firms. Hence both approaches agree that large firms report tougher competition than smaller firms, even though some details concerning the nature of the relationship between firm size and competition intensity differ depending on how competition is measured. According to the last column of Table 7, larger firms are also more likely to compete internationally: the share of foreign sales monotonically increases from 13 percent among the smallest firms to 46 percent among the largest.

To recap, the main insights given by our overview of the selected institutional and structural characteristics of the Estonian economy are as follows. In comparison to the EA and also to other non-EA countries, unionisation and collective coverage in the private sector of the Estonian economy are very low. When it is used, collective bargaining is predominantly firm-level and thus decentralised. Overall, collective bargaining is largely irrelevant for the wage setting process in the economy. Employment protection legislation is not as stringent as it generally is in the euro area, but it is substantially more so than in countries where such regulation is particularly liberal, like Ireland and the US. The survey-based measures of price competition are broadly in line with the corresponding indicators for the EA and non-EA countries, though claims that competition is severe are somewhat less frequent among Estonian firms. On the other hand, the relative openness of the economy makes firms more exposed to international competition; on average, the share of exports in total sales is about a third higher in Estonia than in EA or non-EA countries. The survey-based estimate of the share of labour costs in total costs is 30 percent, which is lower than the corresponding averages for the EA and non-EA countries, but not substantially. At the same time, the labour cost component is considerably more important in the services sector at 38 percent than it is in the rest of the economy, where it is only 27 percent. As a final remark, we find that collective bargaining coverage and export intensity increase with firm size, and that large firms are more likely to report facing a highly competitive business environment.

Given this background, we proceed to the main body of the paper and examine our survey evidence on the wage setting behaviour of Estonian firms: the frequency and timing of wage and price changes, downward wage rigidity and labour cost adjustment after shocks

## 4. Wage and price adjustment: frequency, timing and interaction

This section analyses the frequency of wage and price changes and the possible relation between them. It starts with a discussion of survey evidence on the frequency of wage changes (subsection 4.1) and price changes (4.2), and a comparison of them (4.3). Time and state dependence in wage and price setting is covered in subsection 4.4, and the issue of possible synchronisation between wage and price changes is addressed in subsection 4.5. In each subsection, we first provide a broad-brush description of a particular issue as revealed by the WDN cross-country evidence, and then focus on the Estonian case more closely.

### 4.1. Frequency of wage changes

One of the central themes underlying various analyses of wage setting conducted by the WDN survey group has been wage flexibility, understood, broadly speaking, as the capacity of wages to adjust to economic disturbances sufficiently strongly and promptly to ensure continuous and efficient allocation of labour resources. The survey was designed to address the issue of wage flexibility from a number of perspectives, each providing only partial but instructive details on how wages are set, determined and adjusted. In particular, one set of questions was aimed at inferring the frequency of wage and price changes and learning about potential linkages between the two.<sup>26</sup>

The WDN survey evidence on the frequency of base wage changes in European countries is summarized in Table 8, which shows the distribution of firms in terms of three broadly defined ranges of wage change frequencies: wages changed more often than yearly, yearly, and less frequently than yearly.<sup>27</sup> Though comparing distributions is generally not straightforward, the presence of cross-country heterogeneity in Table 8 is quite notable. For ex-

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<sup>26</sup> There are at least two reasons for being interested in the frequency of wage changes in the present context. The first reason is straightforward in the sense that, everything else being equal, a higher frequency of wage changes implies more flexible wages. The second reason is related to the way wage and price stickiness is handled in many of today's new Keynesian monetary models. For example, if wages or prices are assumed to be set according to the Calvo mechanism, the model parameter that is „responsible“ for wage or price stickiness also determines the frequency of wage or price changes. Hence, this frequency can be regarded as one of the characteristics that a „micro-founded“ monetary model might be expected to match.

<sup>27</sup> In the questionnaire, the third category actually consisted of two narrower ones: once in every two years and less frequently than that. To simplify the discussion, these two categories are merged in Table 8.

ample, the overall average share of firms in the first group is 12.1 percent, but at the country level this fraction varies from 4.2 percent in Italy to 42.1 percent in Lithuania. In fact, as reported by Druant et al. (2009), the cross-country standard deviation of the share is 11.2 percent, which is only slightly below its overall mean.

Table 8: Frequency of wage changes, percent of firms

Country	More frequently than once a year	Once a year	Less frequently than once a year	Never/don't know	Average duration of wage spells, months
Austria	6.8	84.2	5.9	3.1	12.5
Belgium	22.0	64.8	9.8	3.4	12.6
Czech Republic	11.5	64.1	23.0	1.4	14.6
Estonia	19.9	64.4	10.5	5.2	12.7
Spain	11.9	84.1	2.5	1.5	11.9
France	19.7	74.1	5.2	1.1	12.0
Greece*	33.9	56.4	9.7	0.0	11.9
Hungary	2.6	75.0	12.2	10.2	13.8
Ireland	14.6	71.2	9.9	4.3	12.8
Italy	4.2	26.9	64.6	4.3	20.3
Lithuania	42.1	44.0	7.5	6.4	11.4
Netherlands	10.8	70.1	17.0	2.1	13.9
Poland	13.6	56.3	28.2	1.9	15.4
Portugal	5.9	82.2	8.4	3.5	12.9
Slovenia	27.2	65.6	5.9	1.3	11.8
Total	12.1	59.5	25.6	2.9	14.9
Euro area	11.4	59.5	26.4	2.7	15.0
Non-euro aera	14.0	59.5	23.2	3.3	14.7

Notes: Figures weighted by employment weights, rescaled excluding non-responses.

(\*) Option "Never/don't know" was not allowed in the Greek questionnaire.

Source: Druant et al., 2009.

On the other hand, countries are alike in terms of the predominant frequency of wage changes: with the exception of Italy, the modal frequency of wage changes is annual. As shown in Table 8, this frequency applies to 60 percent of all firms. Approximately 26 percent of firms change wages less often than yearly, while 12 percent do so more frequently than once a year. Interestingly, the same typical (average) pattern is characteristic of both the EA and non-EA country groups.

Compared to the cross-country average, the distribution of wage change frequency in Estonia contains considerably less mass in its low-frequency tail and more mass in its high-frequency end. Specifically, the share of firms changing base wages less frequently than once a year is substantially lower in

Estonia at 11 percent than the corresponding averages for all and non-EA countries of 26 and 23 percent respectively. At the same time, the shares of firms changing base wages yearly, 64 percent, or more frequently, 20 percent, are higher than the corresponding European averages of 60 and 12 percent respectively. Though these Estonian statistics are certainly not exceptional in the European context, they nevertheless imply that on average wages are changed more frequently in Estonia than is typically the case in the EA and non-EA countries.

Summarising and comparing evidence on the frequency of wage changes when the data are presented in the form of tabulated distributions, as in the first four columns of Table 8, is generally not easy. To present the insights more compactly, Druant et al. (2009) additionally report estimates of the average durations of wage spells, which they obtain by assuming that wage durations are log-normally distributed. These results — the average duration of wage spells, in months, for each country — are replicated in the last column of Table 8. They imply that the average duration of wages across all the countries under consideration is about 15 months, and that the EA and non-EA countries are similar in this regard, at least on average. The corresponding estimate for Estonia is somewhat lower at 12.7 months, which illustrates the previous qualitative conclusion that wage changes are somewhat more frequent in Estonia than in the EA and non-EA countries on average.

As discussed by Druant et al. (2009), a potential explanation for the cross-country variation in the frequency of wage changes might be the differences in national institutions, some of which we reviewed in Section 3. For example, there is a tendency for countries with extensive collective coverage, such as Austria, France, Portugal and Spain, to have high fractions of wages changed once a year (or once in every two years in Italy), which reflects the frequency of centralised collective wage negotiations in those economies. Since collective bargaining coverage in Estonia is very low, the lowest among the countries considered in this paper, the potential coordinating effect of union contracts is absent, and this could be part of the explanation why the Estonian distribution of wage change frequencies is not as concentrated at the yearly frequency as in some high-coverage countries.<sup>28</sup>

If factors determining the frequency of wage changes were predominantly national, frequency distributions of wage changes in different sectors of a given country should be alike. Yet according to Table 9, which gives similar information to Table 8 but for the four sectors of the Estonian economy, cross-sector differences in the distributions of wage change frequency are comparable to the cross-country ones. Notably, in Estonia, manufacturing

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<sup>28</sup> In Austria, Spain and Portugal the share of firms changing wages annually is 82–84 percent compared to 64 percent in Estonia (see Table 8).

and construction firms change wages more frequently than do trade and services firms. For example, the fraction of those adjusting wages more often than once a year is approximately 25 percent in manufacturing and construction but only 11 percent in trade and 18 percent in services. As a result, the incidence of yearly wage changes is under 60 percent in manufacturing and construction but approximately 70 percent in services and trade.

Table 9: Frequency of wage changes by sector, Estonia, percent of firms

	More frequently than once a year	Once a year	Less frequently than once a year	Never/don't know
<b>Sector</b>				
Manufacturing	25.4	58.9	10.7	5.1
Construction	23.0	56.2	14.5	6.4
Trade	11.0	67.6	12.3	9.1
Market services	17.6	73.2	7.1	2.1
<b>Size</b>				
5–19	17.5	60.4	11.5	10.6
20–49	19.2	63.4	16.5	0.9
50–199	20.4	68.0	7.4	4.3
200 and more	26.0	58.3	10.5	5.2

Source: *Estonian WDN Survey 2007*, authors' calculations.

This sector-level variation in the frequency of wage changes seems to be unrelated to cross-sector differences in the market and the structural characteristics that we discussed in Section 3: collective coverage, perceived competition, share of foreign sales, labour share, etc. Such insights, though based on a broad-brush descriptive analysis of the Estonian data alone, are in fact consistent with the implications of the multivariate statistical analysis in Druant et al. (2009). For example, Druant et al. find that, taking manufacturing as a reference sector, the frequency of wage changes is higher in construction but lower in trade and services.<sup>29</sup> Their multivariate results also show that neither the labour cost share nor price competition or the share of exports in total sales is systematically related to the frequency of wage changes. On the other hand, Druant et al. find that frequency increases with a firm's size, and this tendency can be also noticed in our Table 9. Its bottom panel shows that the proportion of firms changing wages more frequently than annually increases monotonically from 18 percent to 26 percent going from the smallest to the largest firms.

<sup>29</sup> See Table 9 in Druant et al. (2009).

In addition to learning about the frequency of wage changes per se, the WDN survey has tried to infer how this frequency relates to two specific causes of wage changes — wage adjustments to inflation and tenure. Even though the design of this particular inquiry has been problematic,<sup>30</sup> the collected data allow us to shed some light on an interesting issue: how often are wages adjusted to, or because of, inflation and tenure in Estonia?

Table 10: Frequency of wage changes for different reasons

	More frequently than once a year	Once a year	Less frequently than once a year	Never/don't know
Wage changes due to				
Any reason	19.9	64.4	10.5	5.2
Tenure	2.3	18.0	15.1	64.7
Inflation	8.0	49.5	9.6	33.0

*Source: Figures in the row “Any reason” are taken from Druant et al. (2009); the rest is the authors’ calculations based on the Estonian WDN survey 2007.*

The data are summarised in Table 10. For convenience, its first row (“Any reason”) reiterates our evidence on the overall frequency of wage changes, previously reported in Table 8, while the other two rows show similar information on the frequencies at which wages are adjusted specifically because of tenure and inflation. Somewhat surprisingly, we find that as many as 65 percent of all firms have chosen “Never/don’t know” in the case of tenure, suggesting that wage increases due to tenure are quite uncommon. The majority of the remaining 35 percent of firms say they reward tenure on an annual basis (18 percent) or less often (15 percent). In contrast, only a third of all respondents are not aware of wage adjustments in response to inflation: 50 percent of firms review wages because of inflation once a year, while the remaining firms are about equally divided between those adjusting wages in response to inflation more and less often than annually, 8 and 10 percent of firms respectively.

<sup>30</sup> Specifically, the survey inquiry about the frequency of wage changes was designed as follows. The questionnaire asked firms to indicate how often they change wages due to tenure, inflation and all other reasons except tenure and inflation in three separate sub-questions. Strictly speaking, such a question design allows the frequency of wage changes for each of the three reasons individually to be inferred but precludes the simpler question: what is the overall frequency of wage changes? Eventually it was decided to assume that this overall frequency can be approximated by the highest of the three frequencies measured by the survey. Obviously, it is easy to imagine situations when this assumption would be inappropriate, but we made the same assumption in Tables 8 and 9.

In short, Table 10 suggests there is a reasonably strong association between the overall frequency of wage changes and the frequency, as perceived by businesses, at which wages are adjusted for inflation. Though this finding is not about causality, it seems warranted to conclude that, with regard to the frequency of wage changes, inflation considerations are more important than rewarding tenure. Inflation might not cause wage adjustments to be of a given frequency, but, given the frequency, inflation is more often than not one of the reasons why wages are changed. The same cannot be said about tenure.

## 4.2. Frequency of price changes

We will revisit the issue of how inflation, a macro phenomenon, influences wage changes at the firm level when discussing survey evidence on wage indexation. However, one of the main motivations of the WDN survey has been to improve our understanding of how wages and prices interact at the micro level. To prepare for insights in this direction, we next focus on the frequency of price changes.

The WDN survey question on the frequency of price changes was, in its form and nature, very similar to the questions on the frequency of wage changes, except for two technical details. Firstly, the question about prices allowed for additional, finer characterisations of higher-frequency price changes: “daily”, “weekly”, “monthly”, “quarterly” and “half-yearly” instead of the all-encompassing “more [frequently] than once a year” option.<sup>31</sup> Secondly, the set of possible answers was extended by a qualitatively different option “No particular pattern”, which had to account for those cases when price changes were largely irregular.

The WDN survey evidence on the frequency of price changes is summarized in Table 11.<sup>32</sup> It reveals, among other things, that a very considerable share of firms, about 29 percent on average, has chosen to characterize price changes as irregular. This share is noticeably lower in non-EA than EA countries, respectively 19 and 32 percent, but it is clear that the difference is mostly due to the unusually low estimate for Poland of 10 percent. The frac-

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<sup>31</sup> To be precise, the question on wage change frequency in the Estonian questionnaire was more detailed in this respect. Unlike the commonly agreed formulation of the question in the template WDN questionnaire, the Estonian version had the “More than once a year” option split into three: “More than four times a year”, “Four times a year” and “Twice a year”. Because such more detailed information on high-frequency wage changes is not available for other countries, we decided not to discuss it either.

<sup>32</sup> Frequency categories from “daily” to “monthly” are combined in this table.

tion of Estonian firms indicating that their price changes have no particular time pattern is 35 percent, somewhat higher than these averages.

Table 11: Frequency of price changes, percent of firms

Country	Daily to monthly	Quarterly to half yearly	Yearly	Less frequently than once a year	No pattern	Estimated average duration of prices, months
Austria	11.6	13.2	37.3	4.9	32.9	9.1
Belgium	8.5	12.2	43.9	6.1	28.9	9.9
Czech Republic	9.7	12.6	36.3	8.5	32.7	9.7
Estonia	5.1	18.4	32.5	8.8	34.7	10.0
Spain	10.4	7.7	47.3	3.1	31.2	9.7
France	5.5	14.3	49.3	4.2	26.6	10.1
Greece*	3.6	18.2	40.8	6.6	30.8	10.2
Hungary	6.1	10.3	45.2	8.6	28.0	10.7
Ireland	14.8	15.4	33.6	6.7	29.1	8.5
Italy	8.9	12.9	32.3	6.5	39.3	9.5
Lithuania	8.9	27.5	20.4	11.0	30.3	8.4
Netherlands	12.7	16.0	44.4	5.6	21.4	9.1
Poland	11.1	27.7	34.2	16.8	10.2	9.5
Portugal	7.9	12.2	44.2	2.1	33.6	9.5
Slovenia	7.7	17.2	37.5	6.2	26.4	9.6
Total	9.2	15.4	39.2	7.4	28.5	9.6
Euro area	9.0	12.9	40.8	5.1	32.1	9.6
Non-euro area	9.9	22.5	35.0	13.6	18.6	9.6

Notes: Figures weighted by employment weights, rescaled excluding non-responses. \* Option "Never/don't know" was not allowed in the Greek questionnaire.

Source: Druant et al. (2009).

For regular price changes, the predominant rate is one price adjustment a year. Across all countries, the average share of prices changed annually is 39 percent, or 41 percent in the EA and 35 percent in the non-EA countries. The majority of the remaining firms change prices more frequently. The fraction of firms changing prices most often, from "daily" to "monthly", is 9–10 percent in both country groups. Approximately 15 percent of firms change prices "quarterly" or "half-yearly", and this share is bigger in non-EA than EA countries, 23 and 13 percent respectively. Finally, the average fraction of prices changed less often than yearly is only 7 percent, or 14 percent in non-EA and 5 percent in EA countries. The corresponding figures for Estonia do not stand out in the cross-country context and are generally in line with these broader aggregates.

As with wages, Druant et al. (2009) provide estimates of the average duration of price spells, which we report in the last column of Table 11. Despite the differences in distributions observed in Table 10, the estimates of price durations appear to be remarkably similar across countries. Notably, the same average price duration of 9.6 months is obtained for both EA and non-EA countries. The estimate of 10.0 months for Estonia is very close to these averages as well.

We note, however, that Druant et al.'s estimates of price durations are based solely on information about the frequency of regular price changes. Irregular price changes ("No pattern") were ignored because the common WDN questionnaire did not include a question on the frequency of irregular price changes, and therefore such information was generally unavailable. The Estonian survey, in contrast, asked firms reporting irregular price changes to indicate the number of actual price adjustments in each of the three years prior to the survey: 2004, 2005 and 2006. Since about one third of firms say they change prices irregularly, it is legitimate to ask whether the average frequency of such price changes is similar to that inferred from regular price changes, as in Druant et al., and if it is not, to what extent the estimated average frequency of price changes for the whole economy changes once the difference is taken into account.

Out of 366 firms in our sample, 139 or 38 percent<sup>33</sup> said they change prices irregularly (the "No pattern" category). When asked about the actual number of price changes in the previous three years, 89 of the 139 firms gave that answer for at least one of the years. These informative answers are summarised in Table 12, which reports the mean, standard deviation, median, minimum and maximum number of price changes for each year as well as the average. The last column shows the number of observations in each case.<sup>34</sup>

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<sup>33</sup> 34.7% if employment weights are applied, see Table 11.

<sup>34</sup> The average number of price changes is computed without promulgating missing values if some but not all of the yearly observations are missing. That explains why the number of observations for the average number of price changes is larger than for price changes in any individual year.

Table 12: Number of irregular price changes, Estonia

Year	Mean	Std. Dev.	Median	Min	Max	Num. obs.
2004	4.1	12.6	1	1	117	70
2005	4.0	12.1	1	1	118	78
2006	4.7	11.1	2	1	105	86
Average	4.3	11.5	1.5	1	113.3	89
<i>Excluding 100 or more price changes per year</i>						
2004	2.9	4.0	1	1	30	69
2005	2.9	4.1	1	1	33	77
2006	3.8	5.9	2	1	35	85
Average	3.3	5.4	1.5	1	32.7	88
<i>Excluding 30 or more price changes per year</i>						
2004	2.5	2.4	1	1	11	68
2005	2.5	2.4	1	1	10	76
2006	2.9	3.2	2	1	21	83
Average	2.5	2.4	1.5	1	12.0	86

*Notes: Figures weighted by employment weights, rescaled excluding non-responses.*

*Source: Estonian WDN Survey 2007, authors' calculations.*

According to the top section of Table 12, the average number of price changes that were characterized as irregular is about 4.3 per year, considerably more than the average 1.2 (=12/10) price changes inferred by Druant et al. from the regular price changes.<sup>35</sup> The range of the number of price changes is wide, from 1 to more than 100 per year, and the corresponding standard deviation is also large, about 11.5. Indeed, the number of price changes is distributed across firms highly unevenly: about half of the firms in this sub-sample report a single price change per year. In Table 12, this tendency is reflected by the low values of the median: one price change in 2004 and 2005 and two in 2006. Surprisingly, not a single firm reported no price changes in any given year.

The middle and bottom sections of Table 12 provide similar information to that above but for sub-samples when some observations corresponding to the highest frequency of price changes are excluded. We have no particular reason for considering this other than to provide more details about the frequency distribution of irregular price changes. Hence, the middle section of Table 12 restricts the sample to only those observations for which the number of price changes does not exceed 100. This restriction eliminates only one observation, but just because the original distribution is so skewed, its effects on the mean and standard deviation are quite pronounced: the mean declines from 4.3 to 3.3, while the standard deviation drops from 11.5 to 5.4.

<sup>35</sup> Because of Jensen's inequality, the ratio 12/10 (i.e., 12 months/average duration of price spells) underestimates the average frequency of price changes in the Druant et al. (2009) data.

Finally, the bottom part of Table 12 describes a sub-sample of firms that changed prices no more than 30 times a year. Depending on the reference year, the constraint reduces the sample by an additional one or two observations, but the average number of price changes declines to 2.5, and the standard deviation drops to 2.4. In terms of the number of price changes, the resulting sub-sample is clearly more compact, and it is interesting to note that the maximum count of price changes becomes 12, which is “equivalent” to the “monthly” frequency on average. For illustrative purposes, a histogram of this sub-sample is shown in Figure 4.

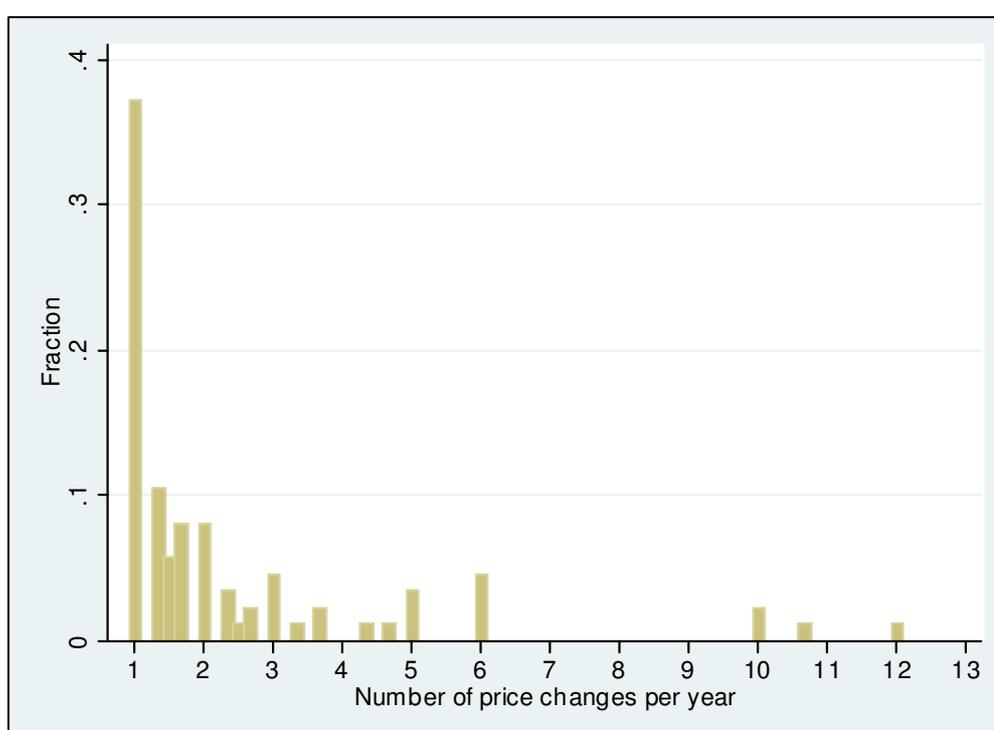


Figure 4: Number of price changes per year, average during 2004–2006, irregular price changes excluding observations exceeding 30, Estonia

Source: *Estonian WDN Survey 2007*, authors’ calculations.

At this point, our main results for the frequency of price changes are as follows. We find that price changes at about 34.7 percent of Estonian firms are irregular and that the average frequency of such price changes is 4.3 per year; this corresponds to an average duration for price spells of 7.5 months.<sup>36</sup>

<sup>36</sup> This is an employment-weighted average of firm-specific (average) price durations, in months, calculated as the inverse of the number of (firm-specific) price changes per year

<sup>37</sup> The remaining 65.3 percent of firms change prices regularly, and for them the average duration of price spells is 10.0 months (Druant et al., 2009). We therefore conclude that the average duration of price spells for the whole economy is 9.1 months or 3 quarters.

In the rest of this subsection, we focus on the Estonian survey and take a more detailed look at how the frequency of price changes varies by sector, firm size and competition intensity. Because the information provided by the survey on the frequency of regular and irregular price changes varies substantially in its nature, we will continue to analyse the two separately.

To begin, Table 13 gives details for the frequency of regular price changes and reports the share of prices that are adjusted irregularly. Unlike before, the fraction of price changes (firms) in each of the frequency categories of “Daily to monthly”, “Quarterly to half yearly”, etc. shown in the table is now normalised in relation to the share of regular price changes, i.e. one minus the fraction for irregular changes. As a result, the first four columns of Table 13 add up to 100 percent in each row, which makes it easier to compare the frequency distributions implied by regular price changes alone.

One notable implication of Table 13 is that the relative incidences of regular and irregular price adjustments differ substantially across sectors. For example, only slightly more than a quarter of manufacturing and services firms indicate that their price changes have no particular time pattern, but, the share of such firms in the construction and trade sectors is much higher, 66 and 44 percent respectively.

These differences have important implications for our comparison of price change frequencies. Firstly, as discussed above, the frequency of price changes differs depending on whether the changes are regular or not. Secondly, both of these frequencies may vary by sector. And thirdly, Table 13 demonstrates that the two types of prices are distributed across sectors unevenly. Fortunately, more often than not the two sources of information tend to agree, at least qualitatively, on how the frequency of price changes varies by sector.

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times 12 (12/number of price changes per year). Evaluating the overall duration at the mean frequency results in 2.8 months ( $=12/4.3$ ). The difference between 7.5 and 2.8 is due to Jensen’s inequality, and thus the first estimate is more accurate.

<sup>37</sup> As noted above, 50 of the 89 firms that described their price changes as irregular declined to provide further information on the number of actual price changes they made. In what follows, we will assume that these firms are not different from the ones that supplied such information, and thus we will assume that the 4.3 estimate applies to all firms whose price changes do not follow a particular time pattern.

Table 13: Frequency of *regular* price changes by sector, size and competition, percent of firms, Estonia

	Time pattern present, <i>of which (%)</i> :				No pattern	Estimated average duration of prices, months
	Daily to monthly	Quarterly to half yearly	Yearly	Less frequently than once a year		
Total	7.9	28.3	50.2	13.6	34.7	10.0
Sector						
Manufacturing	3.8	34.8	51.2	10.2	26.7	
Construction	15.0	19.8	60.9	4.4	66.0	
Trade	21.0	27.5	30.6	20.9	43.9	
Market services	4.7	21.8	57.3	16.2	26.1	
Size						
5–19	4.0	29.1	51.3	15.6	34.7	
20–49	7.4	40.3	40.1	12.2	47.2	
50–199	9.9	23.6	54.1	12.4	30.1	
200 and more	7.8	31.1	43.2	17.9	33.0	
Price competition <sup>1</sup>						
Strong	13.6	33.0	46.2	7.2	36.0	
Weak	0.8	22.6	55.1	21.6	33.5	

Notes: 1 – degree of price competition measured on the basis of how likely a given firm is to lower the price of its product in response to the firm’s main competitor having lowered the price of its product beforehand; “Strong competition” codes the responses “Very likely” and “Likely”; “Weak competition” covers to the remaining answers: “Not likely”, “Not at all”, “It doesn’t apply”, “Don’t know/no answer”. Figures weighted by employment weights, rescaled excluding non-responses.

Source: Estonian WDN Survey 2007, authors’ calculations.

According to the data on regular price changes shown in Table 13, the highest frequency of price changes is reported by trade firms, followed by those in construction and manufacturing, and finally, by services firms. We judge that by comparing the shares of prices that are changed more often than once a year, which are 49, 39, 35 and 27 percent respectively.<sup>38</sup>

The evidence on irregular price changes, summarised in Table 14, makes the comparison more complicated. For example, Table 14 shows that the frequency of irregular price changes in services was higher than in manufacturing, with an average of 3 and 2 price changes per year respectively, though we should also keep in mind that in these sectors the share of firms changing prices irregularly was relatively small at around 27 percent. The importance of irregular price changes was notably higher in the trade and construction sectors, but the corresponding estimates of price change frequencies are in line with our previous conclusion that trade and construction firms change

<sup>38</sup> These percentages are obtained by adding up the first two columns of Table 13.

prices relatively more often. Taken as a whole, the results based on regular (Table 13) and irregular (Table 14) price changes are broadly in agreement with each other with regard to qualitative differences in the frequency of price changes across sectors.

Table 14: Number of *irregular* price changes, Estonia

Year	Mean	Std. Dev.	Median	Min	Max	Num. obs.
Total	4.3	11.5	1.5	1.0	113.3	89
Sector						
Manufacturing	2.0	1.4	1.3	1.0	6.0	31
Construction	6.6	21.7	1.5	1.0	113.3	19
Trade	7.4	10.8	1.4	1.0	32.7	14
Market services	3.0	3.0	2.0	1.0	12.0	25
Size						
5–19	6.3	19.4	1.4	1.0	113.3	26
20–49	3.5	6.1	1.5	1.0	32.7	32
50–199	3.7	6.5	1.7	1.0	30.0	28
200 and more	2.3	1.9	1.0	1.0	5.0	3
Price competition <sup>1</sup>						
Strong	6.1	14.7	1.8	1.0	113.3	50
Weak	1.7	1.5	1.3	1.0	10.7	39

Notes: 1 – degree of price competition measured on the basis of how likely a given firm is to lower the price of its product in response to the firm’s main competitor having lowered the price of its product beforehand; “Strong competition” codes the responses “Very likely” and “Likely”; “Weak competition” covers to the remaining answers: “Not likely”, “Not at all”, “It doesn’t apply”, “Don’t know/no answer”. Figures weighted by employment weights, rescaled excluding non-responses.

Source: Estonian WDN Survey 2007, authors’ calculations.

Finally, the frequency of price changes appears to be unrelated to a firm’s size<sup>39</sup> but positively associated with the intensity of price competition in the product market.<sup>40</sup> According to Table 13, 47 percent of firms facing strong competition change prices more often than once a year, but this fraction is only 23 percent among those subject to weak competitive pressure. Similarly, Table 14 shows that stronger competition is associated with more frequent irregular price changes as well. The median number of price changes per year is 1.8 when competition is “strong” but only 1.3 when it is “weak”. These re-

<sup>39</sup> Of course, a proper multivariate analysis is needed to check this. In their multivariate cross-country analysis, Druant et al. (2009) find that the frequency of price changes increases with firm size; see Table 8 therein.

<sup>40</sup> Here competition is measured on the basis of the survey question about the likelihood of a firm lowering the price in a situation when the main competitor lowers its price first. Competition is defined as “Strong” if such a reaction is “Very likely” or “Likely”, and “Weak” otherwise.

sults agree with the conclusion by Álvarez et al. (2007) and Druant et al. (2009) that price flexibility, here proxied by the frequency of price changes, is positively associated with product market competition.

### 4.3. Comparing the frequency of wage and price changes

To help us compare the frequencies of wage and price changes, Table 15 re-iterates these WDN statistics for the three country groups, all, EA and non-EA, and for Estonia.<sup>41</sup> Note that to facilitate the comparison, the number of frequency categories for price changes is now reduced to the same as that for wages, and that the incidence of each price change frequency is normalised against the share of regular price changes (as in Table 13). Thus, in the part of the table devoted to prices, the first three columns add up to 100 percent in each row.

In addition, the bottom row of Table 15 shows what we deem a better characterisation of the distribution of price change frequency in Estonia than that considered by Druant et al. (2009). In particular, we modify their description of this frequency — which is based only on the data for regular price changes — by drawing on the information that is available in the Estonian part of the WDN survey on the frequency of irregular price changes. By comparing the last two rows of Table 15 we can see that the adjustment increases the relative share of higher-frequency price changes, lowering the implied average duration of prices from 10 months (as estimated by Druant et al., 2009) to 9 months.

If the frequency of wage and price changes are compared, Table 15 illustrates one of the most general findings emphasised by Druant et al. (2009), that prices are changed more often than wages. To take the evidence for Estonia as a specific example, the 43-percent share of firms adjusting prices more frequently than once a year is twice as large as the 20-percent fraction of firms changing wages at a similar frequency. The same pattern is captured even more succinctly by the estimated average durations of wage and price spells, which are 12.7 months for wages but only 9.1 months for prices.

Another general conclusion made by Druant et al. (2009) is that the frequency of price changes varies relatively more by sector than country, whereas the reverse holds for the frequency of wage changes. From this observation and the assumption that the frequencies of price and wage changes are related to price and wage flexibility, Druant et al. conjectured that product

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<sup>41</sup> The statistics are taken from Table 8 (wage changes) and Table 11 (regular price changes).

market characteristics such as product market competition, exposure to foreign competitive pressures, cost structure etc. are relatively more important for price stickiness, whereas labour market institutions, particularly bargaining mechanisms, are more relevant for wage rigidity.

Table 15: Comparing the frequency of wage and price changes, percentage of firms

	More frequently than once a year	Once a year	Less frequently than once a year	Never/don't know	Average duration, months <sup>1</sup>
<i>Wage changes</i>					
Total	12.1	59.5	25.6	2.9	14.9
Euro area	11.4	59.5	26.4	2.7	15.0
Non-euro area	14.0	59.5	23.2	3.3	14.7
Estonia	19.9	64.4	10.5	5.2	12.7
<i>Price changes: regular<sup>2</sup></i>					
Total	34.4	54.8	10.3		9.6
Euro area	32.3	60.1	7.5		9.6
Non-euro area	39.8	43.0	16.7		9.6
Estonia	36.0	49.8	13.5		10.0
<i>Price changes: regular and irregular<sup>3</sup></i>					
Estonia <sup>4</sup>	43.0	46.8	10.2		9.1 <sup>5</sup>

Notes: 1 – assuming that the durations are log-normally distributed, see Druant et al. (2009); 2 – re-scaled after exclusion of the “No pattern” category; 3 – re-scaled excluding non-responses; 4 – authors’ calculations; 5 – authors’ calculation: a weighted average of the average duration reported by Druant et al. (2009) and that implied by the Estonian survey data on irregular price changes.

Sources: Druant et al. (2009); Estonian WDN Survey 2007, authors’ calculations.

Above, we looked at how the two frequencies vary by sector in the Estonian data and noted evident cross-sector differences for both (see Tables 9 and 13). For example, we found that manufacturing and construction firms changed wages more often than did trade and services firms. However, for prices, the cross-sector variation appeared to be more pronounced, which in principle agrees with Druant et al.’s conjecture that price setting is more influenced by sectoral factors. In addition, our results illustrated some of their finer insights, for example, that the frequency of price changes increases with the degree of competition in the product market.

Because of its cross-country nature, the institutional dimension of the Druant et al. (2009) conjecture is obviously beyond the scope of our analysis. We therefore only mention some of Druant et al.’s related findings and comment on their potential implications for wage flexibility in Estonia.

In particular, Druant et al. estimate that the frequency of wage changes is positively associated with the presence of firm-level collective agreements but is negatively related to coverage. For Estonia, both indicators are very low (see subsection 3.1), and thus it might seem that, everything else being equal, the frequency of wage changes would be higher in Estonia if firm-level collective agreements were more common. However, the estimates are based on firm-level variation in the data, and thus drawing such country-level implications is likely to be misleading because of unaccounted for general equilibrium effects. In Druant et al.'s estimations, country-level effects are captured by country dummies, and they imply that there are only three countries — Greece, Lithuania and Slovenia — where the frequency of wage changes is on average higher than it is in Estonia. Generally, most national effects are large, suggesting that firm-level covariates leave much of the cross-country variation in wage change frequency unexplained. Thus, even if Druant et al. (2009) are right, and most of the cross-country differences in the frequency of wage changes are due to institutional factors, it remains largely unknown to what extent that is so and what the nature of the underlying relationships is.

#### **4.4. Time versus state dependence in wage and price changes**

Theoretical and empirical macroeconomic models with micro foundations of wage and price setting often make a heuristic distinction between time and state dependent price and/or wage setting behaviour. The former implies that prices or wages are changed at regular or irregular time intervals that are independent of economic conditions. In contrast, state dependent behaviour denotes reactive price or wage setting, that is, when prices or wages are adjusted only in reaction to changes in economic conditions.

There are at least four reasons for making this distinction and investigating it empirically. First, since price or wage stickiness resulting from time-dependent price or wage setting is easier to model, it is of interest how well the assumption of time dependence approximates actual behaviour. Second, state dependence implies more flexibility in prices and/or wages because such behaviour is more closely linked to market developments. Third, investigating the incidence of time and state dependence in price and wage setting can provide additional insights into whether firms' price and wage setting policies depend predominantly on market considerations or on institutional factors. And finally, if nominal variables are reset unevenly through time so that their changes are highly concentrated in some months or quarters, the ability of monetary policy to have real effects on the economy will depend on

its timing relative to when the bulk of wages and prices are adjusted (Olivei and Tenreyro, 2008).

In this subsection, we follow Druant et al. (2009) and adopt a stricter definition of time dependence: we consider price or wage setting to be time dependent if prices or wages are changed in some particular month or months. After measuring how prevalent such practices are among firms, we also examine the monthly timing patterns that regular price and wage adjustments have throughout a year.

The cross-country distribution of the proportion of firms that typically change prices or wages in some particular month or months is shown in Figure 5. It illustrates four general results. First, the incidence of time dependent behaviour is clearly higher in wage setting than in price setting. Across all the countries under consideration, the average share of firms that can relate the timing of wage changes to some particular month or months is 54 percent, compared to only 35 percent for price changes. In fact, more firms acknowledge time dependence in wage than in price setting in all countries except Italy. Second, time dependent behaviour is about twice as common in EA countries as in non-EA countries. The share of time dependent wage changes is 61 percent in the EA but only 34 percent in non-EA countries, while the incidence of time dependence in price setting is 42 and 17 percent respectively.

Third, in some countries time dependent wage setting is especially common, and this may be due to national particularities in the collective bargaining and indexation mechanisms. For example, the highest incidence of time dependent wage setting is found in Portugal at 95 percent, and in Spain and the Netherlands at about 80 percent, but Table 2 shows that these countries also have widespread collective bargaining. The countries with the lowest share of time dependent wage changes are Lithuania at 17 percent, and Poland and Italy at between 20 and 35 percent, and incidentally, Lithuania and Poland also feature very low collective bargaining coverage. Italy, on the other hand, has very high coverage but a low incidence of time dependent wage setting. This shows that even if bargaining institutions are linked with the pronounced regularity of wage changes in some countries, the relation is not so clear-cut.

The fourth general observation is that the incidence of time dependence in wages is positively correlated with that in prices. For example, Lithuania and Poland have the lowest occurrence of time dependence in both wage and price setting, with the latter at about 15 percent. Similarly, Portugal, Spain and the Netherlands, the three countries noted earlier with the highest shares of firms reporting time dependent behaviour in wage setting, also have relatively high shares of firms claiming time dependence in price changes,

ranging from about 40 to 55 percent. The correlation between the two characteristics across countries is about 70 percent.

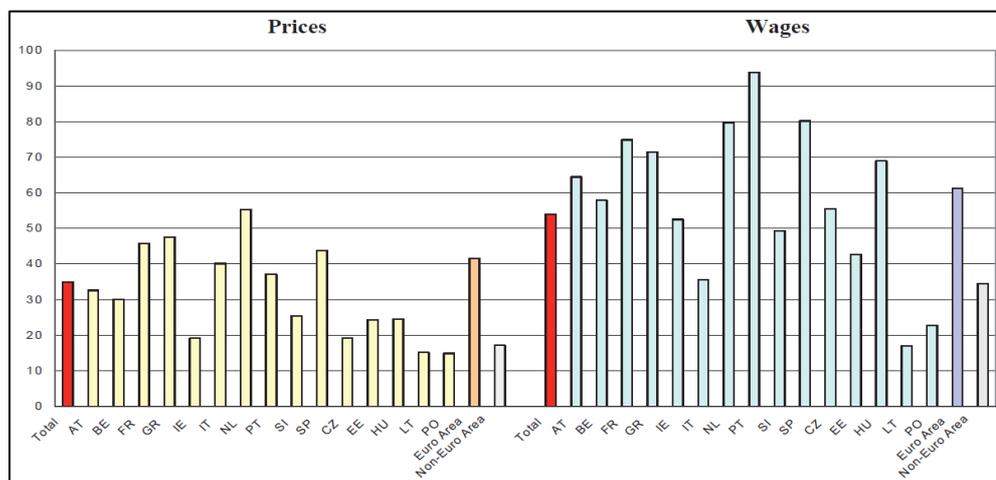


Figure 5: Time-dependent price and wage adjustment across countries (percentages of firms reporting changes to wages/prices in a particular month)

Notes: Figures are weighted by employment weights, rescaled excluding non-responses.

Source: Druant et al., 2009.

In Estonia, the share of firms reporting time dependent wage setting is 43 percent, but for price setting the share is only 24 percent, which clearly shows that time dependence is more characteristic of wages than of prices. Both estimates are well below the respective averages for the whole cross-section of European countries under consideration, but they fall almost exactly midway between those for the non-EA and the EA countries (see Figure 5). Low collective bargaining coverage<sup>42</sup> may be part of the explanation why the incidence of time dependence is lower in Estonia than in the euro area, but this reasoning is not sufficient to explain why it is more common in Estonia than in the non-EA countries taken as a group, or Lithuania and Poland in particular.

That differences in labour market institutions cannot be the whole story is also suggested by the considerable gaps in the incidences of time dependent wage and price setting across sectors of the Estonian economy. This evidence is summarised in Table 16. The share of firms that typically change wages in

<sup>42</sup> As discussed in subsection 3.1, collective coverage in Estonia is very low, and perhaps the only clearly centralised aspect of the wage setting process is the determination of the national minimum wage. It is agreed annually in tripartite negotiations between trade unions, employers' unions and the government.

a specific month or months is 50 percent in the services sector, 44 percent in manufacturing and 40 in trade, but only 25 percent in the construction sector.<sup>43</sup> Interestingly, services firms also report the highest incidence of time dependent price changes at 32 percent; such pricing practices are almost as common among manufacturing firms, at 30 percent, but considerably less so in trade and construction at 11 and 10 percent, respectively. These differences are quite substantial and suggest that the likelihood of time dependence is influenced not only by national but also by sectoral factors. Finally, we note that our cross-sector results share some of the characteristics observed in the cross-country data, namely, that wages are more likely to be changed in some specific month or months than prices are, and that the incidence of time dependence in wages tends to co-vary with that in prices.

Table 16: Percentages of firms reporting changes to wages and/or prices in a particular month or months, Estonia

Year	Base wage changes concentrate in a particular month	Price changes concentrate in a particular month
Total	42.7	24.2
Sector		
Manufacturing	44.3	30.0
Construction	25.2	10.2
Trade	39.6	11.3
Market services	50.3	31.7
Size		
5–19	21.7	22.5
20–49	27.9	16.0
50–199	56.5	25.9
200 and more	61.9	39.4
Price competition <sup>1</sup>		
Strong	43.4	25.0
Weak	41.7	23.3

*Notes: 1 – degree of price competition measured on the basis of how likely a given firm is to lower the price of its product in response to the firm’s main competitor having lowered the price of its product beforehand; “Strong competition” codes the responses “Very likely” and “Likely”; “Weak competition” covers to the remaining answers: “Not likely”, “Not at all”, “It doesn’t apply”, “Don’t know/no answer”. Figures weighted by employment weights, rescaled excluding non-responses.*

*Source: Estonian WDN Survey 2007, authors’ calculations*

<sup>43</sup> On the basis of pooled WDN survey data, cross-sector differences in the extent of time-dependence in firms’ wage and price setting behaviour are discussed in Druant et al. (2009) and ECB (2009). They find that cross-sector variation in the incidence of time dependence is small for wage changes but relatively large for price changes. Our findings for the former are clearly different.

Another tendency revealed by Table 16 is that time dependent behaviour in wage and price setting becomes more prevalent as a firm's size increases. The pattern is particularly clear for wages, as the incidence increases from 22 percent among the smallest firms to 62 percent among the largest. Similarly, the share of firms changing prices in specific months rises from 23 to 39 percent. In contrast, the incidence of time dependent behaviour does not seem to vary with competition intensity.

To complete the review of time dependence, we finally look at how these regular, time dependent wage and price changes are distributed throughout a year. Panel A of Figure 6 illustrates this evidence using the pooled WDN survey data (Druant et al., 2009), and Panel B shows analogous information for Estonia. The main message of both figures is that there is a very clear "January effect", as considerably more wage and price changes take place in January than in any other month. Across all countries, almost 30 percent of regular wage changes occur in January. Because of national particularities in the timing of collective bargaining in some countries, smaller spikes in the distribution can also be observed in November, July and April.<sup>44</sup> For prices, the January effect is less pronounced as only slightly more than 20 percent of European firms regularly change prices in this month, while all the remaining months have more or less similar intensity of price changes. In addition, Druant et al. (2009) note that January is the month with the largest amount of price and wage changes in all sectors (not shown in Figure 6).

In Estonia too, disproportionately many wage and price changes, 22 and 25 percent respectively, occur in January (Panel B of Figure 6). The January effect is more similar between wages and prices and the distribution of wage changes throughout the rest of the year is more uniform than in the pooled WDN data. Other than that, the timing patterns of wage and price changes in Estonia are similar to what could be regarded as typical in Europe. Consequently, the implications of these considerations, and the January effect in particular, for the effectiveness of monetary policy at different times of the year, as discussed by De Walque et al. (2010) for example, apply to Estonia as well.

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<sup>44</sup> For example, significant fractions of wages are changed in July in Belgium and May in Austria, which shows that monthly pattern of wage changes is linked to the timing of wage negotiations (Druant et al., 2009).

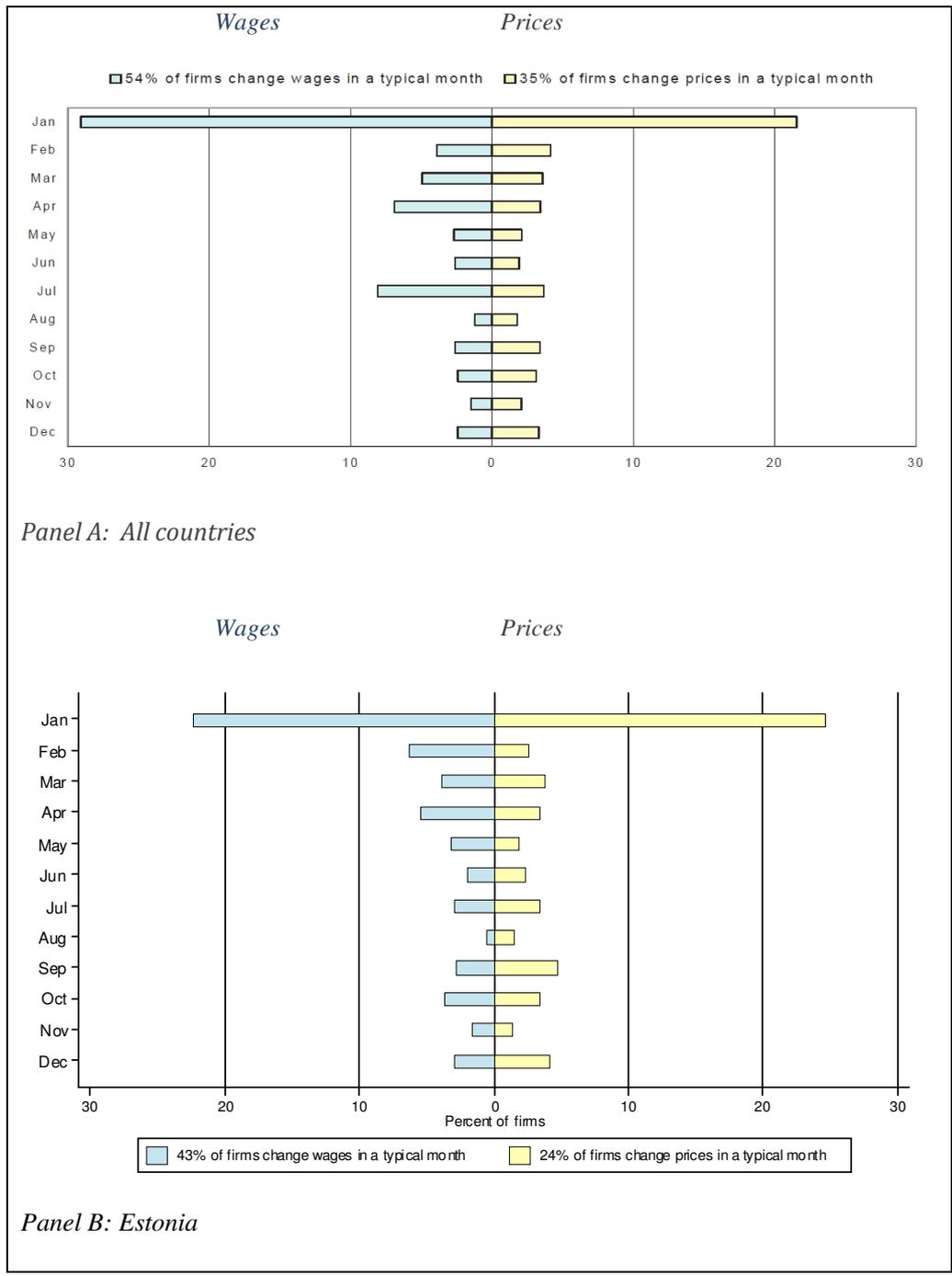


Figure 6: Timing of wage and price changes at firm level  
 (Percentages of firms reporting changes to wages/prices in a particular month)

Notes: Figures weighted by employment weights, rescaled excluding non-responses.  
 Source: Panel A – Druant et al. (2009); Panel B – 2007/2008 WDN Survey, authors' calculations.

## 4.5. Synchronization of wage and price changes

Some of the previously discussed characteristics of wage and price changes could be interpreted as suggesting that there is a certain degree of synchronisation between wage and price changes at the level of the firm. Indicative of this are, for example, the findings that the modal frequency of both wage and price changes is once a year and that the two frequencies tend to correlate positively in different cross-sections; but particularly suggestive of the presence of synchronisation at the aggregate level is the January effect observed in both wage and price changes. To learn more about whether changes in wages and prices are somehow aligned in time at the level of the firm, the following question was included in the WDN questionnaire: “How does the timing of price changes relate to that of wage changes?” And five alternatives were offered as possible answers to it: there is no link between the two; there is a link, but no particular pattern; decisions are taken simultaneously; price changes tend to follow wage changes; and wage changes tend to follow price changes.

Before we consider the resulting data, it is worth emphasising that the question investigates the relationship between wage and price changes from a very specific perspective, that of timing: the timing of price and wage changes themselves or, as suggested by the third of the alternatives offered, the timing of the decisions concerning price and wage changes. Therefore, the inference should not be overly generalised and should not be interpreted, for example, as saying much, or perhaps even anything, about the causality between wages and prices or whether the respondents see any conceptual, economic link between the two. Rather, it is just another piece of information in the overall mosaic of inferences from the WDN survey on the nexus between wage and price setting in the behaviour of firms; and it basically sheds light on only one aspect of that, the timing pattern of wage and price changes or decisions about them at the firm level.

Figure 7 plots the distribution of answers to the above question in the Estonian survey and compares it with the analogous evidence for all the countries in the pooled WDN data set and with that for euro area and non-euro countries separately. According to the broadest sample, the majority of firms, approximately 60 percent, report that there is no link between the timing of their price and wage change decisions. Slightly more than 20 percent of firms acknowledge that there is such a link, but say it has no particular pattern. Excluding non-responses, the remaining 15 percent of firms indicate that the relationship has one of the range of specific time patterns: wage and price changes are decided simultaneously in about 4 percent of firms, price changes follow wage changes in about 8 percent of them, and price changes precede wage changes in about 3 percent of firms. In general, the corre-

sponding results for EA and non-EA countries do not differ much and are thus quite well represented by the overall aggregates, with one notable exception: the share of firms indicating that price changes follow wage changes is about 10 percent in the EA sub-sample but only 3 percent in the non-EA group.<sup>45</sup>

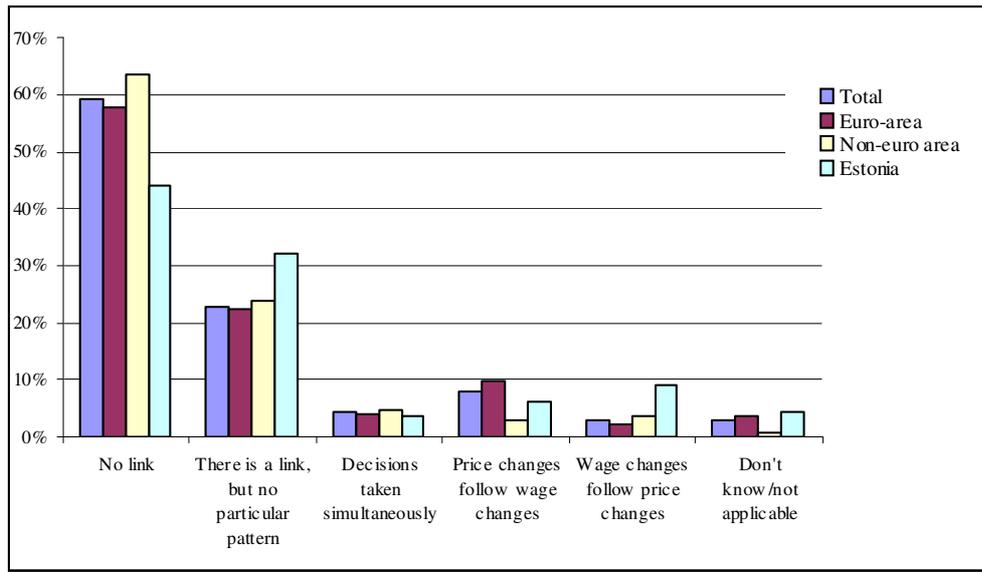


Figure 7: Relation between the timing of price and wage changes (percent of firms)

Notes: Figures weighted by employment weights, rescaled excluding non-responses.

Source: 2007/2008 WDN Survey, authors' calculations.

Interestingly, the distribution of responses to the same inquiry by Estonian firms identifies some differences. The share of firms saying that there is no link between the timing of price and wage changes is 44 percent and is thus almost a third smaller than the share in the broader samples considered above. Part of the difference is accounted for by a higher fraction of firms agreeing that the relationship exists but has no discernible pattern, with 32 percent of firms agreeing in Estonia compared to about 23 percent in the other samples. Finally, and perhaps most interestingly, 9 percent of firms claim that wage changes typically follow price changes in Estonia, relatively more than in either EA or non-EA countries, which rated 2.5 and 4 percent on average, respectively.

<sup>45</sup> The difference is “made up” by about 7 p.p. higher fraction of “No link” responses in the non-EA sub-sample compared to the EA group.

To recap, according to the European aggregates, the proportion of firms that do not acknowledge any link between the timing of their wage and price changes compared to those that do is about 60:40. In Estonia, the ratio is more like 50:50. About 60 percent of the latter firms indicate that the sequencing of decisions concerning wage and price changes is not regular, while about 20 percent of them say that wage changes follow price changes.<sup>46</sup>

We finish this section with a short comment on how firms' responses to the inquiry about the timing of wage and price decisions compare across sectors. According to Figure 8, the frequency of "No link" responses is about average in manufacturing and services, at around 40 percent in each case, but exceeds 70 percent among trade firms and is only 30 percent among firms in the construction sector. We consider that the result for trade firms is not surprising if we accept that the timing of changes in the wages of retailers and wholesalers might indeed have little to do with the timing of price changes of the products they sell. The result for construction firms, on the other hand, may be related to the fact that, in 2006 and 2007, the reference and the survey year respectively, this sector was experiencing a strong boom and that some sort of a price-wage-rise spiral was part of it. As a result, construction firms were more likely to acknowledge the presence of a link, though often of a non-specific nature, between the timing of wage and price changes.

As a final remark, we note that firms operating in the services sector appear to be more likely to change wages after prices change than firms in the rest of the economy covered by the survey. More precisely, this order of events is indicated by 15 percent of services firms but only by 10 percent of manufacturing firms. However, given that the total fraction of Estonian firms that related to this pattern of timing is only 10 percent, the economic significance of the difference in question is most likely minor.

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<sup>46</sup> The Estonian survey data also suggest that larger firms are less likely to indicate that there is a relationship between the timing of wage and price changes. In fact, the share of "No link" responses increases from 43 percent among the smallest firms (5–19 employees) to 60 percent among the largest ones (200 and more employees). One possible explanation for this tendency is that larger firms produce broader ranges of products and employ more diverse labour, so the connection between wage and price decisions becomes less direct. On the other hand, if the average firm size in the Estonian economy is smaller than that in the pooled WDN sample, this "size effect" might be one of the reasons why the Estonian share of firms claiming no link between the timing of the two decisions is smaller than the European share.

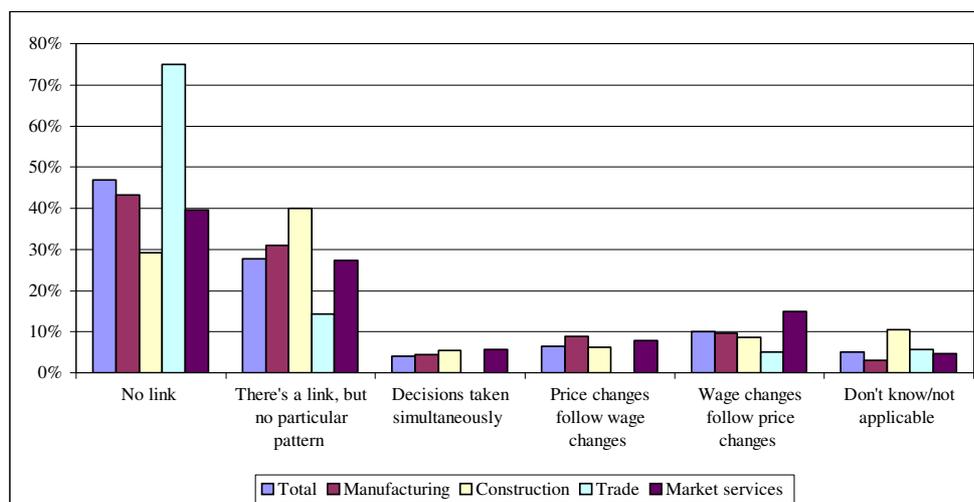


Figure 8: Relation between the timing of price and wage changes by sector, Estonia, percent of firms

Notes: Figures weighted by employment weights, rescaled excluding non-responses.

Source: Estonian WDN Survey 2007, authors' calculations.

## 5. Downward wage rigidity

The extent of flexibility in the wage setting process, especially in the context of recessionary shocks, depends not only on how promptly wages can react once economic conditions shift — that should, in principle, be related to the frequency of wage changes, the characteristic of wage dynamics which was analysed earlier — but also on such aspects of wage adjustment as whether or not individual wages can decline in real and/or nominal terms. It is well documented that wages are generally not as flexible downwards as they are upwards, so that some degree of downward wage rigidity (DWR) is often an empirical norm. Since such asymmetry in wage behaviour has important macroeconomic and monetary policy implications, the WDN survey has contributed to this area of research by collecting information on wage setting practices that are indicative of DWR at firm level. A thorough analysis of these data can be found in Babecký et al. (2010) and Messina and Rõõm (2011). In the following, we borrow some of the descriptive evidence provided in these papers to discuss how certain measures of DWR for Estonia compare in the European context.

In the economic literature, downward real wage rigidity (DRWR) is said to prevail when individual wages tend never to be reduced in real terms. In the presence of positive inflation, DRWR implies that nominal wages increase at a rate not lower than the actual or expected inflation rate. In this

case, histograms depicting the density distributions of individual wage changes typically feature a characteristic spike at the point of actual or expected inflation and a correspondingly lower incidence of wage changes below that rate (Dickens et al., 2007). As a result, in situations when economic adjustment calls for a decline in real wages, DRWR tends to shift the burden of adjustment onto employment, making the resulting episodes of higher unemployment more prolonged.

Downward nominal wage rigidity (DNWR) instead characterises a situation when wages do not decline in nominal terms. In this case, a typical histogram of individual wage change frequencies features a concentration of data points (a spike) at zero (i.e., no wage change) and lacks observations to the left from it, meaning there are relatively few nominal wage reductions (e.g. Kahn, 1997; Card and Hyslop, 1997). In a low inflation environment, the absence of nominal wage cuts resulting from DNWR may interfere with the natural, continual need for adjustment in relative wages as different parts of the economy are hit by various idiosyncratic shocks. Since a wage adjustment mechanism that has been constrained in this way reduces the ability of the system to absorb shocks, DNWR may be seen as a reason for central banks to aim at positive steady state inflation: such inflation, the argument goes, would “grease” the wage adjustment mechanism by undermining the effects of the one-sided stickiness of nominal wages.

Since both types of wage rigidity have macroeconomic implications that are central to monetary policy, the WDN surveys included several questions that were aimed specifically at measuring the extent of nominal and real wage rigidity. This particular block of questions was included in both WDN surveys — the original survey conducted in 2007/2008 and the follow-up survey carried out in 2009 — but the duration of the reference periods defined by the questions was different in the two surveys. In the first survey, firms were asked whether they had ever cut base wages during the five-year period prior to the survey (2002–2006 or 2003–2007, depending on the year the original survey was conducted in a given country). Likewise, firms were asked if they had ever frozen base wages during the five years prior to the survey. Respondents also had to indicate the percentages of employees to whom the wage cuts and freezes had applied. The follow-up survey copied the structure of the questions on wage cuts and freezes, but in this case they referred to the time period ranging from the beginning of the financial and economic crisis until the date of the 2009 survey, i.e. from Q3 2008 until summer 2009.

In addition to collecting data on the incidence of wage cuts and freezes, the 2007/2008 survey inquired about wage indexation practices: whether or not firms adjusted wages to inflation and whether any such adjustment was rule-based (automatic) or discretionary (“inflation is taken into account”).

The questions on wage indexation were not included in the 2009 survey however.

To map all this information to measures of nominal and real wage rigidity we follow Babecký et al. (2010) and Rõm and Messina (2011). As described above, the existence of nominal DWR is reflected in a relative lack of nominal wage cuts and an abundance of wage freezes in comparison to the notional wage change distribution, which would prevail if wage changes were randomly distributed. Consequently, the extent of nominal DWR can be proxied by the incidence of wage freezes and/or wage cuts.

Our measure of real DWR, again following Babecký et al. (2010), will be based on the incidence of automatic indexation of wages to inflation. In principle, wage indexation may imply not only downward but also upward real rigidity of wages. However, as argued in Babecký et al. (2010), the common indexation clauses are independent of other wage increases and only apply upwards in most European countries, Belgium being an exception. Thus, the indexation-based measure of real wage rigidity is more likely to reflect downward than upward rigidity.

It is important to keep in mind, though, that the cross-sectional data on the incidence of wage freezes and cuts may not be very informative regarding the prevalence of downward nominal wage rigidity, since countries may have experienced different paths of economic growth during a particular time period. This in turn means that the share of firms experiencing negative economic shocks and having to lower wage costs may differ from country to country.<sup>47</sup> During sustained periods of high economic growth the observed incidence of firms freezing wages most probably underestimates the actual frequency of firms subject to DNWR.

To overcome this potential problem, we employ the data from the 2009 WDN survey, which cover the initial phase of the financial and economic crisis that started in Q3 2008. As argued by Messina and Rõm (2011), the economic downturn which followed the onset of the financial crisis in the third quarter of 2008 offers a unique opportunity to observe DNWR on the basis of the survey data. This time period can be viewed as resembling a natural experiment, given that a substantial share of firms were facing negative shocks, which were to a large extent exogenous. In the absence of various reasons preventing wage cuts (i.e. in the absence of DNWR), it would have been optimal for firms to lower wages in response to negative shocks. Moreover, if the economic downturn caused a fall in the aggregate wage level, as

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<sup>47</sup> Note that this is not a serious problem in the regression context, since it is possible to include the fixed effects for countries and sectors in the regressions to account for the differences in country- and sector-specific economic shocks.

was the case in Estonia, wage cuts constituted a preferred strategy even for the firms that did not experience strong negative shocks themselves but witnessed a decline in competitors' wages.

Table 17 presents an overview of the incidence of wage cuts and freezes on the basis of the 2007/2008 and 2009 WDN surveys. The data collected by the first survey show the proportion of firms freezing or cutting wages at any point during a five year period prior to the survey. The same questions in the second survey refer to the time period spanning from the beginning of the financial and economic crisis until summer 2009. For comparability purposes, only firms that participated in both surveys are included in the sample. The figures presented in Table 17 reveal that wage cuts have been very rare in most of the countries sampled. This result holds for 2002–2006 as well as for 2008–2009, which indicates that a vast majority of firms do not cut nominal wages even in the initial phase of a severe economic crisis. It is also evident from Table 17 that although the incidence of wage cuts did not increase much during the crisis, wage freezes became significantly more common. On average, approximately 1.8% of employees in the surveyed countries experienced wage cuts during the current crisis, whereas this share was 1% in the earlier WDN survey. The frequency of wage freezes among employees was 32% according to the 2009 survey, whereas it was only 5% in the 2007/2008 survey.

The frequencies of wage cuts and freezes presented in Table 17 imply that downward nominal wage rigidity was prevalent in Europe — firms were freezing wages instead of cutting them even in the environment of a sharp economic downturn accompanied by near zero or negative inflation.<sup>48</sup> It is notable that the incidence of wage cuts is substantially larger in the non-euro area countries in both the 2007/2008 survey and the 2009 one. The share of firms that cut wages during the current crisis was 2.1% in the euro area and 6.5% in the non-euro area. The same shares were 1.3% and 6.4% during the five years prior to the 2007/2008 survey. The most likely reason for lower resistance to wage cuts in the non-euro area countries is institutional differences in wage setting. As described in Section 3, union penetration is much lower in the non-euro area countries than in the euro area countries in the sample. This indicates that DNWR is stronger in unionised wage setting environments, and this indication is supported by the regression analysis in Babecký et al (2010) and Messina and Rõõm (2011).

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<sup>48</sup> An overview of GDP and inflation trends in all the countries sampled during Q3 2008 – Q2 2009 is given in Appendix 2.

Table 17: The incidence of wage cuts and freezes

	Share of firms cutting/freezing wages (%)			Share of employees experiencing wage cuts/freezes (%)	
	2007/2008	2009 (past)	2009 (expected)	2007/2008	2009 (past)
<b>Wage cuts</b>					
Austria	1.54	1.72	1.51	0.06	1.23
Belgium	2.87	1.04	1.76	0.2	0.27
Czech Republic	9.32	8.95	3.24	1.13	3.71
Estonia	3.68	44.08	38.61	0.14	30.35
Spain	0.14	2.55	0.52	0.03	1.35
France	2.54	1.92	4.73	0.86	1.21
Italy	0.68	2.03	4.29	0.06	1.14
Luxembourg	7.29	0.3	0.32	0.55	0.03
Netherlands	1.58	2.55	3.78	0.17	1.18
Poland	5.7	4.2	1.58	3.79	2.6
Total	2.63	3.22	3.13	0.99	1.81
Euro area	1.27	2.07	3.29	0.23	1.14
Non-euro area	6.43	6.48	2.68	3.1	3.7
<b>Wage freezes</b>					
Austria	9.3	1.76	8.43	5.71	1.07
Belgium	15.89	23.72	4.41	2.39	14.58
Czech Republic	31.39	54.63	11.72	11.95	49.13
Estonia	21.27	61.54	64.61	9.6	56.94
Spain	1.45	26.68	3.73	0.8	22.21
France	7.68	85.98	83.77	5.27	82.48
Italy	3.81	31.71	62.77	1.25	30.86
Luxembourg	8.02	46.83	44.51	2.39	35.87
Netherlands	25.8	15.22	8.67	15.86	12.58
Poland	9.72	17.98	8.07	7.79	16.59
Total	9.53	34.51	34.46	5.18	31.88
Euro area	7.64	37.09	43.12	3.89	34.38
Non-euro area	14.8	27.37	10.25	8.76	24.99

*Notes: The table presents percentages of employees/firms, figures are employment-weighted and rescaled excluding “do not know” answers. The construction sector is not included in Spain, France and Italy; financial intermediation is not included in the Czech Republic, Estonia, Spain, and France. “Past” refers to those instances when the wage freeze/cut had already been implemented by the time of the 2009 survey; “expected” refers to those cases when respondents confirmed that they expected wage freezes/cuts in the future. The “past” and “expected” options are not mutually exclusive.*

*Source: Messina and Rõõm (2011).*

The figures presented in Table 17 imply that the extent of past wage cuts during the crisis is larger in non-euro area countries, while the incidence of expected wage cuts is higher in euro area countries. This indicates that non-

euro area firms have reacted faster to economic downturn. As discussed in Messina and Rõõm (2011), the slower reaction in the euro area may also be related to stronger unionisation, which in turn makes firms more reliant on time-dependent (as opposed to state-dependent) wage setting practices. An analysis of the timing of wage changes by Druant et al. (2009) using the 2007/2008 WDN survey implies that the clustering of wage changes in particular months is more widespread in euro area countries than in non-euro area ones, possibly owing to a higher level of collective wage bargaining agreements and indexation clauses in the former.

Among the countries covered by the WDN survey, Estonia stands out as the only one presenting evidence of substantial downward wage flexibility during the recent crisis: in summer 2009 around 46% of Estonian firms had already cut wages and 40% planned to do so. The wage cuts applied to 30% of the work force, a far larger percentage than in any other country surveyed. However, Estonia had a high incidence of wage freezes in addition to wage cuts, indicating that some of the firms were still constrained by DNWR. In June 2009 approximately 62% of companies had frozen wages and 65% expected to freeze them in the future.

Why did Estonian firms behave so differently from the companies of other countries in the sample? First, Estonia has a flexible institutional environment for wage setting: it has the lowest collective bargaining coverage among the countries covered. Also, it implemented a reform of labour regulations in 2009, which imposed more flexible employment protection legislation (EPL) and considerably lowered layoff costs for employers. As a result of this reform, EPL in Estonia became the least strict among the covered sample of countries.<sup>49</sup> We have already discussed the impact of collective bargaining on downward wage rigidity, and previous research on this topic has also shown that EPL is also related to DWR: the more strictly employment relations are regulated, the stronger is the resistance to nominal wage cuts (Holden, 2002; Babecký et al., 2010).

The second reason for the high incidence of wage cuts in Estonia was the depth of the crisis. Output declined by more in Estonia than in any other country in the sample: GDP fell by 16% in seasonally adjusted terms between Q3 2008 and Q2 2009. A decline of such magnitude induces firms to use all possible channels for cost-cutting, including lowering the base wage. We show below, however, that there was more to it than just variation in the se-

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<sup>49</sup> The new Labour Law came into effect in July 2009, i.e. one month after the 2009 WDN survey was conducted. However, it is plausible to assume that firms already took the new legal framework into account in their earlier decisions. The implementation of the new Labour Law was widely discussed, and moreover, it was postponed: under the initial plans, the law was supposed to come into force in January 2009.

verity of the crisis: the incidence of wage cuts was substantially higher in Estonia than in other countries even if we make this comparison on the basis of firms for which the negative demand shock was strong as opposed to moderate or absent. Put differently, conditioning on the strength of demand shock does not eliminate the cross-country disparity in the incidence of base wage cuts.

Third, Estonia had a currency board arrangement until January 2011, when it adopted the euro. This differentiated Estonia from the other two non-euro area countries in the sample, Poland and the Czech Republic. These two countries had floating exchange rate regimes and their national currencies depreciated during the initial phase of the crisis. This gave Czech and Polish firms more leeway in cost optimisation and reduced the need to cut wages. To regain competitiveness, Estonian firms could only rely on internal devaluation, i.e. lowering the wage costs in local currency. The impact of the crisis was also much milder in the Czech Republic and especially in Poland, which was the only country in the sample where GDP did not decline between Q3 2008 and Q2 2009.

Next, we present evidence on how the incidence of wage cuts among firms that were strongly affected by declining demand differed across the countries surveyed. The data on the firm-specific negative demand shock is based on company managers' perception of its magnitude.<sup>50</sup> Table 18 depicts the frequencies of past and expected wage cuts in summer 2009 for two groups of firms, the first group consisting of companies that were weakly affected by a decline in demand and the second group containing strongly affected firms. As would be expected, the frequency of wage cuts was higher in the latter group: about 6% of these firms had cut wages since the beginning of the crisis and 5% planned to do so. Wage cuts were significantly rarer among firms that had experienced no or only a moderate fall in demand — the frequency of both past and expected wage cuts was 2% in this subgroup.

The data presented in Table 18 imply that in the face of a strong or exceptionally strong fall in demand, non-euro area firms were substantially more likely to cut base wages than were euro area companies. The incidence of past wage cuts among strongly negatively affected firms is 16% and that of expected cuts 8% in the non-euro area, whereas these figures are only 3% and 4% in the euro area.

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<sup>50</sup> Company managers were asked to indicate whether a fall in demand for their products due to the financial and economic crisis did not affect them or had a moderate, strong or exceptionally strong impact.

Table 18: Perceived magnitude of negative demand shock and the incidence of wage cuts

	No/moderate fall in demand		Strong/severe fall in demand	
	Past wage cut	Expected wage cut	Past wage cut	Expected wage cut
Austria	0.82	0.84	4.00	3.21
Belgium	0.43	0.33	1.93	3.79
Cyprus	0.87	2.35	3.61	1.34
Czech Republic	1.84	0.00	15.49	6.22
Estonia	12.70	9.98	51.02	45.89
Spain	1.24	0.13	4.50	1.10
France	0.70	5.68	3.67	3.16
Italy	1.50	2.55	2.79	6.73
Luxembourg	0.00	0.00	0.81	0.89
Netherlands	1.59	3.34	4.29	4.62
Poland	4.03	1.31	9.98	4.51
Total	1.81	2.19	5.89	5.10
Euro area	1.18	2.55	3.40	4.48
Non-euro area	3.71	1.12	16.09	7.71

*Notes: The Table presents the percentage of firm managers who have cut or are expecting to cut wages in relation to the crisis. Figures are employment-weighted and rescaled to exclude non-responses.*

*Source: Messina and Rõõm (2011).*

Like in the previous table, Estonia stands out as a country with an exceptionally high frequency of wage cuts. In summer 2009 51% of strongly negatively affected Estonian firms had cut wages since the beginning of the crisis and 46% were planning to do so. Both of these figures were almost 10 times larger than the average frequencies in the survey. Unlike in other non-euro area and euro area countries, the incidence of wage cuts was also substantially higher in Estonia among firms that were weakly affected by the crisis: 13% of such companies had cut wages since the beginning of the crisis and 10% were planning to. The tendency to cut wages may have been a consequence of the falling aggregate wage level. Even in the absence of idiosyncratic negative demand shocks, firms would be inclined to cut wages in response to declining competitors' wages.

The information on downward real wage rigidity is summarised in Figure 9. Though cross-country variation is strong, the Figure shows that automatic wage indexation (which proxies for DRWR) is on average more common in the euro area than in the non-euro area countries: it is applied by 20.1% of firms in the former and by 8.5% of firms in the latter region. Estonia ranks very low in terms of wage indexation. The share of firms automatically indexing base wages to inflation is only 4.4 percent, which is the second lowest incidence of wage indexation in Figure 9. According to this measure,

the extent of real wage rigidity in Estonia is about half the average in non-euro area countries and about one-fifth of the mean level among the euro area countries.

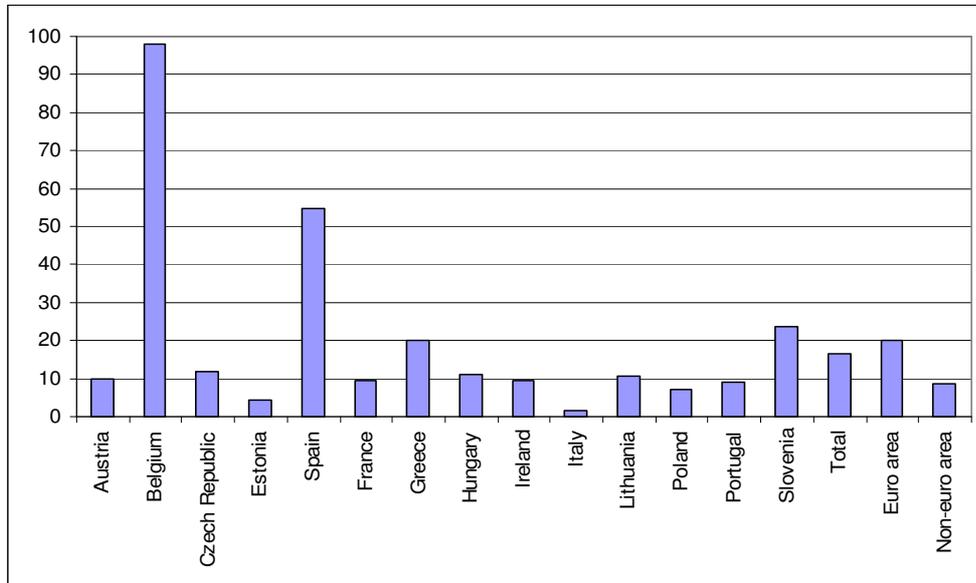


Figure 9: The incidence of automatic wage indexation

Notes: The figures shown on the Graph present the proportion of firms applying an automatic indexation mechanism in a given country. Figures are employment-weighted and re-scaled to exclude non-responses.

Source: Babecký et al. (2010).

Next, we focus on the Estonian economy and take a more detailed look at how the incidence and nature of indexation vary by economic activity and firm size. This information is summarised in Table 19. The economy-wide incidence of automatic wage indexation of 4.5 percent is broadly representative, though indexation appears to be more widespread in the services sector, where it is reported by 7.2 percent of firms, and less common in the trade sector, where it is practised by only 1.7 percent of firms. This suggests that service sector firms are the most likely to be subject to real wage rigidity and trading firms least. It is more common to automatically index wages to past rather than to expected inflation, though manufacturing appears to be an exception, and there seems to be no monotonic relationship between automatic indexation and firm size.

Table 19: Incidence of wage cuts, freezes and indexation mechanisms by sector and size, Estonia (percent)

	Automatic indexation			Inflation “taken into account”		
	Overall	Past inflation	Expected inflation	Overall	Past inflation	Expected inflation
Sector						
Manufacturing	4.3	2.0	2.3	45.1	29.2	19.8
Construction	3.7	3.7	0.0	55.8	40.5	21.5
Trade	1.7	0.9	0.9	50.1	44.1	11.4
Market services	7.2	5.2	2.7	53.9	35.5	28.5
Size (number of employees)						
5–19	7.7	5.8	1.9	50.4	34.5	18.7
20–49	0.0	0.0	0.0	51.8	40.0	19.7
50–199	5.7	3.1	3.0	52.4	36.0	24.9
200 and more	0.0	0.0	0.0	30.9	24.1	6.8
All economy	4.5	2.9	1.8	49.9	35.4	20.8

*Notes: Figures are employment-weighted and re-scaled to exclude non-responses.*

*Source: Estonian WDN survey2007, authors' calculations.*

The data presented in Table 19 show that even though automatic wage indexation is rare, about 50 percent of Estonian firms admit that inflation is “taken into account” when wages are changed. The questionnaire did not provide a definition for “taken into account”; nevertheless, it is informative that the share of positive responses shown in the “Overall” column is relatively stable across sectors and firm sizes, perhaps with the exception of the figure for the largest firms, which are less likely to take inflation into account than the rest. The data also show that it is more common to adjust wages to past than to expected inflation, and that the proportions of firms that do this — approximately 60% and 40% in the whole sample — are similar to those reported in the case of automatic indexation. Thus, inflation is not only one of the main determinants of the frequency at which wages are changed, the finding we discussed in subsection 4.1, but also an important factor influencing the magnitude of wage changes.

In conclusion, the survey evidence suggests that the prevalence of downward wage rigidity is low in Estonia in comparison to other European countries. This applies to nominal as well as real DWR. Automatic wage indexation, potentially the primary source of real wage rigidity in Europe, is very rare. Judging on the basis of the incidence of wage cuts, Estonian firms appear much more flexible downwards than do their counterparts in the other countries surveyed.

## 6. Wages of newly hired employees

Our analysis of downward wage rigidity (DWR) concerned all wages, i.e. we were interested in the downward stickiness of wages in all ongoing employment relations. However, the search and matching framework for modelling the labour market, an approach that has gained popularity in today's new-Keynesian DSGE models, implies that job creation and the behaviour of employment and wages over the business cycle crucially depend on the flexibility/rigidity of a particular category of wages — those paid to newly hired employees (Pissarides, 2009; Haefke et al., 2008). In this context, wage rigidity is understood as the tendency of the wages of the newly employed not to deviate from those of incumbent employees. In theory this kind of rigidity may have important macroeconomic and monetary policy implications, but the evidence for its empirical prevalence is inconclusive, so the WDN survey has attempted to contribute to the debate by collecting managers' opinions as to what they regard to be the main determinants of wages paid to the newly hired and as to whether firms pay higher and lower wages to their new employees than to present ones when the labour market is tight or when it is loose. The corresponding WDN cross-country data are thoroughly analysed by Galuščák et al. (2009).<sup>51</sup> In this sub-section, we use some of their findings as background information for assessing the implications of similar evidence for Estonia. The aim is to see how our insights about the determination of wages of newly hired employees in Estonia compare to analogous measures for other European countries.

One of the underlying reasons for asking firms to indicate the main factors determining the wages of newly hired employees was to learn, somewhat indirectly, whether those determinants are predominantly internal or external to the firm. In particular, the respondents were asked to pick the single most important consideration influencing the wages of the newly hired from the following list: collective agreement; wages of similar employees in the firm; wages of similar employees outside the firm; availability of workers with similar characteristics in the labour market; other reasons.<sup>52</sup> In Table 20,

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<sup>51</sup> Within the WDN, macroeconomic consequences of this rigidity are investigated by De Walque et al. (2009).

<sup>52</sup> Three countries — France, Italy and Poland — have adopted a different approach, however. Instead of requesting firms to reveal the most important individual factor, they asked them to assess the relevance of each wage determinant separately by assigning them scores. As this difference complicates the analysis of pooled data, Galuščák et al. (2009) considered both the overall pooled sample, which they constructed after manipulating the data of the second group of countries in a certain way, and more homogenous sub-samples. In their Table 1, for example, column “Full WDN sample” corresponds to the first case, whereas the column “WDN sub-sample” illustrates the second case; it is based on the data of the countries that only inquired about the most important wage determinant.

these alternative options are grouped into internal factors — the first two on the list — and external factors — the second two.

Table 20: Importance of internal and external factors in determining the pay of newly hired employees, percent of firms

Factor	Full WDN sample	WDN sub-sample <sup>a</sup>	Estonia
<i>Internal factors, of which</i>	78.3	86.5	68.0
Collective pay agreement	N/A	40.5	2.9
Wages in the firm	N/A	46.0	65.0
<i>External factors, of which</i>	21.7	13.5	32.0
Wages outside the firm	N/A	6.5	11.4
Labour supply	N/A	7.0	20.6
Total	100.0	100.0	100.0

Notes: Employment weighted averages.

<sup>a</sup> Includes only those national surveys (12 countries: AT, BE, CZ, EE, GR, HU, IE, LT, NL, PT, SI, ES) in which firms were asked to indicate the single most relevant wage determinant. This sub-sample corresponds to Sample A in Table 1 of Galuščák et al. (2009). Compared to the sample represented by column “Full WDN sample”, it excludes three countries – FR, IT and PL – that followed a different approach and asked firms to assess the relevance of each of the suggested determinants. See also footnote 50.

Sources: The first and second columns for WDN samples are from Galuščák et al. (2009); third column: Estonian WDN Survey 2007, authors’ calculations.

According to the broadest sample of the pooled WDN survey data set, with 15 countries, a clear majority of firms, almost 80 percent, indicate that the most important determinants of the wages offered to the newly hired are those factors that are internal to the firm (the first column of Table 20). The external factors are of most relevance to only about 20 percent of European firms.<sup>53</sup> The second column of Table 20, which is based on a sub-sample of 13 countries that collected the information in exactly the same way and thus could be pooled and compared in a straightforward manner, not only confirms the result that internal factors are the most important but also reveals the relative significance of the individual and more specific determinants that the firms were asked to consider. For example, the second column shows that collective pay agreements and the wages of existing employees — the internal factors — are emphasised by roughly equal fractions of firms: 41 and 46 percent respectively. Interestingly, even though the overall share of firms highlighting external factors is much smaller, in this sample only about 14 percent, they are also about equally divided between those stressing the relevance of pay for similar jobs in other firms and those indicating that the

<sup>53</sup> See footnote 50 for an explanation of what the broadest WDN sample represents in the present context.

availability of the required employees in the market is the most important determinant of their wage during hiring.

A clear prevalence of internal over external factors as the main determinants of wages paid to the newly hired is also notable in the Estonian WDN sample, though the gap in support between the two is not as large: the proportions of firms emphasizing internal and external considerations are 70 and 30 percent respectively. Thus, in relative terms, there are somewhat more firms in Estonia for which market conditions are the primary determinant of wages offered to newly hired employees than is generally the case in Europe. As shown in Figure 10, the extent to which external factors are emphasized by Estonian firms is not exceptional in the European context, but it places Estonia fourth among the 15 countries considered here.

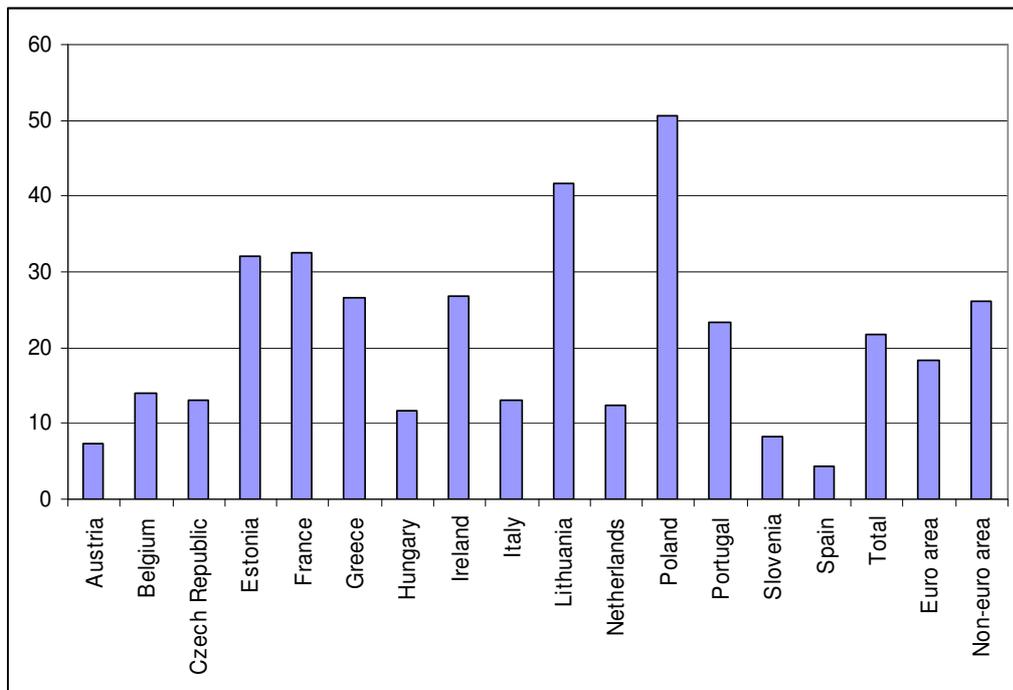


Figure 10: Importance of external labour market conditions in determining wages of the newly hired, percent of firms in each country<sup>54</sup>

Source: Galuščák et al. (2009).

In this context, Galuščák et al. (2009) also note that the relevance of external factors in the determination of the wages of the newly hired is negatively

<sup>54</sup> In Figure 8 the euro area and non-euro area averages are calculated as simple cross-country arithmetic means.

correlated with collective bargaining coverage. Figure 11, taken from their paper, succinctly illustrates the cross-country dimension of this point. The scatter-plot also reveals, however, that several countries with low levels of coverage similar to Estonia's — Hungary, Lithuania and Poland — differ notably in terms of their location along the horizontal axis, suggesting that coverage is clearly not the only determinant of the extent to which external factors matter in determining the wages of newly hired workers.

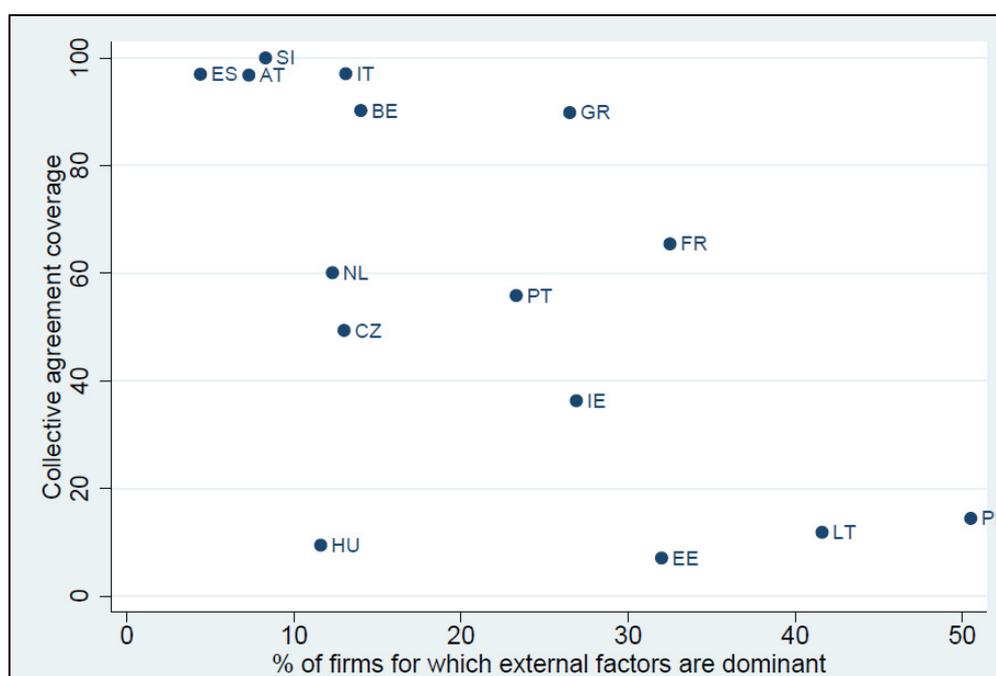


Figure 11: Collective agreement coverage and support for external factors  
*Source: Galuščák et al. (2009).*

Indeed, as shown by the last column of Table 20, only 3 percent of Estonian firms indicate that collective agreements are the primary reason why internal factors dominate the determination of the wages paid to newly hired employees. Given how low collective coverage is in Estonia, this result is hardly surprising. What appears to be much less expected, however, is the relative importance of the other internal factor considered in this context — the wage paid by the firm to its incumbent employees in similar positions. The share of firms stressing this aspect of wage determination in the Estonian sample is 65 percent, much higher than the 46 percent average in the pooled WDN sample (see the second column of Table 20). In a sense, it appears as if the role that would otherwise be played by collective agreements in con-

straining the determination of the wage paid to newly hired employees is partly taken up by firms' willingness to adhere to the internal pay structures that firms already have.<sup>55</sup>

The last result we emphasise in Table 20 is the finding that the availability of similar employees in the labour market — one of the two external factors explicitly considered by the survey — has more relevance in determining the wages of newly hired employees in Estonia than it does in Europe as a whole. That relatively more firms emphasise the importance of external factors in Estonia, 32 percent, than generally in Europe, 14–22 percent, was already discussed above. However, while the availability of workers and the wages of similar employees in the market get about equal support in the WDN pooled sample, the share of Estonian firms emphasising the importance of the availability is about twice the share of those stressing the significance of market wages, with 21 percent to 11 percent. This micro evidence suggests that, compared to similar results based on the pooled WDN data set, the wages offered to the newly hired in Estonia are not only more sensitive to market conditions in general but also relatively more responsive to the tightness of the labour market in particular. In principle, this relative responsiveness of marginal wages to labour market tightness should make firms more willing to create jobs when the labour market is loose, but unfortunately it is not possible to use the survey data to give a quantitative assessment of how substantial these differences are from the macroeconomic point of view — e.g. in terms of the elasticity of the aggregate average wage with respect to unemployment, etc.

In addition to the general inquiry about the single most important determinant of wages paid to newly hired employees, the WDN survey included two other questions that asked specifically whether or not firms offer higher or lower wages to new employees, as compared to similarly qualified incumbent workers, when the labour market for the kind of labour needed is tight or loose. If the response was negative, the firm was further asked to clarify what considerations prevented it from doing so.

Table 21 shows that about 13 percent of European firms hire at wages that are lower than those paid to incumbent employees when the labour market is loose and that 16 percent pay higher wages when it is tight. These percentages are higher in the Estonian sample, 18 percent in both cases, and it is interesting that the difference between the two samples is more pronounced for downward flexibility, i.e. for paying less when the labour market is loose. On the other hand, the share of firms giving positive answers to both questions, i.e. saying that the wages paid to the newly hired would be either higher or

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<sup>55</sup> The importance of internal pay structures for the wages of newly hired employees in the US is emphasized by Bewley (2007).

lower than the wages of incumbent workers depending on the circumstances in the labour market, is only 5.3 percent in both samples.

Table 21: Readiness to offer wages to newly hired employees that are different from the going wage, depending on labour market conditions, percent of firms in each country

Country	Loose labour market	Tight labour market	In both conditions
Czech Republic	10.4	16.2	4.1
Estonia	18.1	17.9	5.3
Greece	15.5	15.1	2.9
Hungary	11.8	17.3	6.3
Italy	12.5	23.5	7.6
Lithuania	18.4	12.4	6.1
Poland	15.7	5.8	2.9
Slovenia	4.4	4.0	1.0
Total	13.4	16.0	5.3

Notes: Employment weighted averages.

Source: Galuščák et al. (2009).

According to the pooled WDN sample, the most prominent reasons for not paying lower wages to the newly hired when the labour market is slack are concerns that such practices would either have a negative impact on effort (36 percent of firms, see Table 22), be perceived as unfair (33 percent) or run against labour regulations or collective agreements (28 percent). Paying the newly hired more when the labour market is tight is prevented by similar considerations, the most important being perceived unfairness (39 percent) and potentially lower work effort (35 percent) by the incumbents. The importance of regulation and collective bargaining in this case is lower, emphasised by only 12 percent of firms.

Analogous information from the Estonian survey shows that the most prominent reason for not offering different wages to the newly hired and to incumbent workers is managers' concern that such a pay policy would negatively affect the work effort of those employees who would end up performing similar jobs but for lower pay. In fact, according to Table 22, support for this idea as the main obstacle to differentiated pay is almost twice as common among Estonian firms as among European firms in general.<sup>56</sup> Other

<sup>56</sup> Note also that the degree of support for this explanation is asymmetric: there are relatively more firms that put it forward as a primary reason for not paying the newly hired *lower* wages when the labour market is loose (68 percent) than for not paying them *higher* wages when the labour market is tight (57 percent). Put differently, the pattern suggests that this version of efficiency wage theory is likely to have more weight in explaining downward rather than general rigidity of new wages.

factors are deemed considerably less relevant. In particular, fairness considerations are emphasized by less than a quarter of firms, while labour regulations and collective agreements are regarded as crucial by only 3–4 percent of firms.

Table 22: Reasons that prevent the newly hired being offered a wage that is different to the going wage, depending on labour market conditions, percent of firms

Reasons	Full WDN sample		Estonia	
	Lower wage	Higher wage	Lower wage	Higher wage
Unfair/bad reputation	32.9	39.2	24.7	22.8
Negative impact on effort	36.2	35.3	68.1	57.1
Labour regulation/ Collective agreement	28.1	11.7	3.6	3.1
Unions would contest such action	1.6	–	0.7	–
Possible pressure for wage increases	–	13.0	–	14.3
Other	2.9	2.6	2.9	2.8

Sources: Full WDN sample: Galuščák et al. (2009); Estonia: Estonian WDN Survey 2007, authors' calculations.

Thus on the whole, the tendency for the wages of newly hired workers to be aligned with those of incumbent employees in Estonia is predominantly driven by efficiency wage or productivity considerations. In contrast to broader European evidence, concerns related to fairness and reputation are of secondary importance, while collective bargaining matters in this regard to only a tiny fraction of Estonian firms. In other words, firms appear to be primarily motivated by the economic reason rather than ethical or fairness consequences of their pay practices, and institutional constraints are largely immaterial.

## 7. Adjustment to demand and cost shocks

So far we have discussed the characteristics of wage and price changes without explicitly considering the reasons behind those changes, the various disturbances or economic shocks to the business environment of the firm. Essentially all information about the wage and price setting behaviour of firms that we gave before depended on firms' actual historical experiences rather than on a particular economic situation or circumstance that would cause the behaviour: the data collected characterised either what firms typically do, as in the case of wage and price change frequency, or have done over the past

five years, as in the case of wage freezes and cuts. However, we did not explicitly consider the nature of the shocks that typically hit the firm; and even though the questionnaire did collect some information on the reasons behind the wage cuts and freezes over the last five years, we do not know whether those circumstances were exceptional or not, if they happen very rarely or not, etc.

In contrast, this section will draw on a set of WDN survey questions that conditioned firms' responses in a qualitatively different way: they asked firms to assume hypothetical situations in which they are hit by particular shocks and requested them to indicate what adjusting to those shocks would typically involve. In this context, firms are positioned to consider price and wage changes as elements of a broader set of alternative margins of adjustment to specific, "identified" shocks. This allows us to infer how the implied price and/or wage changes emerge as endogenous responses to particular disturbances, shedding some light on the trigger-response side of wage and price changes, something that remained largely behind the scenes in the previous sections of the paper.

The WDN survey asked firms to consider three types of hypothetical shocks: two cost-push or supply shocks — an increase in the price of an intermediate input, e.g. a rise in the price of oil, affecting all firms in the market, and a rise in base wages e.g. due to a higher labour income tax rate also affecting all firms in the market — and one demand shock, a slowdown in demand. All three shocks were assumed to be unanticipated, but only the wage shock was explicitly said to be permanent. As a means of responding to each of these shocks, firms were offered four different margins of adjustment to consider: adjust prices — increase them in response to the two cost-push shocks and lower them in the case of the demand shock; reduce margins; reduce output; and lower other costs.<sup>57</sup> They then were asked to assess the relevance of each strategy on a four-point scale: "not relevant", "of little relevance", "relevant" and "very relevant". Set up in this way, the inquiry can in principle tell us not only whether or not a given adjustment strategy would be used but also how important it would be, and perhaps how intensively the margin would be changed relative to the other margins of adjustment.<sup>58</sup> Finally, those firms that indicated the cost reduction option as at least of minor importance were further asked to reveal the main way of achieving the desired reduction in costs, from a set of possibilities listed in the question-

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<sup>57</sup> The "other costs" has a somewhat different meaning with each shock: for the intermediate input price shock it means costs other than the part subject to the shock; for the base wage shock it refers to any other part of costs except the base wage itself; for the demand shock it stands for any costs.

<sup>58</sup> On the other hand, one obvious limitation of the formulation is that the size of a hypothetical shock that the firm assumes remains unknown.

naire. We discuss the evidence provided by the two stages of this inquiry one at a time.

To simplify the exposition of the first set of results, we collapse the original four levels of relevance to only two categories by combining “very relevant” and “relevant”, on the one hand, and “of little relevance” and “irrelevant”, on the other. Sometimes, we will interpret these new “synthetic categories” as indicating if a given adjustment strategy is either “important” or “unimportant”. Somewhat more loosely, we will occasionally assume that the new dummy variables also say something about whether the corresponding adjustment margins are used or not: yes, if “important”, and not otherwise. In a sense, we will blur the distinction between the incidence and intensity of a given adjustment. Though certainly crude, these approximations greatly simplify the broad-brush exposition of the main descriptive results.

Table 23 presents the proportions of answers “relevant” or “very relevant” for each of the four adjustment margins and three shocks for all countries taken together and for Estonia separately. According to the evidence for all countries, the most popular response to all three shocks is reduction of other costs, followed closely by price adjustment. These margins are considered relevant or very relevant by about 70 percent of firms faced with an intermediate input cost shock and 60 percent of those faced with a wage shock. Even more managers, close to 80 percent, deem lowering costs important when coping with a negative demand shock; in this case, however, reducing prices is supported by only about 50 percent of managers. The popularity of both cost and price adjustment strategies hints at the possibility that, even though adjusting prices is often unavoidable, firms try to manage their costs in order to smooth price changes out. Indeed, about 55 percent of firms would also let their profit margins deteriorate in the aftermath of cost shocks. In contrast, output reduction is acknowledged as relevant or very relevant by the smallest fraction of respondents: about 25 percent for cost-push shocks and close to 50 percent for the demand shock.

The first thing to note about the corresponding evidence for Estonia is that in all cases the fractions of “relevant” or “very relevant” substantially exceed their aggregate European counterparts. Unfortunately, interpreting this result is difficult because it could be caused by many things. For example, it may mean that Estonian firms are indeed more responsive on average than firms in other European countries. Alternatively, it might also mean that the Estonians assumed larger hypothetical shocks or simply interpreted the scale of relevance differently from the others. As shown by Bertola et al. (2010), in the context of the cost shock, Estonian firms appear to be the most responsive on average in the whole cross-section of countries covered by the WDN survey; according to their calculations, the average fraction of “relevant” or

“very relevant” across all adjustment margins among Estonian firms is more than 75 percent. However, this characteristic does not seem to be a definite outlier: though somewhat lower, the average responsiveness to the cost-push shocks is also high, above 65 percent, in Poland, Lithuania and Italy. Surprisingly, these average levels of responsiveness are the lowest in Ireland and Hungary, at under 40 and 30 percent respectively. In our view, this shows that we should be very cautious about giving any particular interpretation to the cross-country differences in this statistic.

Table 23: Reaction after cost, wage and demand shocks  
(Percentage of firms that answered “relevant” or “very relevant”)

Adjustment strategy	All countries			Estonia		
	Cost shock	Wage shock	Demand shock	Cost shock	Wage shock	Demand shock
Reduce (other) costs	71.0	62.1	78.0	89.2	89.4	90.3
Adjust prices <sup>1</sup>	68.1	61.8	51.2	87.3	82.7	88.5
Reduce margins	57.1	53.3	56.8	76.0	73.7	76.8
Reduce output	23.4	24.3	48.6	54.6	50.4	56.6

*Notes: 1 – Reduce prices in the face of demand shocks, increase prices in the face of cost-push shocks. Figures are weighted to reflect overall employment and are rescaled to exclude non-responses.*

*Sources: All countries: Bertola et al. (2010) for the cost and wage shocks and ECB (2009) for the demand shock; Estonia: Estonian WDN Survey 2007, authors’ calculations.*

Despite the high level of importance given to all adjustment margins, their ordering by relevance in the Estonian sample is the same as in the pooled WDN sample. Specifically, the vast majority of firms, about 90 percent, indicate that they would react to the shocks by trying to reduce (other) costs and by adjusting prices. Around 75 percent of them would also cut profit margins, and about 50–55 percent of firms would reduce output.

One other interesting result that can be spotted on both sides of Table 23 is that the extent to which the wage shock feeds to prices — measured by the fraction of answers that increasing the price is either “relevant” or “very relevant” in response to a shock — is lower than the pass-through of the intermediate cost shock. In the pooled data, the incidence of price response declines from 68 to 62 percent, while in the Estonia data, it goes down from 87 to 83 percent.

Finally, we note that the relevance of price adjustment is smaller after the demand shock than after either of the two cost-push shocks in the pooled data set but not in the Estonian sample. Importantly, price adjustment in the first case calls for a price reduction, whereas it means a price increase in the other two cases. It follows that one potential explanation for the decline in the inci-

dence of price adjustment in the pooled data could be price stickiness. Following the same logic, the absence of a similar result in the Estonian data would suggest that in this economy prices are equally flexible, or sticky, in both directions.

By construction, the survey questions on the relevance of adjusting prices, margins, output and costs did not prevent firms from indicating that several or even all of these individual adjustments are equally important. Indeed, the sums of percentages presented in each column of Table 23 substantially exceed 100, suggesting that there is a non-trivial share of firms that equally prioritised more than one individual strategy.<sup>59</sup> In other words, there must be a substantial share of firms that deal with shocks by employing combinations of different measures. For convenience, from now on we will refer to the four individual adjustment strategies as simple strategies or adjustments and to combinations of several adjustment margins as complex strategies or adjustments.

We investigate the complexity of adjustment strategies using Table 24, which shows the empirical frequency of each of the four simple adjustments as well as the incidence of some of the most commonly used complex adjustment strategies. All in all, there can be 16 different simple and complex adjustments. In Table 24, we explicitly consider 10 of them, 4 of which are simple, and let its bottom row show the incidence of the remaining, least widely used adjustment strategies. To illustrate how the table should be read, consider its first row, “Price/Margin/Costs”. This corresponds to when adjustments to prices, margins and costs are all assessed as “relevant” or “very relevant” but adjusting output is either “irrelevant” or “of little relevance”. A case when adjusting output is also considered to be at least “relevant” is taken up by the second row. This complex strategy implies that the response to shocks involves adjusting all four elements: prices, margins, output and costs. The opposite case to this is captured by row “None”: for some firms, none of the four explicitly considered margins appears relevant in the adjustment process.

Unsurprisingly, Table 24 shows that regardless of the shock type or sample the majority of firms react to shocks by employing complex rather than simple adjustment strategies. Starting with the evidence from all countries, for example, the first four rows of the table show that the complex adjustment strategies are used by almost 60 percent of firms after the intermediate input and demand shocks and by about 50 percent of firms after the wage shock. An important common feature of these four complex strategies

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<sup>59</sup> The number of cases when several adjustment strategies appear (equally) “important” must have also increased once we collapsed the original scale of four levels of relevance to only two categories.

is that they all include adjusting prices and lowering costs. Indeed, as emphasised by Bertola et al. (2010) in the context of supply shocks, the result that the price-cost pair is the most common ingredient of all complex adjustment strategies suggests that firms try to limit the extent to which cost-push shocks pass through to prices.<sup>60</sup> And the finding that the price-cost element is also very widespread in the face of demand shocks seems to indicate that, when hit by an adverse demand shock, firms try to protect their profit margins and levels of output.

Table 24: Share of firms choosing different adjustment strategies

Adjustment strategy	All countries			Estonia		
	Cost shock	Wage shock	Demand shock	Cost shock	Wage shock	Demand shock
Price/Margin/Costs	18.3	14.8	15.8	23.4	19.2	22.2
Price/Margin/Output/Costs	15.1	12.3	19.7	40.5	38.3	43.7
Price/Costs	14.5	11.8	15.7	9.6	12.7	10.0
Margin/Costs	9.6	9.2	7.1	2.6	6.3	2.4
Adjust price <sup>1</sup>	9.3	9.6	9.7	5.5	6.3	4.9
Reduce costs	7.3	9.3	7.4	1.4	2.5	1.2
None	7.0	9.1	8.1	1.4	0.5	1.3
Price/Margin	6.8	6.5	5.4	1.4	1.4	1.3
Reduce margin	3.6	5.5	2.3	0.0	0.7	0.0
Reduce output	0.5	1.4	0.6	0.0	0.0	0.0
Remaining combinations <sup>2</sup>	7.9	10.6	8.5	14.3	12.0	13.0

*Notes:* 1 – Reduce prices in the face of demand shocks, increase prices in the face of cost-push shocks. Figures are weighted to reflect overall employment and are rescaled to exclude non-responses. 2 – the remaining combinations are: Price/Output/Costs; Margin/Output/ Costs; Output/Costs; Price/Margin/Output; Price/Output; Margin/Output. Responses weighted by employment and rescaled excluding non-responses.

*Sources:* All countries: Bertola et al. (2010) for cost-push shocks; authors' calculations for a demand shock. Estonia: Estonian WDN Survey 2007, authors' calculations.

The adjustment strategies shown in the top four rows of Table 24 very clearly dominate in the Estonian sample as well. Taken together, these strategies describe the behaviour of more than 75 percent of all firms, regardless of the type of shock. Interestingly, more than half of these firms, or about 40 percent of all firms, indicate that their reaction to shocks would involve adjusting all four economic margins: the price, the profit margin, output and costs (the second row). The popularity of this adjustment strategy is quite remarkable as it exceeds the corresponding European average 2–3 times. In principle, this sheds some light on why the Estonian firms appear so responsive compared to firms in other countries (see e.g., Figure 1 in Bertola et al.,

<sup>60</sup> Price as the only important adjustment strategy is reported by only 9–10 percent of firms.

2010). Nevertheless, one should be cautious about drawing strong conclusions based on this evidence alone because it is not so clear whether the result reflects objective reality — i.e. that the Estonian firms are indeed more likely to be flexible in terms all four margins of adjustment — or whether it has more to do with firms’ ignorance when answering the questionnaire, implying that there could be issues with data quality.

After characterising firms’ responses to shocks in terms of price, margin, output and cost adjustments, we next focus on cost reduction and consider several different means firms use to achieve it. As briefly mentioned in the introduction to this section, additional information on how firms would lower costs in response to each hypothetical shock was collected with the help of follow-up questions addressed to only those firms which initially specified that cost reduction was at least “of minor importance”. The set of specific cost reduction strategies that the questionnaire inquired about is shown in Table 25. The first five measures cover different ways of lowering labour costs: reducing the number of temporary employees, permanent employees or hours worked, and lowering base wages or flexible wage components (bonuses). The last, sixth, strategy is a catch-all for reducing any non-labour costs. The table shows how firms’ choices are distributed between the cost reduction strategies for the same cost, wage and demand shocks. As before, the left side of the table presents the results for all countries, while the right side summarises similar evidence for Estonia. It is important to note, however, that this time the percentages add up to 100 in each column, as firms were instructed to indicate only the one most important way of lowering costs from the list of cost-cutting measures provided.

Table 25: Acceptance of different means of cost adjustment (share of firms)

Cost-cutting strategy	All countries			Estonia		
	Cost shock	Wage shock	Demand shock	Cost shock	Wage shock	Demand shock
Reduce number of temporary/other employees	17.6	19.5	25.0	13.4	16.7	18.1
Reduce number of permanent employees	10.9	11.4	15.5	8.4	16.7	16.5
Reduce hours worked per employee	7.1	7.8	8.5	1.9	4.1	3.9
Reduce flexible wage components	9.4	11.6	10.5	16.2	12.5	17.5
Reduce base wages	1.6	–	1.2	1.0	–	0.2
Reduce non-labour costs	53.4	49.8	39.4	58.9	49.6	43.8

*Notes: Responses weighted by employment and rescaled excluding non-responses.*

*Source: All countries: Bertola et al. (2010) for the cost and wage shocks and ECB (2009) for the demand shock; Estonia: Estonian WDN Survey 2007, authors’ calculations.*

Starting from the evidence based on the pooled data, we would like to emphasise the following four results. First, roughly speaking, the extent to which the need to lower costs falls on labour and non-labour costs appears to be close to 50:50. According to the information presented in the bottom row of Table 25, reducing non-labour costs is the main way of lowering overall costs for 40–50 percent of European firms. The share is the highest with an intermediate input shock (53 percent), somewhat lower with the wage shock (50 percent) and lowest after the demand shock (39 percent). Conversely, reducing labour costs represents the most important cost-cutting strategy for about 50 percent of European firms after cost-push shocks and for about 60 percent of firms after a negative demand shock. As the share of labour costs in total costs is only slightly above 30 percent, this finding suggests that on average labour shoulders a relatively larger share of the cost adjustment burden than do other inputs.

The second important result is that when it comes to reducing labour costs, only about 20–25 percent of the reduction comes from lowered labour compensation; the bulk of the adjustment in labour costs, the remaining 75–80 percent, is typically achieved by lowering the quantity of labour employed. More precisely, the share of firms that mainly adjust pay — reduce base wages or bonuses — is about 12 percent whichever the shock, whereas the fraction of businesses adjusting mostly labour inputs — temporary and permanent employment or hours worked — is about 36–49 percent, depending on the shock.

The third, related finding is that lowering base wages is a particularly unpopular measure for achieving a reduction in labour costs. Only 1.6 percent of European firms indicated that cutting base wages would be their main method for bringing labour costs down after the intermediate input price shock and 1.2 percent after the negative demand shock.<sup>61</sup> Instead, the necessary reduction in labour compensation would be achieved predominantly through cuts in bonuses: depending on the shock, this would be the main means of lowering labour costs for about 9–12 percent of firms. Interestingly, the very low frequency of downward base wage adjustments implied by this evidence is in line with a related result obtained from a different question of the WDN survey, which asked firms whether they had cut the base wages of at least some employees during the five-year period prior to the survey. Only 2.3 percent of firms surveyed gave an affirmative response (Babecký et al., 2010). Thus, both approaches imply that the incidence of base wage cuts is very low, and the usual prime suspect for explaining this empirical regularity is downward nominal wage rigidity.

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<sup>61</sup> Note that the option of reducing costs after the wage shock by lowering base wages was a priori excluded from the questionnaire.

The fourth result concerns labour cost adjustment by lowering of the quantity of labour inputs — the number of temporary or permanent employees or the hours worked. In total this would be the dominant cost reduction strategy for 35–50 percent of firms. Though this share increases from the intermediate input price shock to the wage shock to the demand shock, the “within” distribution of firms across the three measures of labour input adjustment maintains remarkably stable proportions: 50:30:20 for laying off temporary employees, laying off permanent employees and reducing hours worked, respectively.

The distribution of cost cutting strategies reported by Estonian firms, which is summarised in the last three columns of Table 25, is broadly similar to that derived from the pooled data, though there are some interesting differences as well. Common to both patterns of cost adjustment are the findings that roughly half of all firms would lower costs primarily by reducing non-labour costs, and that among those that would opt to adjust labour costs instead, a clear majority would shed jobs or hours rather than cut pay, especially the base wage. In general, therefore, the four aspects of cost cutting behaviour described above are in line with the Estonian evidence; the differences that we are about to identify are in the details.

The first difference concerns pay adjustment, the third point above. Though Estonian firms also appear to be very unwilling to cut base wages, they are more likely to reduce flexible pay components (bonuses), at least when faced with intermediate input cost and demand shocks. After these shocks, the fraction of firms relying primarily on the adjustment of bonuses is about 10 percent in the pooled data but approximately 16 percent in the Estonian sample.

Other differences are related to the way firms adjust the quantity of labour employed. Compared to the typical behaviour of firms implied by the data for the whole cross-section of countries, Estonian firms are relatively less likely to cut labour costs by reducing the number of temporary employees or hours worked. In the pooled data, the average share of firms — calculated across all three shocks — that rely on cutting temporary employment is about 20.7 percent. An additional 7.8 percent of firms would reduce hours. The corresponding figures for Estonia are lower, approximately 16.1 and only 3.3 percent, respectively.

To save space, we will not give a similarly detailed account of shock adjustment patterns distinguished by sector, size, competition level, etc. By and large, the conditional response patterns are not so different from the ones described above. When it comes to adjusting prices, costs, margins and output, for example, the most substantial deviation from the typical behaviour is shown by construction firms, which would be considerably more likely to re-

duce output after the wage shock: this response is reported by 70.8 percent of firms in the construction sector compared to 50.4 percent in the whole sample. In two instances, construction firms also stand out in terms of their cost reduction strategies. For example, they would be substantially more likely to lay off temporary employees in response to the intermediate input cost shock — 22.4 percent of firms in the construction sector would do this compared to 13.7 percent in the whole economy — or to the demand shock — 27.3 percent of construction firms compared to 18.1 percent in all sectors. In other cases, tabulations of the data by sector, size and competition level did not indicate very substantial differences from the average adjustment patterns described above.

## **8. Summary: labour market flexibility in Estonia compared to that in the EU**

To complete the paper, we put some of our main results together with the aim of drawing tentative conclusions about how flexible or rigid the Estonian labour market is compared to the labour markets of other EU member states.<sup>62</sup> We base this comparison on a set of labour market characteristics — institutional factors as well as those that pertain to wage setting practices and labour cost adjustment in general — all of which have been discussed at greater length in the preceding sections. To facilitate the comparison, these criteria and the corresponding assessments are summarised in Table 26.

The leftmost column of Table 26 shows that our assessment criteria can be broadly arranged into three groups: institutional characteristics, indicators related to base wage flexibility/rigidity and variables measuring the importance of margins of labour cost adjustment other than the base wage. The underlying specific indicators are listed in the column “Metric”, and the remaining columns (1) through (5) summarise the outcomes of corresponding comparisons by taking several different perspectives. Column (1) shows Estonia’s rank when countries are ordered on the basis of each of the selected criteria from the most to the least flexible. Column (2) reports the countries that rank first according to each given metric. Columns (3) to (5), in turn, summarise the outcomes of three additional comparisons: whether Estonia is more flexible than the average of non-euro area countries; whether Estonia is more flexible than the euro area average; and whether non-euro area countries are more flexible on average than euro area countries.

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<sup>62</sup> With regard to the latter, we will often consider two country sub-groups: euro area countries and non-euro area countries.

We compare institutional characteristics on the basis of the previously discussed measures of collective bargaining coverage, employment protection legislation and two indicators of product market competition for implied and perceived competition. As shown in Table 26, Estonia tops the list of 15 countries considered here in terms of having the lowest collective coverage but finds itself close to the median in terms of EPL and product market competition measures. These indicators also suggest that, compared to the euro area, non-EA countries — including Estonia — feature lower collective coverage, less strict EPL and more intense implied product market competition. Only in terms of perceived competition are euro area countries ahead of the non-EA country group on average.

As in the main text, we assess the flexibility of base wages using four indicators: (i) the share of firms changing wages more frequently than once a year; (ii) the share of firms following state-dependent wage setting; (iii) the incidence of wage cuts during the recent recession as a proxy for downward nominal wage rigidity; and (iv) the share of firms automatically indexing wages to inflation as a measure of downward real wage rigidity. As before, the implicit ordering of countries in this set of comparisons is from the most to the least flexible. That is, we order countries from those with the highest to the lowest share of frequently changed wages and similarly from the highest to the lowest share of state-dependent wage setting. With measures for downward wage rigidity, the ordering goes from the lowest incidence of nominal and real wage rigidity (high flexibility) to the highest (low flexibility).

In terms of the frequency of wage changes, now proxied by the share of firms changing wages more frequently than once a year, Estonia ranks sixth and thus represents a typical case among the 15 European countries considered here. Nonetheless, the same measure implies that the Estonian frequency of wage changes is higher than the average in either non-euro area or euro area countries, though only slightly.

Our second proxy for wage flexibility, the prevalence of state-dependent wage setting as opposed to time-dependent, implies qualitatively similar results. In terms of this measure, Estonia ranks fourth and compares favourably with the euro area average but not with the average share of state-dependent wage setting observed in non-euro area countries.

Table 26: Labour market flexibility in Estonia compared to other EU member states

	Estonia's rank (number of countries)	Country that ranks first	Estonia more flexible than non-euro area average	Estonia more flexible than euro area average	Non-euro area more flexible than euro area	
	(1)	(2)	(3)	(4)	(5)	
Institutions	Collective bargaining coverage	1 (15)	Estonia	Yes	Yes	Yes
	Employment protection legislation*	7 (15)	Ireland	No	Yes	Yes
	Product market competition (implied)	7 (14)	Slovenia	No	Yes	Yes
	Product market competition (perceived)	5 (11)	Netherlands	No	No	No
Wage setting (base wage)	Share of firms changing wages more frequently than once a year	6 (15)	Lithuania	Yes	Yes	Yes
	Share of firms relying on state-dependent (as opposed to time-dependent) wage setting	4 (15)	Lithuania	No	Yes	Yes
	Nominal wage rigidity	1 (11)	Estonia	Yes	Yes	Yes
	Real wage rigidity	2 (12)	Italy	Yes	Yes	Yes
Labour cost adjustment (other than the base wage)	Share of bonuses in total pay	5 (12)	Czech Republic	No	Yes	Yes
	Share of bonuses or piece-rate payment in total pay	2 (9)	Lithuania	Yes	Yes	Yes
	Share of firms considering external factors more relevant in determining the entry wage	4 (15)	Poland	Yes	Yes	Yes
	Share of firms paying higher wages to the newly hired**	2 (8)	Italy	Yes		
	Share of firms paying lower wages to the newly hired	2 (8)	Lithuania	Yes		

Notes: \* The strictness of employment protection legislation is assessed using regulations that were in force at the time the 2007/2008 WDN survey was conducted. In July 2009 Estonia implemented a new Labour Law, which considerably reduced the firing costs for businesses.

\*\* The questions on paying different wages for the newly hired were asked in three euro-area countries only, and thus are not representative of the euro-area average.

Findings concerning the relative flexibility of Estonian wages become more atypical in the European context once we turn to our measures of downward wage rigidity. The survey results imply that Estonian firms show greater downward flexibility in wage setting than do their counterparts in the other countries surveyed. This difference is especially strong for downward nominal wage rigidity. Estonian firms were considerably more likely to cut nominal base wages in response to the strong negative demand shock caused by the recent financial and economic crisis than were companies in the other countries surveyed. We should point out here, however, that this analysis is based on a sample of 11 EU member states only. Notably, it excluded some other countries — e.g. Ireland and Lithuania — for which data from different sources have indicated that the incidence of nominal wage cuts was also quite substantial during the crisis. The evidence from the 2007/2008 WDN survey shows that Estonian wages are also among the most flexible in real terms: automatic indexation of wages is very rare, and in this regard Estonia is second only to Italy.

The last set of criteria that we use to assess the relative flexibility of the Estonian labour market focuses on the principles of wage setting. For this purpose, we compare the share of flexible pay components — bonuses and piece-rate pay — in the total wage bill and the relative flexibility of base wages offered to newly hired employees. We proxy the latter margin of pay adjustment by three different variables: (i) the share of firms considering external factors more important than internal ones in determining entry wages; (ii) the share of firms paying higher wages to the newly hired when the labour market for a given kind of employee is tight; and finally, (iii) the fraction of firms that offer lower wages to the newly hired when the labour market is loose. As a result, we shift our focus from the rigidity of base wages for existing employees to some aspects of pay determination that potentially give firms more leeway in managing the price of the labour input while leaving the wages of incumbents intact.

In terms of the relative importance of bonuses in total pay, Estonia ranks fifth among 12 countries (see Table 26). Though we find that the Estonian share of performance-related pay exceeds the corresponding averages for either EA or non-EA country groups, we conclude that this particular characteristic makes Estonia look quite typical. We also construct another metric which allows that alternative methods of remuneration offer firms different degrees of flexibility when linking workers' productivity with their compensation at the individual level. For this purpose, we treat piece-rate pay as a flexible pay component, since it is directly related to productivity, and we measure the combined share of piece-rate pay and performance-related bonuses in the total wage bill. According to this metric, Estonia ranks second after Lithuania among 9 countries. The non-EA countries attribute a consid-

erably larger share of the wage bill to flexible pay components than do the EA countries covering this particular set of questions. However, since the latter group consists of only four countries, the results may not be representative for the euro area as a whole.

Estonia ranks fourth when we order countries according to the share of firms stating that external market conditions are more important in determining the wages of newly hired employees than internal factors. Support for this view tends to be stronger in non-EA than EA countries, and it is more prevalent in Estonia than in other non-EA countries on average. The finding that Estonian wages for the newly hired are relatively responsive to external conditions becomes more notable once we distinguish between labour market rises and falls. The fraction of firms paying different base wages to the newly hired than to incumbents, though low in all countries, is higher than in Estonian only in Italy when the labour market is tight and in Lithuania when the labour market is loose. For these particular questions we do not present comparisons between the EA and Estonia or the EA and non-EA countries in Table 26, because this information is available for only three euro area countries.

In summary, most of the indicators discussed in Table 26 tend to suggest that labour markets are on average more flexible in non-EA than in EA countries. On the institutional front, the former have lower trade union coverage and milder employment protection legislation. Non-EA countries also feature more flexibility in wage setting, as shown by their higher frequency of base wage changes, more widespread state-dependent wage adjustments and lower downward wage rigidity. A larger share of bonuses in total pay and the stronger responsiveness of the wages of the newly hired to market conditions contribute to the relative flexibility of non-EA labour markets as well. All of these conclusions are valid if we change focus to compare Estonia and the euro area, but for two indicators — collective bargaining coverage and downward wage rigidity — Estonia stands out as more flexible even than the other non-EA countries.

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## Appendix 1: Main economic indicators of the Estonian economy, 1997–2010

Table A1: Main economic indicators of the Estonian economy, 1997–2010

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Real GDP growth (%)	11.7	6.7	-0.3	10.0	7.5	7.9	7.6	7.2	9.4	10.6	<b>6.9</b>	-5.1	-13.9	3.1
HICP growth (%)	9.3	8.8	3.1	3.9	5.6	3.6	1.4	3.0	4.1	4.4	<b>6.7</b>	10.6	0.2	2.7
GDP deflator growth (%)	10.3	5.2	6.8	4.5	5.3	3.3	4.2	3.6	5.5	8.3	<b>10.5</b>	7.2	-0.1	NA
Current account (% of GDP)	-11.1	-8.6	-4.3	-5.4	-5.2	-10.6	-11.3	-11.3	-10.0	-15.3	<b>-17.2</b>	-9.7	4.5	NA
Unemployment rate (%)	9.6	9.8	12.2	13.6	12.6	10.3	10.0	9.7	7.9	5.9	<b>4.7</b>	5.5	13.8	16.9
Employment growth (%)	0.0	-1.7	-4.5	-1.2	0.9	1.4	1.5	0.2	2.0	6.4	<b>1.4</b>	0.2	-9.2	-4.2
Productivity (GDP per employee) growth (%)	14.4	6.7	1.6	15.1	9.1	7.0	6.2	5.7	9.5	8.4	<b>1.5</b>	-5.8	-14.0	NA
Real wage growth (%)	9.1	7.7	3.4	6.6	5.7	8.5	7.2	6.3	6.9	11.0	<b>12.1</b>	4.9	-4.1	NA
Average gross wage growth (%)	19.7	15.4	7.6	10.5	12.3	11.5	9.4	8.4	10.8	16.5	<b>20.5</b>	13.9	-5.0	NA
Fiscal budget balance (% of GDP)	2.2	-0.7	-3.5	-0.2	-0.1	0.3	1.7	1.6	1.6	2.4	<b>2.5</b>	-2.9	-1.8	NA

Notes: NA – data not yet available.

Source: Eesti Pank, Statistics Estonia.

## Appendix 2: Macroeconomic developments in countries that participated in the follow-up WDN survey

Table A2: GDP growth (%)  
(quarter-on-quarter growth rates, seasonally adjusted data)

	2008Q03	2008Q04	2009Q01	2009Q02	Cumulative change
Austria	-0.7	-1.3	-2.5	-0.4	-4.8
Belgium	-0.2	-2.1	-1.7	-0.1	-4.1
Cyprus	0.2	-0.2	-0.5	-0.8	-1.3
Czech Republic	0.2	-0.7	-4.4	0.2	-4.7
Estonia	-3.0	-4.5	-6.0	-3.4	-15.9
Spain	-0.6	-1.1	-1.6	-1.1	-4.3
France	-0.2	-1.5	-1.4	0.3	-2.8
Italy	-0.8	-2.1	-2.7	-0.5	-6.0
Luxembourg	-0.8	-3.1	-0.9	-2.7	-7.3
Netherlands	-0.8	-1.0	-2.4	-1.0	-5.1
Poland	0.8	-0.1	0.1	0.5	1.3

Notes: The last column of the table presents cumulative change from 2008Q3 to 2009Q2 (seasonally adjusted).

Source: European Commission (GDP in volume)

Table A3: Inflation in the countries sampled (monthly data)

	2008 (annual)	1/2009	2/2009	3/2009	4/2009	5/2009	6/2009	7/2009
Austria	3.2	1.2	1.4	0.6	0.5	0.1	-0.3	-0.4
Belgium	4.5	2.1	1.9	0.6	0.7	-0.2	-1.0	-1.7
Czech Republic	6.3	1.4	1.3	1.7	1.3	0.9	0.8	-0.1
Estonia	10.6	4.7	3.9	2.5	0.9	0.3	-0.5	-0.4
Spain	4.1	0.8	0.7	-0.1	-0.2	-0.9	-1.0	-1.4
France	3.2	0.8	1.0	0.4	0.1	-0.3	-0.6	-0.8
Italy	3.5	1.4	1.5	1.1	1.2	0.8	0.6	-0.1
Luxembourg	4.1	0.0	0.7	-0.3	-0.3	-0.9	-1.0	-1.5
Netherlands	2.2	1.7	1.9	1.8	1.8	1.5	1.4	-0.1
Poland	4.2	3.2	3.6	4.0	4.3	4.2	4.2	4.5

Notes: The first column presents the annual change (%) in the HICP. The subsequent columns show m/m-12 change in the HICP (%).

Source: Eurostat.

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