CREDIT SHOCKS AND THE EUROPEAN LABOUR MARKET

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Eurosistema

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Abstract

More than five years after the start of the Sovereign debt crisis in Europe, its impact on labour market outcomes is not clear. This paper aims to fill this gap. We use qualitative firm-level data for 24 European countries, collected within the Wage Dynamics Network (WDN) of the ESCB. We first derive a set of indices measuring difficulties in accessing the credit market for the period 2010-13. Second, we provide a description of the relationship between credit difficulties and changes in labour input both along the extensive and the intensive margins as well as on wages. We find strong and significant correlation between credit difficulties and adjustments along both the extensive and the intensive margin. In the presence of credit market difficulties, firms cut wages by reducing the variable part of wages. This evidence suggests that credit shocks can affect not only the real economy, but also nominal variables.

Keywords: credit difficulties, labour input adjustment, intensive margin.

JEL classification: D53, E24, E44, G31, G32.

Resumen

Más de cinco años después del inicio de la crisis de la deuda soberana en Europa, su impacto sobre las variables del mercado laboral no está claro. El objetivo de este documento es contribuir a llenar este vacío. Utilizamos datos cualitativos a escala de empresa para 24 países europeos, recopilados en la Wage Dynamics Network (WDN) del SEBC. Primero, construimos un conjunto de índices que miden las dificultades para acceder al mercado crediticio en los 24 países para el período 2010-2013. En segundo lugar, describimos la relación entre las dificultades crediticias y los ajustes en las variables laborales tanto en el margen extensivo como intensivo del empleo, así como en los salarios. Encontramos una correlación fuerte y significativa entre las dificultades crediticias y los ajustes a lo largo del margen extensivo y del margen intensivo. En cuanto a los salarios, en presencia de dificultades del mercado de crédito, las empresas reducen el componente variable de los salarios.

Palabras clave: dificultades crediticias, ajuste del mercado laboral, margen intensivo y extensivo.

Códigos JEL: D53, E24, E44, G31, G32.

1. Introduction

In many European countries, the beginning of the current decade has been characterized by significant and unprecedented difficulties in accessing credit by firms, as well as households and governments. The global financial crisis, having originated in 2007 in the US subprime market, and the subsequent sovereign debt crisis, which hit Europe in the summer of 2011, forced European banks to considerably tighten their credit conditions for firms in many economies and for several years.

Before the global financial crisis, the relationship between credit constraints and employment was investigated in the literature, analysing the link between financial development and growth (e.g. Beck et al., 2006, Klapper et al., 2006). The global financial crisis has renewed the interest for the effect of credit shocks on the real economy (Acharya et al. 2016; Bottero et al., 2015; Cingano et al., 2016; Degryse et al., 2016, Berg 2016), and the labour market in particular (Pagano and Pica, 2012; Chodorow-Reich, 2014; Buera et al., 2015; Duygan-Bump et al., 2015; Bentolila et al., 2017, Berton et al., 2017; Hochfellner et al., 2016; Popov and Rocholl, 2016). The existing literature builds primarily on linked firm-bank data and examines the impact of exogenous credit supply shocks, making use of the sticky lender-borrower relationship. Different types of financial shocks have been examined: Popov and Rocholl (2017) focus on the effect of the funding shock of German savings banks during the US mortgage crisis, Chodorow-Reich (2014) take advantage of the different exposures of the lenders on the syndicated market to mortgage-backed securities in the US, and Bentolila et al. (2016) use the differences in Spanish banks' health at the start of the Great Recession. Other papers derive local-level measures of credit supply (e.g. Greenstone et al. 2014). These papers typically focus on a single country, and do not analyse the heterogeneity in firms' adjustments across countries.

Since the European perspective is fundamental for the European policy makers, in this paper we try to fill this gap, by using a unique, fully harmonized survey conducted in 25 European countries by the Wage Dynamics Network (WDN), a research network of the European System of Central Banks[1]. The survey, which was the third one conducted by the network and thus is labelled as WDN3 in this paper, focusses on the period between 2010 and 2013 and asks firms to report both their difficulties in accessing credit and the ways of adjusting labour costs, be it through employment or through wages. Based on the

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[1] Previous WDN surveys do not allow to make a similar analysis on the impact of credit constrains on labour cost adjustments. WDN1 survey did not include any question regarding difficulties in access to finance while WDN2, which was an update of WDN1 with small sample sizes and conducted only in 10 European countries, included merely one question regarding the extent of difficulties in access to finance for firms. Using this dataset, Fabiani et al. (2015), although they focus on demand shocks, find that negative finance shocks increase the likelihood to adjust margins and costs at the firm level and once the impact of demand shocks is taken into account, financially constrained firms are more likely to adjust non-labour costs.

answers of firms (after removing the impact of demand and other shocks), we construct an index of credit difficulties, fully comparable across firms in different countries, and we use that to analyse the intensity of credit restrictions in different EU countries. Then we relate our index of credit difficulties to firms' labour cost adjustments. First, we find that credit difficulties were extremely heterogeneous both within and across countries. According to our estimates, in countries with low average values of the credit difficulty index, the within-country variability was also quite low. On the contrary, in the most severely hit countries (mainly Southern European and some Eastern European countries) the within-country variability was remarkably high. If we compare countries, we find that the interquartile range (the difference between the 25th and the 75th percentiles) of the distribution of our index in Austria, the country registering the lowest level of credit difficulties, was three times lower than that observed in the most severely hit countries. Second, we find that European firms hit by a credit shock report more frequently a reduction in both employment, confirming the findings of the literature, and wages than firms without financing difficulties.

More precisely, we estimate an increase in the probability to adjust employment by close to 2 pp. (over a mean probability of 16%) after a 1 point increase in our index of credit difficulties. As the survey collects detailed information on the strategies to adjust labour costs, we can distinguish also between adjustment along the extensive and the intensive margin (i.e. reduction in hours per employee). Consistently with Berton et al. (2017), who focus on one Italian region, we find that credit supply shocks affected both the extensive and the intensive margin. More importantly, we find that the reduction of the intensity of the use of labour as a response to a credit shock was not confined to Italy, as found by Berton et al. (2017), where subsidized reduction of hours was widely used, but also happened in other European countries, mainly through non-subsidized reduction of hours (i.e. part time work arrangements).

Consistently with Bentolila et al. (2016), who focus on Spain, and Caggese and Cuñat (2008), who examine the case of Italy, we also find that the probability of an adjustment in case of an adverse credit shock was higher for temporary workers. Firms also stopped hiring, with a particularly significant effect on the employment opportunities of younger job-seekers. Labour market adjustment as a response to credit constraints is thus a potential explanation behind the considerable rise of youth unemployment in most European countries (see Hoynes et al., 2012 for the US and Verick, 2009 for European countries for a description of how youth unemployment developed following financial crisis).

In addition to the adjustment in employment, we also investigate the response of wages. The relationship between credit shocks and wage dynamics has been neglected so far by the literature, probably because

of data constraints and because it has not been clear whether European firms have margins to adjust wages. An exception is Hochfellner et al. (2016), who use employer-employee matched data for a sample of German firms to examine the impact of credit shocks on earnings, among other factors. We find that in our sample an increase of 1 point on our credit difficulty index is associated with an increase in the probability to cut wages, by around 1pp. over an average of 14%. Probably because of institutional rigidities which prevent cuts of base wages, the impact of credit difficulties is stronger for the flexible part of workers' compensation, whereas the impact on base wage is small and not precisely estimated.

More importantly, we find that for a given credit supply shock, the reaction of firms is similar across Europe. This suggests that the different impact of credit shocks on employment is due to differences in the intensity of the shocks across countries rather than to differences in the sensitivity of firms to credit restrictions.

We are aware that our estimates, based on qualitative self-reported information, do not allow for the identification of the effect of an exogenous credit supply shock to firms' labour costs. Firms in the WDN3 sample were required to report whether they were hit by many different types of shocks (not only credit, but also product demand and volatility shocks, availability of supplies, customers' inability to pay), which allows us to rule out the major part of the effect of the other shocks from our credit supply index. Still, our empirical strategy does not allow us to claim for a causal relationship. Our estimation strategy, however, is supported by some additional exercises based on matching banks in the credit registers of France and Italy with firms in the WDN3 survey (a similar strategy, for Belgium only, is used by Cornille et al. 2017). Based on these data, we construct a credit supply shock index which is used as an instrumental variable for our survey-based measure of credit difficulties. Within this setting, we find that our results for the entire WDN3 sample are fully confirmed.

This paper is organized as follows. In sections 2 and 3 we describe the main features of the data and the way in which we calculate our index of credit difficulties. In section 4, we show how our index correlates with measures about employment and wage adjustments in our sample of firms from 24 EU countries. In section 5, we focus on France and Italy and on a sample of WDN3 firms matched with credit register data. Last, section 6 briefly concludes.

2. The WDN3 survey

In this paper we use firm-level survey data collected by the Wage Dynamics Network (WDN). The Wage Dynamics Network is a research network of the European System of Central Banks, dedicated to the study of the features and sources of wage and labour cost dynamics and their implications for

monetary policy in the euro area. The first survey on firms' price and wage setting practices has been carried out by 17 national central banks in 2007. Additional questions – mainly to respondents of the first wave – have then been issued in a second wave in 2009, in order to assess the firms' initial reaction to the global financial crisis that hit Europe in 2008. The third survey, the results of which are used in this paper, was conducted in 2014 by national central banks in 25 countries of the European Union. It covers the 2010-2013 period, and was answered by over 25,000 firms (see Izquierdo et al. 2017 for details).

Since late 2009, in the aftermath of the financial crisis, several European countries have been confronted with the severe sovereign debts crisis, which, together with more stringent regulation about capital requirements and the related tightening of credit standards, transmitted into the second phase of the double-dip recession (2011-2013) in the European Union as a whole. Firms were hit by adverse demand and credit shocks, and both types of shocks affected their strategies to adjust their labour input during 2010-13. Therefore, the third wave of the WDN survey (WDN3) was designed specifically to differentiate between the different shocks (to product demand, demand volatility, credit availability, customers' ability to pay and supply availability) and their intensity, as well as to explore firms' adjustment strategies during this period. Special attention was given to firms' adjustments of labour input, wage dynamics and wage settings practices. For a more detailed description of the WDN3 survey, see Appendix 1.

This paper uses four sets of questions from the survey (see Table A2 in the Appendix for the exact list of the questions). First, we use the questions on credit availability and credit conditions. Six questions aim at capturing the taxonomy in the severity of credit constraints. They consider both the worsening in the quantity or access to credit and the costs and conditions of credit supplied by the banks. Firms were also asked to qualify the intensity of the difficulties. Both the questions on access to credit and credit conditions were asked in relation to three types of requested credit (financing working capital, financing new investments, refinance debt).

Second, a group of questions was asked on the changes in economic conditions faced by the firms during 2010-13. Firms could choose between five symmetrical responses describing the change in level of demand, volatility of demand, customers' ability to pay and availability of supplies (the potential answers were: strong decrease, moderate decrease, unchanged, moderate increase, strong increase). We use these questions to control for the effects of other shocks, deriving an uncorrelated measure of credit difficulties.

Third, several questions were asked on the channels of labour market adjustments used by the firms during 2010-13. Firms were asked if they needed to significantly reduce their labour input or to alter its composition. Firms that needed to adjust their labour input were asked about the exact way of doing so (e.g. layoffs, reduction of hours, freeze of new hires, etc.). We use these questions to make a distinction between the extensive and the intensive margins of labour adjustment. Adjustment along the extensive margin is defined as individual or collective layoffs, while the intensive margin is defined as a reduction of working hours per worker (be it unsubsidised or carried out in the framework of subsidized schemes).

Finally, some questions allow us to measure the propensity of firms to adjust base and variable wages. (For a description of the labour adjustment please see Table A3 in the Appendix.) We combine these four sets of data and control for firm-level characteristics to examine the connection between credit shocks and labour adjustment.

3. Measuring credit difficulties using WDN3

Using the questions about credit difficulties, we construct firm-specific indices of credit constraints, comparable for 24 EU countries included in the WDN3 survey. Data for Ireland are excluded as answers about the availability of credit are not collected for this country. We focus on firms in manufacturing, trade and business services sectors (we call the latter two sectors together private services). Our final sample consists of around 19,000 firms[2]. See Table A1 for a description of our sample.

A look at the raw data confirms the high cross-country heterogeneity. Table 1 reports the share of firms stating that the lack of credit for a given purpose, or the cost of credit was a relevant or very relevant problem. Over 40% of firms in Greece, Bulgaria, Poland and Slovenia report that credit difficulties were relevant or very relevant for their activity, but the values are also high for Italy, Spain, Portugal and Cyprus. While in Greece, Slovenia, Italy, Spain, Portugal, and Cyprus the high values are likely to reflect the impact of the sovereign debt crisis on financial intermediation, in Poland the reason may be the high share of self-financing (Strzelecki and Wyszynski, 2016). In Malta and Austria, on the other hand, only a minor proportion of firms faced difficulties in getting credit. Within firms, the responses about the

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[2] Firms' non-response to the credit availability questions is not homogenous across countries. In the UK, almost 30% of firms in manufacturing, trade and business services sectors haven't provided answers to this block of questions. In Greece this share is 12%, followed by Hungary (9%), Latvia (9%) and Italy (8%). In the remaining of the countries the non-response rate was smaller.

difficulties to obtain credit for different purposes are highly correlated. This explains why the average share of firms reporting problems to obtain credit is similar for different credit types within one country.

Relying on the high correlation between the six credit availability measures and combining both conditions and quantity aspects of credit availability, we derive a unique comparable measure of credit difficulties across European countries via principal component analysis (PCA)[3]. Before applying PCA, we remove the part of the correlation which could be due to other shocks hitting firms and affecting also their ability to access credit. To do so, we first regress our basic measures of credit restrictions on variables measuring demand and demand volatility shocks, customers' ability to pay, the availability of supplies and firms' characteristics, such as sector and size. We use the residuals of these six regressions to carry out the PCA.

The descriptive statistics of the obtained components is given in Table 2. The first principal component explains 70% of the total variance in credit difficulty measures and has positive loadings of roughly similar size for all the six questions, therefore representing the overall credit difficulty for a firm.

Figure 1 reports the average firm scores of the "credit difficulty index" by country, as measured by the first principal component. Countries are ranked according to their average level of firms' credit difficulties. The values are normalized around the average level of credit indexes for all countries. Thus, values above zero reflect above-average levels of credit difficulty. As mentioned above, in 2010-13 the countries with above-average values were Italy, Spain, Portugal, Poland, Slovenia, Bulgaria and Greece. The distribution of countries by credit difficulty is quite symmetric, with a roughly similar number of countries experiencing above-average and below-average level of credit problems.

The lower graph of Figure 1 shows the distribution of the obtained credit difficulty indices by country, with the lower and upper borders representing the 25th and the 75th percentiles, respectively. The line in the box shows the median. In all countries, the distribution of the credit difficulty index has a long positive tail, suggesting that even in countries where a majority of the firms had no credit difficulties, quite a large minority faced financing problems. Austria and Malta are extreme cases, where over 75% of firms had the same low level of credit difficulty. In Poland, Slovenia, Bulgaria and Greece, the distribution of the credit difficulty index is more even. In these countries the occurrence of both the very low and the very high values of the credit difficulty indices were rare and the majority of firms had similar, relatively severe credit access problems. All in all, the figure shows the presence of high

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[3] As robustness check we derive credit difficulty index using factor analysis. The obtained results lead to the same findings. The difference in the size of the marginal effects using both measures (with standardized variance) is negligible.

heterogeneity of credit difficulties across EU countries: the interquartile range (the difference between the 25th and the 75th percentile of the distribution) of the index of credit difficulties in Austria is around three times lower than that observed in Italy or in Greece.

Figure 2 shows the distribution of the derived credit difficulty index for all countries in the sample, weighing observations to reflect total employment in the countries. The large mass in the negative interval reflects the high weight of France, Austria and Germany in the total sample of firms and rather good credit availability in these countries. The right tail is much longer and mostly positive, reflecting the overall severity of credit conditions for many firms.

To cross-check whether our index indeed captures the credit difficulties that we intend to measure, we compare it with external data sources. For this cross-check, we first look at the Survey on the access to finance of enterprises (SAFE), conducted by the ECB and the European Commission since 2009. The SAFE Survey is comparable to the WDN Survey in the sense that it measures credit difficulties as perceived by the firms, and not by the banks as a supplier of credit. The SAFE survey collects data from small and medium sized enterprises (SMEs) in Europe asking, among other things, what the most pressing problem for firms during the reference period is. Figure 3, panel a, is based on the 2013 SAFE survey and refers to the same period as the WDN3. It compares the share of firms reporting at least one obstacle in obtaining a (bank) loan in the SAFE survey in 2013 (on the vertical axis) to the country level average of the index of access to finance from the WDN survey (horizontal axis). The figure confirms the high correlation between the two measures.

The ECB's Bank Lending Survey (BLS) provides another possibility to validate our results, by looking at credit conditions from the banks' perspective. The BLS was launched in 2003 by the ECB to enhance the Eurosystem's knowledge of the financing conditions in the euro area. It can be seen as the European equivalent of the Senior Loan Officer Opinion Survey on Bank Lending Practices in the US. In the BLS, a sample of banks is asked every quarter about, among others, how they changed their credit standards in the previous three months for loans to non-financial enterprises. We have extended the ECB sample of the euro area countries with data from the Czech Republic, Poland and Hungary, making use of data collected and published by national central banks. For each country and every quarter, a net percentage of banks tightening (+) and loosening (-) their credit conditions is reported. Figure 3, panel b reports, on the vertical axis, the average of the net percentages of tightening banks for each country during the 16 quarters over 2010Q1 to 2013Q4 (2012Q1-2013Q4 for CZ). The horizontal axis shows the first principal component from the WDN3. The positive correlation between the BLS-measure of credit supply

conditions and the WDN-measure of firms' difficulties in obtaining finance, gives confidence to our interpretation of the first principal component as a supply measure of credit difficulties.

Finally, Figure 4 plots the correlation between our credit difficulty index and important labour market macro variables, drawn from national accounts, measuring changes in the use of labour (measured by total hours worked) and nominal hourly wages during the period 2010-13. Figure 4 shows that there is a clear negative correlation between the change in employment at the macro level and our index of credit difficulties. A (weaker) negative correlation also arises between credit difficulties and nominal wage growth. This preliminary look at the aggregate data gives some comfort to our interpretation of the credit difficulty index and provides a strong motivation for our micro analysis.

4. Credit market access and labour adjustments: evidence from microdata

The aggregate data may hide considerable differences across firms. Thus, we look at the micro data to see whether the correlation between credit difficulties and labour adjustment is observable on the firm level and if there are any differences in terms of the type of adjustment. Furthermore, the countries analysed in this study have very different labour market institutions, which can affect the firms' response to shocks. Therefore, it is worthwhile to look at several different channels of adjustment.

Starting with the total adjustment (question about the need to reduce labour input), adjustments along the extensive margin (i.e. if the firm undertook individual or collective layoffs) and adjustments along the intensive margin (subsidised as well as non-subsidised reductions of hours), we construct a set of dummy variables equal to 1 if firm i adjusted its labour input using a specific method of adjustment k, and zero otherwise.[4] We also look at the other instruments to adjust labour input and in particular at firms that stopped new hiring and did not renew temporary job contracts. These outcomes are particularly relevant, because they help understanding the impact of the sovereign debt crisis on specific dimensions of the European labour markets, for example the rise in youth unemployment, which could have been particularly affected by the stop in hiring, and the segmentation between temporary and permanent job contracts.

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[4] The dummy for the adjustment on the extensive margin is equal to 1 if the firm answered that individual and/or collective layoffs were used moderately or strongly, and 0 otherwise. The dummy for the intensive margin is equal to 1 if the firm answered that the decrease of hours worked per worker, either subsidised or non-subsidised, was used moderately or strongly, and 0 otherwise.

We do not limit our analysis to employment changes, but we also look at adjustments in wages as a response to credit difficulties. Data limitations have prevented analysing this relationship until now. Based on the WDN survey, however, we can check whether firms adjusted base and variable wage components in response to credit shocks.

To check for a correlation between labour cost adjustments and the measures of credit market difficulties described in Section 3, we consider the following baseline specification:

[1] $pr(adj\_k_i = 1) = \alpha + \beta * credit\_difficulty_i + \gamma * X_i + u_i$

where

- adj_k_i is a dummy variable on k-th type of labour market adjustment for firm i (equal to 1 in case of strong or moderate decrease in the use of the method of adjustment),

- credit_difficulty$_i$ constraint is the measure of credit constraint experienced by firm *i*, i.e. credit difficulties is a vector of firm-level control variables, which in all models correspond to country, sector and size dummies.

The results on labour input adjustments are reported in Table 3 and 4 and on wage adjustments in Table 5.

As shown by Table 3, the index of credit market difficulty correlates positively with the probability to adjust labour input, a result which is in line with the current literature on the employment effect of credit shocks. Our findings, however, suggest that adjustments took place along both the extensive and the intensive margins, although with a somewhat higher intensity in the case of the extensive margin. In particular, we estimate an increase in the probability to adjust employment by close to 2 pp. (over a mean probability of 16%) after a 1 point increase in our index of credit difficulties. This result is also robust to the inclusion of additional controls such as the share of labour costs in total costs, the share of flexible labour costs, and dummies on the degree of firm´s autonomy, structure and ownership.

This result is confirmed also if we look separately at all the methods to adjust labour input (Table 4). For all the methods, credit market difficulties are always positively correlated to the probability to adjust firm workforce. Results show that firms more strongly affected by credit difficulties as measured by our index tend to use individual layoffs to adjust their labour force more than collective or temporary layoffs, probably reflecting higher institutional rigidities to use these alternative methods of adjustment. Also, credit difficulties are positively associated with the freeze or reduction of new hires and the non-renewal of temporary contracts, while the impact on early retirement or temporary agency workers is more

limited. On the intensive margin, firms hit by credit shocks tend to use non-subsidised reduction of hours with a higher probability, while higher credit difficulties are not significantly associated with a higher incidence of subsidised reductions of working hours, probably because the possibility to access subsidised reduction of hours worked (available on a large scale only in a few countries) allow firms to hoard labour, and the related decline of labour costs relax the financing difficulties.

Table 5 reports the marginal effect of worsening credit conditions on the probability to adjust wages. Our estimates confirm the positive correlation between credit market difficulties and the adjustment of wages, reflecting their impact on the adjustment of flexible wages (increasing this probability by almost 1 pp.). By contrast, the impact on base wages is not significant, possibly showing the larger institutional rigidities to adjust base wages in European countries (on average, just 5% of European firms adjusted base wages over this period).

In other specifications we include an interaction term between our index of credit difficulties and firms' characteristics, to check whether there are country specific factors affecting the response of labour market variables to credit shocks. The interaction of the credit difficulty index with other variables related to firm's characteristics show very similar results, suggesting that the effect of credit market conditions on labour adjustments was rather similar across types of firms (estimates are available upon request).

We then look more closely at country heterogeneity. We define three geographical areas corresponding to (i) Continental Europe and UK, (ii) Eastern European and Baltic countries and (iii) Southern European countries. The grouping is based on differences in the financial sector. Firms in Continental Europe and in the UK are typically less dependent on banks for their financial needs (this is true especially for UK, see Brown et al, 2009) and are characterized by lower leverage (see e.g. Bach Outlook no.2, 2014). Eastern European and Baltic countries are grouped together because their banking sectors are characterized by a large market share of foreign banks, and a considerable degree of dependence on banking finance. Finally, in the Southern European countries the banking sector suffered the most during the period 2010-13 because of their exposure to sovereign debt risk. We interact the index of credit difficulties with area dummies to check the differences in the elasticity of employment to credit difficulties in the different areas. The results of this exercise are reported in Table 6. Interestingly, we do not find much evidence that the elasticity of employment to credit shocks was different across these countries. In particular, no significant differences are found between group (i) and (iii) in any method of labour cost adjustment, although the impact of credit difficulties on the employment adjustment in the intensive margin and flexible wage adjustment seems to be lower in the Eastern European and Baltic

countries. More detailed estimates in which the credit difficulty index is interacted with country dummies give the same picture, suggesting that the heterogeneous reaction of the EU labour markets in response to the sovereign debt crisis is mainly explained by the differences in the intensity of the crisis across countries.

5. Causality: Evidence from France and Italy

Our index of credit difficulties has been calculated after removing the impact of common shocks, however, it is still possible that there is endogeneity, i.e. the credit difficulty index partially reflects credit demand shocks. For instance, it is possible that a demand shock explains both the adjustment of labour input and wages and a rejection of access to credit.

To solve this problem, we carry out an instrumental variable examination for Italy and France. We merge the WDN3 sample with credit register data in the two countries. Credit registers include all loans above EUR 25,000 in France and EUR 30,000 in Italy, and both databases include identifiers that make it possible to link the firms with the WDN3 and identify their financing banks.

Credit register data are used to construct an index of credit supply very similar in spirit to Amiti and Weinstein (2016) which can be assigned to the firms in the WDN sample. We consider the universe of banks in Italy and France from 2007 to 2013, i.e. before the burst of the global financial crisis and after the sovereign debt crisis. Aggregating loan data by bank, we calculate the three-year percentage change in total loans for each bank. This way we remove bank fixed effects. We then carry out the simple regression [2] to remove a time trend t, aimed at capturing demand factors and supply invariant characteristics.

[2]
$$\Delta^3 L_{bt} = \alpha + \beta t + u_t$$

Last, we take the residuals of [2], and in particular residuals in year 2013, $\hat{u}_{b,t=2013}$. Finally, we assign the residual of the change in loans observed in the period 2010-2013 to each WDN firm. Firms have multiple bank relationships, thus, we weight each residual with the share of loans $L_{fb,t=2009}$ of firm f (in the WDN sample) in the total amount of loans of the firm with any bank b in the register in 2009, i.e. the year preceding the survey reference period, to limit the impact of possible selection bias in the firm-bank relationship. In particular we calculate the index of credit supply to firm f, CS_f , as:

[3]
$$CS_f = \sum \frac{L_{fb,t=2009}}{L_{f,t=2009}} *, \hat{u}_{b,t=2013}$$

This procedure leads to an imperfect match between the two datasets and we get around 750 observations per country. We normalize the two indices and pool the two datasets. Figure 4 compares the index of credit difficulties drawn from the WDN survey with this measure of credit supply change. As expected, the two indices are negatively correlated. We then use our measure of credit supply as an instrument for the index of credit difficulties.

The results are reported in Table 7 (the models also include sector and size dummies and a country dummy). The first column refers to the first stage estimation. The correlation between the two indices is highly significant. Columns 2-5 show the estimated probabilities to reduce the extensive margin, the intensive margin, the base wage and the variable wage, respectively. The results are substantially confirmed. The impact of credit difficulties on the probability to reduce labour is always positive. The same holds for flexible wages, but not for base wages, as found in the examination of all countries. In line with the exceptions, the IV results on base wages also show that the reaction of firms to the credit shock is larger than those obtained by simple OLS regressions presented in Tables 3-5 (and similar to OLS regressions carried out only for Italy and France). Thus, the results of Tables 3-5 can be viewed as a lower bound for the effect of a credit shock on the European labour markets.

6. Conclusions

In this paper we provide empirical evidence about a strong correlation between credit shocks and labour market adjustments in Europe. We rely on survey data, which has the advantage to offer a unique European perspective, providing comparable, harmonised results for 24 countries.

We are aware of the limits of our approach. First, the data allow us to calculate only the probability of an adjustment and not how much of the observed employment drop can be imputed to credit difficulties. Second, since we use survey data on self-reported credit difficulties and other shocks, our index of credit difficulty does not allow for a proper identification of the credit supply shock hitting the various countries, net of any demand effect. Thus, our main estimates are simple correlations between credit difficulties and firms' labour cost adjustment strategies. A more precise identification, however, is available for France and Italy, thanks to the possibility to merge credit register data with our survey data. Even with this limitation, our results confirm that credit shocks are important determinants of labour market fluctuation in Europe. More importantly, the reaction to adverse credit shocks was quite similar across areas, the total effect being determined only by the different intensity of credit difficulties across countries.

Credit market difficulties are associated not only with a decrease in employment, but also a decline in the intensity of the use of labour. One of our main findings is that after the sovereign debt crisis, standard

measures of labour market slack, like the unemployment rate, probably under-estimate the unutilized labour in Europe. Our results suggest also that European firms reduced nominal wages, by cutting the variable part of employee compensation (bonuses, performance related premia, etc.). Thus, credit difficulties may have consequences not only on real variables but also on nominal ones, through their effects on wages (for an analysis on the impact of credit difficulties on prices, see also Duca et al. 2017). This interaction has potentially important consequences for monetary policy and asks for future research on this topic.

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Tables and figures

Table 1: Share of firms in manufacturing, trade and business services, who viewed that credit access problem in 2010-2013 (as described in the credit accessibility questions) was relevant or very relevant, %

| | Credit was NOT available to | | | Credit was available to | | |
	finance working capital	finance new investment	refinance debt	finance working capital, but conditions were too onerous	finance new investment,	refinance debt,
AT	5.4	3.6	1.5	4.3	2.0	0.9
BE	16.3	20.8	15.9	17.7	18.0	12.0
BG	52.2	51.5	44.3	53.4	52.6	49.6
CY	36.8	35.0	30.8	35.7	31.0	28.9
CZ	12.3	13.7	10.5	18.2	18.5	15.2
DE	10.0	9.2	8.9	7.7	6.6	5.9
EE	11.0	13.3	7.3	14.1	13.3	8.0
ES	32.5	32.8	29.5	38.4	38.2	34.3
FR	14.0	16.1	11.4	8.2	8.3	6.7
GR	56.3	53.1	46.5	54.2	41.9	46.2
HR	30.9	28.7	22.1	39.3	41.1	35.3
HU	9.1	10.5	9.5	26.5	26.4	24.4
IT	29.3	39.2	27.0	34.9	27.6	33.4
LT	24.1	19.1	12.3	27.9	21.4	14.6
LU	17.1	23.0	13.5	15.9	15.1	10.3
LV	33.0	22.8	17.3	28.8	24.3	18.4
MT	4.6	3.1	1.5	6.1	6.2	2.3
NL	23.4	26.2	16.8	18.4	19.4	13.5
PL	51.3	46.8	23.5	47.7	43.5	26.7
PT	31.4	31.3	25.3	42.8	40.5	33.7
RO	21.2	21.0	16.2	31.7	29.4	24.7
SI	46.4	46.6	36.7	47.3	47.4	40.9
SK	26.4	34.5	19.8	33.6	38.8	26.8
UK	28.7	26.6	21.6	24.4	24.3	24.6

Note:
Frequency. Data weighted by employment weight.

Table 2: Principal component analysis of the credit difficulty measures

Component	Eigenvalue	Difference	Proportion	Cumulative	Loading 1
1	4.353	3.605	0.726	0.726	0.403
2	0.748	0.392	0.125	0.850	0.403
3	0.356	0.110	0.059	0.910	0.404
4	0.246	0.088	0.041	0.950	0.416
5	0.158	0.018	0.026	0.977	0.411
6	0.140	.	0.023	1.000	0.412

Note:
PCA on answers about credit difficulties, after removing variables measuring demand and volatility shocks, difficulties in customers' ability to pay, availability of supplies, sector and size dummies.

Table 3: Labour input adjustments and credit availability. Probit marginal effects

	(1) Adjust labour input	(2) Adjust the extensive margin	(3) Adjust the intensive margin
Index of credit difficulties	0.018*** [0.000]	0.017*** [0.000]	0.011*** [0.002]
Observations	18,139	18,130	17,068
Mean probability	0.303	0.156	0.116

Note:
Robust p-values in brackets *** p<0.01, ** p<0.05, * p<0.1. The models include country, sector and size dummies.

Table 4: Labour input adjustments and credit availability, by detailed method of adjustment. Probit marginal effects

	(1) Collective layoffs	(2) Individual layoffs	(3) Temporary layoffs
Index of credit difficulties	0.002** [0.270]	0.017*** [0.000]	0.001 [0.502]
Observations	18,133	18,134	13,403
Mean probability	0.061	0.121	0.038
	(4) Subsidized reduction of hours	(5) Not subsidized reduction of hours	(6) No renewal of temporary job contracts
Index of credit difficulties	0.004 [0.143]	0.010*** [0.000]	0.010*** [0.003]
Observations	15,853	18,128	18,131
Mean probability	0.071	0.071	0.125
	(7) Early retirement	(8) Freeze/reduction new hire	(9) Reduction temporary work agency
Index of credit difficulties	0.003* [0.090]	0.013*** [0.001]	0.007** [0.019]
Observations	17,391	18,133	18,129
Mean probability	0.044	0.170	0.099

Note:
Robust p-values in brackets *** p<0.01, ** p<0.05, * p<0.1. The models include country, sector and size dummies.

Table 5: Wage adjustments and credit availability, base wage and variable wage components. Probit marginal effects

	(1) Wages (total)	(2) Base wages	(3) Flexible wages
Index of credit difficulties	0.009**	0.002	0.009***
	[0.016]	[0.188]	[0.004]
Observations	18,282	18,282	18,282
Mean probability	0.142	0.050	0.123

Note:
Robust p-values in brackets *** p<0.01, ** p<0.05, * p<0.1. The models include country, sector and size dummies.

Table 6: Credit availability and labour market adjustments by geographical area. Probit marginal effects

	(1) Extensive margin	(2) Intensive margin	(3) Base wage	(4) Flexible wage
Credit difficulties index	0.020***	0.015***	0.001	0.009**
	[0.001]	[0.001]	[0.700]	[0.036]
Southern Europe * Credit diff. Index	0.003	-0.005	0.001	0.010
	[0.793]	[0.520]	[0.835]	[0.211]
Eastern/Baltic * Credit diff. Index	-0.014*	-0.009	0.002	-0.014**
	[0.058]	[0.109]	[0.423]	[0.017]
Observations	18,130	17,068	18,282	18,282
Mean probability	0.156	0.116	0.050	0.123

Note:
Robust p-values in brackets *** p<0.01, ** p<0.05, * p<0.1. Southern Europe includes: Spain, Italy; Greece, Portugal, Cyprus. Eastern Europe/Baltic countries includes: Czech Republic, Estonia, Croatia, Hungary, Romania, Bulgaria, Latvia, Lithuania, Poland, Slovenia, and Slovakia. The models include area, country, sector and size dummies

Table 7: Italy and France. Instrumental variables. Pooled data. Credit supply as an instrument for credit access difficulties and labour market adjustments

	(1) Index of credit difficulties	(2) Extensive margin	(3) Intensive margin	(4) Base wage	(5) Flexible wage
IV: index of credit supply	-1.212				
	[0.000]**				
Index credit difficulties (instrumented)		0.141	0.122	0.028	0.107
		[0.011]**	[0.033]**	[0.219]	[0.045]**
Observations	1,558	1,558	1,558	1,603	1,603

Note:
Index pf credit supply, based on credit registers. Robust p-values in brackets *** p<0.01, ** p<0.05, * p<0.1. The models include country, sector and size dummies.

Figure 1: Country averages of credit difficulty index and box-plot analysis of firm level variation
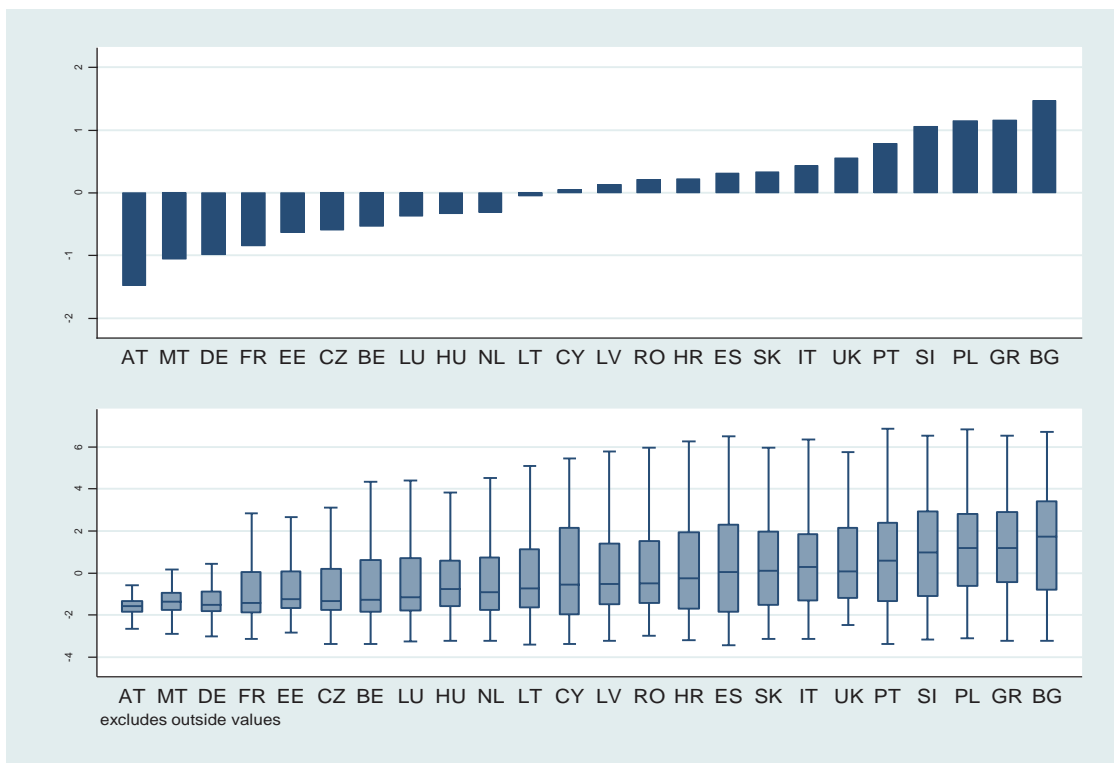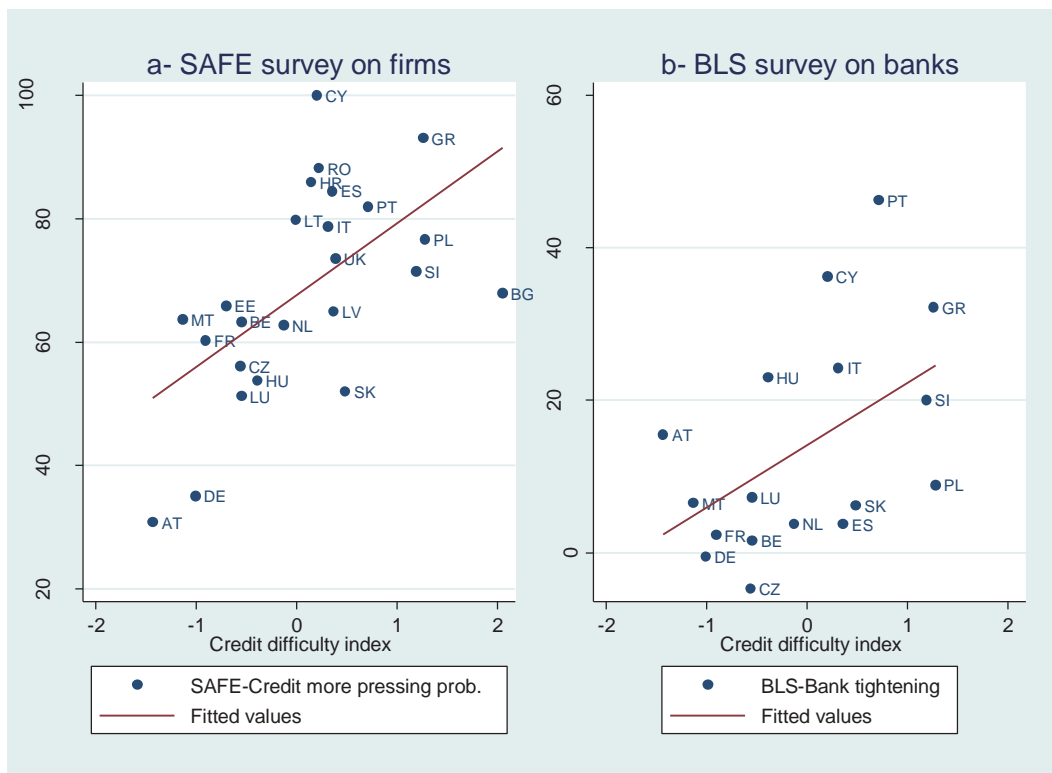

Note:
Sample is restricted to manufacturing, trade and business service firms.

Figure 2: Histogram of credit accessibility index
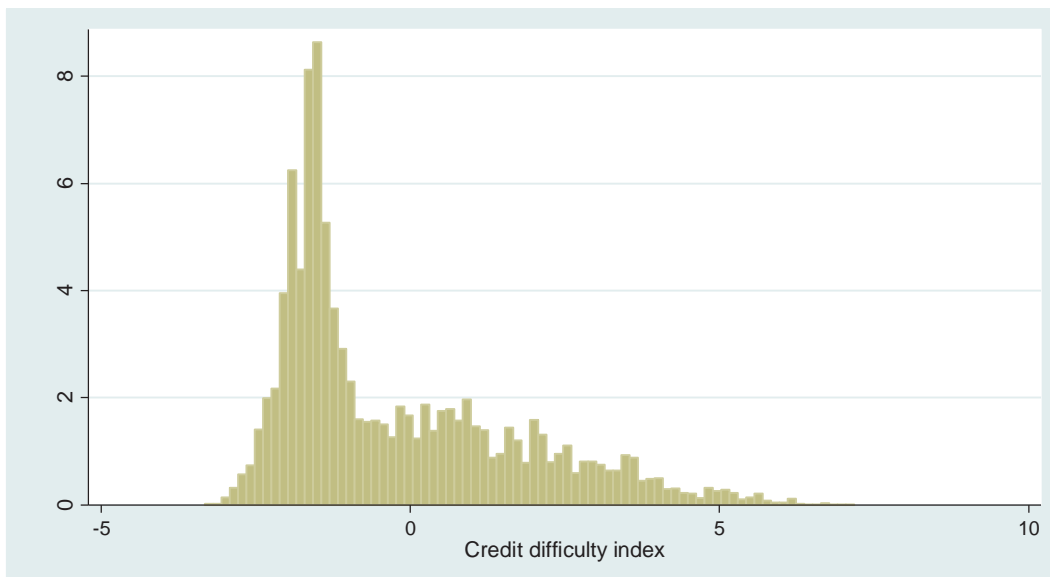
Note: Sample is restricted to manufacturing, trade and business service firms. Data weighted to reflect an overall employment in the country.

**Figure 3: Correlations of the results of SAFE survey on firms and BLS on banks, and index of credit difficulties.**

Note:
Panel a: Safe survey, share of firms reporting credit availability as the more pressing problem and index of credit difficulty (mean values for each country). Panel b: Safe survey, share of banks reporting a tightening in conditions and index of credit difficulty (mean values for each country).

Figure 4: Correlations between adjustments in employment (total hours worked, panel (a) and nominal hourly wages (panel b) and index of credit difficulties.
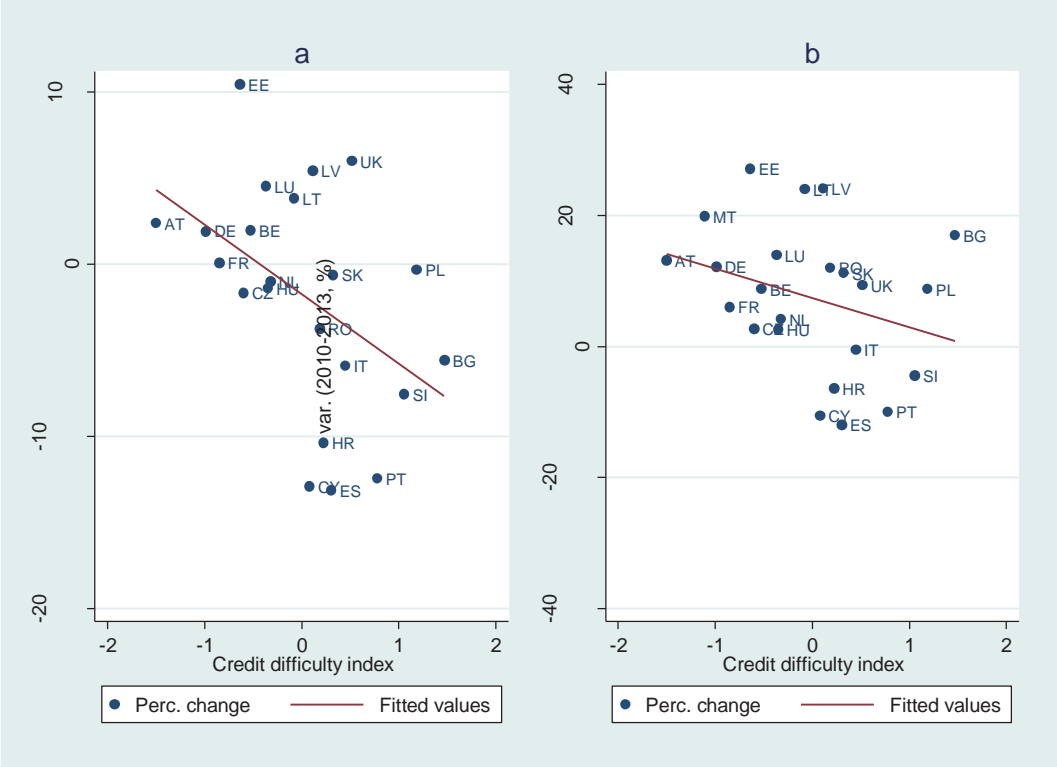
Note:
National accounts (Private sector only) and index of credit difficulty (mean values for each country).

Figure 5: Correlations between the change in credit supply and the index of credit difficulties.
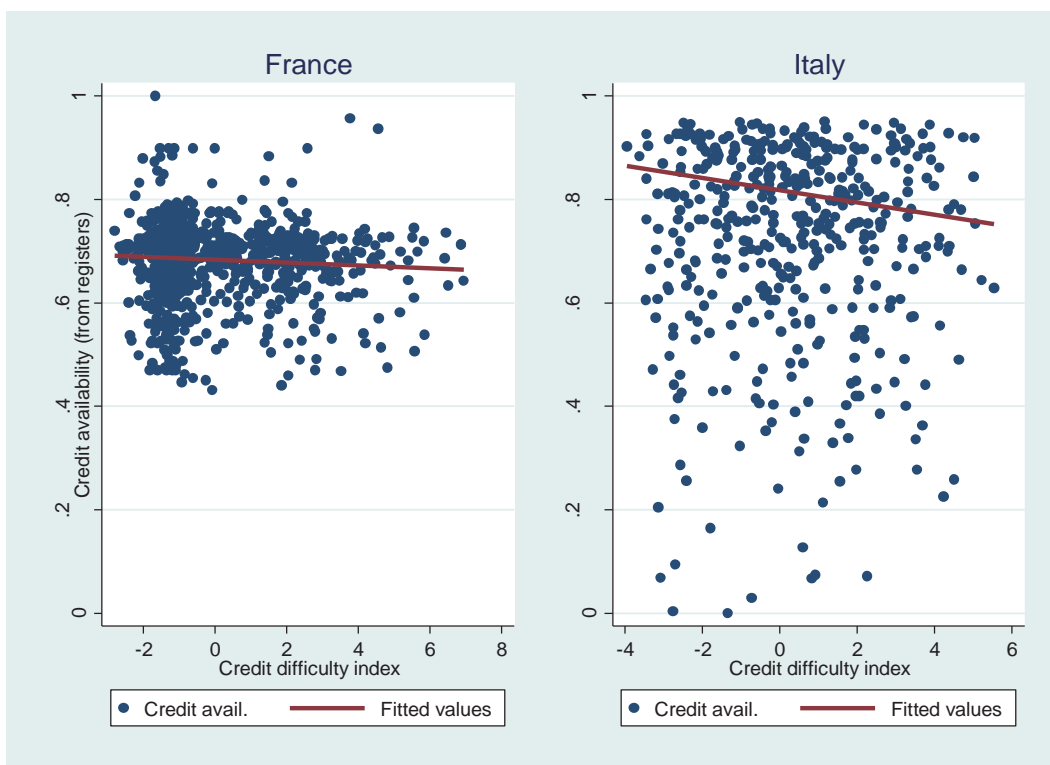
Note:
Credit supply (measured on credit registers and normalized between zero and one in both countries) and index of credit difficulty.

Appendix 1: The WDN3 survey

In this paper we use so-called WDN3 survey, conducted in 2014 by national central banks in 24 countries of the European Union. This survey constitutes the main data source we use to deal with these issues. This survey is the third wave of enquiries led by the Wage Dynamics Network (WDN) of the European System of Central Banks, a research network dedicated to the study of the features and sources of wage and labour cost dynamics and their implications for monetary policy in the euro area. The first survey on firms' price and wage setting practices has been carried out by 17 national central banks in 2007-2008. Additional questions –mainly to respondents of the first wave– have then been issued in a short second wave in 2009, in order to assess the firms' reaction to the global financial crisis of 2007-2008.

Since late 2009, the European countries have been confronted to the sovereign debts crisis, and labour market reforms have occurred: the third wave was designed to measure the nature of shocks and the firms' reaction during the period 2010-2013, and especially the adjustments they made in their price and wage settings practices. The harmonised questionnaire contains three main parts: the nature of the shocks (changes in demand, in accessibility of funding, costs and mainly elements of the labour costs), the adjustments on employment and wages, and the main obstacles to hiring.

Each participating national central bank was responsible for the translation of the questionnaire and for the conduct of the survey in the country. Each central bank chose both the sample computation and the data collection method for its national data, leading to a large variety of sample computation and data characteristics. More than 24 000 firms were surveyed during the year 2014: if the perimeter of sectors can differ from a country to another, the manufacturing, trade, business services and, to a lesser extent, construction are well represented across the participating countries. To improve firm comparability between countries we restrict our analysis to the three main sectors – manufacturing, trade and business services (see Table A1 for detailed information on sample).

In most countries, firms with less than 5 employees were excluded from the survey: they only represent 2% of the data. 29% of firms have 5 to 19 employees, 24% 20 to 49, 25% 50 to 199 and 20% more than 200 employees. For all countries we only include firms with at least 5 employees.

Table A1: Survey sample by country, sector and size (firms that provided answers about credit availability)

Country	Number of firms that provided answers about credit availability (all sectors)	Share of firms in manufacturing, trade or business services (%)	Firms in manufacturing, trade or business services								Average item non-response (% of total number of firms)	
			distribution by sector (%)			distribution by employee number (%)					for credit availability questions	for labour input adjustment questions
			manufacturing	trade	business services	< 5	5-19	20-49	50-199	200 and >		
AT	744	83.9	34.8	25.8	39.4	0.6	18.1	22	31.6	27.7	1.9	3.2
BE	958	77.5	54.3	14.8	30.9	-	22.8	23.9	42.6	10.8	2.1	0.6
BG	507	75.9	14	59.5	26.5	-	72.5	18.2	7	2.3	1.4	0
CY	167	85	22.5	32.4	45.1	26.1	41.5	15.5	9.9	7	5.4	2.6
CZ	944	91.5	54.5	16.1	29.4	-	15.4	18.9	25.8	39.9	4.7	1.8
DE	2297	80.8	34	28.1	37.9	9.2	24	28	27.2	11.7	3.8	2.9
EE	500	76.6	35	24	41	-	36	34.7	23.2	6	0	0
ES	1975	99.1	25.9	30.7	43.5	-	73.1	18	6.6	2.3	0	0
FR	1120	85.4	51.4	25.2	23.4	-	18.4	22.2	27.7	31.7	2.6	0.8
GR	348	100	39.4	35.3	25.3	-	11.2	36.2	34.8	17.8	11.5	2.0
HR	301	90.4	42.6	21	36.4	-	30.1	25.7	33.1	11	0	0
HU	1782	90.1	43.7	23.6	32.7	-	10.5	29.5	40.1	19.9	9.2	0
IT	919	97.6	51.7	21.1	27.2	-	6.7	51.4	29	12.5	8.3	0.5
LT	515	77.3	19.1	42.5	38.4	-	57.5	19.3	18.3	4.8	0	0
LU	661	64.9	17.2	35.9	46.9	23.5	35.7	21.9	14.9	4	1.3	0
LV	463	85.3	20.8	36.7	42.5	-	47.6	25.8	20.8	5.8	8.6	0
MT	178	73	24.6	20	55.4	-	13.8	24.6	37.7	23.8	0	0
NL	727	58.2	22.9	34.8	42.3	-	45.6	25.8	24.3	4.3	0	0
PL	1414	84.4	33.9	34	32.1	20.8	27.9	15.3	22.4	13.7	3.5	4.8
PT	1261	70.9	47.5	20.4	32.1	-	13.4	23.6	36.4	26.6	3.7	0
RO	2030	89.4	60.4	16.1	23.5	-	-	8.2	14.7	77.1	0.4	0.1
SI	1269	80.9	40.8	20.1	39.1	-	48.3	20	20.5	11.2	0	0
SK	601	84.7	37.3	24.4	38.3	-	25.9	27.3	32.6	14.1	2.1	0
UK	395	72.4	23.1	19.2	57.7	5.6	6.6	24.1	28.7	35	29.6	0.8

Table A2. List of the WDN3 questions used in this paper

Credit availability	With regard to finance, please indicate for 2010-2013 how relevant were for your firm each one of the following happenings? Please choose ONE option for each line (not relevant, of little relevance, relevant, very relevant). Note: Credit here refers to any kind of credit, not only bank credit. Credit was not available to finance working capital Credit was not available to finance new investment Credit was not available to refinance debt Credit was available to finance working capital, but conditions (interest rate and other contractual terms) were too onerous Credit was available to finance new investment, but conditions (interest rate and other contractual terms) were too onerous Credit was available to refinance debt, but conditions (interest rate and other contractual terms) were too onerous
Labour force adjustment	During 2010-2013 did you need to significantly reduce your labour input or to alter its composition? (Yes/No) If YES, which of the following measures did you use to reduce your labour input or alter its composition when it was most urgent? Please choose ONE option for each line (not at all, marginally, moderately, strongly) Collective layoffs Individual layoffs Temporary layoffs (NOT asked in: CZ, DE, EE, IT, LT, LV and MT) Subsidised reduction of working hours (NOT asked in EE, LT, LV, UK and PT) Non-subsidised reduction of working hours (including reduction of overtime) Non-renewal of temporary contracts at expiration Early retirement schemes (NOT asked in EE) Freeze or reduction of new hires Reduction of agency workers and others
Change in economic conditions	How did the following factors affect your firm's activity during 2010-2013? Please choose ONE option for each line (Strong decrease, Moderate decrease, Unchanged, Moderate increase, Strong increase) The level of demand for your products/services Volatility/uncertainty of demand for your products/services Customers' ability to pay and meet contractual terms Availability of supplies from your usual suppliers

Table A3: Share of firms in manufacturing, trade and business services, who reported need to reduce labour input or alter its composition; and use of labour adjustment measures by corresponding firms, %

| Country | Need to significantly reduce labour input or to alter its composition? | | If YES, which of the following measures did you use to reduce your labour input or alter its composition when it was most urgent? * | | | | | | Negative wage adjustment * | |
	No	Yes	Extensive margin (collective and individual layoffs)	Intensive margin (subsidised and non-subsidised reduction of working hours)	Non-renewal of temporary contracts at expiration	Freeze of new hires	Temporary layoff	Early retirement	Base wage	Flexible wage
AT	76.2	23.8	38.8	42.2	4.1	55.2	9.1	1.7	1.8	14.2
BE	59.8	40.2	46.6	15.5	33.3	62.7	37.7	15.0	5.4	3.8
BG	76.2	23.8	78.6	14.2	27.6	62.5	31.3	15.4	25.9	38.6
CY	48.6	51.4	54.5	28.6	19.3	49.3	13.5	7.7	83.1	83.9
CZ	63.6	36.4	68.2	25.9	38.4	58.0	-	13.0	9.7	31.1
DE	78.4	21.6	44.5	60.4	28.1	42.9	-	13.3	9.4	8.6
EE	86.7	13.3	48.8	29.2	13.0	42.0	-	-	22.7	23.4
ES	54.1	45.9	58.1	34.5	49.2	32.6	24.7	18.4	12.4	44.8
FR	74.3	25.7	58.1	38.2	47.4	74.4	4.9	7.4	4.4	22.3
GR	44.7	55.3	37.5	34.0	19.1	59.9	2.8	6.4	78.4	66.8
HR	60.5	39.5	64.3	13.0	45.7	33.5	8.2	29.5	29.6	38.2
HU	84.2	15.8	51.2	26.4	24.7	29.9	12.0	16.8	8.4	32.0
IE	65.8	34.2	54.9	48.7	23.9	52.2	12.1	3.4	25.2	34.9
IT	53.4	46.6	65.4	89.5	53.1	71.1	-	21.8	5.9	30.0
LT	80.9	19.1	24.1	13.8	25.0	36.0	-	3.1	16.6	18.9
LU	74.4	25.6	35.1	19.3	36.5	50.2	4.3	19.6	7.7	37.4
LV	77.3	22.7	34.0	21.6	10.5	22.8	-	1.5	19.7	12.2
MT	76.0	24.0	18.8	31.2	17.8	41.0	-	13.2	5.1	2.1
NL	48.4	51.6	56.8	8.2	53.5	51.8	1.4	9.4	21.8	37.7
PL	61.7	38.3	70.0	35.3	53.0	72.7	18.8	24.8	8.7	17.0
PT	74.9	25.1	58.1	28.7	61.8	74.3	6.2	12.9	23.0	39.9
RO	73.8	26.2	71.8	41.6	31.5	57.5	13.5	11.5	10.2	23.8
SI	74.0	26.0	56.6	22.2	42.8	49.3	10.8	20.1	32.0	48.6
SK	66.4	33.6	113.9	27.2	38.4	75.3	8.4	23.4	7.9	36.3
UK	78.3	21.7	72.6	18.9	13.5	47.3	2.1	2.3	6.1	23.8

Note: * - share of firms, of those, who reported necessity to reduce labour input or its composition, and used a particular type of labour adjustment moderate or strongly. Sample is restricted to manufacturing, trade and business service firms. Data weighted to reflect an overall employment in the country.

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